BIDDING DOCUMENTS
FOR

SAULT TRIBE OF CHIPPEWA INDIANS
ESCANABA COMMUNITY CENTER
ESCANABA, MICHIGAN

Prepared by:

U.P. Engineers & Architects, Inc.
424 S. Pine Street
Ishpeming, MI 49849

November 16, 2022

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ADVERTISEMENT FOR BIDS
ESCANABA COMMUNITY CENTER PHASE 2
SAULT STE. MARIE TRIBE OF CHIPPEWA INDIANS
PROJECT #22-098

SECTION 00 11 16

Sealed bids are being solicited for: **Sault Ste. Marie Tribe of Chippewa Indians, Escanaba Community Center Phase 2 Construction, Escanaba, Michigan**. The project consists of approximately 9,720 sft wood framed construction for a new community center including commercial kitchen, community room, storage and office space. Construction includes concrete slab on grade (foundations and footings part of Phase 1 bid/awarded Fall 2022), architectural finishes (interior/exterior), plumbing system, HVAC, and electrical. Civil sitework (storm sewer and site preparation to gravel part of Phase 1 bid/awarded Fall 2022) including utilities (water, sewer, electrical), paving, concrete and restoration as shown on the drawings and presented at the walk-thru.

Bids will be received by the said Owner above addressed to:

Sault Ste. Marie Tribe of Chippewa Indians
Sault Tribe Purchasing
Attn: Marissa MacDonald
2186 Shunk Road
Sault Ste. Marie, MI 49783

Bids must be received at Sault Tribe Purchasing no later than 2:00 p.m. EST, Tuesday, January 3, 2023, at which time a public video recorded bid opening will be conducted. Bids must be complete at time of submission prior to bidding deadline to be considered a responsive bid. Incomplete or late bid proposals will not be considered.

Contractor please clearly mark **"ESCANABA COMMUNITY CENTER PHASE 2, ESCANABA, MI. PROJECT #22-098"** on outside envelope of sealed bid.

A MANDATORY WALK-THRU for contractors submitting a bid will be held at the project site – meet at corner of Spruce Street and Wigob St, Escanaba, MI, **on Tuesday, November 29, 2022, at 11:00 a.m. EST**.

The Contract Documents may be examined beginning November 17, 2022 at the office of U.P. Engineers & Architects, Inc., 707 Ashmun Street, Sault Ste. Marie, MI 49783 and at the following Builder's Exchanges: Marquette, Michigan, Northwest Michigan, Iron Mountain, Michigan and Appleton, Wisconsin.

Additional copies of the Contract Documents may be obtained from the office of U.P. Engineers & Architects, Inc., 707 Ashmun Street, Sault Ste. Marie, MI 49783 beginning November 17, 2022 upon payment of a $150.00 nonrefundable handling fee or $50.00 for a pdf (checks made payable to U.P. Engineers & Architects). Please contact Marissa MacDonald via email (mmacdonald@saulttribe.net) copied to Hattie Sharland (hsharland@upea.com) to request prints.

The Sault Ste. Marie Tribe of Chippewa Indians reserves the right to accept and / or reject any or all bid proposals for any reason whatsoever it deems appropriate. A bid shall constitute an irrevocable offer for a period of one-hundred twenty (120) days from the bid opening date or until date of award, whichever is earlier. In the event that an award is not made by the Sault Tribe within one-hundred twenty (120) days from the bid opening date, the bidder may withdraw the bid or provide a written extension of the bid.

UPEA
ENGINEERS & ARCHITEC

NOTICE TO BIDDERS
ESCANABA COMMUNITY CENTER PHASE 2
SAULT STE. MARIE TRIBE OF CHIPPEWA INDIANS
PROJECT #22-098

PROJECT AND BID REQUIREMENTS:

- Bidders must provide a total price for the Escanaba Community Center broken down as presented in the Bid Form.

- Bidders must provide a timeline for construction. Phase 1 is scheduled for completion by May 31, 2023. Construction of Phase 2 is anticipated to begin in June 2023 with substantial completion required by September 30, 2023. Further details on schedule requirements will be stipulated in the Agreement.

- Bidders must acknowledge receipt of all addenda.

- Bidders shall be required to hold a Michigan Builders License and perform 50% of the project work based on scope of work.

- Sault Tribe Sales Tax and Use Tax Exemption: Materials purchased for the Escanaba Community Center Project shall be exempt from sales tax and use tax.

- Wages: Davis Bacon Wages are NOT required on the Project.

- Qualifications: This bid shall be awarded to a responsible, responsive bidder, qualified and experience to provide the work specified. In addition to other requirements specified in this RFP.

- Native Preference Policy: As per the Sault Ste. Marie Tribe of Chippewa Indians Purchasing Policy, revised October 6, 2015, all proposals received for the Escanaba Community Center Project will be subject to the Native Preference Policy. To qualify for native preference, a contractor must be classified as an "Indian Economic Enterprise", which means any business entity which is at least 51 percent owned by one or more members of a federally recognized Indian Tribe; and has one or more of the tribe members involved in the daily business management of the economic enterprise; and a majority of the earnings from said Economic Enterprise benefits said member or members. The vendor claiming to be an Indian Economic Enterprise must have satisfied the requirements of eligibility/ certification. *Eligibility would include proof that a member/vendor is an Enrolled Tribal Member of a Federally Recognized Indian Tribe.* Certification of eligibility for native preference could include: Bureau of Indian Affairs Certification, Michigan Minority Business Development Council, Small Business Administration, and Certification of membership from another Tribe. Eligibility/Certification shall be submitted with the bid response. A prospective vendor seeking to qualify for preference shall evidence showing extent of Indian ownership and interest. Evidence of structure, management and financing affecting the Indian character of the enterprise, including major subcontractors and purchase agreements; materials or equipment supply arrangement; and management salary or profit–sharing arrangements; and evidence showing the effect of these on the extent of Indian ownership and interest. Evidence to demonstrate that the contractor has the technical, administrative, and financial capability to perform work of the size and type involved. The Indian Economic Enterprise must submit a letter as evidence of Indian ownership and control certifying that the enterprise will continue to meet requirements necessary to sustain Indian ownership and control throughout the period of service.

- Background Clearances: Prior to contract award, the selected bidder will be required to provide company information, including their DUNS number, for conducting a debarment clearance as part of their contractor approval process

- Insurance Requirements: The following insurance requirements must be submitted to Sault Tribe prior to commencement of any work on the Escanaba Community Center Project:
  - **A.** Minimum Scope of Insurance Coverage
    Coverage shall include:
    1. Commercial General Liability Insurance; to include Contractual Liability coverage.
    2. Workers Compensation and Employer's Liability Insurance.
    3. Builders Risk Insurance.
    4. Automobile Liability Insurance.
  - **B.** Minimum Limits of Insurance
    Contractor shall maintain limits no less than:
    1. General Liability: $1,000,000.00 per occurrence for bodily injury, personal injury and property damage; at least $2,000,000.00 in the aggregate.
    2. Worker's Compensation statutory limits and Employer's Liability: $1,000,000.00 per accident for bodily injury or disease.
    3. Automobile Liability: Must meet State of Michigan minimum requirements.
  - **C.** Deductibles and Self-Insured Retentions
    Any deductibles or self-insured retentions must be declared to and approved by the Tribe.
  - **D.** Other Insurance Provisions
    The general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:
    1. The Sault Tribe, 523 Ashmun, Sault Ste. Marie, MI 49783, its agents, officers, officials, employees and volunteers are to be named as additional insured's with respect to liability arising out of automobiles owned, leased, hired or borrowed by or on behalf of the contractor; and with respect to liability arising out of work or operations performed by or on behalf of the contractor including materials, parts or equipment furnished in connection with such work or operations. General liability coverage can be provided in the form of an endorsement to the contractor's insurance, or as a separate owner's policy.
    2. For any claims related to this project, the contractor's insurance coverage shall be primary insurance as respects the Tribe, its agents, officers, officials, employees and volunteers. Any insurance or self-insurance maintained by the Tribe, its agents, officers, officials, employees or volunteers shall be excess of the contractor's insurance and shall not contribute with it.
    3. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be cancelled or reduced by either party or modified in any way, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the Tribe.
  - **E.** Waiver of Subrogation
    The Workers' Compensation and General Liability policies are to be endorsed with a waiver of subrogation. The insurance company, in its endorsement, agrees to waive all rights of subrogation against the Tribe, its agents, officers, officials, employees and volunteers for losses paid under the terms of the policy which arises from the work performed by the named insured for the Tribe.
  - **F.** Acceptability of Insurers
    Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII.
  - **G.** Verification of Coverage
    Contractor shall furnish the Tribe with original certificates and amendatory endorsements effecting coverage required by this clause. All certificates and endorsements are to be received and approved by the Tribe before work commences. The Tribe reserves the right to require complete, certified copies of all required insurance policies, including endorsements affecting the coverage required by these specifications at any time.
  - **H.** Subcontractors
    Contractors shall include all subcontractors as insured's under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverage's for subcontractors shall be subject to all of the requirements stated herein.

- Notice of Award: The Sault Tribe Purchasing Department will notify in writing the successful bidder of the acceptance of their bid.

- Contract: Prior to any services being performed by the awarded contractor, the Sault Tribe and awarded contractor shall enter into a separate signed Agreement which sets forth the obligations of the parties for the project. Such Agreement will be a separate document, which will be negotiated and executed after bid has been awarded. Moreover, such Agreement will include all provisions and requirements as set forth in this RFP along with other required provisions agreed to between the parties.

- Governing Law: This RFP and/or any Agreement entered into between the Sault Tribe and the Awarded Contractor for services will be governed by the laws of the Sault Ste. Marie Tribe of Chippewa Indians. Contractor agrees that all disputes, actions and claims arising from said Agreement shall be subject to the exclusive jurisdiction of the Sault Ste. Marie Tribe of Chippewa Indians Tribal Court and Contractor consents to the personal jurisdiction of said Tribal Court. Contractor further consents to enforcement of any judgment of said Tribal Court in any state court of applicable jurisdiction.

- Shop Drawings: To establish compliance with specified requirements, the awarded contractor shall submit shop drawings, product data and other documentation for approval by the Owner prior to commencing work.

- Licenses, Permits and Fees: The awarded contractor shall obtain and pay for all licenses, fees, permits and inspections required for the proper execution and completion of the Escanaba Community Center Project.

- Worksite Access / Coordination: The awarded contractor, contractor's workers and subcontractors shall coordinate and schedule worksite access with Sault Tribe Facilities Management prior to working at the Project site.

- Safety and Protection of Property: The awarded contractor shall take all reasonable precautions, including but not limited to the following:
  - To prevent injury to employees and all other persons affected by their operations
  - To prevent damage or loss of property of the Sault Tribe
  - To comply with all ordinances, rules, regulations, standards and lawful orders from regulatory authorities, including the National Fire Protection Association (NFPA) and Occupational Safety and Health Administration (OSHA), in addition to Tribal Code, when applicable, bearing on the safety of persons or property or their protection from damage, injury or loss.

- Worksite Cleanliness: The awarded contractor shall be responsible for the prompt removal of all debris from the work area as a result of performance and for maintaining a clean and safe worksite.

- Bid Package Materials: Bidders must submit the items listed below in their bid package.
  - ✓ Total pricing for Escanaba Community Center Project on Bid Form
  - ✓ Timeline for the Escanaba Community Center Project
  - ✓ Acknowledgement of receipt of all addenda
  - ✓ Native Preference Policy eligibility documentation, if applicable

- A mandatory walk through of the project site will be held at Project Site on **Tuesday, November 29, 2022 at 11:00 a.m. EST.**

- Questions regarding the Escanaba Community Center Project RFP **must be emailed** to the Sault Tribe Purchasing Department to Marissa MacDonald at mmacdonald@saulttribe.net. Responses will be sent electronically to all bidders via Addenda. The deadline for questions regarding the Escanaba Community Center Project Bidding is **December 13, 2022 by COB**.

- Bid Package Submission: Bidders must submit their **SEALED** bid package clearly marked **"ESCANABA COMMUNITY CENTER PHASE 2, ESCANABA, MI. PROJECT #22-098"** as directed below.

  Bid packages **must be submitted** to:

  Sault Tribe Purchasing Department
  Attn: Marissa MacDonald #22-098
  2186 Shunk Road
  Sault Sainte Marie, MI 49783

  ****Faxed or emailed bids will not be accepted****

Bids **must** be received at the Sault Tribe Purchasing Department no later than **2:00 p.m. EST, Tuesday January 3, 2023.** Bids must be complete at time of submission prior to bidding deadline to be considered a responsive bid. Incomplete or late proposals will not be considered.

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

1.1 SUMMARY

A. Document Includes:
1. Bid submission.
2. Intent.
3. Work identified in Contract Documents.
4. Contract Time.
5. Definitions.
6. Contract Documents identification.
7. Availability of documents.
8. Examination of documents.
9. Inquiries and Addenda.
10. Product substitutions.
11. Site examination.
12. Prebid meeting.
13. Bidder qualifications.
14. Subcontractors.
15. Submission procedure.
16. Bid ineligibility.
17. Bid Security.
18. Bid Form requirements.
19. Bid Form signature.
20. Bid opening.
21. Duration of offer.
22. Acceptance of offer.

B. Related Documents:
1. Document 00 11 16 - Invitation to Bid.
2. Document 00 41 13 - Bid Form - Stipulated Sum (Single-Prime Contract).

1.2 BID SUBMISSION

A. Bids signed and sealed, executed, and dated will be received by Owner located at the office of the Architect as noted on the Advertisement for Bids.

B. Bids submitted after the above time may be returned to Bidder unopened.

C. Amendments to submitted Bids will be permitted when received in writing prior to Bid closing and when endorsed by the same party or parties who signed and sealed the Bid.

D. Bidders may withdraw their Bid by written request before the above time.

1.3 INTENT

A. The intent of this Bid request is to obtain an offer to perform work to complete the Work for a Stipulated Sum contract, according to Contract Documents.

1.4 WORK IDENTIFIED IN CONTRACT DOCUMENTS

A. Work of this project includes concrete slab on grade (foundations and footings part of Phase 1 bid/awarded Fall 2022), architectural finishes (interior/exterior), plumbing system, HVAC, and electrical. Civil sitework (storm sewer and site preparation to gravel part of Phase 1 bid/awarded Fall 2022) including utilities (water, sewer, electrical), paving, concrete and restoration as shown on the drawings and presented at the walk-thru.

1.5 CONTRACT TIME

A. Perform the Work within time stated in the Advertisement for Bids. Bidder, in submitting an offer, accepts Contract Time period stated for performing the Work. Owner requires Work of this Contract be completed as soon as possible. Consideration will be given to time of completion when reviewing submitted Bids.

1.6 DEFINITIONS

A. Bidding Documents: Contract Documents supplemented with Advertisement for Bids, Instructions to Bidders, Bid Form, and Bid securities.

B. Contract Documents: Defined in AIA A101-2007.

C. Bid: Executed Bid Form and required attachments submitted according to Instructions to Bidders.

D. Bid Sum: Monetary sum identified by the Bidder in the Bid Form.

1.7 CONTRACT DOCUMENTS IDENTIFICATION

A. Contract Documents are identified as Project number S10-02174 as prepared by U.P. Engineers & Architects, Inc. and identified in the Project Manual.

1.8 AVAILABILITY OF DOCUMENTS

A. Bidding Documents may be obtained as stated in Advertisement for Bids.

B. Bidding Documents are made available only for the purpose of obtaining offers for this Project. Their use does not grant a license for other purposes.

1.9 EXAMINATION OF DOCUMENTS

A. Upon receipt of Bidding Documents verify that documents are complete. Notify Architect if documents are incomplete.

B. Immediately notify Architect upon finding discrepancies or omissions in Bidding Documents.

1.10 INQUIRIES AND ADDENDA

A. Requests for Information/Clarification:
   a. Questions regarding the Escanaba Community Center Project RFP must be emailed to the Sault Tribe Purchasing Department to Marissa MacDonald at mmacdonald@saulttribe.net. Responses will be sent electronically to all bidders via Addenda. The deadline for questions regarding the Escanaba Community Center Project Bidding is **December 13, 2022 by COB**.
   2. Verbal answers are not binding on any party.
   3. Replies will be made by Addenda.
   4. Responses to inquiries affecting clarity of documents or perceived to affect cost will be addressed by Addenda, to be issued during Bidding period.

B. Addenda:
   1. Addenda will be sent to known Bidders and to those who are known to have received a complete set of Bidding Documents.
   2. Addenda become part of Contract Documents.
   3. Include resultant costs in Bid Price.

1.11 PRODUCT SUBSTITUTIONS

A. Where Bidding Documents stipulate particular products, substitution requests will be considered by Architect up to 10 days before receipt of Bids.

B. With each substitution request, provide sufficient information for Architect to determine acceptability of proposed products. Comply with substitution request submittal requirements in Section 01 60 00 - Product Requirements including the use of the Substitution Request Form.

C. When a request to substitute a product is made, Architect may approve the substitution. Approved substitutions will be identified by Addenda.

D. In submission of substitutions to products specified, Bidders shall include in their Bid changes required in the Work changes to Contract Time and changes to Contract Sum to accommodate such approved substitutions. Later claims by the Bidder for an addition to the Contract Time or Contract Sum because of changes in Work necessitated by use of substitutions will not be considered.

1.12 SITE EXAMINATION

A. Examine the Project site before submitting a Bid.

1.13 PREBID MEETING

A. A prebid meeting is scheduled as listed in the Advertisement for Bids.

B. General Contract Bidders are required to attend.

C. Representatives of the Architect and Owner will attend.

D. Information relevant to Bidding Documents will be issued by Addenda.

1.14 BIDDER QUALIFICATIONS

A. To demonstrate qualification for performing the Work of this Contract, Bidders may be requested to submit written evidence of financial position, previous experience, and current commitments.

1.15 SUBCONTRACTORS

A. Owner reserves the right to reject a proposed Subcontractor for reasonable cause.

1.16 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for delivery of Bids in manner and time prescribed.

B. Submit one copy of the executed offer on Bid Forms provided, signed and sealed with required security deposit in a closed opaque envelope, clearly identified with Bidder's name and address, Project name, and Owner's name on the outside.

C. Improperly completed information, including irregularities in Bid bond, may be cause not to open the Bid Form envelope and to declare the Bid invalid or informal.

D. An abstract summary of submitted Bids will be made available to all Bidders following Bid opening.

1.17 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, and obscure, or Bids that contain arithmetical errors, erasures, alterations, or irregularities of any kind, may be declared unacceptable at Owner's discretion.

B. Bid Forms, Appendices, and enclosures that are improperly prepared may be declared unacceptable at Owner's discretion.

C. Failure to provide security deposit, may invalidate the Bid at Owner's discretion.

1.18 BID SECURITY

A. Bids shall be accompanied by Bid security as follows:
   1. Bid bond of a sum no less than 5 percent of the Bid Sum on AIA A310 - Bid Bond or on standard surety company form.

B. Endorse Bid bond in name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.

C. If the accepted Bidder fails to execute the Agreement and the indicated bonds within 10 days after the Notice of Award, the Notice of Award may be annulled and the Bid security of the Bidder will be forfeited.

D. Include the cost of Bid security in the Bid Sum.

E. If no contract is awarded, Bid security will be returned.

1.19 BID FORM SIGNATURE

A. Sign Bid Form as follows:
1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Include the words "Sole Proprietor" under the signature. Affix seal.
2. Partnership: Signature of all partners in the presence of a witness who will also sign. Include the word "Partner" under each signature. Affix seal to each signature.
3. Corporation: Signature of at least one duly authorized signing officer. Include the officer's capacity under each signature. Affix the corporate seal. If Bid is signed by officials other than the president, secretary, or treasurer of the company, submit a copy of the bylaws or a resolution of the board of directors authorizing them to do so, with the Bid Form in the Bid envelope.
4. Joint Venture: Signature of all parties of the joint venture under their respective seals in a manner appropriate to such party as described above, similar to requirements for Partnerships.

1.20 BID OPENING

A. Bids will be opened publicly immediately after time for receipt of Bids. Bidders may be present.

1.21 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of 120 days after Bid closing date.

1.22 ACCEPTANCE OF OFFER

A. Owner reserves the right to waive irregularities and to accept or reject any or all offers.

B. After acceptance by Owner, Architect, on behalf of Owner, will issue to the accepted Bidder a written Notice of Award.

C. Notwithstanding delay in the preparation and execution of the Agreement, accepted Bidder shall be prepared, upon written Notice to Proceed, to commence work within seven days following receipt of official written order of Owner to proceed, or on date stipulated in such order.

D. The accepted Bidder shall assist and cooperate with Owner to prepare Agreement and shall execute Agreement and return it to Owner within seven days following its presentation.

END OF DOCUMENT

DOCUMENT 00 41 13

BID FORM - STIPULATED SUM

Project: Escanaba Community Center, Escanaba, MI

Owner: Sault Ste. Marie Tribe of Chippewa Indians
523 Ashmun Street
Sault Ste. Marie, Michigan 49783

Date: _____

Submitted by: _____
(Firm name and address)

_____

_____

_____
(Telephone Number)

1. OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by U.P. Engineers and Architects, Inc. for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Bid Sum of:

1. Main Building and Site:

$_____, (_____dollars), in lawful money of the United States of America.

2. Healing Room: (Includes all Divisions)

$_____, (_____dollars), in lawful money of the United States of America.

3. Total Bid:

$_____, (_____dollars), in lawful money of the United States of America.

Alternate #1: Kitchen Equipment

$_____, (_____dollars), in lawful money of the United States of America.

- We have included the Bid Bond as required by the Instruction to Bidders.

2. ACCEPTANCE

This offer shall be open to acceptance and irrevocable for 120 days from the bid closing date.

If this bid is accepted by the Owner within the time period stated above, we will:

- Execute the Agreement within seven days of receipt of Notice of Award.
- Furnish the required bonds at the time of the execution of the Agreement.
- Commence work in conformance with requirements found in Instructions to Bidders.

If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the bid bond shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the bid bond or the difference between this bid and the bid upon which a Contract is signed.

3. CONTRACT TIME

If this Bid is accepted, we will Complete Work within the time specified in Section 01 10 00. Bidder agrees to pay as liquidated damages the sum of $500 for each calendar day thereafter as provided in Article 3 of the Contract.

4. CHANGES TO THE WORK

On Work added to the Contract, changes in the Work will be net cost plus a percentage fee of _____ percent overhead and profit on the net cost of our own Work, and _____ percent on the gross cost of Work performed by any Subcontractor.

On Work deleted from the Contract, our credit to the Owner shall be the approved net cost plus _____percent of the overhead and profit percentage noted above.

5. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

Addendum #_____Dated_____

Addendum #_____Dated_____

Addendum #_____Dated_____

6. SUBCONTRACTORS

The following firms have submitted costs for their portion of the Work, and it is the intent of this Contractor to enter into a Subcontractor agreement if we are awarded the Work:

Carpentry: _____

Plumbing/HVAC:_____

Electrical: _____

Site Work: _____

7. APPENDICES

The Bid Bond documents are attached to and made a condition of the Bid

8. BID FORM SIGNATURES

(Seal) The Corporate Seal of:_____
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____
(Authorized signing officer) (Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT

CERTIFICATE OF NON-SEGREGATED FACILITIES

The (_____ Company) assures GOVERNMENT CONTRACTORS and CONCERNED FEDERAL AGENCIES that we do not and will not maintain or provide for our employees any segregated facilities at any of our establishments, and that we do not and will not permit our employees to perform their services at any location, under our control, where segregate facilities are maintained. The company understands that the phrase "Segregated Facilities" includes facilities which are, in fact, segregated on a basis of race, color, creed or national origin, because of habit, local custom or otherwise. The company understands and agrees that maintaining and providing segregated facilities for our employees or permitting our employees to perform their services at any locations, under our control, where segregated facilities are maintained is a violation of the equal opportunity clause required by Executive Order 11246 of September 24, 1965.

The company further understands and agrees that a breach of the assurance herein contained subjects us to the provisions of the Orders of the Secretary of Labor and the provisions of the equal opportunity clause enumerated in contracts or referenced on purchase orders by the Government or Government contractors.

Finally we are aware that whoever knowingly and willfully makes any false, fictitious or fraudulent representation may be liable to criminal prosecution under 18 U.S.C. 1001.

_____

Signature & Title of Highest Official

Byrd Amendment Certification For Contracts,
Grants, Loans And Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of a cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, An officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

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

Executed this _____ day of _____, _____.

By _____
(signature)

_____
(typed or printed name)

_____
(title, if any)

Covered Action: _____
(type and identity of program, project or activity)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion

--Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the department of Agriculture agency with which this transaction originated.

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

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

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above certifications.

NAME OF APPLICANT
AWARD NUMBER AND / OR PROJECT NAME
PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE
SIGNATURE DATE

TRIBAL CODE

CHAPTER 13:

AFFIRMATIVE ACTION PLAN

CONTENTS:

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HISTORY NOTE:

Current Ordinance

Original Affirmative Action Plan adopted by Board motion on April 25, 1978.

Amended Plan adopted by Board motion on April 29, 1981.

Reenacted in Tribal Code Format as part of the Tribal code July 5, 1995, Resolution No. 95-89, effective immediately.

Amendments

Resolution 2-24-82A, adopted February 24, 1982, added current §13.114.

Indian employment percentage changed to 75% by Board motion on June 23, 1982.

TRIBAL CODE

CHAPTER 13:

AFFIRMATIVE ACTION PLAN

13.101 Contract Requirement.

The Sault Ste. Marie Tribe of Chippewa Indians Affirmative Action Plan, Tribal Code Chapter 13, shall be included as a requirement of all construction contracts and all other contracts with the Tribe to be performed on or near Tribal lands. It shall likewise apply to all subcontractors of any such contractor. It is established to ensure that a reasonable percentage of Indian people will be employed by each contractor and subcontractor on every Tribal project. The Affirmative Action Plan is set forth in the remaining sections of this Chapter.

13.102 Legal Basis of Plan.

(1) Federal law prohibits racial discrimination by private employers in connection with federally funded contracts under the Civil Rights Act of 1964. It is unlawful for employers to refuse to hire an individual, to segregate employees, to differentiate wages paid or to otherwise discriminate in employment practices, on the basis of color, race, religion or national origin.

(2) Indian tribes are exempted from this requirement; they may employ all Indian work forces. Also, enterprises on or near Tribal land may give hiring preference to Indians.

13.103 Affirmative Action Policy.

Indian persons are to be given preference in employment. In achieving the specific goals set forth in this plan, Sault Ste. Marie Tribal members are given primary preference, and other Indians are given preference over non-Indians.

13.104 Seventy-five Percent Indian Employment.

Every contractor will be required to employ seventy-five percent (75%) Indian employees on all Tribal projects. This provision does not require a contractor to change his hiring or firing practices regarding unproductive employees.

13.105 Each Job Classification or Trade.

The 75% Indian employment requirement will apply in each job classification or trade. The contractor may hire one non-Indian in any trade; however, the second, and 75% of all employees hired thereafter, must be Indian.

13.106 Openings and Record Keeping.

A list of Indian applicants will be maintained at the Tribal office for the convenience of the contractors. Contractors will file a notice of all openings with the Tribal office and will maintain records of employment of Indians on the job, showing the dates of employment and payroll of both Indian and non-Indian employees.

13.107 Employment Preference; Indian Defined.

Indian persons are given preference in employment. Indian persons are enrolled members of Indian tribes and persons recognized as such by the Indian community. The Tribe shall resolve any disputes regarding Indian status.

13.108 Minority Contracts.

Minority contractors with appropriate federal approval will be given preference, but must also comply with this Chapter.

13.109 All Contracts.

This policy is part of all Tribal contracts. All contractors and subcontractors will sign a copy of this plan and file same with the Tribe's Executive Director before commencing work.

13.110 Public Announcement.

The contractor on any Tribal project shall publish, in a local newspaper of general distribution, notice of his intention to give employment preference to Indians.

13.111 Waiver.

The requirement of Indian preference may be waived by the Tribe's contracting officer if qualified Indians are not available for any job opening. A separate waiver must be done for each position filled by any contractor in violation of this policy prior to filling the position. All waivers must be in writing signed by the contract officer.

13.112 Compliance and Penalties.

Contractors must comply with this Chapter within five working days after execution of the contract. Failure to do so may result in termination of the contract or other remedies which may include a penalty equal to the payroll wrongfully denied to Indian people.

13.113 Grievances.

Complaints by individual Indians or noncompliance will be arbitrated by a board established for the purpose by the Tribe. The contractor will represent himself at the hearing. Disputes between the Tribe and the contractor arising under this policy will be resolved as any other disputes arising under the contract are to be resolved.

13.114 Indian Preference in Contracting.

Indian preference will apply to all contracting by the Tribe. Eligibility for Indian preference in contracting will be determined on the basis of the HUD Indian Enterprise Qualification Statement.

SECTION IV: NATIVE PREFERENCE

4.1 "Indian Economic Enterprise" *means any business entity which is at least 51 percent owned by one or more members of a federally recognized Indian Tribe; and has one or more of the tribe members involved in the daily business management of the economic enterprise; and a majority of the earnings from said Economic Enterprise benefits said member or members.*

4.2 Eligibility/Certification. *The vendor claiming to be an Indian Economic Enterprise must have satisfied the requirements of eligibility/ certification. Certification of eligibility for native preference could include: Bureau of Indian Affairs Certification, Sault Ste. Marie Tribe of Chippewa Indians, Michigan Minority Business Development Council, Small Business Administration, and Certification of membership from another Tribe or Michigan Commission on Indian Affairs Certification. Certification shall be submitted with the bid response.*

4.3 Qualification Statement. *A prospective vendor seeking to qualify for preference shall evidence showing extent of Indian ownership and interest. Evidence of structure, management and financing affecting the Indian character of the enterprise, including major subcontractors and purchase agreements; materials or equipment supply arrangement; and management salary or profit–sharing arrangements; and evidence showing the effect of these on the extent of Indian ownership and interest. Evidence to demonstrate that the contractor has the technical, administrative, and financial capability to perform work of the size and type involved. The Indian Economic Enterprise must submit a letter as evidence of Indian ownership and control certifying that the enterprise will continue to meet requirements necessary to sustain Indian ownership and control throughout the period of service.*

SECTION 00 52 14

AGREEMENT FORM - AIA STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 SUMMARY

A. Document Includes:
   1. Agreement.
   2. General Conditions.

1.2 DOCUMENTS

A. Basis of Agreement between Owner and Contractor: **AIA Document A101 – 2017**, *Standard Form of Agreement between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum*.
   1. Exhibit A: Insurance and Bonds.

B. General Conditions of the Agreement: **AIA Document A201 – 2017** may be obtained by request.

END OF DOCUMENT

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contract description.
   2. Specification conventions.

1.2 CONTRACT DESCRIPTION

A. Work of the Project includes complete site development and building construction as described in the Advertisement for Bids.

B. Contracts will be awarded to a Single Prime Contractor.

1.3 OWNER OCCUPANCY

A. Owner intends to occupy the existing building during the construction.

B. Owner's use and occupancy of designated areas before Substantial Completion of the entire Project do not relieve Contractor of responsibility to maintain specified insurance coverages on a 100 percent basis until date of final payment.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.4 PERMITS

A. Furnish all necessary permits and approvals for construction of Work including associated fees.

1.5 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within phrases.

B. In these specifications, any reference to “Architect” or “Engineer” shall be interpreted to also include the Owner or all of the construction administrative duties.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 10 00

DRAFT

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Sault Ste. Marie Tribe of Chippewa Indians »« »
«523 Ashmun Street »
«Sault Ste. Marie, MI 49783»
«Telephone Number: (906) 635-6050
Fax Number: (906) 635-4969»

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«Sault Ste. Marie Tribe of Chippewa Indians»
«Escanaba Community Center Phase 2 Construction
Escanaba, MI »
«The project consists of approximately 9,720 sft wood framed construction for a new community center including commercial kitchen, community room, storage and office space. Construction includes concrete slab on grade (foundations and footings part of Phase 1 bid/awarded Fall 2022), architectural finishes (interior/exterior), plumbing system, HVAC, and electrical. Civil sitework (storm sewer and site preparation to gravel part of Phase 1 bid/awarded Fall 2022) including utilities (water, sewer, electrical), paving, concrete and restoration as shown on the drawings and presented at the walk-thru.»

The Architect:
(Name, legal status, address and other information)

«U.P. Engineers & Architects, Inc. »« »
«707 Ashmun Street »
«Sault Ste. Marie, MI 49783 »
«Telephone Number: (906) 635-0511
Fax Number: (906) 635-0612»

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

The Tribe is exempt from state taxation on this transaction, among other things. Contractor shall be responsible for all state and federal tax filing requirements, insurance and worker's compensation coverage and any other state or federal requirements pursuant to any tax, insurance of governmental program that may apply to an independent contractor, When required by law, the Tribe shall provide an IRS 1099 form to Contractor and the IRS at the proper time.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

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§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[«X»] By the following date: «October 31, 2023»

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

«$500.00 for each calendar day after the completion date.»

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

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« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the «1st » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «30th » day of the «same » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «Thirty » («30 ») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

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« 10% Retainage»

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

« »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

« » % « »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »

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« »
« »

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[»] Litigation in a court of competent jurisdiction

[« X »] Other *(Specify)*

«This Agreement shall be interpreted and construed in accordance with the laws of the Sault Ste. Marie Tribe of Chippewa Indians. If a proceeding or claim or pertaining to this Agreement, or any other aspect of Contractor's service with the Owner, whether such service preceded or follows the execution of this Agreement, is initiated by either party hereto, such proceeding or claim shall and must be filed in the Sault Ste. Marie Tribe of Chippewa Indians Tribal Court. Nothing in this Agreement shall constitute a waiver of sovereign immunity by the Tribe or any of its affiliates, or prevent the Tribe of any of its affiliates from asserting sovereign immunity as a complete defense to any cause of action Contractor may allege in any federal, State or Tribal court or any other venue before which an action may be pending. Contractor explicitly accepts the jurisdiction of the Sault Ste. Marie Tribe of Chippewa Indians Tribal Court and recognizes that by entering into this Agreement Contractor is subject to the personal and subject matter jurisdiction of the Sault Ste. Marie Tribe of Chippewa Indians Tribal Court. »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

«Sault Ste. Marie Tribe of Chippewa Indians»
«2186 Shunk Road »
«Sault Ste. Marie, MI 49783»
« »
« »
« »

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User Notes: (909266291)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3

.4

« »

.5 Drawings

Number	Title	Date
See attached table of Contents		

.6 Specifications

Section	Title	Date	Pages
See attached table of contents			

.7 Addenda, if any:

Number	Date	Pages

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Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

«

»

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

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DRAFT

AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

«Sault Ste. Marie Tribe of Chippewa Indians, Escanaba Community Center Phase 2 Construction»
«Escanaba, MI»

THE OWNER:
(Name, legal status and address)

«Sault Ste. Marie Tribe of Chippewa Indians »« »
«523 Ashmun Street
Sault Ste. Marie, MI 49783
Telephone Number: (906) 635-6050
Fax Number: (906) 635-4969»

THE CONTRACTOR:
(Name, legal status and address)

«. »« »
« »

TABLE OF ARTICLES

A.1 GENERAL

A.2 OWNER'S INSURANCE

A.3 CONTRACTOR'S INSURANCE AND BONDS

A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

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§ A.2.2 Liability Insurance
The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.3 Required Property Insurance
§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures
If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

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§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[« »] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

« »

[« »] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

« »

[« »] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

« »

[« »] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

« »

[« »] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

« »

[« »] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

« »

[« »] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

« »

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

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(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[« »] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

« »

[« »] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than «One Million Dollars » ($ «1,000,000.00 ») each occurrence, «Two Million Dollars » ($ « 2,000,000.00 ») general aggregate, and « Two Million Dollars » ($ «2,000,000.00 ») aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;

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.2 personal injury and advertising injury;
.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
.3 Claims for bodily injury other than to employees of the insured.
.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
.8 Claims related to roofing, if the Work involves roofing.
.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
.10 Claims related to earth subsidence or movement, where the Work involves such hazards.
.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than «One Million Dollars» ($ «1,000,000.00 ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than «One Million Dollars » ($ «1,000,000.00 ») each accident, «One Million Dollars » ($ «1,000,000.00 ») each employee, and «One Million Dollars » ($ «1,000,000.00 ») policy limit. As required by law.

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

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(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

« INSURANCE REQUIREMENTS

The OWNER requires a 5% Bid Bond, 100% Payment and a 100% Performance Bond

A. Insurance Requirements: The following insurance requirements must be submitted to Sault Tribe prior to commencement of any work on the Minimum Scope of Insurance Coverage
Coverage shall include:
1. Commercial General Liability Insurance; to include Contractual Liability coverage.
2. Workers Compensation and Employer's Liability Insurance.
3. Professional Liability Insurance.
4. Automobile Liability Insurance.
5. Cyber Liability is needed if there is storage and transmittal of sensitive data.

B. Minimum Limits of Insurance
Contractor shall maintain limits no less than:
1. General Liability: $1,000,000.00 per occurrence for bodily injury, personal injury and property damage; at least $2,000,000.00 in the aggregate.
2. Worker's Compensation statutory limits and Employer's Liability: $1,000,000.00 per accident for bodily injury or disease.
3. Professional Liability: $1,000,000.00 per occurrence.
4. Automobile Liability: Must meet State of Michigan minimum requirements.

C. Deductibles and Self-Insured Retentions
Any deductibles or self-insured retentions must be declared to and approved by the Tribe.

D. Other Insurance Provisions
The general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:
1. The Sault Tribe, 523 Ashmun, Sault Ste. Marie, MI 49783, its agents, officers, officials, employees and volunteers are to be named as additional insured's with respect to liability arising out of automobiles owned, leased, hired or borrowed by or on behalf of the contractor; and with respect to liability arising out of work or operations performed by or on behalf of the contractor including materials, parts or equipment furnished in connection with such work or operations. General liability coverage can be provided in the form of an endorsement to the contractor's insurance, or as a separate owner's policy.
2. For any claims related to this project, the contractor's insurance coverage shall be primary insurance as respects the Tribe, its agents, officers, officials, employees and volunteers. Any insurance or self-insurance maintained by the Tribe, its agents, officers, officials, employees or volunteers shall be excess of the contractor's insurance and shall not contribute with it.
3. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be cancelled or reduced by either party or modified in any way, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the Tribe.

E. Waiver of Subrogation
The Workers' Compensation and General Liability policies are to be endorsed with a waiver of subrogation. The insurance company, in its endorsement, agrees to waive all rights of subrogation against the Tribe, its agents, officers, officials, employees and volunteers for losses paid under the terms of the policy which arises from the work performed by the named insured for the Tribe.

F. Acceptability of Insurers
Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII.

G. Verification of Coverage
Contractor shall furnish the Tribe with original certificates and amendatory endorsements effecting coverage required by this clause. All certificates and endorsements are to be received and approved by the Tribe before work commences. The Tribe reserves the right to require complete, certified copies of all required insurance policies, including endorsements affecting the coverage required by these specifications at any time. »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

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(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[« »] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

[« »]

[« »] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[« »] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[« »] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	100%
Performance Bond	100%

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:« »

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Sault Ste. Marie Tribe of Chippewa Indians
Escanaba Community Center Phase 2 Construction
Escanaba, MI

THE OWNER:
(Name, legal status and address)

Sault Ste. Marie Tribe of Chippewa Indians
523 Ashmun Street
Sault Ste. Marie, MI 49783
Telephone Number: (906) 635-6050
Fax Number: (906) 635-4969

THE ARCHITECT:
(Name, legal status and address)

U.P. Engineers & Architects, Inc.
707 Ashmun Street
Sault Ste. Marie, MI 49783
Telephone Number: (906) 635-0511
Fax Number: (906) 635-4969

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

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§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

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delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

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specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, 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 the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

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§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

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§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

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§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

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.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

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promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

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or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

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approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

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§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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PAGE 1

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PAGE 2

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_____

(Signed)

_____

(Title)

_____

(Dated)

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SECTION 03100

CONCRETE FORMS AND ACCESSORIES

1 GENERAL

1.1 SUMMARY

A. Section includes formwork for cast-in place concrete, with shoring, bracing, and anchorage; openings for other work; form accessories; and form stripping.

B. Products Installed But Not Furnished Under This Section:

1. Section 03300 - Cast-in-Place Concrete: Supply of concrete accessories for placement by this Section.
2. Section 04820 – Reinforced Masonry Assemblies: Supply of masonry accessories for placement by this Section.
3. Section 05120 – Structural Steel: Supply of metal fabrications for placement by this Section.

C. Related Sections:
1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 04820 – Reinforced Unit Masonry Assemblies.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Formwork (Vertical Structures):
1. Basis of Measurement: By the square foot.
2. Basis of Payment: Includes form materials, placement, placing accessories, stripping.

B. Formwork (Horizontal Supported Structures):
1. Basis of Measurement: By the square foot.
2. Basis of Payment: Includes form materials, placement, placing accessories, stripping.

C. Formwork (All Structures):
1. Basis of measurement and payment shall be included in the cost of cast-in-place concrete installation.

1.3 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. American Society for Testing and Materials:
   1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

E. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.4 DESIGN REQUIREMENTS

A. The contractor shall assume responsibility, design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

B. The contractor shall assume responsibility for the safety of structures, occupants, and workers during construction.

1.5 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit formwork and shoring shop drawings.
   2. Indicate the following:
      a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
      b. Means of leakage prevention for concrete exposed to view in finished construction.
      c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
      d. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
      e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.

C. Product Data: Submit data on void form materials and installation requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347.

B. For wood products furnished for work of this Section, comply with applicable provisions of AF&PA National Design Specifications for Wood Construction.

1.1 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Products storage and handling requirements.

B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.2 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: Unless specified otherwise, the contractor shall use metal, plywood, presswood form liners or plastic surfaced plywood.

B. Build all forms using the largest pieces possible. All form joints shall be laid out having straight lines.

C. Plywood: Plywood shall be sound undamaged sheets with clean, true edges.

D. Lumber Forms:
1. Application: Use for edge forms and unexposed finish concrete.
2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

E. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS-1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA “B-B Plyform Structural I Exterior” grade.
4. Plywood where “Smooth Finish” is required, as indicated on Drawings: “HD Overlay Plyform Structural I Exterior” grade, minimum of space 3/4 inch thick.

2.2 PREFABRICATED FORMS

A. Manufacturers:
1. Aluma-Systems Inc., Burke Co.
2. Economy Forms Corp.
3. Molded Fiber Glass Concrete Forms Co.
4. Perma Tubes.
5. Sonoco Products Co.
6. Symons Corp.
7. Western Forms, Inc.
8. Other products submitted and approved by Engineer/Architect.
9. Substitutions: Section 01600 - Product Requirements.

B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Pan Type: Steel of size and profile required.

E. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes required; manufactured by Sonotube or equal.

F. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use shown on Drawings.

G. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise shown on Drawings.

H. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable Snap-off type, galvanized metal, fixed or adjustable length, cone type, with waterproofing washer, free of defects capable of leaving holes larger than one (1) inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within one (1) inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
1. “Arcal-80”; Arcal Chemical Corporation.
2. “Synthex”; Industrial Synthetics Company.
3. “Nox-Crete Form Coating”; Nox-Crete Company.
4. Substitutions: Section 01600 - Product Requirements.
5. Other products submitted and approved by Engineer/Architect.

E. Corners: Chamfer, type; 3/4"x3/4" inch with 45 degree angle cut.

F. Flashing Reglets: Galvanized steel 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Vapor Retarder: Where shown on Drawings, 6 mil thick polyethylene sheet.

H. Bituminous Joint Filler: ASTM D1751.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

J. Joints at intersections and at ends of pieces shall be made to develop effective watertightness fully equal to that of the continuous water stop material.

2.4 COATINGS

A. Coatings for Aluminum:
1. Conlux:
   a. Primer: Bond Plex 46 or 66 (water-borne urethane).
   b. Top Coat: Epolon Multi-Mil 39 (epoxy polyamide).
2. Sherwin Williams: Topcoat of Heavy Duty Epoxy B67-B60B3 (epoxy polyamide). Note: Self-priming.
3. Benjamin Moore:
   a. Primer: Epoxy Rust-Inhibitive Primer (epoxy polyamide).
   b. Top Coat: Epoxy Enamel (epoxy polyamide).

3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted unless approved by Engineer.

B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 PREPARATION

A. Compact soil to requirements prior to placing forms.

3.4 INSTALLATION

A. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

B. Forms for “Smooth Finish” Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

C. Framing, Studding and Bracing:

1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of two (2) inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

F. Obtain Architect/Engineer's approval before framing openings in structural members that are not indicated on Drawings.

G. Install chamfer strips on external corners of beams, joists, columns, and slabs.

H. Thoroughly clean, patch and repair wood formwork before reusing. Replace any rejected form materials with an acceptable material.

3.5 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.6 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

G. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

H. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

I. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

J. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318, Section 6.3.

K. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where shown on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

L. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

M. Screed Supports:
1. For concrete over waterproof membranes and vapor barrier membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not be permitted.

N. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

Q. Keyways:
1. Keyways shall be a minimum 2" deep by 1/3 the thickness of the pour unless shown otherwise on the drawings.

3.7 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and inspection services.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

3.8 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.10 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

1 GENERAL

1.1 SUMMARY

A. Section includes reinforcing steel bars, welded wire fabric and accessories for cast-in-place concrete.

B. Related Sections:
1. Section 03100 - Concrete Forms and Accessories.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 03350 - Concrete Finishing: Reinforcement for concrete floor toppings.
4. Section 04820 - Reinforced Unit Masonry Assemblies: Reinforcement for masonry.

C. Concrete Reinforcement shall be included in the cost of cast-in-place concrete.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Bar Reinforcement:
1. Basis of Measurement: By the ton.
2. Basis of Payment: Includes reinforcement, placement, and accessories.

B. Welded Wire Fabric Reinforcement:
1. Basis of Measurement: By the square foot.
2. Basis of Payment: Includes welded wire reinforcement, placement, and accessories.

1.3 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 318M - Metric Building Code Requirements for Structural Concrete.
4. ACI SP-66 - ACI Detailing Manual.

B. American Society for Testing and Materials:
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

5. ASTM A616/A616M - Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
6. ASTM A617/A617M - Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
7. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
8. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
9. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
10. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
11. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
12. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
13. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
14. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:
1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Submit certified copies of mill test report of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

A. Comply with pertinent provisions of the following, ACI 318 “Building Code Requirements for Reinforced Concrete” and CRSI “Manual of Standard Practice”.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Delivery and Storage:
1. Use necessary precautions to maintain identification after bundles are broken.
2. Store in a manner to prevent excessive rusting and folding with dirt, grease, and other bond-breaking coatings.

1.6 QUALIFICATIONS

A. Welders' Certificates: Submit under provisions of Section 01400 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within previous 12 months.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with placement of formwork, formed openings and other Work.

2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed and plain billet steel bars, unfinished.

B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A615, Grade 60; steel bars or rods, unfinished.

C. Stirrups Steel: ASTM A82, unfinished, [epoxy coated in accordance with ASTM A884/A884M finish].

D. Welded Steel Wire Fabric: ASTM A497 Deformed Type; in flat sheets or coiled rolls; unfinished shall be 10 ga. minimum.

E. Welded Steel Wire Fabric: ASTM A185, Plain wire in rolls or flat sheets, unfinished, 10 ga. minimum.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage, comply with ASTM A82.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel type; size and shape as required for Project conditions.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice.

B. Locate reinforcement splices not indicated drawings, at point of minimum stress. Submit location of splices with Architect/Engineer.

3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. General:

1. Comply with the specified standards for detail and method of placing reinforcement and supports, except as may be modified herein.
2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce of destroy bond with concrete.
3. Position, support and secure reinforcement against displacement by formwork, construction and concrete placing operations.
4. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as required.

E. Conform to ACI 318 code for concrete cover over reinforcement.

3.2 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and Inspection Services, 01700 - Execution Requirements: Testing, adjusting, and balancing.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete footings, foundation walls, floors and slabs on grade; control, expansion and contraction joint devices associated with concrete work, including joint sealants, equipment pads, light pole base, flagpole base, and miscellaneous concrete devices.

B. Related Sections:
1. Section 03100 - Concrete Forms and Accessories: Formwork and accessories.
2. Section 03200 - Concrete Reinforcement.
3. Section 03350 - Concrete Finishing.
4. Section 03390 - Concrete Curing.

C. Products Furnished But Not Installed Under This Section

1. Section 03100 - Concrete Forms and Accessories: Placement of joint device and anchors in formwork.
2. Section 03200 - Concrete Reinforcement.

1.1 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 305 - Hot Weather Concreting.
3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
4. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials:
1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
5. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
6. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
7. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
8. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
9. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

10. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
11. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
12. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type.
13. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
14. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories, admixtures and concrete mix design.

C. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

D. Submit concrete cylinder testing results.

1.3 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Acquire cement and aggregate from one source for Work.

C. Conform to ACI 305 when concreting during hot weather.

D. Conform to ACI 306.1 when concreting during cold weather.

E. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

1.5 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal, Type IA - Air Entraining, [Type III - High Early Strength] Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete. Water shall be free from injurious amounts of oils, acids, alkalies, organic materials, or other deleterious substances.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494 Type A - Water Reducing.

C. Fly Ash: ASTM C618, Fly Ash is not permitted unless approved by Engineer.

D. Plasticizing: ASTM C1017, Plasticizer is not permitted unless approved by Engineer.

2.3 ACCESSORIES

A. Vapor Retarder: 6 mil thick clear polyethylene film, fabric reinforced plastic film, type recommended for below grade application.

B. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

C. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength -130 ksi; toughness- 15 ksi; 3/4 inch long fibers, 34 million/lb fiber count.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile.

B. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

C. Joint Filler Type C: ASTM D1752; Premolded sponge rubber fully compressible with recovery rate of minimum 95 percent.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94.

B. Provide concrete to the following mix design:

Unit	Measurement
Compressive Strength (7 day)	2400 psi
Compressive Strength (28 day)	3500 psi
Cement	517 pounds
Coarse Aggregate	1700-1900 pounds
Fine Aggregate	1400-1600 pounds
Water/Cement Ratio	0.4 - 0.48
Coarse Aggregate Size	MDOT 6A
Fine Aggregate Size	MDOT 2NS
Air Entrained	4-6%
Fly Ash	80-120 pounds*
Slump	Less than 4"

* - Must be Approved by Engineer

C. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

D. The use of calcium chloride will not be permitted.

E. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

F. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

2.6 OTHER MATERIALS

A. Insulation

1. Provide 2 inches of extruded polystyrene insulation under slabs on grade and at foundation walls as indicated on plans.

3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

D. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.

D. Install vapor retarder under interior slabs on grade. Lap joints minimum six (6) inches and seal watertight by sealant applied between overlapping edges and ends.

E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum six (6) inches and seal watertight.

F. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

G. Prepare subgrade with six (6) inch minimum MDOT Class II granular fill compacted to a minimum of 95% of the maximum density.

H. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.

I. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

K. Apply sealants in joint devices in accordance with Section 07900.

L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Do not interrupt successive placement; do not permit cold joints to occur.

O. Place floor slabs in saw cut pattern indicated.

P. Saw cut joints within 24 hours after placing. Use 1/4 inch thick blade, cut into 1/4 depth of slab thickness. Fill joints with joint sealer.

Q. Screed floors and slabs on grade level, maintaining surface flatness per Section 03350.

R. Coordinate the various trades who are required to fasten work to the structure, or are required to insert therein any sleeve, box, bolt, anchor insert or other items.

S. Provide in the forms for all sleeves, boxes, bolts, anchors, inserts, and other items required for the Work and which are shown or required for the Work and which are shown or required to be embedded in the concrete.

T. Conduits and sleeves
1. Locate so as not to reduce the strength of construction. Do not place pipes, except conduits, in a slab of less than 3-1/2" thickness.
2. In supported concrete slabs do not bury conduit having an outside diameter greater than 33% of the thickness of the slab. Increase thickness of slab locally to meet their requirement as necessary.
3. In placing conduits at slabs on earth, place below the reinforcement, and encase in concrete by increasing thickness of the slab locally to provide a minimum of 3" of concrete around all sides of conduit or sleeve.

3.4 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

3.5 CONCRETE FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and Section 03350.

B. Completely compact concrete with tampering poles and by tapping forms until thorough compaction is achieved. Determine number of tampers required by the amount and method of placement.

C. Mechanical vibrators may be used with the following precautions.
1. Exercise care to insure quick handling of vibrator from one position to another.
2. Do not over vibrate concrete.
3. Do not use vibrator to move concrete.

I. Top concrete placing only when and where by the Engineer.

3.6 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 301.

D. Spraying: Spray water over floor slab areas and maintain wet for seven (7) days.

3.7 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and Inspection Services.

B. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01400.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work.

E. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

F. Three concrete test cylinders will be taken for every 20 cu yds, of each class of concrete placed.

G. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

H. One slump test will be taken for each set of test cylinders taken.

I. One air content test will be made for each set of test cylinders taken.

3.8 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C. Patch imperfections as directed by Architect/Engineer in accordance with ACI 301.

3.9 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

D. The following concrete will be deemed to be defective and shall be removed promptly from the job site.
   1. Concrete that is not formed as indicated, is not plumb, level and to intended grades.
   2. Concrete with sawdust, wood shavings or embedded debris.
   3. Concrete that does not conform fully to the provisions of the contract documents.

END OF SECTION

SECTION 033500

CONCRETE FINISHING

1 GENERAL

1.1 SUMMARY

A. Section includes finishing slabs-on-grade, monolithic floor slab, and separate floor toppings; and surface treatment with concrete hardener, sealer, and slip resistant coatings.

B. Related Sections:
1. Section 03300 - Cast-in-Place Concrete.
2. Section 03390 - Concrete Curing.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. American Society for Testing and Materials:
1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on sealer and curing compounds, compatibilities, and limitations.

C. Submit floor flatness testing report.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Deliver materials in manufacturer's packaging including application instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Do not finish floors until interior heating system is operational, if required.

C. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.

D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.8 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with concrete floor placement and concrete floor curing.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Dayton Superior Corp.
2. Euclid Chemical Co.
3. Sika Corp.
4. Substitutions: Section 016000 - Product Requirements.

2.2 COMPOUNDS - HARDENERS AND SEALERS

A. Sealer: Direct Color EasyTint or equivalent.
1. Color determined by owner.
2. Apply per manufacturer’s recommendations.

3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify floor surfaces are acceptable to receive the Work of this section.

3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set quarry tile, and thin set ceramic tile.

C. Steel trowel surfaces which are scheduled to be exposed.

D. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

E. Provide a light broom finish on exterior slabs and sidewalks after steel troweling. Interior slabs shall be troweled smooths with no broom finish.

3.3 FLOOR SURFACE TREATMENT

A. Apply sealer as scheduled on floor surfaces.
B. Grind, polish, apply densifier and sealer where colored concrete floors are called for on the plans.

3.4 TOLERANCES

A. Contractor's tester shall measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

B. Section 014000 - Quality Requirements: Tolerances.

C. Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch in 10 ft.

D. Maximum Variation of Surface Flatness Under Seamless Resilient Flooring: 1/8 inch in 10 ft.

E. Maximum Variation of Surface Flatness Under Carpeting: 1/8 inch in 10 ft.

F. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

SECTION 03350

CONCRETE FINISHING

1 GENERAL

1.1 SUMMARY

A. Section includes finishing slabs-on-grade, monolithic floor slab, and separate floor toppings; and surface treatment with concrete hardener, sealer, and slip resistant coatings.

B. Related Sections:
1. Section 03300 - Cast-in-Place Concrete.
2. Section 03390 - Concrete Curing.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. American Society for Testing and Materials:
1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on sealer and curing compounds, compatibilities, and limitations.

C. Submit floor flatness testing report.

1.4 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Deliver materials in manufacturer's packaging including application instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not finish floors until interior heating system is operational, if required.

C. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.

D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.8 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with concrete floor placement and concrete floor curing.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Dayton Superior Corp.
2. Euclid Chemical Co.
3. Sika Corp.
4. Substitutions: Section 01600 - Product Requirements.

2.2 COMPOUNDS - HARDENERS AND SEALERS

A. Sealer: Clear silane type on all slabs.

3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify floor surfaces are acceptable to receive the Work of this section.

3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set quarry tile, and thin set ceramic tile.

C. Steel trowel surfaces which are scheduled to be exposed.

D. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

E. Provide a light broom finish on exterior slabs and sidewalks after steel troweling. Interior slabs shall be troweled smooths with no broom finish.

3.3 FLOOR SURFACE TREATMENT

A. Apply sealer as scheduled on floor surfaces.

3.4 TOLERANCES

A. Contractor's tester shall measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

B. Section 01400 - Quality Requirements: Tolerances.

C. Maximum Variation of Surface Flatness For Exposed Concrete Floors: 1/8 inch in 10 ft.

D. Maximum Variation of Surface Flatness Under Seamless Resilient Flooring: 1/8 inch in 10 ft.

E. Maximum Variation of Surface Flatness Under Carpeting: 1/8 inch in 10 ft.

F. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural wall and roof framing.
2. Wall and roof sheathing.
3. Sill gaskets and flashings.
4. Preservative treatment of wood.
5. Miscellaneous framing and sheathing.
6. Telephone and electrical panel back boards.

B. Related Requirements:
1. Section 06 17 53: Shop-Fabricated Wood Trusses.
2. Section 07 53 03: Elastomeric Membrane Roofing-Fully Adhered.

1.2 REFERENCE STANDARDS

A. American Wood Protection Association:

1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
2. AWPA U1 - Use Category System: User Specification for Treated Wood.

B. APA - The Engineered Wood Association:

1. APA - Plywood Design Specification, including supplements.
2. APA PS 1 - Voluntary Product Standard - Structural Plywood.

C. ASTM International:

1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
3. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
4. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
6. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

D. California Department of Health Care Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

E. Forest Stewardship Council:

1. FSC Guidelines.

F. Green Seal:

1. GS-36 - Green Seal Standard for Adhesives for Commercial Use.

G. National Lumber Grades Authority:

1. NLGA - Standard Grading Rules for Canadian Lumber.

H. Northeastern Lumber Manufacturers Association:

1. NELMA - Standard Grading Rules for Northeastern Lumber.

I. South Coast Air Quality Management District:

1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

J. Southern Pine Inspection Bureau:

1. SPIB - Standard Grading Rules for Southern Pine Lumber.

K. U.S. Department of Commerce National Institute of Standards and Technology:

1. DOC PS 1 - Structural Plywood.
2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20 - American Softwood Lumber Standard.

L. West Coast Lumber Inspection Bureau:

1. WCLIB Standard 17 - Grading Rules for West Coast Lumber.

M. Western Wood Products Association:

1. WWPA - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 013300 – Submittals Requirements. Requirements for submittals.

B. Product Data:
1. Submit grades for wood framing.
2. Submit cut sheets on GRK and other structural fasteners.

1.4 QUALITY ASSURANCE

A. Perform Work according to:

1. Lumber Grading Agency: Certified by NIST PS 20.
2. Wood Structural Panel Grading Agency: Certified by APA - The Engineered Wood Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 – Product Requirements: Requirements for delivery, storage and handling.

B. Protection:

1. Protect trusses from warping or other distortion by stacking in vertical position and bracing to resist movement.
2. Provide additional protection according to manufacturer instructions.
3. Protect wood from weather until installed (do not leave lumber stacks exposed to weather)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Lumber Grading Rules: Comply with APA NELMA RIS SPIB WCLIB WWPA.
2. Provide framing as follows unless stricter provisions required in the PLANS.
3. Beam and Lintel Framing:

    a. Stress Group: A.
    b. Species: Douglas Fir Larch (CF). Southern Pine or Hem Fir.
    c. Grade: No. 1 or 2.
    d. Maximum Moisture Content: 19 percent.

4. Joist Framing:

    a. Stress Group: D.
    b. Species: Spruce, Pine, Fir (SPF).
    c. Grade: No. 2.
    d. Maximum Moisture Content: 19 percent.

5. Non-structural Light Framing:

    a. Stress Group: D.
    b. Species: Spruce, Pine, Fir.
    c. Grade: No 2.
    d. Maximum Moisture Content: 19 percent.

6. Studding:

    a. Stress Group: D.
    b. Species: Spruce, Pine, Fir (SPF).
    c. Grade: No. 2.
    d. Maximum Moisture Content: 19 percent.

7. Miscellaneous Framing:

    a. Stress Group: D.
    b. Species: Spruce, Pine, Fir (SPF).
    c. Maximum Moisture Content: 19 percent.

B. Sheathing:

1. Wood Structural Panel Roof Sheathing:

    a. Description: APA Structural I, oriented strand board (OSB).
    b. Span Rating: 24/16.
    c. Exposure Durability: Exterior.
    d. Facing: Unsanded.

2. Wood Structural Panel Wall Sheathing:

    a. Description: APA-rated.
    b. Material: Structural I, oriented strand board (OSB).
    c. Span Rating: 24/16.
    d. Exposure Durability: Exterior.
    e. Facing: Unsanded.

3. Telephone and Electrical Panel Boards: APA plywood per code, ¾" minimum.

2.2 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA U1, commodity specification A-sawn products for F-wood composites using waterborne ACQ preservative.

B. Moisture Content after Treatment:
1. Lumber: Maximum 19 percent.
2. Structural Panels: Maximum 15 percent.

2.3 ACCESSORIES

A. Fasteners and Anchors:

1. Fasteners:

    a. Exterior, High-Humidity and Treated Wood Locations: ASTM A153, hot-dip galvanized steel.
    b. Elsewhere: Unfinished steel.

2. Nails and Staples: Comply with ASTM F1667.
3. Drywall Screws:

    a. Description: Bugle head, hardened steel, power-driven.
    b. Length: Three times thickness of sheathing.

4. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Die-Stamped Connectors:

1. Material: Hot-dipped galvanized steel.
2. Thickness: 1/8 inch.

C. Structural Framing Connectors:

1. Material: Hot-dipped galvanized steel.
2. Size: To suit framing conditions.
3. Manufactured by Simpson or equal

D. Sill Gasket on Top of Foundation Wall:

1. Material: Closed-cell polyethylene foam from continuous rolls.
2. Thickness: 1/4 inch.
3. Width: Plate width.

PART 3 - EXECUTION

3.1 APPLICATION

A. Framing:

1. Select individual pieces such that knots and defects will not interfere with placement of bolts when nailing or making connections.
2. Discard defective pieces.
3. Set structural members level, plumb, and in correct position.
4. Fasten framing according to applicable code.
5. Make provisions for erection loads and for sufficient temporary bracing to maintain that structure is safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
6. Place horizontal members crown side up.
7. Construct load-bearing framing members full length without splices.
8. Openings:

    a. Double members at openings over 24 wide.
    b. Space short studs over and under opening to stud spacing.

9. Sill Gaskets:

    a. Place directly on cementitious foundation.
    b. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

10. Roof Curbs:

    a. Curb roof openings except where prefabricated curbs are provided.
    b. Form corners by alternating lapping side members.

11. Provide pressure treated lumber where called for on the plans, all exterior/exposed locations and wall plates attached to masonry or concrete.

B. Sheathing:
1. Secure roof sheathing with longer edge (strength axis) perpendicular to framing members, with ends staggered and sheet ends over bearing.
2. Use sheathing clips between sheets between roof framing members.
3. Place building paper horizontally over wall sheathing and weather-lap edges and ends.
4. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.
5. Do not use untreated plywood or OSB within 8 inches of exterior grade. Install pressure treated plywood in minimum 2 foot tall panels at such locations.

C. Site-Applied Wood Treatment:

1. Brush-apply two coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings.
2. Allow preservative to dry prior to erecting members.

3.2 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Other Framing Members: Maximum 1/4 inch from indicated position.

END OF SECTION 061000

SECTION 061300

HEAVY TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heavy structural timber for posts, beams and joists.
2. Connection hardware.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Placement of steel support fabrications to be cast in concrete.

1.2 REFERENCE STANDARDS

A. American Institute of Timber Construction:

1. AITC 108 - Standard for Heavy Timber Construction.

B. ASTM International:

1. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. American Wood Protection Association:

1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
2. AWPA U1 - User Specification for Treated Wood.

E. Forest Stewardship Council:

1. FSC Guidelines.

F. Southern Pine Inspection Bureau:

1. SPIB - Standard Grading Rules for Southern Pine Lumber.

G. U.S. Department of Commerce National Institute of Standards and Technology:

1. DOC PS 20 - American Softwood Lumber Standard.

H. West Coast Lumber Inspection Bureau:

1. WCLIB Standard 17 - Grading Rules for West Coast Lumber.

I. Western Wood Products Association:

1. WWPA - Western Lumber Grading Rules.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with Work of other Sections.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit manufacturer information on proprietary connection devices.
2. Submit technical data on wood preservative materials.

C. Shop Drawings: None.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Lumber Grading Agency: Certified under NIST PS 20.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section and certified by AITC, with minimum three years' experience.

PART 2 - PRODUCTS

2.1 HEAVY TIMBER FRAMING

A. Lumber Grading Rules: Comply with AP&PA RIS. SPIB. WCLIB. WWPA G-5.

B. Lumber:
   1. Species: Red Cedar
   2. Maximum Moisture Content: 19% percent.
   3. Smooth finish

2.2 FABRICATION

A. Fabricate components in accordance with AITC 108, with joints neatly fitted, welded and ground smooth. Account for shrinkage of timber in design and arrangement of fasteners for connections.

2.3 FINISHES

A. Timber Surfaces Exposed to View: Smooth.

B. Galvanizing:

   1. Comply with ASTM A123.
   2. Hot-dip galvanize after fabrication.

2.4 WOOD TREATMENT

A. Stain/finish per plans/specifications. Color by Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for erection preparation.

B. Make provisions for erection loads and for sufficient temporary bracing such that structure is safe, plumb, and in indicated alignment until completion of erection and installation of permanent bracing.

3.2 ERECTION

A. Set structural timber framing level, plumb, and in correct position.

B. Install structural timbers with minimum 1/2 inch clearance for air circulation around timbers set into concrete or masonry.

C. Do not field-cut or alter structural members without approval of Architect/Engineer.

D. After erection, touch up primed and galvanized surfaces with primer consistent with shop coat or zinc primer.

3.3 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

END OF SECTION 061300

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Shop-fabricated wood trusses for:
      a. Roof framing.
      b. Bridging, bracing, and anchorage.

B. Related Requirements:
   1. Section 06 10 00 - Rough Carpentry: Framing of openings between trusses.
   2. Section 07 53 03 – Elastomeric Membrane Roofing – Fully Adhered.

1.2 REFERENCE STANDARDS

A. American Wood Protection Association:
   1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
   2. AWPA U1 - Use Category System: User Specification for Treated Wood.

B. APA - The Engineered Wood Association:
   1. APA/EWA Plywood Design Specification.

C. ASTM International:
   1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   3. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   4. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   7. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

D. California Department of Public Health:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers (includes Addendum 2004).

E. Forest Stewardship Council:
   1. FSC Guidelines.
   2. RIS - Standard Specifications for Grades of California Redwood Lumber.

F. Southern Pine Inspection Bureau:
   1. SPIB - Standard Grading Rules for Southern Pine Lumber.

G. Truss Plate Institute:
   1. TPI - Building Component Safety Information (BCSI): Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses.
   2. TPI DSB - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses.
   3. TPI 1 - National Design Standard for Metal Plate Connected Wood Truss Construction.

H. U.S. Department of Commerce - National Institute of Standards and Technology:
   1. Voluntary Product Standard PS 1 - Structural Plywood.
   2. Voluntary Product Standard PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. Voluntary Product Standard PS 20 - American Softwood Lumber Standard.

I. West Coast Lumber Inspection Bureau:
   1. WCLIB Standard 17 - Grading Rules for West Coast Lumber.

J. Western Wood Products Association:
   1. WWPA G-5 - Western Lumber Grading Rules.

1.3 COORDINATION

A. Section 013000 – Administrative Requirements: Requirements for coordination.

B. Coordinate placement of sheathing with Work of this Section.

1.4 SUBMITTALS

A. Section 013000 – Submittals Requirements: Requirements for submittals.

B. Product Data: Submit truss plate connections, bearing plates, anchor connections, wind uplift connections, and bridging and bracing.

C. Shop Drawings: Indicate truss sizes, dimensions, spacing of trusses, associated components, uplift connectors, web and chord sizes, plate sizes, fastener descriptions and spacings, loads and truss cambers, and framed openings.

D. Design Calculations: Indicate design loads, truss reactions, and member forces, deflections, and stresses.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for sizes, dimensions, spacing of trusses, associated components, uplift and truss to truss connectors, web and chord sizes, plate sizes, fastener descriptions and spacings, design loads, truss cambers, and framed openings.

F. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

1.5 QUALITY ASSURANCE

A. Perform Work as follows:
   1. Lumber Grading: Certified by DOC PS 20.
   2. Plywood Grading Agency: Certified by APA/EWA.
   3. Lumber: Comply with DOC PS 20.
   4. Wood Structural Panels: DOC PS 1 or DOC PS 2.

B. Truss Design, Fabrication, and Installation: Comply with TPI BSCI, TPI DSB, and TPI 1.

1.6 QUALIFICATIONS

A. Manufacturer/Fabricator: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Erector: Company specializing in performing Work of this Section with minimum three years' experience.

C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Michigan.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 – Product Requirements: Requirements for delivery, storage, and handling.

B. Inspection: Accept materials on Site and inspect for damage.

C. Storage:
   1. Do not lay trusses flat.
   2. Store truss depth in vertical position resting on intermittent bearing pads.
   3. Protect trusses from inclement weather.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Design trusses for loads shown on plans. Limit deflections to L/360 of span.

2.2 MATERIALS

A. Lumber Grading Rules: Comply with NFPA SPIB WCLIB WWPA G-5.

B. Wood Members:
   1. As required for design.
   2. Moisture Content:
      a. Maximum: 19 percent.
      b. Minimum: 7 percent.
      c. Finger scarfing not permitted.

C. Steel Plate Connectors:
   1. Comply with TPI 1, Section 6.
   2. Thickness: as required.
   3. Die stamped with integral teeth.
   4. Finish: Hot dip galvanized.

D. Truss Bridging: Type, size, and spacing as recommended by truss manufacturer/fabricator.

2.3 FABRICATION

A. Fabricate trusses to achieve specified structural requirements.

B. Fabricate bottom and top chord extensions as indicated on Drawings.

C. Fabricate to achieve minimum end bearing of 7-1/4". Provide heel blocks or bearing enhancers as required to meet 425 psi wall plate bearing capacity.

2.4 WOOD TREATMENT

A. Moisture Content:
   1. Kiln dried (KDAT).
   2. Lumber: Maximum 19 percent after treatment.
   3. Structural Panels: Maximum 15 percent after treatment.

2.5 ACCESSORIES

A. Wood Blocking:
   1. Softwood Lumber:
      a. S/P/F species.
      b. Grade: No. 2.

   2. Moisture Content:
      a. Maximum: 19 percent.
      b. Minimum: 7 percent.

B. Fasteners and Anchors:
   1. Material:

a. High Humidity and Treated Wood Locations: ASTM A153, hot dipped galvanized steel.
b. Elsewhere: Unfinished steel.

2. Nails and Staples: Comply with ASTM F1667.
3. Anchors Type: Toggle bolt type for anchorage to hollow masonry.

C. Bearing Plates
1. Material:
a. Hot-dip galvanized steel.

2.6 SOURCE QUALITY CONTROL

A. Section 014000 – Quality Requirements.

B. Inspection: Inspect Work performed at manufacturer's/fabricator's facility to verify conformance to Contract Documents.

C. Owner Inspection:
1. Make completed trusses available for inspection at manufacturer's/fabricator's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

D. Certificate of Compliance:
1. If manufacturer/fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's/fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer/fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 – Administrative Requirements: Requirements for examination.

B. Verify that supports and openings are ready to receive trusses.

3.2 PREPARATION

A. Coordinate placement of bearing items.

3.3 ERECTION

A. Set members level, plumb, and in correct position.

B. Contractor shall be responsible for all temporary erection and stability bracing. Install bracing as required by the truss manufacturer and the SBCA.

C. Make provisions for erection loads and sufficient temporary bracing to maintain plumb and aligned structure until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. Place headers and supports to frame openings.

F. Frame openings between trusses with lumber as specified in Section 061000 - Rough Carpentry.

G. Install permanent truss bracing as required by the truss supplier, SBCA and the plans. Contractor shall install bottom chord bracing and permanent diagonal bracing at all locations of lateral bracing per the drawings.

H. Repair truss damage as directed by the Truss Manufacturer. Provide engineer sealed truss details for all required repairs.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for quality control.

B. Maximum Variation from Indicated Position:
   1. Framing Members: 1/2 inch.

END OF SECTION 06 17 53

SECTION 061800

GLUE-LAMINATED CONSTRUCTION

1 GENERAL

1.1 SUMMARY

A. Section includes glued laminated timber beams and columns; and steel hardware and attachment brackets.

B. Related Sections:
1. Section 06 10 00 – Rough Carpentry.

1.2 REFERENCES

A. American Institute of Timber Construction:
1. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species.
2. AITC A190.1 - Wood Products - Structural Glued Laminated Timber.

B. American Society for Testing and Materials:
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
5. ASTM D2559 - Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions.

C. American Wood-Preservers' Association:
1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
3. AWPA C28 - Standard for Preservative Treatment of Structural Glued Laminated Members and Lamination Before Gluing of Southern Pine, Coastal Douglas Fir, Hemfir and Western Hemlock by Pressure Processes.

1.1 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings.

C. Product Data: Submit technical data on wood preservative materials, application technique and resultant performance information.

1.2 QUALIFICATIONS

A. Manufacturer/Fabricator: Company specializing in manufacture of glue laminated structural units with three years experience, and certified by AITC and APA/EWS. in accordance with ANSI A190.1.

B. Erector: Company specializing in erection of this Work with three years experience.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Protect members to AITC or APA/EWS requirements for not wrapped materials.

C. Leave individual wrapping in place until finishing occurs.

2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:
1. Truss Joist MacMillan.
2. Boise Cascade.
3. Georgia Pacific.
4. Louisiana Pacific.
5. Substitutions: Section 01600 - Product Requirements.

B. Laminated Veneer Lumber (LVL): Design for the following values:
1. Bending (F_b): 2800 psi.
2. Compression Parallel to Grain (F_c): 3000 psi.
3. Compression Perpendicular to Grain Bottom (F_c): 900 psi.
4. Horizontal Shear (Fv): 285 psi.
5. Modulus of Elasticity (E): 2.0 psi.

C. Glue-Laminated Timbers: Laminated combinations shall meet the requirements of ANSI/AITC A190.1-1992 and shall provide the design values equal to or exceeded the following:
1. Bending (Fb): 2400 psi
2. Shear Parallel to Grain (Fv): 165 psi
3. Compression Parallel to Grain (Fc): 1600 psi
4. Compression Perpendicular to Grain Bottom (Fc): 650 psi
5. Compression Perpendicular to Grain Top (Fc): 650 psi
6. Architectural Grade Finish
7. Tension Parallel to Grain (Fc): 1100 psi

8. Modulus of Elasticity (E): 1.8E6 psi

D. Steel Connections and Brackets: ASTM A36 weldable quality, hot dip galvanized to 1.5 oz/sq ft to ASTM A123. Prime components except where cast in concrete.

E. Hardware: ASTM A325, structural quality steel, hot dip galvanized to 1.5 oz/sq ft to ASTM A123. Prime components except where cast in concrete.

F. Anchor Bolts: ASTM A307 steel; galvanized.

G. Wood Sealer at end cuts.

H. Bearing Plate Anchors: Lag bolt type for anchorage to hollow masonry, expansion shield and lag bolt type for anchorage to solid masonry or concrete, bolts or ballistic fasteners for anchorage to steel.

I. Fasteners: Hot dip galvanized steel to ASTM A123 for high humidity and treated wood locations.

2.2 FINISH

A. Stain and protective coating per plans/specifications. Color by owner.

2.3 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC or APA/EWS Industrial Architectural Premium grade.

B. Verify dimensions and site conditions prior to fabrication.

C. Cut and fit members accurately to length to achieve tight joint fit.

D. Camber: None.

E. Do not splice or join members in locations other than those indicated without permission.

F. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

G. After end trimming, seal with penetrating sealer in accordance with AITC or APA/EWS requirements.

H. Field Finishing of Members: Specified in Section 099000.

3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify supports are ready to receive units.

C. Verify sufficient end bearing area.

3.2 PREPARATION

A. Coordinate placement of bearing and support items.

3.3 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Install temporary bracing and anchorage to hold members in place until permanently secured.

D. Fit members together accurately without trimming, cutting, or other unauthorized modification.

E. Swab and seal interior wood surfaces of field drilled holes in members with primer.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Framing Members: 1/2 inch maximum from indicated position.

END OF SECTION

SECTION 062000 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior Finish Carpentry:
      a. Locker Room Benches

B. Related Requirements:
   1. Section 061000 - Rough Carpentry: Grounds and support framing.
   2. Section 09 90 00 - Painting and Coating: Painting and finishing of finish carpentry items.

1.2 REFERENCE STANDARDS

a. American National Standards Institute:
   1) ANSI A135.4 - Basic Hardboard.
   2) ANSI A156.9 - Cabinet Hardware.
   3) ANSI A208.1 - Mat-Formed Wood Particleboard.
b. APA-The Engineered Wood Association:
   1) APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
c. Architectural Woodwork Institute, Woodwork Institute, and Architectural Woodwork Manufacturers Association of Canada:
   1) AWS - Architectural Woodwork Standards.
   2) Supplemented with The WI Approach.
d. ASTM International:
   1) ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2) ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3) ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
   4) ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   5) ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
e. Forest Stewardship Council:
   1) FSC Guidelines - Forest Stewardship Council Guidelines.
f. Green Seal:
   1) GS-11- Product Specific Environmental Requirements.
   2) GS-36- Aerosol Adhesives.
g. Hardwood Plywood and Veneer Association:
   1) HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
h. National Electrical Manufacturers Association:
   1) NEMA LD 3 - High Pressure Decorative Laminates.

2) NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with installation of associated and adjacent components.

1.4 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

1.5 SUBMITTALS

A. Product Data: Submit data on:
1. Fire-retardant treatment materials and application instructions.
2. Preservative treatment materials and application instructions.
3. Plastic-finish carpentry products.
4. Attachment hardware and finish hardware.

B. Shop Drawings:
1. Indicate materials, component profiles, fastening methods, jointing details and accessories, to minimum scale of 1-1/2 in to 1 ft.

C. Samples:
1. Submit two samples of finish plywood, 8 x 10 inches in size, illustrating wood grain and specified finish.
2. Submit two samples of wood trim 10 in long.
3. Submit two samples of synthetic lumber, hardware items and shop finishes.

D. Qualification Statements:
1. Submit manufacturer and fabricator experience qualifications.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with AWI AWS.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience similar to this Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect work from moisture damage.

C. Maintain storage space relative humidity within ranges indicated in AWI AWS Section 2.

1.9 EXISTING CONDITIONS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WOOD BENCHES

A. Reference Section 06 10 00 Rough Carpentry.

B. Solid Softwood Lumber

2.2 WOOD TREATMENT

A. Wood Preservative Pressure Treatment: WDMA I.S.4

2.3 FABRICATION

A. Fabricate finish carpentry to AWI AWS Standards.

B. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

2.4 FINISHES

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed indentations.

C. Stain/seal finished wood product.

2.5 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: ASTM A153/A153M, hot dipped galvanized ASTM B695, Class 55 mechanically galvanized steel for high humidity and treated wood locations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify adequacy of backing and support framing.

C. Verify building items affecting work of this section are placed and ready to receive this work.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Prime paint surfaces of exterior wood items and assemblies.

3.3 INSTALLATION

a. Modify and extend existing finish carpentry installations using materials and methods as specified.
b. Install Work according to AWS Section 6 and Section 7 custom grade and manufacturer's instructions.
c. Set and secure materials and components in place, plumb and level.
d. Carefully scribe work abutting other components, with maximum gaps of 1/32 in. Do not use additional overlay trim to conceal larger gaps.
e. Install components trim with finish nails or screws at12 in o.c..
f. Site-Applied Wood Treatment:
    1) Brush apply two coats of preservative treatment on wood in contact with cementitious materials roofing and related metal flashings.
    2) Treat Site-sawn cuts. Apply preservative to Site-sawn cuts according to WDMA I.S.4.
    3) Allow preservative to dry prior to erecting members.
g. Preparation for Site Finishing:
    1) Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand Work smooth.
    2) Site Finishing: Comply with Section 099000 - Painting and Coating.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Conform to AWI AWS Section 6 requirements for the following:
1. Smoothness.
2. Gaps.
3. Flushness.
4. Flatness.

END OF SECTION

SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom casework.
      a. Plastic-laminate-finished casework.
   2. Counter tops.
      a. Plastic-laminate-finished counter tops.
   3. Cabinet hardware.
   4. Interior finish carpentry.
      a. Standing and running trim.
   5. Prefinish the Work of this Section.

1.2 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A156.9 - Cabinet Hardware.
   3. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. APA - The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

C. Architectural Woodwork Institute, Woodwork Institute, and Architectural Woodwork Manufacturers Association of Canada:
   1. AWS - Architectural Woodwork Standards.
   2. Supplemented with The WI Approach.

D. ASTM International:
   1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood Base Fiber and Particle Panel Materials.
   4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   5. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

E. Forest Stewardship Council:
   1. FSC Guidelines - Forest Stewardship Council Guidelines.

F. Green Seal:
   1. GS-11 - Product Specific Environmental Requirements.

2. GS-36 - Aerosol Adhesives.

G. Hardwood Plywood and Veneer Association:
1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

H. National Electrical Manufacturers Association:
1. NEMA LD 3 - High-Pressure Decorative Laminates.

I. National Fire Protection Association:
1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

J. U.S. Department of Commerce National Institute of Standards and Technology:
1. DOC PS 20 - American Softwood Lumber Standard.

K. Western Red Cedar Association:
1. WRCA - Lumber Grades and Standards.

L. Window and Door Manufacturers Association:
1. WDMA I.S.4 - Water-Repellent Treatment for Millwork.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals, including AWS Section 1.

B. Product Data: Submit data on:
1. High-pressure decorative laminates.
2. Hardware accessories.

C. Shop Drawings:
1. Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, schedule of finishes, and Certified Compliance Label on each set.

D. Samples:
1. Submit two, 4 x 4 in samples, illustrating cabinet finish.
2. Submit two, 4 x 4 in samples, illustrating counter top finish.
3. Submit two samples of drawer pulls and hinges, illustrating hardware finish.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for stairs, handrails, and balusters under direct supervision of licensed professional.

1.4 QUALITY ASSURANCE

A. Perform Work according to AWS, Section 6, Section 10, and Section 11; premium grade.

B. Surface Burning Characteristics: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each fire-retardant-treated and preservative-treated material.

D. Perform Work according to AWI standards.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience similar to this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Protect units from moisture damage.

1.7 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient conditions control facilities for product storage and installation.

B. Maintain storage space relative humidity within ranges indicated in AWS Section 2.

C. Subsequent Conditions: Maintain same temperature and humidity conditions in building spaces as will occur after occupancy during and after installation of Work of this Section.

1.8 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 CUSTOM CASEWORK

A. Plastic-Laminate-Finished Custom Casework:
   1. Frameless construction.
   2. Style: Flush overlay.
   3. AWS Section 10.
   4. Premium grade.
   5. Exterior and Interior Exposed Surfaces: High-pressure decorative laminate over plywood.
   6. Semi-Exposed Surfaces: High-pressure decorative laminate over particleboard High-pressure decorative laminate over plywood.
   7. Refer to A602 for specifics.

B. Casework Construction Details:
   1. Drawer Side Joinery: Multiple dovetailed.
   2. Drawer and Door Edge Profile: Square with thin, applied band.
   3. Toe Base Finish: .

C. Plastic-Laminate-Finished Counter Tops: Post-formed; AWS Section 11; premium grade.
   1. Core: Particleboard Medium density fiberboard.
      a. Core at Sink Tops: Exterior or exterior glue type panels.
   2. Splash Top Profile: Waterfall.
   3. Deck at Splash Joint Type: Coved.
   4. Front Edge: Waterfall.
   5. Splash Assembly: Shop assembled.

2.2 WOOD TREATMENT

A. Fire-Retardant Treatment: Chemically treated and pressure impregnated, having flame spread of 25 or less when tested according to ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20-minute period, interior type.

B. Provide identification on fire-retardant-treated material.

C. Deliver fire-retardant-treated materials cut to required sizes. Minimize field cutting.

D. Moisture Content after Treatment: Kiln dried (KDAT).
   1. Lumber: As specified for exterior and interior lumber.
   2. Plywood: Maximum 15 percent.

2.3 FABRICATION

A. Fabricate interior finish carpentry to AWS Section 6 premium grade.

B. Fabricate casework to AWS Section 10 premium grade.

C. Fabricate counter tops to AWS Section 11 premium grade.

D. Shop-assemble casework for delivery to Site in units easily handled and to permit passage through building openings.

E. Fit exposed plywood edges with PVC plastic edging. Use one piece for full length only.

F. Cap exposed high-pressure decorative laminate finish edges with material of same finish and pattern.

G. Door and Drawer Fronts: 3/4 in thick.

H. When necessary to cut and fit on-Site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and Site cutting.

I. Apply high-pressure decorative laminate finish in full, uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises Locate plastic laminate joints minimum 18 in from sink cutouts.

J. Apply laminate backing sheet to reverse side of plastic- laminate-finished surfaces where required by AWS for specified grade.

K. Fabricate cabinets and counter tops with cutouts for plumbing fixtures outlet boxes fixtures and fittings. Verify locations of cutouts from on-Site dimensions. Prime paint Seal cut edges.

L. Shop-glaze glass materials using interior dry method as specified in Section 088000 - Glazing.

2.4 FINISHES

A. Sand Work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and types recommended for applied finishes.

D. Seal surfaces in contact with cementitious materials.

E. Finish according to Section 099000 - Painting and Coating.

2.5 ACCESSORIES

A. Adhesive for High-Pressure Decorative Laminates: Type recommended by laminate manufacturer to suit application.

B. Fasteners and Anchors:
   1. Fasteners: ASTM A153, hot-dip galvanized steel for high-humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and Staples: ASTM F1667.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; finish in concealed locations and finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Veneer Edge Band: AWS; standard wood veneer edge band matching face veneer.

F. Plastic Edge Trim: AWS; standard PVC; color as selected.

G. Grommets: Plastic material for cutouts.

H. Shelf Standards and Rests: Formed steel channels and rests, cut for fitted rests spaced at 1 in centers; chrome finish.

I. Drawer and Door Pulls:

1. Edge Pull, ADA, steel with stainless steel finish.
2. Size and Spacing: 7 in centers.

J. Cabinet Locks: Keyed cylinder, two keys for each lock, master keyed, bronze with satin finish.

K. Catches: Magnetic Touch type.

L. Drawer Slides: Self-closing, galvanized steel construction, ball bearings separating tracks, rail mounted full extension type.

M. Hinges: Concealed Grade butt knuckle disappearing type, bronze with satin finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with Work of this Section.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Prime paint surfaces of woodwork items and assemblies to be in contact with cementitious materials.

3.3 INSTALLATION

A. Install interior finish carpentry according to AWS Section 6 premium grade.

B. Install casework according to AWS Section 10 premium grade.

C. Install counter tops according to AWS Section 11 premium grade.

D. Set and secure casework, interior finish carpentry, and counter tops in place; rigid, plumb, and level.

E. Use fixture attachments in concealed locations for wall-mounted components.

F. Use concealed joint fasteners to align and secure adjoining cabinet units AND counter tops.

G. Carefully scribe casework abutting other components, with maximum gaps of 1/32 in. Do not use additional overlay trim for this purpose.

H. Secure woodwork cabinet and counter bases to floor using appropriate angles and anchorages.

I. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

J. Site glaze glass materials using interior dry method specified in Section 088000 - Glazing.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Position: 1/16 in.

C. Maximum Offset from Alignment with Abutting Materials: 1/32 in.

3.5 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust moving or operating parts to function smoothly and correctly.

3.6 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 064100

SECTION 066113 - SIMULATED STONE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Quartz, cast resin, and cast plastic fabrications, for vanity tops with integral sink, countertops, and shower enclosure as indicated on Drawings.

B. Related Requirements:

1. Section 061000 - Rough Carpentry: Framing of shower openings.
2. Section 061053 - Miscellaneous Rough Carpentry: Wood blocking and supports.
3. Section 064100 - Architectural Wood Casework: Cabinets with cast plastic countertop, integral sink.
4. Section 079000 - Joint Protection: Perimeter sealant to adjacent construction.
5. Section 224000 - Plumbing Fixtures: Plumbing drains and fixture trim.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM C97 - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
3. ASTM C615 - Standard Specification for Granite Dimension Stone.
4. ASTM C880 - Standard Test Method for Flexural Strength of Dimension Stone.

B. California Department of Health Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. South Coast Air Quality Management District:

1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

D. Underwriters Laboratories Inc.:

1. UL - Fire Resistance Directory.

1.3 SEQUENCING

A. Section 011000 - Summary: Requirements for Work sequencing.

B. Sequence Work to permit installation of adjacent affected construction, wall framing, electrical, and plumbing rough-in.

C. Coordinate installation of shower stalls with partition erection and plumbing work.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on specified component products.

C. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, design load parameters, methods of support, integration of plumbing and electrical components and anchorages.

D. Samples: Submit two samples representative of vanity top, countertop, and shower stall,by 2 x 3 inch in size, illustrating color, texture, and finish.

E. Manufacturer's Instructions: Submit preparation of opening required, rough-in sizes, tolerances for item placement, temporary bracing of components; furnish templates for cast-in or placed frames or anchors.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and fabricator.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify that the following products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project Site.

2. Indoor Air Quality Certificates:

a. Certify volatile organic compound content for each interior adhesive, sealant, and related primer.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.

b. Regional products.

1.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required; list substances harmful to component materials. Include instructions for stain removal, surface and gloss restoration.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials: Furnish two containers of 16 oz. of polishing cream.

1.8 QUALITY ASSURANCE

A. Surface-Burning Characteristics: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

B. Perform Work according to <_____> standards.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented production experience similar to this Project.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented production experience similar to this Project.

1.10 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish 5-year manufacturer's warranty for each type of unit.

PART 2 - PRODUCTS

2.1 QUARTZ AND RESIN FABRICATIONS

A. Manufacturers:

1. Cosentino. (Design Basis)
2. LX Hausys. (Design Basis)
3. LG Chemical, Ltd.
4. Meganite Inc.
5. OKITE Quartz Surfacing by Seieffe Corporation.
6. Technistone USA, Inc.
7. Transolid Div of Trumbull Industries.
8. Substitutions: Section 016000 - Product Requirements.

2.2 PLASTIC FABRICATIONS

A. Manufacturers:

1. Formica Corporation.
2. LX Hausys. (Design Basis)
3. Corian.
4. Wilsonart. (Design Basis)
5. Soliditas.
6. Substitutions: Section 016000 - Product Requirements.

2.3 COMPONENTS

A. Refer to A602 for selections.

B. Composition: 93 percent crushed quartz, proprietary resin, and integral coloring. Scratch resistant and high stain resistance. Thickness as indicated on Drawings.

1. Absorption: Less than 0.04 percent according to ASTM C97.
2. Flexural Strength: 5,600 psi and higher according to ASTM C880.

C. Resin: Polyester type, with integral coloring, stain resistant to domestic chemicals and cleaners.

D. Polishing Cream: Compatible polishing cream to achieve specified sheen to gel coat.

E. Core Framing: Softwood lumber, clear and free of knots.

F. Adhesive: seamless silicone adhesive, color matched, cartridge dispensed.

2.4 FABRICATION

A. Fabricate components by mold to achieve shape and configuration.

B. Finish surfaces smooth and polish to low sheen.

C. Radius corners and edges.

D. Gel coat exposed finish surfaces smooth and polish to low sheen.

E. Cure components prior to shipment, except sheet materials requiring Site handling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Provide anchoring devices for installation.

C. Provide templates and rough-in measurements.

3.3 INSTALLATION

A. Align Work plumb and level.

B. Install according to manufacturer's printed instructions.

C. Rigidly anchor to substrate to prevent misalignment.

D. Seal to adjacent construction as specified in Section 079000 - Joint Protection.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Dimension: [1/8] inch.

C. Maximum Offset from Indicated Position: [1/8] inch.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean and polish fabrication surfaces.

END OF SECTION 066113

SECTION 072113 - BOARD INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rigid and semi-rigid board insulation at cavity wall construction and perimeter foundation wall.

1.2 REFERENCE STANDARDS

A. ASTM International:

   1. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.
   2. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
   3. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   4. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   5. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   6. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
   7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   8. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

1.3 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements. Board insulation shall comply with air barrier requirements of ASHRAE 90.1 for building envelopes.

B. Materials of This Section: Provide thermal protection to vapor retarder in conjunction with vapor retarder materials in Section 07 26 00.

C. Materials of This Section: Provide thermal protection to air seal materials at building enclosure elements in conjunction with air barrier materials in Section 07 27 00.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information on product characteristics, performance criteria, limitations and adhesives.

C. Manufacturer Installation Instructions: Submit special environmental conditions required for installation, and installation techniques.

1.5 QUALITY ASSURANCE

A. Insulation Installed in Concealed Locations Surface Burning Characteristics::
   1. Foam Plastic Insulation: Maximum 75/450 flame-spread/smoke-developed index when tested according to ASTM E84.
   2. Other Insulation: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

B. Maintain one copy of each document on site.

1.6 ENVIRONMENTAL REQUIRLEMENTS

A. Section 016000 – Product Requirements.

B. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

1.7 SEQUENCING

A. Section 01 10 00 – Summary: Work Sequence.

B. Sequence Work to ensure air barrier materials are in place before beginning Work of this section.

1.8 COORDINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with Section 07 27 00 for installation of air seal materials.

PART 2 - PRODUCTS

2.1 BOARD INSULATION

A. Manufacturers:
   1. Dow Chemical – Extruded-Polystyrene Insulation.
   2. Owens Corning – Foamular Extruded-Polystyrene Insulation.
   3. Certain Teed – Extruded-Polystyrene Insulation.
   4. Substitutions: As specified in Section 016000 - Product Requirements.

B. Indoor Environmental Quality Characteristics:
   1. Adhesives and Sealants: Maximum VOC content according to product and testing requirements of CA/DHS/EHLB/R-174.

C. Indoor Environmental Quality Characteristics:
   1. Interior Adhesives: Maximum VOC content according to SCAQMD Rule 1168.
   2. Interior Aerosol Adhesives: Maximum VOC content according to GS-36.

2.2 MATERIALS

A. Extruded Polystyrene Insulation:
   1. Type: Cellular.
   2. Comply with ASTM C578, Type VI.
   3. Board Density: 1.8 lb / pcf.
   4. Board Size: 48 by 96 inches.
   5. Board Thickness: per drawings.
   6. Thermal Resistance: R-value of 5.0 per inch.
   7. Water Absorption:
      a. Comply with ASTM D2842.
      b. Maximum: 0.10 percent by volume.
   8. Minimum Compressive Strength: 25 psi.
   9. Board Edges: Square.

B. Polyisocyanurate Insulation:
   1. Description: Rigid board.
   2. Comply with ASTM C1289.
   3. Board Density: 2.0 pcf.
   4. Board Size: 48 by 96 inches.
   5. Board Thickness: as noted.
   6. Facing: foil-faced.
   7. Thermal Resistance: Aged R-factor of 6.0 per inch.
   8. Minimum Compressive Strength: 20 psi.
   9. Board Edges: Square.
   10. Water Absorption:
      a. Comply with ASTM D2842.

2.3 ACCESSORIES

A. Adhesive: Type as recommended by insulation manufacturer for application.

B. Tape:
   1. Material: Bright aluminum.
   2. Type: Self-adhering, mesh reinforced.
   3. Width: 2 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements

B. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

C. Verify that substrate surface is flat, free of honeycomb, fins, irregularities, and materials or substances affecting adhesive bond.

3.2 INSTALLATION

A. Foundation Perimeter:
   1. Polyethylene Sheeting:
      a. Adhere 4-inch-wide strip of polyethylene sheet over construction joints, with double beads of Type adhesive on each side of joint.
      b. Tape to seal joints.
      c. Extend sheet full height of joint.
   2. Apply adhesive in three continuous beads per board length to full bed 1/8 inch thick.
   3. Foundation Wall:
      a. Install boards on foundation wall perimeter.
      b. Place boards in method to maximize contact bedding.
      c. Stagger side end joints and butt edges and ends tight to protrusions and adjacent board.
   4. Extend boards over expansion joints unbonded to foundation and 12” on one side of joint.
   5. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

B. Cavity Walls:
   1. Secure impale fasteners to substrate at frequency of six per insulation board.
   2. Adhere polyethylene sheet over control joints, with double beads of adhesive on each side of joint between sheets, and extend sheet full height of joint.
   3. Apply adhesive in three continuous beads per board length in continuous beads per board length to full bed 1/8 inch thick on substrate, and daub adhesive tight to protrusions to ensure continuity of vapor retarder and air seal.
   4. Install boards horizontally between wall reinforcement.
   5. Provide notches or groove in board to accommodate flashing termination bar.
   6. Place boards in method to maximize contact bedding.
   7. Stagger side end joints.
   8. Butt edges and ends tight to adjacent board and protrusions.
   9. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
   10. Place 6-inch-wide polyethylene sheet at perimeter of wall openings, and tape-seal in place to ensure continuity of insulation board vapor retarder and air seal.
   11. Foam/seal all board joints.

C. Under Concrete Slabs:
   1. Place insulation under slabs-on-grade after base for slab has been compacted.
   2. Cut and fit insulation tight to protrusions or interruptions to insulation plane.
   3. Tape/seal board joints.
   4. Prevent insulation from being displaced or damaged while placing slab.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 – Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit damage to insulation prior to covering.

END OF SECTION 072113

SECTION 072116 - BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Batt insulation in wall construction.
   2. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior walls and roofs.

B. Related Requirements:
   1. Section 072113 - Board Insulation: Boards of polystyrene, polyurethane, or polyisocyanurate foam, cellular glass, or rigid or semi-rigid glass fiber.
   2. Section 092116 - Gypsum Board Assemblies: Acoustic insulation.

1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   4. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer data on product characteristics, performance criteria, limitations, and installation procedures.
   1. Samples: Provide 12”x12” sample of each type of insulation and vapor barrier.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics of Insulation Installed in Concealed Locations:
   1. Batt Insulation: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection:
   1. Provide only new materials in unopened packages.
   2. Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Remove insulation that becomes wet or damp.
   3. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 BATT INSULATION

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Johns Manville.
   3. Knauf Insulation.
   4. Owens Corning.
   5. Rockwool International.
   6. Substitutions: As specified in Section 016000 - Product Requirements.

B. Performance and Design Criteria:
   1. Vapor Retarder Permeance: Maximum 1 perm when tested according to ASTM E96, desiccant method.

2.2 MATERIALS

A. Batt Insulation:
   1. Description: Preformed mineral-fiber batt roll, with friction fit.
   2. Thermal Resistance: R-60 or prescriptive R-value required to meet Michigan Energy Code requirements for Building Envelope, whichever is greater.

B. Sheet Vapor Retarder:
   1. Description: polyethylene film for above-grade applications.
   2. Thickness: as required for perm rating less than 1.0.

C. Staples:
   1. Material: Steel wire.
   2. Type and Size: To suit application.

D. Tape:
   1. Material: Bright aluminum.

2. Type: Self-adhering.
3. Width: 2 inches.

E. Insulation keeper:
1. Wire Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

A. Install in exterior ceiling spaces without gaps or voids.

B. Do not compress insulation.

C. Trim insulation neatly to fit spaces.

D. Insulate miscellaneous gaps and voids.

E. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
1. Retain in place with wire mesh secured to framing members.
2. Tape-seal tears or cuts in vapor retarder.

F. Vapor Retarder:
1. Install insulation with factory-applied vapor retarder membrane facing warm side of building spaces.
2. Lap ends and side flanges of membrane over framing members.

G. Tape-seal butt ends, lapped flanges, and tears or cuts in membrane.

H. Wood Framing:

1. Place vapor retarder on warm side of insulation by stapling at 6 inches o.c.
2. Lap and seal sheet retarder joints over member face.

I. Extend vapor retarder tight to full perimeter of adjacent window and door frames and to other items interrupting plane of membrane and tape-seal in place.

END OF SECTION 072116

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foamed-in-place insulation in masonry cores.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
4. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
5. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. California Department of Health Care Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

C. Green Seal:

1. GS-36 - Green Seal Standard for Adhesives for Commercial Use.

1.3 COORDINATION

A. Section 013000 – Administrative Requirements. Requirements for coordination.

B. Coordinate Work of this Section with Work of other Sections.

1.4 SUBMITTALS

A. Section 013300 – Submittals Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer product description, insulation properties, preparation requirements.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit special procedures, perimeter conditions requiring special attention.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.
2. Submit manufacturer's approval of applicator.

1.5 QUALITY ASSURANCE

A. Conform to applicable code for flame and smoke requirements.

B. Surface Burning Characteristics for Insulation Installed in Concealed Locations:

1. Foam Plastic Insulation: Maximum 75/450 flame-spread/smoke-developed index when tested according to ASTM E84.
2. Overcoat: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic component.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 – 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 AMBIENT CONDITIONS

A. Section 015000 – Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Do not install insulation if ambient temperature is below 70 degrees F.

PART 2 - PRODUCTS

2.1 FOAMED-IN-PLACE INSULATION

A. Manufacturers:

1. Superior Polymers or equal.
2. Substitutions: As specified in Section 016000 – Product Requirements: Substitution requirements.

2.2 MATERIALS

A. Insulation:

1. Material: Polyurethane.
2. Comply with ASTM C1029, Type I.

2.3 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 – Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that Work within construction spaces or crevices is complete prior to insulation application.

C. Verify that surfaces are clean, dry, and free of matter capable of inhibiting insulation adhesion.

3.2 PREPARATION

A. Section 017000 – Execution and Closeout Requirements: Requirements for installation preparation.

B. Apply primer.

3.3 APPLICATION

A. Apply insulation by spray method, to uniform monolithic density without voids.

B. Apply to fill entire core or concrete masonry block.

C. Patch damaged areas.

3.4 FIELD QUALITY CONTROL

A. Section 014000 – Quality Requirements: Requirements for field quality control.

B. Inspection: Verify insulation thickness and density.

3.5 PROTECTION

A. Section 017000 – Execution and Closeout Procedures: Requirements for protecting installed construction.

B. Mask and protect adjacent surfaces from overspray or dusting.

C. Do not permit subsequent construction Work to disturb applied insulation.

END OF SECTION 072119

SECTION 072400 - EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior insulation and finish system applied over plywood sheathing.

B. Related Sections:

1. Section 061000 - Rough Carpentry: Sheathing under insulation.
2. Section 076200 - Sheet Metal Flashing and Trim: Perimeter flashings.
3. Section 079000 - Joint Protection: Sealing EIFS joints.

1.2 REFERENCES

A. ASTM International:

1. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
2. ASTM C847 - Metal Lath.
3. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Exterior Insulation Manufacturers Association:

1. EIMA - Guideline Specification for Exterior Insulation and Finish Systems, Class PB and Class PM.

C. National Fire Protection Association:

1. NFPA 259 - Standard Test Method for Potential Heat of Building Materials.
2. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
3. NFPA 285 - Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.

1.3 SYSTEM DESCRIPTION

A. Exterior Insulation and Finish System: EIMA Class [**PB**] [**PM**] system.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate details of construction including attachments, joint patterns, penetrations, interface with flashings and adjacent materials.

C. Product Data: Submit data on system materials, product characteristics, performance criteria, limitations.

D. Samples: Submit (2) 6” X 6” inch size samples illustrating coating color and texture range for selection.

E. Manufacturer's Installation Instructions: Submit preparation required, installation techniques, jointing requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.
c. <_____.>

1.6 QUALITY ASSURANCE

A. Fire Rated Wall Construction: min. 1 hour rating.

1. Tested Rating: Determined in accordance with ASTM E119.

B. Fire Performance:

1. Potential Heat of Foam Insulation: Determined in accordance with NFPA 259.
2. Potential Heat of Foam Insulation in Wall Assembly: Maximum not to exceed potential heat of foam insulation within assembly when tested in accordance with NFPA 285.
3. Ignition: No sustained flaming when tested in accordance with NFPA 268.

C. Surface Burning Characteristics:

1. Foam Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

D. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

E. Perform Work in accordance with industry / State code standards.

F. Maintain (1) copies of document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 MOCKUP

A. Section 014000 - Quality Requirements: Requirements for mockup.

B. Provide mock-up of system materials illustrating method of attachment.

C. Construct (1) mock-up, 1 feet long by 1 feet wide, including insulation, substrate, surface finish, color, texture, perimeter and control joints, and typical interface with adjacent construction.

D. Locate where indicated on Drawings.

E. Incorporate accepted mockup as part of Work.

1.9 PRE-INSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum 1 week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Protect adhesives and finish materials from freezing by storing in environment recommended by manufacturer.

1.11 SCHEDULING

A. Section 013000 - Administrative Requirements: Requirements for scheduling.

B. Schedule Work to maintain integrity of exterior wall to prevent water penetration behind EIFS. Allow sufficient time for curing of EIFS materials prior to sealant application.

1.12 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish the following materials to Owner, with maintenance instructions and repair procedures:

1. One gallon of base coat.
2. One gallon of primer coat.
3. One gallon of each color of finish coat.
4. Ten foot length of each type of mesh.

PART 2 - PRODUCTS

2.1 EXTERIOR INSULATION AND FINISH SYSTEM

A. Manufacturers:

1. Acrocrete; BASF Corp.
2. Corev America, Inc.
3. Dryvit Systems, Inc.
4. Finestone; BASF Corp.
5. Master Wall Inc.
6. Omega Products International, Inc.
7. Parex USA, Inc.
8. Pleko LLC.
9. Senergy; Master Builders Solutions.
10. Sto Corp.
11. Stuc-O-Flex International, Inc.
12. Total Wall, Inc.
13. Substitutions: Section 016000 - Product Requirements.

****** [OR] ******

B. Furnish materials in accordance with industry / State standards.

2.2 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.3 COMPONENTS

A. [**Molded**] [**Extruded**] Polystyrene Insulation: [**ASTM C578, Type [I] [II] [VI] [VII] [X] <_____>;**] conforming to the following:

1. Thickness: [**Thickness indicated**] [**<_____> inch thick**].
2. Thickness Tolerance: [1/32] <_____> inch maximum.
3. Board Size: <____>x<____> inch.
4. Board Size Tolerance: [1/16] <_____> inch from square and dimension.
5. Edges: [**Square**] <_____> edges.

B. [**Primer/Adhesive**] [**Base Coat**]: [**Recommended by manufacturer.**] <**_____.**>

C. Reinforcing Mesh: Interwoven glass fiber mesh, types as recommended by manufacturer for each location and substrate.

1. Standard Mesh: Minimum 4.0 oz/sq yd.
2. Intermediate Mesh: Minimum 12.0 oz/sq yd.
3. Impact-Resistant Mesh: Minimum 15.0 oz/sq yd.

D. Metal Lath: [**ASTM C847;**] [**flat diamond [self furring] mesh**] [**stamped sheet**]; [**[3.4] [2.5] [1.75] lb/sq ft**] [**of weight to suit application**]; [**backed with [treated] [foil] <_____> paper**].

E. Finish Coat Materials, EIMA Class PB: [**Synthetic [vinyl] composition,**] [**Polymer base,**] as recommended by manufacturer, color and texture [**as selected**].

F. Finish Coat Materials, EIMA Class PM: [**Polymer modified**] Portland cement containing [**chopped glass fibers,**] <**_____'**> as recommended by manufacturer, color and texture [**as selected**].

G. Exposed Aggregate: Washed [**granite**] [**marble**] <**_____**>, graded to <**_____**> minimum and <**_____**> maximum size, <**_____**> color [**as selected**].

2.4 ACCESSORIES

A. Insulation Adhesive: [**Recommended by manufacturer.**] <**_____.**>

B. Insulation Fasteners: [**Fasteners with washers.**] [**Galvanized metal channel with non-corrosive fasteners.**] <**_____.**>

C. Trim [**and Control Joints**]: [**Galvanized steel**] [**Extruded plastic**] <**_____**>, with attachment flanges.

D. Sealant Materials: [**Recommended by coating manufacturer.**] [**<_____> type, specified in Section 079000.**]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate and adjacent materials are dry.

C. Verify substrate surface is flat, free of [**fins**] [**or**] [**irregularities**].

3.2 INSTALLATION

A. Insulation:

1. Install boards on sheathing surface per Manufacturer.
2. Place boards in method to maximize tight joints. Stagger vertical joints. Butt edges and ends tight to adjacent board and to protrusions.
3. Secure boards to substrate by mechanical attachment to achieve continuous flush insulation surface.

B. Lathing:

1. Install metal lath in accordance with ASTM C1063.
2. Apply metal lath taut, with long dimension perpendicular to supports.
3. Lap ends minimum [1] inch. Secure end laps with tie wire where they occur between supports.
4. Attach metal lath to wood supports using nails at maximum spacing per Manufacturer.
5. Continuously reinforce internal angles with corner mesh, except where metal lath returns 3 inches from corner to form angle reinforcement; fasten at perimeter edges only.
6. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
7. Place casing beads at terminations of plaster finish. Place corner bead at external wall corners; fasten at outer edges of lath only. Butt and align ends. Secure rigidly in place.

C. Coatings:

1. Install trim in full lengths only to minimize moisture intrusion; cut horizontal trim tight to vertical trim.
2. Apply primer, basecoat and/or adhesive to minimum thickness per Manufacturer fully embed reinforcement, wrinkle free.
3. Lap reinforcement edges and ends 2 inches.
4. Apply finish to total minimum thickness per Manufacturer. Finish to uniform texture and color.
5. Coordinate sealant application with placement of base and finish coats as recommended by EIFS manufacturers and in accordance with Section 079000.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements Field inspecting, testing, adjusting, and balancing.

B. Inspect Work during progress of the Work to verify conformance to Contract Documents.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit finish surface to become soiled or damaged.

END OF SECTION 072400

SECTION 07 42 13 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes preformed metal siding system for walls, with related flashings and accessory components.

1. Provide building paper back-up over wood sheathed walls.

B. Related Sections:

1. Section 06 10 00 – Rough Carpentry.

2. Section 06 17 53 – Shop-Fabricated Wood Trusses

1.2 REFERENCES

A. American Society of Civil Engineers:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:

1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
6. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
8. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
9. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

1.3 SYSTEM DESCRIPTION

A. System: Preformed and prefinished metal siding system of horizontal profile; site assembled.

1.4 PERFORMANCE REQUIREMENTS

A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with ASCE 7-10.

1. Design Pressure: 23.16 lb/sq ft. (based on p=38.6 lb/sq ft. with a 0.6 factor for a 10 square foot or smaller area).

B. Maximum Allowable Deflection of Panel: 1/180 of span.

C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

E. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials.

F. Provide building wrap, Dupont Tyvek or equal.

1.5 SUBMITTALS

A. Section 01300 – Submittals.

B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.

C. Product Data: Submit data on panels.

D. Design Data: Submit design calculations.

E. Samples: Submit two samples of siding finish, 6x6 inch in size illustrating finish color, sheen, and texture.

F. Manufacturer's Installation Instructions: Submit special procedures.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience**.**

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials capable of causing discoloration or staining.

1.8 COORDINATION

A. Section 01040 – Coordination.

B. Coordinate Work with installation of louvers**,** adjacent components or materials.

1.9 WARRANTY

A. Section 00700 – General Conditions; Item 5: Warranty; Tests, Inspections and Approvals; Corrections to Work.

B. Furnish five or more years manufacturer warranty for metal siding.

PART 2 - PRODUCTS

2.1 METAL WALL PANELS

2.2 COMPONENTS

A. Exterior Panel and Other Sheet Materials: Minimum 26 gage thick precoated galvalume steel; 36 inches wide panel; lapped edges, filled with sealant.

2.3 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; to match siding.

B. Sealants: Specified in Section 07 90 00; to match siding.

C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel hot dip galvanized; fastener cap same color as exterior panel. Exposed fasteners same finish as panel system.

D. Field Touch-up Paint: As recommended by panel manufacturer.

E. Bituminous Paint: Asphalt base.

2.4 FABRICATION

A. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest practicable lengths.

C. Form panels for flat seams.

D. Fabricate corners in one continuous piece with minimum 18 inch returns.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01040 – Coordination.

B. Verify building framing members are ready to receive panel system.

3.2 INSTALLATION - BUILDING PAPER

A. Install 1 layer building paper horizontally on walls to receive metal siding.

B. Weather lap edges 2 inches and ends minimum 6 inches, minimum.

C. Stagger vertical joints of each layer.

D. Securely nail in place.

3.3 INSTALLATION

A. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

B. Fasten siding to structural supports; aligned, level, and plumb. Space fasteners maximum 24 inches on center either horizontally or vertically to suit application.

C. Locate joints over supports. Lap panel ends minimum 2 inches.

D. Use concealed fasteners unless otherwise approved by Architect/Engineer.

E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 ERECTION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Offset From Indicated Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

C. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.5 CLEANING

A. Section 01700 – Contract Close-Out.

B. Remove site cuttings from finish surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.6 SCHEDULES

A. 24 inch wide panels, Color: As selected by Owner.

END OF SECTION 07 42 13

SECTION 07 53 03 - ELASTOMERIC MEMBRANE ROOFING - FULLY ADHERED

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sheathing over metal deck surface; insulation; and membrane roofing base; flashings; roofing membrane expansion joints and counterflashings.

B. Related Sections:
1. Section 06 10 00 – Rough Carpentry: Wood nailers.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashing.

1.2 REFERENCES

A. ASTM International:
1. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
2. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
3. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
4. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
5. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
6. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
7. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
8. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
9. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
10. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
11. ASTM D4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.
12. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
15. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
16. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

17. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

B. FM Global:
1. FM DS 1-28 - Wind Loads to Roof Systems and Roof Deck Securement.
2. FM 4450 - Approval Standard for Class 1 Insulated Steel Deck Roofs.

C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

D. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

E. Single Ply Roofing Institute:
1. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

F. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
3. UL 1256 - Fire Test of Roof Deck Construction.
4. UL 1897 - Uplift Tests for Roof Covering Systems.

G. International Energy Code:
1. ANSI/ASHRAE/IESNA Standard 90.1-2013: Building Envelope Requirements.

1.3 SYSTEM DESCRIPTION

A. Elastomeric Sheet Membrane Conventional Roofing System: One ply membrane system with insulation and adhesive applied membrane finish.

1.4 DESIGN REQUIREMENTS

A. Low Slope Membrane Roof Edge Securement: Conform to SPRI ES-1 for wind speeds determined from applicable code.

B. Vapor barrier, insulation, EPDM membrane, and adhesives from a single manufacturer, designed as a complete system, over an approved substrate, for a warranty as specified in Section 2.2 Components; warranty shall be determined by membrane thickness.

1.5 SUBMITTALS

A. Section 01300 – Submittals.

B. Shop Drawings: Indicate setting plan for tapered insulation, joint and termination detail conditions, conditions of interface with other materials. Indicate membrane layout and seam locations.

C. Product Data: Submit characteristics on membrane materials, adhesives, seaming materials, flashing materials, insulation, and vapor retarders.

D. Manufacturer's Affidavit: testifying to the experience, high quality of installations, and customer service provided by the installing contractor.

E. Samples: Submit two, 6x6 inch in size illustrating insulation, adhesive, membrane.

F. Manufacturer's Installation Instructions: Submit special precautions required for seaming.

G. Manufacturer's Field Reports: Indicate procedures followed; ambient temperatures, humidity, wind velocity during application, and items requiring correction.
   1. Intermediate inspection and final inspection by manufacturer's field inspector.
   2. Submit manufacturer's report to Owner and Architect within 48 hours of inspection.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
   2. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.

C. Roof Maintenance and Service Agreement: Provide inspection and maintenance on two occasions within the first year: one after the spring melt and the second after one summer, as follows:
   1. Inspection shall be performed by the manufacturer's authorized field inspector with observation by the Owner.
   2. Inspect the entire roof area for damage that may have resulted from foreign debris or human activity.
   3. Inspect entire membrane to verify there are no gaps or voids between the membrane and substrate.
   4. Verify no lifting has occurred in the system, either from wind uplift, adhesive failure in the system, or other cause.
   5. Remove debris that may have accumulated to ensure positive roof drainage and to avoid roof membrane damage.
   6. Inspect and clean all roof drains, overflow drains, and scupper drains to ensure a free flow of rain water and snow melt.
   7. Inspect field seams, roof curbs, and roof penetrations. Verify no voids have developed at seams.
   8. Inspect sheet metal flashings and counter flashings at copings, gutters collector boxes, and downspouts.
   9. Verify equipment access doors and covers are installed and secured.
   10. Submit a written report to the building owner detailing the current roof condition, evidence of any roof abuse, and any problems that could potentially lead to future roof problems.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum seven years documented experience.

B. Installing Contractor:
1. Company specializing in performing Work of this section
2. Company with minimum seven years documented experience
3. Company recognized by roofing manufacturer as a “Top Tier” or “Master” installer.

C. Installing Contractor’s Representative
1. Applicator certified, trained and approved by manufacturer.
2. Manufacturer-trained applicator On-site for the duration of the roofing installation

1.8 Manufacturer’s Representatives:
1. Field Inspector: Trained and authorized employee of the roofing manufacturer to inspect roofing installations for compliance with standards and to provide a list of any necessary repairs for warranty.
2. Representative: trained by the manufacturer on products, assemblies, and warranty requirements and policies. Assumes authority to provide direction to the installer on behalf of the manufacturer. Minimum five years’ experience.

1.9 PRE-INSTALLATION MEETINGS

A. General Contractor shall schedule pre-installation meeting one week in advance. Meeting shall be held at a minimum one week prior to commencing Work of this section at the project site.

B. General Contractor shall prepare the agenda and have agenda approval by the Architect.

C. General Contractor shall facilitate the meeting and prepare minutes. Distribute minutes to all participants within 48 hours of the meeting.

D. Agenda shall include:
1. Review preparation and installation procedures, coordination and scheduling, and interface with related Work.
2. Demonstrate sequence of operation with actual materials and/or video to represent conditions of the installation. Allow questions from Owner and Architect.
3. Demonstration and discussion shall include substrate material, insulation, membrane, vapor barrier, adhesives, fasteners, roof edge, flashing, etc., as relevant to the project.
4. Identify any requirements in the Project Documents that conflict with the manufacturer’s recommendations, building code, or other regulatory requirements.
5. Review warranty coverage, protection, and limitations.
6. Review procedure for warranty call-backs.

E. Require attendance of Owner, architect, roofing installer, and roofing manufacturer's authorized representative.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 – Material and Equipment.

B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.

D. Protect foam insulation from direct exposure to sunlight.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 – Material and Equipment.

B. Do not apply roofing membrane during inclement weather ambient temperatures below or above manufacturer's acceptable temperature range.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.12 COORDINATION

A. Section 01040 – Coordination.

B. Coordinate Work with installation of associated roof penetrations and metal flashings, as Work of this section proceeds.

1.13 WARRANTY

A. Section 00700 – General Conditions; 5.1 Warranty.

B. Furnish 30 year manufacturer's warranty including coverage of materials and installation and damage resulting from failure to resist penetration of moisture.

PART 2 - PRODUCTS

2.1 SINGLE PLY ROOFING - FULLY ADHERED

A. Manufacturers:

1. Carlisle Syntec, SureSeal EPDM.
2. Firestone Building Products, RubberGard EPDM.
3. Versico Roofing Systems, VersiGard EPDM.
4. Substitutions: Section 01300 – Submittals.

2.2 COMPONENTS

A. 30-year warranty membrane: ASTM D4637; Type I EPDM; non-reinforced, .090 inch thick; conforming to the following criteria (BASE BID):

Properties	**Test**	**Results**
Tensile Strength	ASTM D412	1425 psi minimum
Elongation	ASTM D412	450% minimum
Tear Strength	ASTM D624	200 lbf/in minimum
Factory Seam Strength	Modified ASTM D816	Membrane Failure
Low Temperature Brittleness	ASTM D746	-49 d F
Resistance to Water Absorption	ASTM D-471	+2.0 % Maximum
Water Vapor Permeance (perms)	ASTM E96	0.05 perms Maximum

B. 20-year warranty membrane: ASTM D4637; Type I EPDM; non-reinforced, .060 inch thick; conforming to the following criteria (ALTERNATE 1):

Properties	**Test**	**Results**
Tensile Strength	ASTM D412	1425 psi minimum
Elongation	ASTM D412	450% minimum
Tear Strength	ASTM D624	200 lbf/in minimum
Factory Seam Strength	Modified ASTM D816	Membrane Failure
Low Temperature Brittleness	ASTM D746	-49 d F
Resistance to Water Absorption	ASTM D-471	+2.0 % Maximum
Water Vapor Permeance (perms)	ASTM E96	0.05 perms Maximum

C. Seaming Materials: As recommended by membrane manufacturer.

D. Insulation: ASTM C1289, Type II, Class I, faced rigid cellular polyisocyanurate roof insulation, with the following characteristics:
1. Board Density: 2.0 lb/cu ft.
2. Board Thickness: as required to meet or exceed specified R-value.
   a. Minimum R-value required by ANSI/ASHRAE/IESNA 90.1-2013 for Building Envelopes for the Climate Zone in the location of this project.
3. Board Edges: square.
4. Facing: glass reinforced mat facer, both sides.
5. Long Term Thermal Resistance: R factor specified, as determined by ASTM C177.
6. Compressive Strength: Minimum 20 psi.

E. Flexible Flashings: Same material as membrane.

F. Counterflashings: Aluminum metal, as specified in Section 07 62 00.

G. Insulation Adhesive: two-component, low-rise polyurethane, similar to I.S.O. Stick Insulation Adhesive.

2.3 ACCESSORIES

A. Insulation Fasteners: Appropriate for purpose intended and approved by system manufacturer; length required for thickness of material with metal washers; length as required to secure insulation in place with minimum projection below structural deck allowed by system manufacturer.

B. Insulation Joint Tape: Asphalt treated glass fiber reinforced; 6 inches wide; self adhering.

C. Sealants: As recommended by membrane manufacturer.

D. Strip Reglet Devices: Galvanized steel; maximum possible lengths, with attachment flanges.

E. Walkway Pads: by roofing manufacturer. 8’ wide continuous where shown on drawings.

F. Stack Boots: Flexible boot and collar for pipe stacks through membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01040 – Coordination.

B. Verify surfaces and site conditions are ready to receive Work.

C. Verify deck is supported and secure.

D. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, and suitable for installation of roof system.

E. Verify deck surfaces are dry and free of snow or ice.

F. Confirm dry deck by moisture meter with moisture content acceptable to roofing manufacturer.

G. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and cant strips and reglets are in place.

H. Commencing roof system installation represents that the General Contractor and roofing Subcontractor accept the substrate for all purposes related to roof systems and warranties.

3.2 INSTALLATION

A. Insulation Application:
1. Ensure vapor retarder is clean and dry.
2. Mechanically fasten insulation to deck.
3. Apply adhesive to top surface of insulation. Embed second layer of insulation into adhesive, with joints staggered minimum 6 inch from joints of first layer.

4. Place minimum of two constant thickness layers with joints staggered and tapered thickness insulation layer to required slope pattern.
5. Minimum Total Insulation Thickness: as required to achieve minimum aged insulation R-Value specified and as required by International Energy Code.
6. Place boards perpendicular to deck flutes with edges over flute surface for bearing support.
7. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
8. Lay tapered boards for distance of 24 inches back from roof drains for positive drainage.
9. Apply no more insulation than can be covered with membrane in same day.
10. Tape joints of insulation.

B. Membrane Application:
1. Apply adhesive at manufacturer's recommended rate.
2. Roll out membrane, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
3. Bond sheet to substrate except those areas directly over or within 3 inches of control or expansion joint.
4. Overlap edges and ends and seal by contact tape, minimum 6 inches. Seal permanently waterproof.
5. Shingle joints on sloped substrate in direction of drainage. Apply joint tape and seal.
6. Extend membrane up cant strips minimum of 6 inches onto vertical surfaces.
7. Seal membrane around roof penetrations.

C. Flashings And Accessories:
1. Apply flexible flashings to seal membrane to vertical elements.
2. Coordinate installation of roof drains and related flashings.
3. Seal flashings and flanges of items penetrating membrane.
4. Install walkway pads.

3.3 FIELD QUALITY CONTROL

A. Section 01400 – Quality Control.

B. Require site attendance of roofing materials' manufacturer's field inspector on a minimum of two occasions during installation of the Work and at final inspection. Reinspect as necessary to confirm that all repairs have been completed to specifications.

3.4 CLEANING

A. Section 01700 – Contract Close-Out.

B. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect building surfaces against damage from roofing Work.

B. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes flashings and counterflashings.

B. Related Sections:
1. Section 04 20 00 - Unit Masonry: Through-wall flashings in masonry.
2. Section 06 10 53 - Miscellaneous Rough Carpentry.
3. Section 07 90 00 - Joint Protection.
4. Section 09 90 00 - Painting and Coating: Field painting.
5. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Roof curbs for mechanical equipment.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A625/A625M - Standard Specification for Tin Mill Products, Black Plate, Single Reduced.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
7. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
9. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
10. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
11. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

12. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Copper Development Association Inc.:
   1. CDA - Copper in Architecture - Handbook.

D. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

E. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

D. Samples:
   1. Submit one samples, 4 inch in length illustrating typical profile, material and finish.
   2. Submit two samples 2x2 inch in size illustrating metal finish color.

1.4 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal work with minimum three years documented experience.

1.5 PRE-INSTALLATION MEETINGS

A. Coinciding with Section 075353 pre-installation meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with Work of Section 04 20 00 for installing recessed flashing reglets.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Manufacturers:
   1. Metal-Era.
   2. Pac-Clad.
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M; structural steel sheet, G90 zinc coating; 24 gauge core steel, shop pre-coated with two coat fluoropolymer top coat; color as selected from manufacturer's standard color (minimum 16 colors from which to select.)

2.2 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal.

B. Reglets: Recessed type, galvanized steel.

2.3 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Seal metal joints.

2.4 FACTORY FINISHING

A. Fluoropolymer Coating: Multiple coat as specified for sheet metal system, thermally cured, conforming to AAMA 2605.

B. Washcoat: Finish concealed side of metal sheets with washcoat compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets to lines and levels indicated on Drawings. Seal top of reglets with sealant.

C. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. See Section 04 20 00 for installation of concealed reglets.

B. Secure flashings in place using concealed fasteners.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

3.4 FIELD QUALITY CONTROL

A. Section 07 53 03 – Elastomeric Membrane Roofing: Field inspecting of adhered roofing and terminal flashings.

B. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 72 33

ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Prefabricated single-leaf roof hatches, with operable hardware, counterflashings, and integral support curbs, complete with access ladder and safety railings.

B. Related Requirements:
   1. Section 07 53 03: Roof system.

1.2 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A1264.1 - Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrails Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding unit construction, sizes, configuration, jointing methods, locations if applicable, and attachment methods.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit special installation criteria and interface with adjacent components.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - 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.

1.6 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.7 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for roof hatches.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

A. Manufacturers:
   1. Bilco.
   2. Global Industrial.
   3. Substitutions: As specified in Section 016000 - Product Requirements.

B. Description:
   1. Material: Zinc-coated steel.
   2. Type: Single leaf.
   3. Integral Curb:
      a. Nominally 14 inches high.
      b. Double wall, insulated.

C. Performance and Design Criteria:
   1. Live Load: As calculated according to applicable code.

D. Lid Type:
   1. Single Leaf, Personnel: 2 feet 6 inches by 4 feet 6 inches.

E. Hardware:
   1. Operator and Shock Absorbers: Compression spring.
   2. Pull for Interior and Exterior Operations:
      a. Description: Manual pull handle.
      b. Material: Steel.
   3. Hold-Open Arm: Steel, with grip handle.
   4. Furnish padlock hasp.
   5. Hinges: Manufacturer's recommended type for specific roof hatch.

6. Finish: Manufacturer's standard.

F. Access and Railings:
1. Ladder access by roof hatch supplier.
2. Safety post.

G. Safety Railing and Guards:
1. Fabrication: Fiberglass pipe or tube.
2. Posts, Top Rails, and Intermediate Rails: Minimum 1-1/2-inch OD.
3. Overall Height above Roof Surface: 42 inches.
4. Hatch Access Protection: Galvanized steel chain with snap hook.
5. Guard Openings: Maximum 21 inches.
6. Mounting Hardware: Manufacturer's standard corrosion-resistant type for attachment to hatch without penetrating roof membrane.
7. Fasteners: Stainless steel.
8. Galvanized Steel Finish: Factory painted safety yellow.

2.2 FABRICATION

A. Fabricate components free of defects and visual distortion.

B. Weld corners and joints.

C. Condensation Protection: Drain to exterior above roofing.

D. Fit components for weathertight assembly.

2.3 ACCESSORIES

A. Anchorage Devices: As recommended by manufacturer.

B. Counterflashings: Same metal type and finish as roof hatch frame.

C. Protective Coating: Zinc-molybdate alkyd.

D. Sealant:
1. As recommended by roof hatch manufacturer.
2. Type: Non-hardening, non-skinning, non-drying, non-migrating, and butyl based.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that openings and substrate conditions are ready to receive Work of this Section.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Apply protective coating on aluminum surfaces of roof hatches in contact with cementitious materials or dissimilar metals.

3.3 INSTALLATION

A. According to manufacturer instructions.

B. Install curb assembly, fastening securely to roof decking.

C. Flash curb assembly into roof system.

D. Roof Hatch:
   1. Place and secure to curb assembly.
   2. Install integral setting sealant and counterflashing as required.

E. Coordinate with installation of roofing system and related flashings for weathertight installation.

F. Adjust and lubricate cover for ease of operation and watertightness.

3.4 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust hinges for smooth operation.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Wash exposed surfaces and wipe clean.

C. Remove excess sealant.

END OF SECTION

SECTION 078400 - FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Firestopping through-penetrations of fire rated assemblies.
   2. Firestopping joints in fire rated assemblies.
   3. Firestopping tops of fire rated walls.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

C. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 1479 - Fire Tests of Through-Penetration Firestops.
   3. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   4. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to applicable code and UL for fire resistance ratings and surface burning characteristics.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance and limitation criteria.

C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements and applicable code requirements.

F. UL rating on all products used for firestopping.

1.6 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

B. Through Penetration Firestopping of Non-Fire Rated Assemblies: Materials to resist free passage of flame and products of combustion.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Provide one product for each type of application. Multiple products for the same type of penetration will not be accepted.
   1. Different types of products by multiple manufacturers are acceptable only where required to meet specific system description and performance requirements.

B. Product Description:
   1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   6. Firestop Pillows: Formed mineral fiber pillows.
   7. Mortar as specified in Section 04 05 03 where permitted by applicable code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place intumescent coating in sufficient coats to achieve rating required.

3.4 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 078400

SECTION 079000 - JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealants and joint backing.
   2. Accessories.

B. Related Requirements:
   1. Section 04 20 19 – Veneer Unit Masonry
   2. Section 078400 - Firestopping: Firestopping sealants.
   3. Section 088000 - Glazing: Glazing sealants and accessories.

1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C834 - Standard Specification for Latex Sealants.
   2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
   3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
   4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
   5. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
   6. ASTM D1667 - Standard Specification for Flexible Cellular Materials - Poly(Vinyl Chloride) Foam (Closed-Cell).
   7. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

B. California Department of Health Services:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

C. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

1.3 COORDINATION

A. Coordinate Work of this Section with Sections referencing this Section.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 2 inches in size, illustrating sealant colors for selection.

D. Manufacturer Instructions: Submit special procedures, surface preparation requirements, and perimeter conditions requiring special attention.
   1. Warranty: Include coverage for installed sealants and accessories failing to achieve seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.6 MOCKUPS

A. Section 014000 - Quality Requirements: Requirements for mockup.

B. Construct mockup of sealant joints in conjunction with window and wall mockups as specified in other Sections.

C. Construct mockup with specified sealant types and with other components as indicated.

D. Preparation and Priming:
   1. Determine requirements based on manufacturer recommendations.
   2. Correct failure of sealant tests on mockup if required.

E. Verify that sealants, primers, and other components do not stain adjacent materials.

F. Locate where directed by Architect/Engineer.

G. Incorporate accepted mockup as part of Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - 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 products 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 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain temperature and humidity as recommended by sealant manufacturer during and after installation.

1.9 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish two-year installer's warranty.

C. Include coverage for:
1. Installed sealants and accessories failing to achieve airtight and watertight seal.
2. Installed sealants and accessories exhibiting loss of adhesion or cohesion.
3. Sealants that do not cure.

PART 2 - PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
1. Dow Corning Corp.
2. GE Silicones
3. Pecora Corp.
4. Sika Corp.
5. Tremco Sealants & Waterproofing
6. Construction Specialties, Inc. (Masonry Expansion Joint Filler)
7. Substitutions: As specified in Section 016000 - Product Requirements.

2.2 JOINT SEALERS BY APPLICATION

A. High-Performance General-Purpose Exterior (Nontraffic) Sealant:
1. Material: Silicone.
2. Comply with ASTM C920, Grade NS, Class 25, Uses M, G, and A.
3. Type: Single-component.
4. Color: Standard; match finished surfaces.
5. Applications:
a. Control, expansion, and soft joints in masonry.
b. Joints between concrete and other materials.
c. Joints between metal frames and other materials.
d. Other exterior nontraffic joints for which no other sealant is indicated.

B. General-Purpose Exterior (Nontraffic) Sealant:
1. Description: Acrylic; solvent-release curing.
2. Comply with ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A.

3. Type: Single- or multiple-component.
4. Color: Standard; match finished surfaces.
5. Applications:
    a. Control, expansion, and soft joints in masonry.
    b. Joints between concrete and other materials.
    c. Joints between metal frames and other materials.
    d. Other exterior nontraffic joints for which no other sealant is indicated.

C. General-Purpose Traffic-Bearing Sealant:
1. Material: Polyurethane.
2. Comply with ASTM C920, Grade P, Class 25, Use T.
3. Type: Single- or multiple-component.
4. Color: Standard; match finished surfaces.
5. Applications: Exterior and interior pedestrian and vehicular traffic-bearing joints.

D. Exterior Compressible Gasket Expansion Joint Sealer:
1. Description: Hollow neoprene (polychloroprene) compression gasket.
2. Comply with ASTM D2628.
3. Color: Black.
4. Size and Shape: As indicated on Drawings.
5. Applications: Exterior wall expansion joints.

E. Exterior Metal Lap Joint Sealant:
1. Material: Butyl or polyisobutylene.
2. Type: Non-drying, non-skinning, non-curing.
3. Applications: Concealed sealant bead in sheet metalwork and siding overlaps.

F. General Purpose Interior Sealant:
1. Material: Acrylic-emulsion latex.
2. Comply with ASTM C834.
3. Type: Single-component; paintable.
4. Color: Standard; match finished surfaces.
5. Applications:
    a. Interior wall and ceiling control joints.
    b. Joints between door and window frames and wall surfaces.
    c. Other interior joints for which no other type of sealant is indicated.

G. Sanitary Sealant:
1. Material: Silicone.
2. Comply with ASTM C920, Uses M and A.
3. Type: Single-component; mildew resistant.
4. Color: Clear.
5. Applications:
    a. Joints between plumbing fixtures and floor and wall surfaces.
    b. Joints between countertops and wall surfaces.

H. Acoustical Sealant:
1. Material: Butyl or acrylic.
2. Comply with ASTM C920, Grade NS, Class 12-1/2, Uses M and A.
3. Type: Single-component; solvent-release curing; non-skinning.
4. Applications: Concealed locations only at acoustically rated construction.

2.3 JOINT SEALERS BY TYPE

A. Acrylic-Emulsion Latex Sealant:
   1. Comply with ASTM C834.
   2. Type: Single-component; non-staining, non-bleeding, non-sagging.
   3. Color: Standard; match finished surfaces.
   4. Movement Capability: 2 to 5 percent.
   5. Service Temperature Range: 2 to 160 deg. F.
   6. Hardness Range: Shore A, 15 to 40.

B. Acrylic Sealant:
   1. Comply with ASTM C920, Grade NS, Class 12-1/2, Uses NT, M, A, and O.
   2. Type: Single-component; solvent release curing; non-staining, non-bleeding, non-sagging.
   3. Color: Standard; match finished surfaces.
   4. Movement Capability: Plus and minus 12-1/2 percent.
   5. Service Temperature Range: Minus 13 to plus 180 deg. F.
   6. Hardness Range: Shore A, 25 to 50.

C. Butyl Sealant:
   1. Comply with ASTM C920, Grade NS, Class 12-1/2, Use NT.
   2. Type: Single-component; solvent release curing; non-skinning, non-sagging.
   3. Color: As selected.
   4. Movement Capability: Plus and minus 12-1/2 percent.
   5. Service Temperature Range: Minus13 to plus 180 deg. F.
   6. Hardness Range: Shore A, 10 to 30.

D. Silicone Sealant:
   1. Comply with ASTM C920, Grade NS, Class 25, Uses NT and A.
   2. Type: Single-component; neutral curing; non-sagging, non-staining, non-bleeding; fungus resistant.
   3. Color: Standard, match finished surfaces Clear.
   4. Movement Capability: Plus 40 percent, minus 25 percent.
   5. Service Temperature Range: Minus 65 to plus 180 deg. F.
   6. Hardness Range: Shore A, 15 to 35.

2.4 ACCESSORIES

A. Primer:
   1. Type: Non-staining.
   2. As recommended by sealant manufacturer to suit application.

B. Joint Cleaner:
   1. Type: Non-corrosive and non-staining.
   2. As recommended by sealant manufacturer.
   3. Compatible with joint forming materials.

C. Joint Backing:
   1. Description: Round foam rod, compatible with sealant.
   2. Comply with ASTM D1056, sponge or expanded rubber D1667, closed-cell PVC.
   3. Size: Oversized 30 to 50 percent larger than joint width.

D. Bond Breaker:
   1. Description: Pressure-sensitive tape.
   2. As recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify that substrate surfaces and joint openings are ready to receive Work of this Section.

C. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application preparation.

B. Comply with ASTM C1193.

C. Remove loose materials and foreign matter that could impair adhesion of sealant.

D. Clean and prime joints.

E. Protect elements surrounding Work of this Section from damage or disfiguration.

3.3 APPLICATION

A. Comply with ASTM C1193.

B. Acoustical Sealant:
   1. Comply with ASTM C919.
   2. Provide sealant bead between top stud runner and structure, and between bottom stud track and floor.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated on Drawings.

D. Install bond breaker where joint backing is not used.

E. Apply sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Joint Tooling: Concave.

G. Precompressed Foam Sealant:
   1. Do not stretch.

2. Avoid joints except at corners, ends, and intersections.
3. Apply with face 1/8 to 1/4 inch below adjoining surface.

H. Compression Gaskets:
1. Avoid joints except at ends, corners, and intersections.
2. Seal joints with adhesive.
3. Install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect sealants until cured.

END OF SECTION 079000

SECTION 081213 - STANDARD HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire rated and non-rated steel frames for doors and interior glazed lights.

B. Related Sections:
1. Section 033000 - Cast-In-Place Concrete: Placement of anchors into masonry wall.
2. Section 042016 – Reinforced Unit Masonry: Masonry grout fill of metal frames and placement of anchors into masonry wall construction. Not in table of contents
3. Section 081314 - Standard Steel Doors.
4. Section 081416 – Flush Wood Doors.
5. Section 087100 - Door Hardware: Hardware and weatherstripping.
6. Section 088000 - Glazing.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.
2. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
3. UL 1784 - Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

C. Product Data: Submit frame configuration and finishes.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire Rated Frame Construction: Conform to one of the following:
   1. NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
   2. UL 10C.
   3. 20-Minute Fire Rated Corridor and Smoke Barrier Frames: Fire tested without hose stream test.

C. Installed Fire Rated Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

D. Smoke and Draft Control Door Frames: Tested in accordance with UL 1784 and installed in accordance with NFPA 105.
   1. Air Leakage: Maximum 3.0 cfm/sf of door opening with 0.10 inch water gage pressure differential.

E. Attach label from agency approved by authority having jurisdiction to identify each fire rated door frame.
   1. Attach smoke label to smoke and draft control door frames.

F. Provide a certificate from the manufacturer that steel materials were processed in the United States.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on-site to permit ventilation.

1.7 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with frame opening construction, door, and hardware installation.

C. Sequence installation to accommodate required door hardware electric wire connections.

PART 2 - PRODUCTS

2.1 STANDARD STEEL FRAMES

A. Manufacturers:
   1. Amweld Building Products, Inc.
   2. Ceco Door Products
   3. LaForce, Inc.
   4. Republic Builders Products
   5. Steelcraft.
   6. Substitutions: Section 016000 - Product Requirements.

B. Product Description: Standard shop fabricated steel frames, fire rated and non-rated types.
   1. Frames: To suit ANSI A250.8 Grade and Model of door specified in Section 081314.
   2. Exterior Frames, Galvanized:
      a. Level 3, nominal 16 gage/0.053 inch thick material, base metal thickness.
   3. Interior Frames:
      a. Level 2, nominal 16 gage/0.053 inch thick material, base metal thickness.

2.2 ACCESSORIES

A. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

B. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

C. Primer: ANSI A250.10 rust inhibitive type.

D. Silencers: Resilient rubber fitted into drilled hole.

E. Weatherstripping: Specified in Section 087100.

2.3 FABRICATION

A. Fabricate frames for knock down field assembly.

B. Mullions for Double Doors: Removable type, of same profiles as jambs.

C. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.

D. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

E. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

F. Prepare frames for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.

G. Attach fire rated label to each fire rated frame.

H. Fabricate frames to suit masonry wall coursing with 4 inch head member.

2.4 SHOP FINISHING

A. Steel Sheet: Galvanized to ASTM A653/A653M.

B. Primer: Baked.

C. Factory Finish: Thermosetting epoxy of color as selected.

D. Coat inside of frame profile with bituminous coating to minimum thickness of 1/16 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install frames in accordance with ANSI A250.8.

B. Coordinate with masonry and gypsum board wall construction for anchor placement.

C. Coordinate installation of glass and glazing specified in Section 088000.

D. Coordinate installation of frames with installation of hardware specified in Section 087100 and doors in Section 081314 and 081416.

E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16” measured with straight edges, crossed corner to corner.

END OF SECTION 081213.13

SECTION 08 13 14 - STANDARD STEEL DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes non-rated, fire rated, and thermally insulated steel doors and door louvers.

B. Related Sections:
1. Section 08 12 13 - Standard Hollow Metal Frames.
2. Section 08 71 00 - Door Hardware.
3. Section 08 80 00 - Glazing: Glass for doors.
4. Section 09 90 00 - Painting and Coating: Field painting of doors.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM C1363 - Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E413 - Classification for Rating Sound Insulation.

C. Hollow Metal Manufacturers Association:
1. HMMA 810 - Hollow Metal Doors.

D. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

E. Steel Door Institute:
1. SDI 108 - Recommended Selection and Usage Guide for Standard Steel Doors.

F. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.
2. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
3. UL 1784 - Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finishes.

C. Product Data: Submit door configurations, location of cut-outs for hardware reinforcement.

D. Samples: Submit one sample of door face metal, 2x2 inch in size illustrating shop finish colors and surface texture.

E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A250.8.

B. Fire Rated Door Construction: Conform to NFPA 252.

C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.

D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.
   1. Indicate temperature rise rating for stair doors.
   2. Attach smoke label to smoke and draft control doors.

E. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 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 three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with door opening construction, door frame, and door hardware installation.

C. Coordinate installation to accommodate door hardware electric wire connections.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

A. Manufacturers:
   1. Curries
   2. Republic Builders Products.
   3. Steelcraft.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description:
   1. Exterior Doors (Insulated): ANSI A250.8, 1-3/4 inch thick.
      a. Level 3 – Extra Heavy Duty, Model 1, full flush design.
   2. Interior Doors (Non-Rated): ANSI A250.8, 1-3/4 inch thick.
      a. Level 2 - Heavy Duty, Model 1, full flush design.
   3. Interior Doors (Fire Rated): ANSI A250.8, 1-3/4 inch thick.
      a. Level 2 - Heavy Duty, Model 1, full flush design.

2.2 COMPONENTS

A. Face: Steel sheet in accordance with ANSI A250.

B. End Closure: Channel, 0.04 inches thick, inverted.

C. Core: polystyrene foam or mineral fiberboard with vertical steel stiffeners.

D. Thermal Insulated Door: Total insulation R-Value of 7, measured in accordance with ASTM C1363.

E. Sound Rated Door: STC of 32, measured in accordance with ASTM E413.

2.3 ACCESSORIES

A. Louvers:
   1. Material and Finish: Roll formed steel; shop painted finish to color as selected.
   2. Louver Blade: Inverted Y slat blade, sight proof.

B. Astragals for Double Doors: Steel, T shaped, specifically for double doors.

C. Primer: ANSI A250.10 rust inhibitive type.

2.4 FABRICATION

A. Fabricate doors with hardware reinforcement welded in place.

2.5 SHOP FINISHING

A. Steel Sheet: Galvanized to ASTM A653/A653M.

B. Primer: Baked.

C. Shop Finish: Baked enamel of color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install doors in accordance with ANSI A250.8.

B. Install door louvers, plumb and level.

C. Coordinate installation of glass and glazing specified in Section 08 80 00.

D. Coordinate installation of doors with installation of frames specified in Section 08 12 13 and hardware specified in Section 08 71 00.

E. Touch-up damaged shop finishes.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for adjusting.

B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flush wood doors.
   2. Door glazing.
   3. Door louvers.

B. Related Requirements:
   1. Section 081213 - Standard Hollow Metal Frames.
   2. Section 087100 - Door Hardware.
   3. Section 088000 - Glazing.

1.2 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.

B. ASTM International:
   1. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
   2. ASTM E413 - Classification for Rating Sound Insulation.

C. Architectural Woodwork Institute:
   1. AWI AWS - Architectural Woodwork Standards.

D. California Department of Health Services:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

E. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.

F. Forest Stewardship Council:
   1. FSC Guidelines - Forest Stewardship Council Guidelines.

G. Hardwood Plywood and Veneer Association:
   1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

H. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

I. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.

2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

J. National Institute of Justice
1. NIH 0108.1 - Ballistic Resistant Protective Materials.

K. Underwriters Laboratories Inc.:
1. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
2. UL 1784 - Air Leakage Tests of Door Assemblies.

L. Wood Window and Door Manufacturers Association:
1. WDMA I.S 1A - Architectural Wood Flush Doors.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Submit data for door core materials and construction.
2. Submit data for veneer species, type and characteristics.
3. Submit data for factory finishes.

C. Shop Drawings:
1. Indicate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, and factory machining criteria.
2. Indicate cutouts for glazing and louvers.

D. Samples:
1. Submit two samples of door veneer, 6x6 inch in size illustrating wood grain, stain color, and sheen.

E. Manufacturers' Instructions: Submit special installation instructions.

F. Qualification Statements:
1. Submit manufacturer experience qualifications.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWI AWS Section 9, Premium Grade.

B. Finish doors in accordance with AWI AWS Section 5 Premium Grade.

C. Fire Rated Door Construction: Conform to one of the following:
   1. NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
   2. UL 10C.
   3. 20-Minute Fire Rated and Smoke Barrier Doors: Fire tested without hose stream test.

D. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.

E. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.
   1. Indicate temperature rise rating for stair doors.
   2. Attach smoke label to smoke and draft control doors.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer when stored more than one week.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.
   1. Break seal on site to permit ventilation.

1.8 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Interior Doors:
   1. Factory Finished Doors: Furnish manufacturer's life of installation warranty.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

A. Manufacturers:
   1. Eggers.
   2. Graham Manufacturing Corp.

3. Marshfield Door Systems.
4. Mohawk Flush Doors, Inc.
5. Substitutions: Section 016000 - Product Requirements.

B. Flush Interior Doors: Solid core.
1. Thickness: 1-3/4 inches
2. Core: PC.
3. Face Construction: five ply.
4. Performance Duty Level: Heavy duty.
5. Quality Grade: Premium.

C. Performance / Design Criteria:
1. Performance Duty Level: WDMA I.S. 1A.
2. Fire Resistance: As indicated on Drawings.
3. Sound Transmission Resistance: ASTM E413; minimum STC 35 for door and frame assemblies indicated as acoustically rated.

2.2 MATERIALS

A. Door Cores: AWI AWS Section 9.
1. Solid Core, Non-Fire Rated:
a. Type: PC; particleboard.
2. Solid Core, Fire Rated: Category A for positive pressure fire test.
a. Type FD; fire resistive composite.

B. Interior Door Faces:
1. Opaque Finished Faces: Close-grain hardwood veneer.
2. Transparent Finished Faces: Wood veneer.
a. Species: Red oak.
b. Veneer Cut: Rotary cut.
c. Veneer Matching: Book matched.
d. Face Matching: Running.

2.3 FABRICATION

A. Fabricate doors in accordance with AWI AWS Section 9 requirements.

B. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

C. Furnish lock blocks at top of door for closer for hardware reinforcement.

D. Vertical Exposed Edge of Stiles: Wood veneer matching door facing.

E. Fit door edge trim to edge of stiles after applying veneer facing.

F. Bond edge banding to cores.

G. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

H. Factory fit doors for frame opening dimensions identified on shop drawings.

I. Provide edge clearances in accordance with AWI AWS Section 9.

2.4 FINISHES

A. Finish work in accordance with AWI AWS Section 5; Premium Grade.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.5 ACCESSORIES

A. Door Glazing:
   1. Glass: As specified in Section 088000.
   2. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with AWI AWS Section 9 and manufacturer's instructions.

B. Field Fitting and Trimming:
   1. Trim non-rated door width by cutting equally on both jamb edges.
   2. Trim door height by cutting bottom edges to maximum of 3/4 inch.
      a. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

C. Coordinate installation of doors with installation of frames specified in Section 081213 and hardware specified in Section 087100.

D. Coordinate installation of glass and glazing specified in Section 088000.

3.3 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Conform to AWI AWS Section 9 requirements for the following:
   1. Fit and clearance tolerances.
   2. Gaps.
   3. Flushness.
   4. Flatness.
   5. Squareness.

3.4 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust door for smooth and balanced door movement.

C. Adjust door closer for full closure.

END OF SECTION 081416

SECTION 08 33 00 - ROLLING COUNTER DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Manual closing rolling counter doors.

B. Related Sections:
1. 05 50 00 Metal Fabrications. Door opening jamb and head members.
2. 06 10 00 Rough Carpentry. Door opening jamb and head members.
3. 08 70 00 Hardware. Padlocks. Masterkeyed cylinder.
4. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, installation of control station and wiring, and connection to alarm system.

1.2 SUBMITTALS

A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
1. Product Data.
2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
3. Quality Assurance/Control Submittals:
   a. Provide manufacturer's installation instructions.
4. Closeout Submittals:
   a. Operation and Maintenance Manual.
   b. Certificate stating that installed materials comply with this specification.

1.3 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: ISO 9001:2008 registered and a minimum of five years’ experience in producing counter fire doors and smoke control units of the type specified.
2. Installer Qualifications: Manufacturer's approval.

1.4 DELIVERY STORAGE AND HANDLING

A. Reference Section 01 66 00 - Product Storage and Handling Requirements.

B. Follow manufacturer's instructions.

1.5 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:
1. Cornell Iron Works, Inc., Crestwood Industrial Park, Mountaintop, PA 18707. Telephone: (800) 233-8366, Fax: (800) 526-0841.
2. The Cookson Company, Inc.
3. Amarr
4. Clopay

B. Model: Cornell ESC10

2.2 MATERIALS

A. Curtain:
1. Slats: No. 1F, interlocked flat-faced slats, 1-1/2 inches high by 1/2 inch deep, 22 gauge ASTM A 653, Commercial Quality, galvanized steel with plain steel bottom bar and vinyl astragal.
2. Fabricate continuous interlocking slat sections with high strength galvanized steel endlocks riveted to slats per UL requirements.
3. Slat Finish: GalvaNex™ Coating System
   a. ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation of a chemical bonding, light gray baked-on polyester base coat and a light gray baked-on polyester finish coat.
   b. Produce a superior finish against corrosion and abrasion.
   c. Include a limited two year finish warranty.
4. Bottom Bar Finish:
   a. Steel: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils cured film thickness.

B. Guides:
1. Steel: 12 gauge formed shapes.
2. Finish:
   a. Steel: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils cured film thickness.

C. Counterbalance Shaft Assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

D. Brackets: Fabricate from reinforced steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
1. Finish:

a. Steel: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils cured film thickness.

E. Hood and mechanism covers: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch steel intermediate support brackets as required to prevent excessive sag.
1. Finish:
a. GalvaNex™ Coating System

2.3 OPERATION

A. Motor Operation:
1. Motor – Standard Use – Model MG (Industrial Duty Gear Head) Operator:
a. The operator must not extend above or below the door coil when mounted front-of-coil. Rated for a maximum of 20 cycles per hour (not to be used for consecutive hours)
b. Totally Enclosed Non Ventilated gear head operator(s) rated 1/3 hp as recommended by door manufacture for size and type of door,.
c. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s).
d. Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position.
e. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain.
f. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided.
g. Operator shall be capable of driving the door at a speed up to 9” per second or as recommended for door size.
h. Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door.
2. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 FIELD QUALITY CONTROL

A. Site Test: Test doors for normal operation and automatic closing.

3.5 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.6 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.

B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed storefronts including aluminum and glass doors and frames including hardware, glass, infill panels, and safety and security window film.

B. Related Sections:
1. Section 07 27 26 – Fluid-Applied Membrane Air Barriers: Perimeter air seal between glazing system and adjacent construction.
2. Section 07 90 00 - Joint Protection: System perimeter sealant and back-up materials.
3. Section 08 71 00 - Door Hardware: Mortised hardware reinforcement requirements affecting framing members; hardware items other than specified in this section.
4. Section 08 80 00 - Glazing.
5. Section 08 87 16 – Safety and Security Window Film.
6. Section 09 90 00 - Painting and Coating: Field painting of interior surface of infill panel surfaces.

1.2 REFERENCES

A. Aluminum Association:
1. AA ADM 1 - Aluminum Design Manual.

B. American Architectural Manufacturers Association/Window & Door Manufacturers Association:
1. AAMA/WDMA 101/I.S.2 - Specification for Windows, Doors and Unit Skylights.
2. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.
3. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
4. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
5. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
6. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
7. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
8. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
9. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
10. AAMA MCWM-1 - Metal Curtain Wall Manual.
11. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.

C. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
8. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
9. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
10. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Differential.
11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
12. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
13. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

E. National Fenestration Rating Council Incorporated:
   1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.

F. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
   2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

1.3 SYSTEM DESCRIPTION

A. Aluminum-framed storefront system includes tubular aluminum sections, aluminum and glass entrances, shop fabricated, factory finished, glass and glazing, field applied window film, infill, related flashings, anchorage and attachment devices.

B. System Assembly: Site assembled.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
   1. As calculated in accordance with applicable code, as tested in accordance with ASTM E330.

B. Deflection: Limit mullion deflection to flexure limit of glass; with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

D. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of6.24 psf as measured in accordance with ASTM E283.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

F. Vapor Seal: Limit vapor seal with interior atmospheric pressure of 1 inch sp, 72 degrees F, 40 Percent RH without seal failure.

G. Condensation Resistance Factor: CRF of not less than 45 when measured in accordance with AAMA 1503.

H. Water Leakage: None, when measured in accordance with ASTM E331 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

I. Thermal and Solar Heat Transmittance of Assembly (U Value and SHGC): Comply with ICC IEEC for climate zone in which project is located.

J. Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

K. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface.

E. Design Data: Indicate framing member structural and physical characteristics, dimensional limitations.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA SFM-1.

B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing aluminum glazing systems with minimum three years documented experience.

B. Design structural support framing components under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.

C. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with installation of air barrier and vapor retarder components or materials.

1.12 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for glazed units.

PART 2 PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

A. Manufacturers:
   1. Kawneer Co., Inc. Series 500 Swing Doors, Trifab VG 451T Frames.
   2. EFCO Corp., series D500
   3. Tubelite
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description:
   1. Aluminum Frame: Thermally broken; applied glazing stops; drainage holes; internal weep drainage system. Frames for interior glazing need not to be thermally broken.
   2. Mullions: Profile of extruded aluminum with internal reinforcement of aluminum or shaped steel structural section.
   3. Doors: Aluminum framed glass doors; 1-3/4 inches thick, nominal 5 inch wide top rail and vertical stiles, nominal10 inch wide bottom rail; square glazing stops.

2.2 COMPONENTS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.

C. Glass: Specified in Section 08 80 00.

D. Glazing Materials: Storefront manufacturer’s standard types to suit application and to achieve weather, moisture, and air infiltration requirements.

E. Window Film: Refer to drawing part 1: A606, Part 2: A603.

F. Hardware: Furnish manufacturer’s standard door hardware for types of doors and applications indicated, and as specified below.
   1. Weather Stripping, Sill Sweep Strips, Thresholds, Hinges, Push/Pull Handles, and Closer: Manufacturers standard type to suit application.
   2. Sill Sweep Strips: resilient seal type, of neoprene compound.
   3. Threshold: Extruded aluminum, one piece for each door opening, non-slip surface.
   4. Hinges: butt type; top, intermediate, and bottom.

G. Sealant and Backing Materials:

1. Sealant Used Within System (Not Used for Glazing): Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
2. Perimeter Sealant: Specified in Section 07 90 00.

H. Fasteners: Stainless steel.

2.3 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

E. Prepare components with internal reinforcement for door hardware.

F. Reinforce framing members for imposed loads.

2.4 SHOP FINISHING

A. Color Anodized Aluminum Surfaces:
1. AAMA 611, AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils
2. Dark bronze color.

B. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION

A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent Work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent Work to form water tight dam.

G. Coordinate attachment and seal of perimeter air and vapor retarder materials.

H. Install integral flashings and integral joint sealers.

I. Set thresholds in bed of mastic and secure.

J. Install hardware using templates provided.

K. Coordinate installation of glass with Section 08 80 00 ; separate glass from metal surfaces.

L. Coordinate installation of perimeter sealants with Section 07 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspection to monitor quality of installation and glazing.

C. Test to AAMA 501.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust operating hardware for smooth operation.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

D. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect finished Work from damage.

3.8 SCHEDULES – See drawings.

END OF SECTION

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Extruded aluminum windows.
2. Factory glazing.
3. Operating hardware.
4. Insect screens.

B. Related Requirements:
1. Section 055000 - Metal Fabrications: Steel lintels.
2. Section 079000 - Joint Protection: Perimeter sealant and backup materials.
3. Section 088000 - Glazing: Exterior and interior glass and plastic glazing materials, for shop or Site installation.
4. Section 088716 – Safety and Security Window Film.

1.2 REFERENCE STANDARDS

A. A. American Architectural Manufacturers Association:
1. AAMA 101 - North American Fenestration Standard/Specification for windows, doors, and skylights.
2. AAMA 501 - Methods of Test for Exterior Walls.
3. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
4. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
5. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
6. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
7. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
8. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
9. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
10. AAMA IPCB - Standard Practice for the Installation of Windows and Doors in Commercial Buildings.
11. AAMA MCWM-1 - Metal Curtain Wall Manual.

B. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM D3656/D3656M - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
7. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
8. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
9. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
10. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
11. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
12. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
13. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

D. Consumer Product Safety Commission:
   1. 16 CFR 1201- Safety Standard for Architectural Glazing Materials.

E. Glass Association of North America:
   1. GANA Glazing Manual.

F. National Fenestration Rating Council:
   1. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

G. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
   2. SSPC Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel (Type I and Type II).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information showing component dimensions, anchorage and fasteners, glass, internal drainage, and typical details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related Work, and installation requirements.

D. Manufacturer's Certificate:
   1. Certify that products meet or exceed specified requirements.
   2. Certify product performance ratings by independent third party such as AAMA, California Association of Window Manufacturers, or NFRC as meeting or exceeding specified requirements.

E. Qualifications Statements:
   1. Submit qualifications for manufacturer and installer.
   2. Submit manufacturer's approval of installer.

1.4 QUALITY ASSURANCE

A. Perform Work according to following:
   1. Aluminum Windows: Fabricate window assemblies according to AAMA 101 for types of windows required.
   2. Insulated Glass: Fabricate insulated glass units according to GANA Glazing Manual.
   3. Safety Glass: Comply with CPSC 16 CFR 1201 and applicable codes.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience, certified by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging; 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. Covering:
      a. Protect factory-finished aluminum surfaces with wrapping.
      b. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
   3. Provide additional protection according to manufacturer instructions.

E. Handling: Comply with AAMA MCWM-1.

1.7 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Conditions: Do not install glazing materials when ambient temperature is less than 40 d F.

C. Subsequent Conditions: Maintain minimum temperature of 40 degrees F during and after installation of glazing materials.

1.8 WARRANTY:

A. A.Manufacturer's Warrantees: Submit written warrantees from window manufacturer for the following:
   1. Windows: Windows furnished are certified as fully warranted against any defects in material or workmanship under normal use and service for a period of two (2) year from date of fabrication.
   2. Finish: The pigmented organic finishes on exposed surfaces of windows and component parts are certified as complying fully with requirements of AAMA 2604 for pigmented organic coating and fully warranted against chipping, peeling, cracking or blistering for a period of ten (10) years from date of installation.
   3. Insulated Glass: Warranted from visual obstruction due to internal moisture for a period of ten (10) years.

PART 2 - PRODUCTS

2.1 ALUMINUM WINDOWS

A. Manufacturers:
   1. Tubelite, Inc.
   2. Graham Architectural Products
   3. Wausau Window and Wall Systems
   4. EFCO Corporation
   5. Substitutions: As specified in Section 016000 - Product Requirements.

B. Description:
   1. Tubelite VW 3700, Thermally-broken aluminum window.
      a. ADA compliant for operable windows, using single-lever operation.
      b. NFPA and IBC compliant for Egress windows.
   2. Aluminum window units, sash, glass and glazing, operating hardware, and insect screen.
   3. Aluminum Windows: Thermally broken with interior portion of frame insulated from exterior portion with continuous dual glass fiber reinforced 6/6 polyamide nylon struts.
   4. Glazing: 1” Insulating, Low-E, gray tinted.

C. Window Configuration:
   1. Comply with AAMA 101 for CW-PG75.
   2. Sash Designation: Casement, Sash and Frame depth 3 3/8” minimum.

D. Performance and Design Criteria:

1. Aluminum Windows: Meet minimum performance criteria for AAMA 101 Designation CW-PG75 Architectural Window or better.
2. Dead and Live Loads: Positive and negative wind loads acting normal to plane of window as calculated according to applicable code and as tested according to ASTM E330/E330M.
3. Wind Load Deflection: Limit member deflection to flexure limit of glass with full recovery of glazing materials.
4. Assembly: Accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing and deflection of lintel.
5. Vapor Seal: Test glass seal with interior atmospheric static pressure of 1 inch, 140 degrees F, and continuous UV and water spray exposure, without seal failure.
6. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, and migrating moisture occurring within system to exterior via weep drainage network.
7. Air Infiltration: Limit through assembly to 0.10 cfm/sq. ft. of wall area, measured at reference differential pressure across assembly of 6.24 psf and tested according to ASTM E283.
8. Thermal Performance:
    a. Condensation Resistance Factor Class: Not less than 59 at frame when measured according to AAMA 1503.
    b. Thermal Transmittance of Assembly: Maximum U-value of 0.41 Btu/sq. ft. x h x deg. F when measured according to AAMA 1503 with specified glazing.
9. Comply with International Code Council's International Energy Conservation Code for air infiltration and thermal performance for climate zone in which Project is located.
10. Water Leakage: None, when measured according to ASTM E331 and E547 with test pressure difference of 15 pounds per square foot as defined by AAMA 101.
11. Vapor Seal: Limit vapor seal with interior atmospheric static pressure of 1 inch, 72 degrees F, and 40 percent relative humidity, without seal failure.
12. Forced Entry Resistance: Comply with ASTM F588, Type, Grade 10.
13. Life Cycle Test: Per AAMA 101 and AAMA 910, provide proof that the product meets the criteria including passing air and water tests at the conclusion of the cycle test.
14. ADA operation: Window when tested in accordance with AAMA 513 shall meet the required air, water, structural and operating forces. Opening and closing shall not exceed 5 lbs when tested in a neutral pressure differential condition.
15. See Section 088716 for applied security film.

2.2 COMPONENTS

A. Extruded Aluminum:
1. Description: 6063 alloy, T5 temper.
2. Comply with ASTM B221.

B. Sheet Aluminum:
1. Description: 5005 alloy, H15 or H34 temper.
2. Comply with ASTM B209.

C. Steel Sections: Profiled to suit mullion sections.

D. Insulating Glass:
1. Description: Sealed double-pane units as specified in Section 088000 - Glazing.
2. Outer Pane: Gray-tinted tempered float glass.

3. Inner Pane: Clear Cardinal 270 Low-E tempered float glass.
4. Pane Thickness: Minimum 3/16 inch.
5. Air Space: Fill with argon gas.
6. Minimum Total Unit Thickness: 1 inch.
7. Glazing Materials: Manufacturer's standard as specified in Section 088000 – Glazing.
8. Glaze units to allow glass replacement without the use of special tools. Sash and frame shall be dry glazed. Frame and sash shall contain removable EPDM wedge gasket.

E. Hardware:
1. Material: Aluminum, stainless steel or other non-corrosive materials compatible with aluminum for hardware having component parts which are exposed. Cadmium or zinc-plated steel where used must be in accordance with ASTM Specification B 766 or B 633.
2. Single Lever Operator symmetric mechanism with a minimum of two adjustable locking points shall be provided. Operator shall move the vent from the fully closed to the fully open position which is limited to 4". Limit can be disengaged with a Torx T30 bit. A single lever handle that does not interfere with the window blinds during operation shall be provided to operate the hardware. Handle and operator base shall be silver powder coated finish. Window shall meet AAMA 513-14 for ADA operation.
3. Primary Locking Devices: A single lever handle shall activate hardware assembly with multiple locking points that engage adjustable keepers.
4. Hinges: Euro hinge; two concealed dual cam adjustable hinges per vent. Hinge shall allow the vent to open 90 degrees after disengaging the Limit & Hold open arm.
5. Limit & Hold Open Hardware: Integral part of operator arm. Fully open 4" limit.

F. Insect Screen Frame:
1. Material: Extruded aluminum frame sections finish matching window.
2. Corners: Mitered and mechanically joined with a concealed corner key.
3. Hardware: Leaf springs and concealed set screws which secure the screen.

G. Insect Screens Mesh:
1. Comply with ASTM D3656/D3656M, Class 2.
2. Mesh: 18 by 16 fiberglass mesh retained in screen frame with vinyl spline.
3. Color: Charcoal.

H. Safety and Security Window Film
1. Specified in Section 088716.

2.3 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly while enabling installation and dynamic movement of perimeter seal.

B. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive fabricated anchor devices.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Prepare components with internal reinforcement for operating hardware.

F. Furnish internal reinforcement in mullions with galvanized steel members to maintain rigidity.

G. Drainage: Permit internal drainage weep holes and channels to migrate moisture to exterior.

H. Glazing:
   1. Factory-glaze window units.
   2. Install glass and infill panels as specified in Section 088000 - Glazing using glazing method as required to achieve performance criteria.
   3. Install window film to interior side of exterior glazing with structural attachment system.

2.4 FINISHES

A. Aluminum Surfaces:
   1. Color Anodized to Dark Bronze finish.

B. Locks, Operators, and Exposed Hardware: Match window finish.

C. Apply one coat of bituminous paint on concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.5 ACCESSORIES

A. Fasteners and Anchors: Stainless steel.

B. Limit Stops: Resilient rubber.

C. Frame Extenders: Same material as frame, sized to cover insulation and airspace in cavity wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

C. Verify that opening dimensions and clearances are properly sized to receive window units.

3.2 INSTALLATION

A. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

B. Align window plumb and level, free of warping or twisting.

C. Maintain dimensional tolerances and alignment with adjacent Work.

D. Install sill and sill end angles.

E. Thermal Barrier:
   1. Provide thermal isolation where components penetrate or disrupt building insulation.
   2. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.

G. Perimeter Sealants: As specified in Section 079000 - Joint Protection

H. Install operating hardware.

I. Install window film, field applied, interior side with structural attachment system.
   1. Dow Corning 995 Structural Sealant

3.3 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Level or Plumb: 1/16 inch/3 feet noncumulative, or 1/8 inch/10 feet, whichever is less.

3.4 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust hardware for smooth operation and for secure weathertight closure.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Remove protective material from factory-finished aluminum surfaces.

C. Wash surfaces according to method recommended by and acceptable to sealant and window manufacturers; rinse and wipe surfaces clean.

D. Remove excess sealant using moderate amounts of mineral spirits or other solvent acceptable to sealant and window manufacturers.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hardware for wood, steel, and aluminum doors.
   1. Provide door gaskets, including weatherstripping and seals, and thresholds.

B. Related Sections:
   1. Section 081213 - Standard Hollow Metal Frames: Silencers integral with steel frames.
   2. Section 081314 - Standard Steel Doors.
   3. Section 081416 - Flush Wood Doors.
   4. Section 083113 - Access Doors and Frames: Door hardware.
   5. Section 084113 - Aluminum-Framed Entrances and Storefronts: Door hardware by entrance supplier, except as noted.
   6. Section 101400 - Signage.
   7. Section 255000 - Integrated Automation Facility Controls: Building monitoring system.
   8. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Power supply to electric hardware devices.
   9. Section 281600 - Intrusion Detection: Security system.
   10. Section 283111 - Fire Detection and Alarm: Electrical connection to activate door closers, and release magnetic holders.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A156.1 - Butts and Hinges.
   2. ANSI A156.3 - Exit Devices.
   3. ANSI A156.4 - Door Controls - Closures.
   4. ANSI A156.5 - Auxiliary Locks and Associated Products.
   5. ANSI A156.6 - Architectural Door Trim.
   6. ANSI A156.7 - Template Hinge Dimensions.
   7. ANSI A156.8 - Door Controls - Overhead Holders.
   8. ANSI A156.13 - Mortise Locks and Latches.
   9. ANSI A156.15 - Closer Holder Release Devices.
   10. ANSI A156.16 - Auxiliary Hardware.
   11. ANSI A156.18 - Materials and Finishes
   12. ANSI A156 - Complete Set of 24 BHMA Standards (A156 Series) with Binder.

B. Builders Hardware Manufacturers Association:
   1. BHMA Directory of Certified Products.

C. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.
   2. UL 305 - Panic Hardware.

3. UL - Building Materials Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 PERFORMANCE REQUIREMENTS

A. Fire Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.
1. Hardware: Tested in accordance with NFPA 252.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements.
2. Submit manufacturer's parts lists, and templates.
3. Submit proposed keying schedule

C. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

C. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
1. ANSI A156 series.
2. NFPA 80.
3. UL 305.

B. Furnish hardware marked and listed in BHMA Directory of Certified Products.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with minimum three years' documented experience. approved by primary hardware manufacturers.

C. Hardware Supplier Personnel: Employ qualified person to assist in work of this section.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.

1.8 PRE-INSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Include persons involved with installation of doors, frames, and hardware.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Package hardware items individually with necessary fasteners, instructions, and installation templates, when necessary; label and identify each package with door opening code to match hardware schedule.

1.10 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
   1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

C. Sequence installation to accommodate required utility connections.

D. Coordinate Owner's keying requirements during course of Work.

1.11 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for locksets and ten year door closers.

1.12 MAINTENANCE MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Maintenance materials.

B. Furnish special wrenches and tools applicable for each different and for each special hardware component.

C. Furnish maintenance tools and accessories supplied by hardware component manufacturer.

1.13 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish six extra key lock cylinders for each master keyed group.

PART 2 - PRODUCTS

2.1 DOOR HARDWARE

A. Hinge Manufacturers:
1. Hager.
2. Ives.
3. McKinney.
4. Substitutions: Section 016000 - Product Requirements.

B. Cylinder and Core Manufacturers:
1. Schlage.
a. Substitutions: Section 016000 - Product Requirements Not Permitted.

C. Lock and Latch Set Manufactures:
1. Schlage
2. Substitutions: Section 016000 - Product Requirements Not Permitted.

D. Exit Device Manufacturers:
1. Von Duprin 98 Series.
2. Substitutions: Section 016000 - Product Requirements Not Permitted.

E. Closers Manufactures:
1. LCN Model 4040 Series.
2. Substitutions: Section 016000 - Product Requirements Not Permitted.

F. Door Controls and Overhead Holders Manufacturers:
1. Glynn Johnson.
2. Substitutions: Section 016000 - Product Requirements Not Permitted.

G. Push/Pulls, Manual Bolts, Protection Plates and Trim:
1. Hager.
2. Ives.
3. McKinney.
4. Substitutions: Section 016000 - Product Requirements.

H. Gaskets, Thresholds, and Trim:
1. National Guard Products.
2. Pemko.
3. Rockwood Manufacturing.
4. Reese.
5. Substitutions: Section 016000 - Product Requirements.

2.2 COMPONENTS

A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
   1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
   2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
   3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
      a. Finish: Match hardware item being fastened.
   4. Fire Ratings: Provide hardware with UL or Intertek Testing Services (Warnock Hersey Listed) listings for type of application involved.
   5. Electrical Devices: Make provisions and coordinate requirements for electrical devices and connections for hardware.

B. Hinges: ANSI A156.1, full mortise type complying with following general requirements unless otherwise scheduled.
   1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
   2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
      a. Fire Rated Doors To 86 inches High: Minimum three hinges.
   3. Size and Weight: 4-1/2 inch heavy weight typical for 1-3/4 inch doors.
      a. Doors Over 40 inches Wide: Extra heavy weight ball or oilite bearing hinges.
      b. Doors Over 48 inches Wide: 5 inch extra heavy weight ball or oilite bearing.
   4. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked outswinging doors, non-rising pins at interior doors.
   5. Tips: Flat button tips with matching plug.

C. Locksets: Furnish locksets compatible with specified cylinders. Typical 2-3/4 inch backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames.
   1. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1 unless otherwise indicated.

D. Latch Sets: Match locksets. Typical 2-3/4 inch backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames.
   1. Mortise Latch Sets: ANSI A156.13, Series 1000, Grade 1 unless otherwise indicated.
   2. Bored (Cylindrical) Latch Sets: ANSI A156.2, Series 4000, Grade 1 unless otherwise indicated.

E. Exit Devices: ANSI A156.3, Grade 1 rim type, with cross bar, unless otherwise indicated. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames, with floor strikes.
   1. Types: Suitable for doors requiring exit devices.

F. Cylinders: ANSI A156.5, Grade 1, 6 pin type removable cylinders interchangeable core type cylinders**.** Match existing building cylinders.
   1. Keying: Key to existing keying system.
   2. Include construction keying.
   3. Keys: Nickel silver. Stamp keys with "DO NOT DUPLICATE".
   4. Supply keys in the following minimum quantities:

a. 5 master keys.
b. 3 construction keys.
c. 3 change keys for each lock biting.

G. Closers: ANSI A156.4 modern type with cover, surface mounted closers; full rack and pinion type with steel spring and non-freezing hydraulic fluid; closers required for fire rated doors unless otherwise indicated.
1. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.
2. Arms: Type to suit individual condition; parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.
3. Location: Mount closers on inside of exterior doors, room side of interior doors typical; mount on pull side of other doors.
4. Operating Pressure: Maximum operating pressure as follows.
   a. Interior Doors: Maximum 5 pounds.
   b. Exterior Doors: Maximum 8.5 pound.
   c. Fire Rated Doors: As required for fire rating, maximum 15 pounds.
5. Coordinators: Furnish overhead type at pairs of doors.

H. Door Controls and Overhead Holders: Furnish with accessories as required for complete operational installation.
1. Manual Door Holders and Overhead Stops: ANSI A156.8, Grade 1 types as specified
2. Closer Holder Release Devices: ANSI A156.15 door mounted closer holder release devices closers with single point hold open free swinging release device designed to make swing doors close upon receiving electrical signal.
3. Electro-Magnetic Door Holder: ANSI A156.15 wall mounted type.
4. Power Assist Door Operators: ANSI A156.19 power mechanism which reduces opening resistance of self-closing door.
5. Low Energy Power Door Operators: ANSI A156.19 power mechanism which opens and closes door upon receipt of signal.
6. Low Energy Power Open Door Operators: ANSI A156.19 power mechanism which opens self-closing door; closing of door independent of power operator.

I. Push/Pulls, Manual Bolts, Protection Plates, Gaskets, Thresholds, and Trim: Furnish as indicated in Schedule, with accessories as required for complete operational door installations.
1. Push/Pulls: ANSI A156.6;
   a. Push plates minimum 0.050 inch thick, 6”x16”.
   b. Pulls: 8” CTC, solid 1” pull with 2” clearance, concealed mounting.
   c. Furnish as indicated in Schedule, with accessories as required for complete operational door installations.
2. Manual Bolts: ANSI A156.16 Grade 1 top and bottom flush bolts, with dust-proof floor strike, unless otherwise indicated.
3. Kickplates: ANSI A156.6, metal; height indicated in Schedule by 1 inch less than door width; minimum 0.050 inch thick stainless steel, 10” height.
4. Weatherstripping: Furnish continuous weatherstripping at top and sides of exterior doors.
5. Fire Rated Gaskets: Furnish continuous fire rated gaskets at top and sides of fire rated doors.
6. Thresholds: Maximum 1/2 inch height.
7. Wall Stops: ANSI A156.1, Grade 1, 2-1/2 inch wall stop concave pad wall stop with no visible screws.

2.3 ACCESSORIES

A. Lock Trim: Furnish levers with escutcheon plate.
   1. Type Tubular, as manufactured by Schlage.
   2. Do not permit through bolts on solid wood core doors.

B. Through Bolts: Do not permit through bolts and grommet nuts on door faces in occupied areas unless no alternative is possible.
   1. Do not use through bolts on solid wood core doors.

2.4 FINISHING

A. Finishes: ANSI A156.18; furnish following finishes except where otherwise indicated in Schedule at end of section.
   1. BHMA 626 Satin Chromium
   2. Furnish manufacturer's standard finishes to match similar hardware types on same door, and maintain acceptable finish considering anticipated use and BHMA category of finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings.

C. Verify electric power is available to power operated devices and is of correct characteristics.

3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

B. Mounting Heights From Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes where not otherwise indicated.
   1. Locksets: 38 inch.
   2. Push/Pulls: 42 inch.
   3. Dead Locks: 48 inch.
   4. Push Pad Type Exit Devices: 42 inch.
   5. Cross Bar Type Exit Devices: 38 inch.
   6. Top Hinge: Jamb manufacturer's standard, but not greater than 10 inches from head of frame to center line of hinge.
   7. Bottom Hinge: Jamb manufacturer's standard, but not greater than 12-1/2 inches from floor to center line of hinge.
   8. Intermediate Hinges: Equally spaced between top and bottom hinges.
   9. Hinge Mortise on Door Leaf: 1/4 inch. to 5/16 inch from stop side of door.

3.3 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust hardware for smooth operation.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit adjacent work to damage hardware or hardware finish.

3.5 SCHEDULES

A. The following hardware sets are intended to establish type and standard of quality when used together with this section's requirements. Examine Drawings and Specifications and furnish proper hardware for door openings.

B. **Provide keyed cylinder dogging for all EXIT DEVICES**.

Hardware Set 1: Entrance Doors (Pair), Hardware by Aluminum entrance supplier

CONTINUOUS HINGES				
2 EA	VERTICAL ROD EXIT DEVICE	EL9927TP	626	VON
2 EA	CLOSER	4110 EDA x 18 x 61	689	LCN
2 EA	OVERHEAD STOP	100	626	GLY
2 EA	SWEEP	200N	AL	NGP
1 EA	THRESHOLD	425	AL	NGP
	WEATHERSTRIPPING			

Hardware Set 2: Interior Vestibule Doors (Pair), by Aluminum Entrance Supplier

CONTINUOUS HINGES				
2 EA	VERTICAL ROD EXIT DEVICE	EL9927TP	626	VON
2EA	CLOSER	4010 x ST1544	689	LCN
2 EA	OVERHEAD STOP	410	626	GLY
2 EA	PULL BAR			
1 EA	CARD READER – OWNER SUPPLIED, ACTUATOR BY HARDWARE SUPPLIER			

Hardware Set 3: Exit Doors (Single), Hardware by Aluminum entrance supplier

3 EA	HINGES	BB1199 NRP	626	HAG
1 EA	RIM EXIT DEVICE	XP99NL	626	VON
1 EA	CLOSER	4110 EDA x 18	689	LCN
1 SET	SEALS	160	VA	NGP
1	THRESHOLD			

Hardware Set 4: Exit Doors (interior Single), Hardware by Aluminum entrance supplier

3 EA	HINGES	BB1199 NRP	626	HAG
1 EA	RIM EXIT DEVICE	XP99NL	626	VON
1 EA	CLOSER	4110 EDA x 18	689	LCN

Hardware Set 5: Secure Entrance Door, Hardware by Aluminum entrance supplier

3 EA	HINGES	BB1199 NRP	626	HAG
1 EA	RIM EXIT DEVICE	XP99NL	626	VON
1 EA	CLOSER	4110 EDA x 18	689	LCN
1 EA	ELECTRIC STRIKE			

Hardware Set 6: Classroom Doors

3 EA	HINGES	BB1279	626	HAG
1 EA	CLASSROOM LOCK	ND70PD	626	SCH
1 EA	WALL STOP	WS407	626	IVE
1 EA	KICK PLATE	10” x 2” LDW	626	IVE

* ADD CLOSER AT FIRE-RATED DOORS

Hardware Set 7: Storage Room Doors

3 EA	HINGES	BB1279	626	HAG
1 EA	STOREROOM LOCK	ND80	626	SCH
1 EA	CLOSER	4110 EDA	689	LCN
1 EA	WALL STOP	WS407	626	IVE

Hardware Set 8: Interior Exit Doors (pair)

6 EA	HINGES	BB1199 NRP	626	HAG
2 EA	RIM EXIT DEVICE	XP99L	626	VON
2 EA	RIM CYLINDER	AS REQUIRED	626	BES
2 EA	CLOSER	4110 EDA x 18	689	LCN

Hardware Set 9: Interior Pair

6 EA	HINGES	BB1279	626	HAG
2 EA	CLOSER w/OVERHEAD STOP	410	626	GLY
2 EA	PUSH/PULL	70C	626	ROCK
2 SET	FLUSH BOLT w/CYLINDER			

Hardware Set 10: Toilet Room Doors

3 EA	HINGES	BB1279	626	HAG
1 EA	PUSH/PULL	70C	626	ROCK
1 EA	CLOSER	4110 H CUSH	689	LCN
1 EA	KICK PLATE	10” x 2” LDW	626	IVE

Hardware Set 11: Toilet Room Doors

3 EA	HINGES	BB1279	626	HAG
1 EA	PRIVACY SET	L9040 x 03A	626	SCH
1 EA	KICK PLATE	10” x 2” LDW	626	IVE

Hardware Set 12: Classroom Exit Doors

3 EA	HINGES	BB1199 NRP	626	HAG
1 EA	RIM EXIT DEVICE	XP99NL	626	VON
1 EA	RIM CYLINDER	AS REQUIRED	626	BES
2 EA	CLOSER	4110 EDA x 18	689	LCN
1 SET	SEALS	160	VA	NGP
1	THRESHOLD			
1	SWEEP			

Hardware Set 13: Storage Pair

6 EA	HINGES	BB1279	626	HAG
2 EA	OVERHEAD STOP	410	626	GLY
1 EA	STOREROOM LOCK	ND80	626	SCH
1 SET	FLUSH BOLT (INACTIVE LEAF)			
1 SET	SEALS	160	VA	NGP
1	THRESHOLD			
1	SWEEP			

Hardware Set 14: Kitchen Door (Dutch door)

3 EA	HINGES	BB1279	626	HAG
1 EA	STOREROOM LOCK	ND80	626	SCH
1 EA	CLOSER WITH STOP	4110 EDA	689	LCN
1 EA	WALL STOP	WS407	626	IVE
1 EA	KICK PLATE	10” x 2” LDW	626	IVE

Hardware Set 15: Passage

3 EA	HINGES	BB1279	626	HAG
1 EA	PASSAGE	AL10S	626	SCH
1 EA	WALL STOP	WS407	626	IVE
1 EA	CLOSER	4110 EDA x 18	689	LCN

Hardware Set 16: Existing Entry Doors

1 EA	RIM EXIT DEVICE	XP99NL	626	VON
1 EA	CARD READER – OWNER SUPPLIED, ACTUATOR BY HARDWARE SUPPLIER			

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass glazing for metal frames, doors, windows, and glazed walls.
2. Glass glazing materials and installation requirements are included in this section for other sections referencing this section.

B. Related Sections:
1. Section 079000 - Joint Protection: Sealant and back-up material other than glazing sealants.
2. Section 081314 - Standard Steel Doors: Glazed doors.
3. Section 081416 - Flush Wood Doors: Glazed doors.
4. Section 084113 - Aluminum-Framed Entrances and Storefronts.
5. Section 088716 – Safety and Security Window Film.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
1. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
2. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
4. ASTM C1036 - Standard Specification for Flat Glass.
5. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
6. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
7. ASTM C1193 - Standard Guide for Use of Joint Sealants.
8. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
9. ASTM D635 - Standard Test Method for Rate of Burning and Extent and Time of Burning of Plastics in a Horizontal Position.
10. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
11. ASTM D4802 - Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet.
12. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

13. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
14. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
15. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
16. ASTM E1425 - Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems.
17. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
18. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
19. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

D. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.

E. Deutsches Institut für Normung:
   1. DIN 18516-4 - Back-ventilated, Non-Loadbearing, External Enclosures of Buildings, Made from Tempered Safety Glass Panels - Requirements and Testing.

F. Glass Association of North America:
   1. GANA - Sealant Manual.
   2. GANA - Glazing Manual.
   3. GANA - Laminated Glass Design Guide.

G. National Fenestration Rating Council Incorporated:
   1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
   2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
   3. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

H. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
   3. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.

I. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.

J. Underwriters Laboratories Inc.:
   1. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
   2. UL - Building Materials Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure and air/vapor barrier:

1. To utilize inner pane of multiple pane sealed units for continuity of air barrier and vapor retarder seal.
2. To maintain continuous air barrier and vapor retarder throughout glazed assembly from glass pane to heel bead of glazing sealant.

B. Glass Thickness: Select minimum thickness in accordance with ASTM E1300 to resist specified design loads with the following maximum probability of breakage:
1. Vertical Glass: 8 lites per 1000 for wind loads with 30 seconds maximum load duration.

C. Structural Design: Design in accordance with Michigan code for most critical combination of wind, snow, seismic, and dead loads.

D. Wind Loads: Design and size glass to withstand positive and negative wind loads acting normal to plane of wall, including increased loads at building corners.

E. Exterior Glass Deflection: Maximum of 1/175 of glass edge length or 3/4 inch, whichever is less with full recovery of glazing materials.

F. Interior Glass Deflection: Maximum differential deflection for two adjacent unsupported edges when 50 plf force is applied to one panel at any point up to 42 inches above finished floor less than thickness of glass.

G. Thermal and Solar Optical Performance: Measured or calculated in accordance with the following:
1. Maximum U-Values: Comply with ICC IEEC for climate zone in which project is located. Measure in accordance with AAMA 1503.
2. Maximum SHGC: Comply with ICC IEEC for climate zone in which project is located. Measure in accordance with NFRC 200.
3. Solar Optical Properties: NFRC 300.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
1. Indicate sizes, layout, thicknesses, and loading conditions for glass.

C. Product Data:
1. Glass: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, special handling or installation requirements.
2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

D. Design Data:
1. Submit design calculations for glass thicknesses.

E. Samples:
1. Glass: Submit sample 8x8 inch in size, illustrating glass units, coloration and design.

F. Manufacturer's Certificate: Certify sealed insulating glass, meets or exceeds specified requirements.

G. Submit Qualifications for 3M Film.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual, GANA Sealant Manual, GANA Laminated Glass Design Guide for glazing installation methods.

B. Fire Rated Door Glazing: Tested in accordance with one of the following and complying with NFPA 80.

C. NFPA 257; adjusted so two-thirds of test specimen is above neutral pressure plane at 10 minutes into test.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Do not install glazing when ambient temperature is less than 50 degrees F.

C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish ten year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

2.1 FLOAT GLASS MATERIALS

A. Annealed Glass: ASTM C1036, Type 1 transparent flat, Quality Q3, float glass.
   1. Furnish annealed glass except where heat strengthened or tempered glass is required to meet specified performance requirements.

B. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
   1. Furnish tempered glass where heat strengthened glass cannot meet specified performance requirements.
   2. Furnish tempered glass conforming to CPSC 16 CFR 1201at locations where safety glass is required by code.

2.2 FLOAT GLASS PRODUCTS

A. Float Glass
   1. Manufacturers:
      a. PPG Industries.
      b. Old Castle Glass
      c. Viracon
      d. Substitutions: Section 016000 - Product Requirements.

B. Clear Glass: Annealed, and Tempered float glass as specified; Class 1 clear.
   1. Clear annealed glass (FG-CA).
   2. Clear heat strengthened glass (FG-CH).
   3. Clear tempered glass (FG-CT).
   4. Minimum Thickness: 1/4 inch unless otherwise indicated.

C. Tinted Glass: Annealed, and Tempered float glass as specified; Class 2 tinted.
   1. Tinted annealed glass (FG-TA).
   2. Tinted heat strengthened glass (FG-TH).
   3. Tinted tempered glass (FG-TT).
   4. Minimum Thickness: 1/4 inch unless otherwise indicated.
   5. Tint: Gray.

D. Low E Glass: Annealed, and Tempered float glass as specified; Class 2 tinted.
   1. Clear Low E annealed glass (FG-ECA).
   2. Clear Low E heat strengthened glass (FG-ECH).
   3. Clear Low E tempered glass (FG-ECT).
   4. Tinted Low E annealed glass (FG-ETA).
   5. Tinted Low E heat strengthened glass (FG-ETH).
   6. Tinted Low E tempered glass (FG-ETT).
   7. Minimum Thickness: 1/8 inch unless otherwise indicated.
   8. Coating: ASTM C1376; pyrolytic vacuum deposited.

E. Mirropane Glass: (one-way glass)
   1. ¼" thick glass
   2. Coating: ASTM C 1376

F. Opaque Glass:
   1. Pattern 62 Obscure Glass

2.3 FIRE RESISTIVE GLASS PRODUCTS

A. Fire Resistive Glass
   1. Manufacturers:

a. AGC Glass Company North America
b. SAFTI FIRST Fire Rated Glazing
c. Technical Glass Products (TGP)
d. Substitutions: Section 016000 - Product Requirements.

B. Fire Resistive Ceramic Glass: Transparent polished both surfaces.
1. Clear fire resistive ceramic glass (FRG-CC).
2. Thickness: Manufacturer's standard.
3. Fire Rating: 20-, 45-, or 90-minute rating as listed in UL Building Materials Directory and approved by authority having jurisdiction for applications indicated.

2.4 INSULATING GLASS PRODUCTS

A. Insulating Glass
1. Manufacturers:
a. Guardian Industries Corp.
b. Oldcastle Glass.
c. PPG Industries.
d. Viracon.
e. Substitutions: Section 016000 - Product Requirements.

B. Insulating Glass: ASTM E2190 certified by Insulating Glass Certification Council and Insulating Glass Manufacturers Alliance; with glass elastomer edge seal; place reflective film within unit; purge interpane space with dry hermetic air.
1. Total Unit Thickness: 1 inch unless otherwise indicated.
2. Insulating Glass Unit Edge Seal Construction: Aluminum, thermally broken, mitered and spigoted corners.
3. Insulating Glass Unit Edge Seal Material: Black color.

C. Double Pane Insulating Glass:
1. Total Unit Thickness: 1 inch unless otherwise indicated.
2. U-Factor Winter: 0.35 maximum.

2.5 GLAZING SEALANTS

A. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, insulating glass seals, and glazing channels.
1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; chemical solvent curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.
2. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.

B. Dense Gaskets: Resilient extruded shape to suit glazing channel retaining slot; black color.
1. Neoprene: ASTM C864.
2. EPDM: ASTM C864.
3. Silicone: ASTM C1115.

C. Soft Gaskets: ASTM C509; resilient extruded shape to suit glazing channel retaining slot; black.
   1. Neoprene.
   2. EPDM.

D. Pre-Formed Glazing Tape: Size to suit application.
   1. Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
      a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
   2. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1 168.

E. Structural Sealant: High ultimate tensile strength.

2.6 GLAZING ACCESSORIES

A. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Clips: Manufacturer's standard type.

D. Fire-Resistant Glazing Materials: Materials used to obtain required fire-resistant rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify openings for glazing are correctly sized and within acceptable tolerance.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.
   1. Glazing Sealants: Comply with ASTM C1193.
   2. Fire Rated Openings: Comply with NFPA 80.

B. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
   1. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
   2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
   3. Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
   4. Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of pane or glass unit.
   5. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with 1/4 inch below sight line.
   6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
   7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

C. Interior Dry Method (Tape and Tape) Installation:
   1. Cut glazing tape to length, set against permanent stops, projecting 1/16” above sightline.
   2. Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
   3. Rest glazing on setting blocks and push against tape for full contact at perimeter of unit.
   4. Place glazing tape on free perimeter of glazing in same manner described above.
   5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
   6. Knife trim protruding tape.

3.4 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.
   1. Remove glazing materials from finish surfaces.
   2. Remove labels after Work is complete.
   3. Clean glass and adjacent surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass mirrors for frameless installation and mirrors for installation into sections referencing this section for products and installation.

B. Related Sections:

1. Section 064100 - Architectural Wood Casework: Cabinets with requirement for mirror shelves
2. Section 088000 - Glazing: Glass and glazing.
3. Section 102800 - Toilet, Bath, and Laundry Accessories: Metal framed mirrors.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. ASTM International:

1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
2. ASTM C1036 - Standard Specification for Flat Glass.
3. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
4. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
5. ASTM C1193 - Standard Guide for Use of Joint Sealants.

C. California Department of Health Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

D. Consumer Product Safety Commission:

1. CPSC 16 CFR 1201; Safety Standard for Architectural Glazing.

E. Glass Association of North America:

1. GANA - FGMA Sealant Manual.
2. GANA - Glazing Manual.

F. South Coast Air Quality Management District:

1. SCAQMD Rule 1168[**-January 7, 2005**] - Adhesive and Sealant Applications.

1.3 PERFORMANCE REQUIREMENTS

A. Limit mirrored glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less based on loading requirements specified in Section <_____>.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
2. Glazing Materials: Submit chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Manufacturer's Certificate: Certify mirrors meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

2. Indoor Air Quality Certificates:

a. Certify volatile organic compound content for each interior adhesive and sealant and related primer.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for mirror installation methods.

B. Perform Work in accordance with per industry standards.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Do not install glazing when ambient temperature is less than 50 degrees F.

C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing sealants.

1.8 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year warranty to include coverage for reflective coating on mirrors and replacement of same.

1.9 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Supply two of each mirror size.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

C. Indoor Environmental Quality Characteristics:

1. Adhesives and Sealants: Maximum volatile organic compound content in accordance with product and testing requirements of CA/DHS/EHLB/R-174.

D. Indoor Environmental Quality Characteristics:

1. Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
2. Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.2 MIRRORS

A. Mirror

1. Manufacturers:

a. Avalon Glass and Mirror Company.
b. Binswanger Mirror; a division of Vitro America, Inc.
c. D & W Incorporated.
d. Donisi Mirror Company.
e. Gardner Glass, Inc.
f. Guardian Glass; SunGuard.
g. Head West.
h. Independent Mirror Industries, Inc.
i. Lenoir Mirror Company.
j. National Glass Industries.
k. Trulite Glass & Aluminum Solutions, LLC.
l. Virginia Mirror Company, Inc.
m. Walker Glass Co., Ltd.
n. Substitutions: Section 016000 - Product Requirements.

B. Glazing Materials

1. Manufacturers:

a. C.R. Laurence Co., Inc.
b. Franklin International.
c. Macco Adhesives.
d. OSI Sealants; Henkel Corporation.
e. Palmer Products Corporation.
f. Pecora Corporation.
g. Royal Adhesives & Sealants.
h. Substitutions: Section 016000 - Product Requirements

2.3 COMPONENTS

A. Mirror Glass (Type MR-F): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality type with copper and silver coating, and organic overcoating.

1. Edges: Square
2. Thickness: 1/4inch unless otherwise indicated.
3. Size: sizes noted on Drawings.

B. Laminated Safety Mirror Glass (Type MR-SL): ASTM C1172, Kind LM laminated mirror glass, ASTM C1036 Type 1 transparent flat, Class 1 clear, Quality

1. Core: Manufacturer's standard laminated safety mirror glass core.
2. Edges: Squared.
3. Thickness: 1/4 inch unless otherwise indicated.
4. Size: sizes noted on Drawings.

C. Tempered Safety Mirror Glass (Type MR-ST): ASTM C1048, Kind FT fully tempered, Type 1 transparent flat, Class 1 clear, Quality [**Q1 mirror select**] [**Q2 mirror**]; type with copper and silver coating, and organic overcoating.

1. Core: Manufacturer's standard laminated safety mirror glass core.
2. Edges: Squared.
3. Thickness: 1/4 inch unless otherwise indicated.
4. Size: sizes noted on Drawings.

D. Back Coated Safety Mirror Glass (Type MR-SB): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality [**Q1 mirror select**] [**Q2 mirror**]; type with copper and silver coating, organic overcoating, and special back coating as required to comply with CPSC 16 CFR 1201 safety glazing standard.

1. Core: Manufacturer's standard laminated safety mirror glass core.
2. Edges: Squared.
3. Thickness: 1/4 inch unless otherwise indicated.
4. Size: sizes noted on Drawings.

E. Polycarbonate Mirror (Type MR-P): [**ANSI Z97.1;**] plastic compound, [**clear**] [**translucent**] [**gray tint**] [**bronze tint**] [**light green**]; mirrored coating; [**silicone abrasion resistant coating**] [**acrylate non-yellowing coating**] for scratch resistance; [**multiple layers for bullet resistance**].

1. ACCE Core: Manufacturer's standard laminated safety mirror glass core.
2. Edges: Squared.
3. Thickness: 1/4 inch unless otherwise indicated.
4. Size: sizes noted on Drawings.

2.4 ACCESSORIES

A. Elastomeric Glazing Sealant: Materials compatible with mirrors and adjacent materials.

1. Silicone Sealant: ASTM C920, Type S, Grade NS, Class and Use as recommended by manufacturer for mirror installation; single component; curing; capable of water immersion without loss of properties cured Shore A hardness of 15 to 25.

2. Polysulfide Sealant: ASTM C920, Type M, Grade NS, Class and Use as recommended by manufacturer for mirror installation; two component; chemical curing, non-sagging type; cured Shore A hardness of 15 to 25.

3. Polyurethane Sealant: ASTM C920, Type S, Grade NS, Class and Use as recommended by manufacturer for mirror glazing; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.

4. Acrylic Sealant: ASTM C920, Type S, Grade NS, Class and Use as recommended by manufacturer for mirror installation; single component, solvent curing, non-bleeding; cured Shore A hardness of 15 to 25.

B. Glazing Clips: Manufacturer's standard type.

C. Mirror Attachment Accessories: Stainless steel clips

D. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify openings for mirrored glazing are correctly sized and within tolerance.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive mirrors.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.

1. Glazing Sealants: Comply with ASTM C1193.
2. Set mirrors plumb and level, free of optical distortion.
3. Set mirrors with edge clearance free of surrounding construction including counter tops and backsplashes.

B. Sealant Installation: Comply with GANA Sealant Manual.

1. Install mirrors resting on setting blocks. Install applied stop and center mirror by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.
2. Locate and secure mirror using glazers' clips.

3. Fill gaps between mirror and stops with glazing sealant until flush with sight line. Tool surface to straight line.

C. Frameless Mechanical Installation:

1. Set mirrors with clips. Anchor rigidly to wall construction.
2. Place plumb and level without visible distort.

D. Frameless Adhesive Installation:

1. Set mirrors with adhesive.
2. Place plumb and level without visible distortion.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect for quality of glazing.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Remove wet glazing materials from finish surfaces.

C. Remove labels after Work is complete.

D. Clean mirrors and adjacent surfaces.

3.6 SCHEDULE

A. Mirrors at Interior Hollow Metal Frames: Type MR-F clear float glass mirror, 1/4 inch thick, silicone sealant installation.

B. Mirrors at Interior Display Cabinets: Type MR-P polycarbonate mirror, acrylic sealant installation.

C. Frameless Washroom Mirrors: Type MR-F, rosette installation; sizes noted on Drawings for each Washroom.

D. Frameless Wall Mirrors at Exercise Room: Type MR-SL, laminated safety mirror, 1/4 inch thick; adhesive installation; sizes noted on Drawings.

END OF SECTION 088300

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood stud wall framing.
2. Wood ceiling framing.
3. Gypsum board and joint treatment.
4. Gypsum sheathing.
5. Acoustic insulation.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
3. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
8. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
9. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
10. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
11. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
12. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
13. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.
14. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets.
15. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
16. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

17. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
18. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
19. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

B. American Society of Civil Engineers:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. California Department of Health Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

D. Gypsum Association:

1. GA 214 - Recommended Levels of Gypsum Board Finish.
2. GA 216 - Application and Finishing of Gypsum Board.
3. GA 600 - Fire Resistance Design Manual Sound Control.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

F. National Fire Protection Association:

1. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls, Method B.
2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Wall and Ceiling Interior Finish.

G. South Coast Air Quality Management District:

1. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.

H. Underwriters Laboratories Inc.:

1. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on wood framing, gypsum board, joint tape and acoustic accessories.

C. Shop Drawings:

1. Indicate special details associated with acoustic seals.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Manufacturers:
1. Certain Teed Gypsum, Inc.
2. G-P Gypsum Corp.
3. National Gypsum Co.
4. United States Gypsum Co.
5. Substitutions: Section 016000 - Product Requirements.

B. Framing Manufacturers:
1. CEMCO
2. Custom Stud
3. Deidrich
4. Substitutions: Section 016000 – Product Requirements.

2.2 COMPONENTS

A. Framing Materials:

1. Per Section 06 10 00 Rough Carpentry.

B. Gypsum Board Materials: ASTM C1396/C1396M; Type X fire resistant where indicated on Drawings.

1. Standard Gypsum Board: ½ and 5/8 inch thick, maximum available length in place; ends square cut, tapered and beveled edges.
2. Abuse-Resistant Gypsum Board: ½ and 5/8 inch thick, maximum available length in place; ends square cut, tapered and beveled edges. ASTM C1325 for cementitious backer units.
3. Moisture Resistant Gypsum Board: 1/2 5/8 inch thick, maximum available length in place; ends square cut, tapered and beveled square edges.
4. Exterior Gypsum Soffit Board: 5/8 inch thick, maximum available length in place; ends square cut, tapered and beveled edges.

C. Tile Backer Boards:
1. Fiber Cement Tile Backer Board: ASTM C1288; 1/2 inch thick; mold resistant.
2. Tile Backer Board Joint Tape: 2 inch wide, coated glass fiber tape for joints and corners.

D. Structural Concrete Panel Sub Floor:

1. ¾ Structo-crete, USGSP; ¾ inch thick, noncombustible.

2.3 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, thickness required for sound rating.

B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

C. Gypsum Board Accessories: ASTM C1047; metal; corner beads, edge trim, and expansion joints.

1. Metal Accessories: Zinc.
2. Edge Trim: Type L bead.

D. Joint Materials: ASTM C475/C475M; GA-216; reinforcing tape, joint compound, and water.

E. Gypsum Board Screws: ASTM C954 ASTM C1002; length to suit application.

1. Screws for Steel Framing: Type S.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Metal Stud Installation:

1. Install studs in accordance with ASTM C754.
2. Metal Stud Spacing: as indicated.
3. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
4. Door Opening Framing: Install double studs at door frame jambs.
5. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and openings.

B. Wall Furring Installation:

1. Erect wall furring for direct attachment to concrete masonry walls with adjustable attachment for thru-insulation applications.

2. Install thermal insulation in conjunction with Section 072100 between Z-furring channels directly attached to concrete masonry walls.

C. Ceiling Framing Installation:

1. Install in accordance with ASTM C754.
2. Coordinate location of hangers with other work.
3. Install ceiling framing independent of walls, columns, and above ceiling work.
4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
5. Laterally brace entire suspension system.

D. Acoustic Accessories Installation:

1. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
2. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
3. Install acoustic sealant at gypsum board perimeter at:

    a. Metal Framing: One beads.
    b. Base Layer.
    c. Face Layer.
    d. Seal penetrations of partitions by conduit, pipe, duct work, rough-in boxes, and other penetrations.

E. Gypsum Board Installation:

1. Install gypsum board in accordance with ASTM C840.
2. Erect single layer standard gypsum board, with ends and edges occurring over firm bearing.
3. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
4. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
5. Use screws when fastening gypsum board to metal furring or framing.
6. At acoustical wall: Fasten second layer of gypsum board to first with acoustic adhesive at manufacturer’s recommended rate of coverage.
7. Place second layer perpendicular parallel to first layer. Offset joints of second layer from joints of first layer.
8. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
9. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.
10. Place control joints consistent with lines of building spaces. Review layout with Architect prior to placement.
11. Place corner beads at external corners at exterior corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials

F. Joint Treatment:
   1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   2. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.
   3. Fill and finish joints and corners of cementitious backing board.

3.3 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

END OF SECTION 092116

SECTION 093000 - TILING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes porcelain tile for wall application; using thin-set application method; cementitious backer board as tile substrate; thresholds at door openings; and ceramic accessories.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
   2. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
   3. ANSI A108.1B - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
   4. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
   5. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
   6. ANSI A108.7 - Specifications for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar.
   7. ANSI A108.8 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.
   8. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
   9. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
   10. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
   11. ANSI A118.4 - Latex-Portland Cement Mortar.
   12. ANSI A118.5 - Chemical-Resistant Furan Mortar and Grout.
   13. ANSI A118.6 - Ceramic Tile Grouts.
   14. ANSI A137.1 – Specifications for Ceramic Tile.

B. Tile Council of America:
   a. TCNA 2015 – Handbook for Ceramic Tile Installation F111-15 .

1.3 SUBMITTALS

A. Shop Drawings: Indicate tile layout, perimeter conditions, junctions with dissimilar materials, control and expansion joints, ceramic accessories, and setting details.

B. Product Data: Submit instructions for using grouts and adhesives.

C. Samples: Submit mounted tile and grout on two 12” x 18” in size illustrating pattern, color variations, and grout joint size variations.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with TCA Handbook and ANSI A108 Series/A118 Series.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience and approved by tile manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives and grouts from freezing or overheating.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives and grouts in unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.10 EXTRA MATERIALS

A. Supply remaining tile sq ft of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.1 TILE

A. Manufacturers:
   1. Tile Bar
   2. Interceramic
   3. Florida Tile
   4. Daltile
   5. Armstrong

6. Mannington
7. Substitutions:
    a. Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Refer to A602 for selections.

B. Ceramic Tile: ANSI A137.1, conforming to the following:

C. See Sheet Schedule

2.3 ACCESSORIES

A. Mortar/ Adhesive: TEC 3N1 Mortar or Ultimate Large Tile Mortar as manufactured by HB Fuller Construction Products. ProLite

B. Grout: TEC Power Grout as manufactured by HB Fuller Construction Products. Color as selected by Architect. Prism equivalent is acceptable

C. Patch: TEC Fast-Set Deep Patch for deep fills, ramping and leveling add TEC Patch Additive for exterior applications. BenPatch

D. Crack Isolation Membrane / Waterproofing Membrane: Manufacturer's standard product line that complies with ANSI A118.10 and ANSI 118.12 for high performance and is recommended by the manufacturer for the application indicated.
    1. Crack Isolation and Waterproofing: TEC Hydra Flex as manufactured by HB Fuller Construction Products.

E. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, ½ inch thick;
    1. 2 inch wide coated glass fiber tape for joints and corners.

F. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

G. Patching Compounds: TEC Fast-Set Deep Patch as manufactured by HB Fuller Construction Products.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive work.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Install cementitious backer board. Tape joints and corners, cover with skim coat of dry-set mortar to feather edge.

D. Prepare substrate surfaces for adhesive installation.

3.3 EXISTING WORK

A. Prepare and remodel existing tile installations using materials and methods as specified.

B. Clean and repair existing tile which remains.

3.4 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods over concrete subbase and over gypsum underlayment over wood subbase and framing.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Place edge strips at exposed tile edges.

D. Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
   1. Ceramic Tile: 1/8 inch.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep expansion, control joints free of adhesive or grout. Apply sealant to joints.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Grout tile joints. Use standard grout unless otherwise indicated.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

L. Installation - Wall Tile:
   1. On exterior walls install in accordance with TCNA 2014 Method W201-09, thin-set over cementitious backer units, with waterproofing membrane with metal lath, scratch coat, mortar bed, bond coat, and latex-portland cement grout.

3.5 CLEANING

A. Clean tile and grout surfaces.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Acoustical panels.
2. Suspended metal grid ceiling system and perimeter trim.
3. Supplementary acoustic insulation over system units.
4. Veneered Ceiling Panels.

B. Related Requirements:

1. Section 072116 - Blanket Insulation: Acoustic batt insulation.
2. Section 079000 - Joint Protection: Acoustic sealant for perimeter moldings.
3. Section 099000 - Painting and Coating: Touchup painting of acoustical units.
4. Section 233700 - Air Outlets and Inlets: Air diffusion devices in ceiling system.
5. Section 265100 - Interior Lighting: Light fixtures in ceiling system.
6. Section 283111 – Digital Addressable Fire Alarm.

1.2 REFERENCE STANDARDS

A. ASTM International:
1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
3. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
6. ASTM E580/E580M - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
7. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

B. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. Ceilings and Interior Systems Construction Association:
1. CISCA - Acoustical Ceilings: Use and Practice.

D. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

E. National Fire Protection Association:
   1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

F. Underwriters Laboratories Inc.:
   1. UL - Fire Resistance Directory.

1.3 SEQUENCING

A. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustic units after interior wet work is dry.

1.4 SUBMITTALS

A. Product Data: Submit data on metal grid system components, acoustic units.

B. Shop Drawings:
   1. Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system. Indicate method of suspension where interference exists.

C. Samples:
   1. Submit two full size samples 6 x 6 inch in size illustrating material and finish of acoustic units.
   2. Submit two samples each, 6 inches long, of suspension system main runner, cross runner and perimeter molding.

D. Manufacturer's Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials:
   1. Furnish 5 boxes of extra tile to Owner.

1.6 QUALITY ASSURANCE

A. Conform to CISCA requirements.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 AMBIENT CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

PART 2 - PRODUCTS

2.1 SUSPENDED ACOUSTICAL CEILINGS

A. Manufacturers:
1. United States Gypsum Company (USG).
2. Armstrong. (Design Basis)
3. Substitutions: Section 016000 - Product Requirements.
4. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1/360 of span.

2.2 COMPONENTS

A. Refer to A602 for selections.

1. ACT - 1 Acoustic Tile: Design Basis – Armstrong Kitchen Zone Square Lay-In
   a. Size: 24 x 48 inches.
   b. Thickness: 3/4 inches.
   c. Composition: Wet Formed Mineral Fiber.
   d. Light Reflectance: 89%
   e. Noise Reduction Coefficient (NRC) Range: 33
   f. Edge: Lay-In.
   g. Surface Color: White.
   h. Surface Finish: Smooth.
   i. Warranty: 30-year performance & limited system warranty.

2. Grid 1 (standard):
   a. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking.
   b. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
   c. Exposed Grid Surface Width: 15/16 inch.
   d. Perimeter Molding Width: Match grid width.
   e. Grid Finish: Nickel Chrome.
   f. Accessories: Stabilizer bars, clips, splices, perimeter moldings, hold down clips, and required for suspended grid system.
   g. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

3. WD - 1 Veneered Ceiling Panel: Design Basis – Armstrong Woodworks Grille.

a. Size: 3/4” x 3-1/2”
b. Number of Slats: 3
c. Composition: Fire Rated Particle Board with Real Wood Veneers.
d. Warranty: 1-year limited warranty.

2.3 ACCESSORIES

A. Acoustic Batt Insulation:

1. As specified in Section 072116 - Blanket Insulation.
2. Type: Unfaced.

B. Acoustic Sealant For Perimeter Moldings: Specified in Section 079000.

C. Gasket for Perimeter Moldings: Closed-cell rubber sponge tape.

D. Touch-up Paint: Type and color to match acoustic and grid units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify layout of hangers will not interfere with other work.

3.2 INSTALLATION CEILINGS

A. Lay-In Grid Suspension System:
1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
2. Install system capable of supporting imposed loads with maximum deflection of 1/360 maximum.
3. Lay out system to balanced grid design with edge units no less than 50 percent of acoustic unit size. Arrange system with long dimension of tile parallel to long dimension of the space.
4. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
5. Install additional hangers and inserts as required.
6. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
7. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
8. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

9. Do not eccentrically load system, or produce rotation of runners.
10. Perimeter Molding:
    a. Install edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.
    b. Use longest practical lengths.
    c. Overlap and rivet corners.
    d. Install at junctions with other interruptions.
11. Form expansion joints. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
12. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with UL assembly requirements and light fixture ventilation requirements.

B. Acoustic Units:

1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
2. Layout:
    a. Lay directional patterned units one way with pattern parallel to longest room axis.
    b. Fit border trim neatly against abutting surfaces.
3. Install units after Work above ceiling has been completed.
4. Install acoustic units level, in uniform plane, and free from twisting, warping, and dents.
5. Cutting Acoustic Units:
    a. Cut to fit irregular grid and perimeter edge trim.
    b. Cut square reveal edges to field cut units.
6. Install hold-down clips to retain panels tight to grid system within 20 ft of exterior door.

3.3 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 095113

SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resilient sheet flooring; resilient tile flooring; resilient base; and resilient stair accessories, rubber flooring and rubber accessories.

1.2 REFERENCES

A. ASTM International:
   1. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.
   2. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing.
   3. ASTM F1344 - Standard Specification for Rubber Floor Tile.
   4. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
   5. ASTM F1861 - Standard Specification for Resilient Wall Base.

B. California Department of Health Services:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. Federal Specification Unit:
   1. FS L-F-475 - Floor Covering Vinyl, Surface (Tile and Roll), with Backing.
   2. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant.

D. National Fire Protection Association:
   1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

E. Scientific Certification Systems:
   1. SCS EC10.2 - Environmental Certification Program Indoor Air Quality Performance.

F. South Coast Air Quality Management District:
   1. SCAQMD Rule 1113-January 1, 2004 - Architectural Coatings.
   2. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate seaming plan, custom patterns and inlay designs.

C. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

D. Samples:
   1. Submit manufacturer's complete set of color samples for initial selection.
   2. Submit two samples, 4x6 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Warranty information.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics:
   1. Floor Finishes: Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
   2. Base Material: Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.

B. Installer Qualifications: Installer shall be manufacturer approved for the installation of rubber flooring for the Project.

C. Training for rubber floor installations shall be provided by manufacturer’s technician.

D. Installer shall use manufacturer recommended equipment and installation tools for the rubber floor installations.

E. Templates shall be required for cutting rubber flooring materials on-site. Template patterns and material must be approved by manufacturer, A/E and Owner prior to starting installation.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience, and trained by manufacturer.
   1. Individual installer/applicators shall each be trained and/or certified by the manufacturer.
   2. Crew superintendent and trained installers who begin the project shall remain on the project through completion. Crew changes are subject to the approval of the Owner and the Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Protect roll materials from damage by storing on end.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

C. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.9 PRE-INSTALLATION MEETINGS

A. Section 013000 – Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish 24 sq ft of flooring, 1 coil lineal feet of base, of each type and color specified.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Manufacturers:
1. Roppe. (Design Basis)
2. Armstrong.
3. Tarkett.
4. Substitutions: Section 016000 - Product Requirements.

B. Refer to A602 for selections.

2.2 ACCESSORIES

A. Subfloor Filler: Cementitious; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer (410).

C. Moldings and Edge Strips: Same material as flooring.

2.3 TILE FLOORING:

A. Manufacturers:
1. J&J Flooring. (Design Basis)
2. Roppe. (Design Basis)
3. Armstrong.
4. Tarkett.
5. Substitutions: Section 016000 - Product Requirements.

B. Refer to A602 for selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify concrete floors are dry to maximum moisture content of percent as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

C. Verify floor and lower wall surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials.

D. Verify in field all saw cuts and control joints are clean and free from all saw laitance, dirt, debris, coatings, sealers and visible moisture from the saw cuts. Use a suitable dustless concrete saw with a diamond blade slightly wider than the existing cut width with nora patch (or similar) to fill the pre-cleaned saw cuts.

E. Beginning work means acceptance of existing conditions.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Use appropriate patching compound or self-leveling underlayment following manufacturer’s instructions. Patching or underlayment compounds must be moisture, mildew, and alkali-resistant. Provide a minimum of 3000 psi compressive strength.

C. Prohibit traffic until filler is cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances cannot be removed.

3.3 EXISTING WORK

A. Extend existing resilient flooring installations using materials and methods compatible with existing installations, or as specified.

3.4 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

C. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

D. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

F. Install flooring in recessed floor access covers. Maintain floor pattern.

3.5 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean, seal, and maintain resilient flooring products.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096500

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Carpet tile, fully adhered.
   2. Accessories.

B. Related Requirements:
   1. Section 096500 Resilient Flooring: Base finish, Termination edging of adjacent floor finish.

1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM D2859 - Standard Specification for Ignition Characteristics of Finished Textile Floor Covering Materials.

B. California Department of Health Services:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. Carpet and Rug Institute:
   1. CRI Carpet Installation Standard - Standard for Installation of Commercial Carpet.
   2. CRI Green Label Plus Testing Program.
   3. CRI Model Specifications for Commercial Carpets.

D. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.

E. National Fire Protection Association:
   1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

F. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.

1.3 PRE-INSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples:
1. To verify color selection, submit one full-sized carpet tile and one 6”x6” piece for each carpet color selected, illustrating color and pattern design.
2. Submit two 6 inch long samples of each color of edge strip.

D. Manufacturer's Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials:
1. Furnish remaining box of carpet tiles of each color and pattern selected.

1.7 QUALITY ASSURANCE

A. Surface Burning Characteristics:
1. Floor Finishes: Comply with one of the following:
   a. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
   b. CPSC 16 CFR 1630 and ASTM D 2859.

B. Texture Appearance Retention Rating: Rating classifications as determined by CRI Model Specifications for Commercial Carpets.
1. Greater than or equal to 2.5 TARR for Moderate Traffic Level Classification.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1. FCIB or IFCI certified carpet installers.

1.9 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Store materials in area of installation for 48 hours prior to installation.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Manufacturers:
1. Interface
2. Mohawk Industries
3. Mannington.
4. J & J Flooring (Design Basis)
5. Substitutions: Section 016000 - Product Requirements.

2.2 COMPONENTS

A. Refer to A602 for selections.

B. Sub-Floor Filler: Cementitious latex Type recommended by flooring material manufacturer.

C. Moldings and Edge Strips: Vinyl, color, as selected from manufacturer standard.

D. Contact Adhesive: Compatible with carpet material Recommended by carpet manufacturer releasable type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify floor surfaces are smooth and flat within tolerances specified in Sections 03 35 00 concrete Finishing and Section 03 39 00 Concrete Finishing and are ready to receive work.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Clean substrate.

3.3 INSTALLATION – CARPET TILE

A. Install carpet tile in accordance with CRI Carpet Installation Standard.

B. Do not mix carpet from different cartons unless from same dye lot.

C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

D. Install carpet tile in square pattern, with pile direction alternating to next unit, set parallel to room length (see Installation Guide).

E. Locate change of color or pattern between rooms under door centerline and as indicated on Installation Guide.

F. Fully adhere carpet tile to substrate.

G. Adhere carpet tile adhesive as recommended by manufacturer onto clean and dry substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.4 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean and vacuum carpet surfaces.

END OF SECTION 096813

SECTION 097200 – WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and prime painting.
2. Wall covering and borders.

B. Related Requirements:

1. Section 099000 - Painting and Coating: Preparation and priming of substrate surfaces.
2. Limit list of definitions to terms unique to this Section and not provided elsewhere.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM F793 - Standard Classification of Wall Covering by Use Characteristics.

B. California Department of Public Health:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

C. Federal Specification Unit:

1. FS L-P-1040B - Plastic Sheets and Strips (Polyvinyl Fluoride).

D. Green Seal:

1. GS-11 - Green Seal Standard for Paints, Coatings, Stains, and Sealers.

E. National Fire Protection Association:

1. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls.
2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

F. South Coast Air Quality Management District:

1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

G. UL:

1. UL - Building Materials Directory.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding covering and adhesive.

C. Shop Drawings: Indicate wall elevations, with seaming layout.

D. Samples: Submit two samples of covering, 4 by 4 inches in size, illustrating color, finish, and texture.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer Instructions:

1. Submit special procedures and perimeter conditions requiring special attention.
2. Submit detailed instructions on installation requirements, including storage and handling procedures.

G. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit information regarding cleaning, touchup, and repair of covered surfaces.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials:

1. Furnish remaining stock 25 linear feet of each specified color and pattern of covering.
2. Store extra materials where directed by Owner.
3. Package and label each roll by manufacturer, color, pattern, and destination room number.

1.6 QUALITY ASSURANCE

A. Surface-Burning Characteristics:

1. Textile Wall Coverings:

a. Maximum Flame-Spread/Smoke-Developed Index: 25/450.
b. Testing: Comply with ASTM E84.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - 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. Storage:

1. Store materials according to manufacturer instructions.
2. Do not store roll goods on end.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect packaged adhesive from temperature cycling [and cold temperatures].
3. Provide additional protection according to manufacturer instructions.

1.9 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by adhesive manufacturer or by vinyl covering product manufacturer.

C. Subsequent Conditions: Maintain recommended conditions 24 hours before, during, and after installation of adhesive and covering.

1.10 CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for wall coverings.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

A. Manufacturers:

1. Olivia + Poppy. (Design Basis)
2. Momentum.
3. InPro .
4. MDC.
5. Substitutions: As specified in Section 016000 - Product Requirements.

2.2 WALL PROTECTION

A. Refer to A602 for selection.

2.3 ACCESSORIES

A. Adhesive Type: As recommended by covering manufacturer to suit application to substrate Water based.

B. Termination Trim:

1. Material: Extruded plastic.
2. Color: As selected.

C. Substrate Filler:

1. Type: As recommended by adhesive and covering manufacturers.
2. Compatible with substrate.

D. Substrate Primer and Sealer: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that substrate surfaces are [prime-painted and] ready to receive Work of this Section, and that they comply with requirements of covering manufacturer.

C. Moisture Content:

1. Measure moisture content of surfaces using electronic moisture meter.
2. Do not apply coverings unless moisture content of surfaces is below following maximums:

    a. Plaster and Gypsum Wallboard: 12 percent.
    b. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
    c. Wood Surfaces: 15 percent, as measured according to ASTM D4442.

D. Verify that flatness tolerance of surfaces does not vary more than 1/8 inch.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Fill cracks in substrate, smooth irregularities with filler, and sand smooth.

C. Wash impervious surfaces with tetra-sodium [tri-sodium] phosphate, rinse and neutralize, and then wipe dry.

D. Surface Appurtenances: Remove, or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

E. Surfaces:

1. Correct defects and clean surfaces that affect Work of this Section.
2. Remove existing coatings that exhibit loose surface defects.

F. Seal marks with shellac if they may bleed through surface finishes.

G. Sealer:

1. Apply one coat of primer sealer to substrate surfaces.
2. Allow to dry and lightly sand smooth.

H. Vacuum-clean surfaces free of loose particles.

3.3 INSTALLATION

A. Lighting: Provide lighting level of 80 fc, measured mid height at substrate surfaces.

B. Adhesive:

1. Apply adhesive to wall covering surface immediately prior to application of covering.
2. Let contact adhesive set tack-free.

C. Use covering in roll-number sequence.

D. Razor Trimming:

1. Razor-trim edges on flat worktable, changing blade often to prevent rough cut edges.
2. Do not razor-cut on gypsum board surfaces.

E. Application:

1. Apply covering smooth, and without wrinkles, gaps, or overlaps.
2. Eliminate air pockets and ensure full bond to substrate surface.
3. Butt edges tight.

F. Vertical seams are not acceptable.

G. Do not seam within 2 inches of internal corners, or within 6 inches of external corners.

H. Items Abutting Wall Surfaces:

1. Install covering before installation of bases, cabinets, hardware, or items attached to or spaced slightly from wall surface.
2. Do not install covering more than 1/4 inch below top of resilient base. Do not install covering more than 1 inch below top of resilient base.

I. Cover spaces above and below windows, and above doors, in pattern sequence from roll.

J. Apply covering to electrical, telephone, and wall plates prior to replacing.

K. Covering not required behind radiation and convector covers.

L. Terminations:

1. If covering tucks into reveals, or if metal wallboard or plaster stops, apply covering with contact adhesive within 6 inches of covering termination.
2. Ensure full-contact bond.

M. Install termination trim.

N. Excess Adhesive:

1. Remove excess adhesive while wet from seam before proceeding to next covering sheet.
2. Wipe clean with dry cloth.

3.4 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean coverings of excess adhesive, dust, dirt, and other contaminants.

C. Reinstall wall plates and accessories removed prior to Work of this Section.

END OF SECTION 097200

SECTION 099000 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field application of paints, stains, varnishes, and other coatings.

B. Related Requirements:
1. Section 055000 - Metal Fabrications: Shop-primed items.
2. Section 220553 - Identification for Plumbing Piping and Equipment: Stenciling, color-coding, and identification banding.
3. Section 230553 - Identification for HVAC Piping and Equipment: Stenciling, color-coding, and identification banding.
4. Section 260553 - Identification for Electrical Systems: Stenciling, color-coding, and identification banding.
5. Section 270553 - Identification for Communications Systems: Stenciling, color-coding, and identification banding.
6. Section 321216 - Pavement markings.

1.2 DEFINITIONS

A. Refer to ASTM D16 for definitions of terms used in this Section.

1.3 REFERENCE STANDARDS

A. ASTM International:
1. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. California Department of Public Health:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. Green Seal:
1. GS-03 - Anti-Corrosive Paints.
2. GS-11 - Paints and Coatings.

D. Master Painters Institute:
1. MPI - Approved Products List.
2. MPI - Architectural Painting Manual.

E. South Coast Air Quality Management District:
   1. SCAQMD Rule 1113 - Architectural Coatings.

1.4 SEQUENCING

A. Section 011000 - Summary: Requirements for sequencing.

B. Do not apply finish coats until paintable sealant is applied.

C. Back prime wood trim before installation of trim.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit manufacturer data on finishing products and special coatings.
   2. Include MPI - Approved Products Lists with proposed products highlighted.

C. Samples:
   1. Submit two paper chip samples, 4 by 4 inches in size, illustrating range of colors and textures available for each surface finishing product as scheduled.

1.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit information on cleaning, touchup, and repair of painted and coated surfaces.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials:
   1. Furnish one gallon of each color, type, and surface texture as provided for Project.
   2. Label each container with manufacturer's label, color, type, texture, room number, and Site location.
   3. Store where directed by Owner.

1.8 QUALITY ASSURANCE

A. MPI Standards:
   1. Comply with indicated MPI standards.
   2. Products: Listed in MPI - Approved Products List.

B. Surface Burning Characteristics:
   1. Fire-Retardant Finishes: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Container Labeling: 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. Inspection:
   1. Accept materials on Site in manufacturer's sealed and labeled containers.
   2. Inspect for damage and to verify acceptability.

D. Store materials in ventilated area and otherwise according to manufacturer instructions.

E. 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.

1.11 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Storage Conditions:
   1. Minimum Ambient Temperature: 45 degrees F.
   2. Maximum Ambient Temperature: 90 degrees F

C. Application Conditions:
   1. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint manufacturer.
   2. Do not apply exterior coatings during rain or snow, when relative humidity is outside humidity ranges, or when moisture content of surfaces exceeds those required by paint manufacturer.
   3. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors and 50 degrees F for exteriors, unless otherwise indicated by manufacturer instructions.

4. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interiors and exteriors, unless otherwise indicated by manufacturer instructions.
5. Lighting Level: 80 fc measured mid-height at substrate surface.

1.12 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for paint and coatings.

PART 2 - PRODUCTS

2.1 PAINTS AND COATINGS

A. Manufacturers:
1. Sherwin Williams
2. Benjamin Moore
3. Pittsburgh Paint.
4. Substitutions: As specified in Section 016000 - Product Requirements.

B. Materials:
1. Coatings:
   a. Ready mixed, except field-catalyzed coatings.
   b. Capable of drying or curing free of streaks or sags.
2. Patching Materials: Latex filler.
3. Fastener Head Cover Materials: Latex filler.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify that surfaces and substrate conditions are ready to receive Work as recommended by product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of Work, and report conditions capable of affecting proper application to Architect/Engineer.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Moisture Content:
1. Measure moisture content of surfaces using electronic moisture meter.
2. Do not apply finishes unless moisture content of surfaces are below following maximums:
   a. Plaster and Gypsum Wallboard: 12 percent.

b. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
c. Interior Wood: 15 percent, measured according to ASTM D4442.
d. Exterior Wood: 15 percent, measured according to ASTM D4442.
e. Concrete Floors: 8 percent.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application preparation.

B. Prepare coatings as follows:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For smooth flow and brushing properties.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Defects:
1. Correct defects and clean surfaces capable of affecting Work of this Section.
2. Remove or repair existing coatings exhibiting surface defects.
3. Remove existing coatings, on concrete masonry units where stone veneer is being installed. Sand blast coating to porous concrete surface for best adhesion.
4. Scuff epoxy coating on concrete floor to receive new resilient flooring.

E. Marks: Seal marks that may bleed through surface finishes with shellac.

F. Impervious Surfaces:
1. Remove mildew by scrubbing with solution of tetra-sodium or tri-sodium phosphate and bleach.
2. Rinse with clean water and allow surface to dry.

G. Aluminum Surfaces Scheduled for Paint Finish:
1. Remove surface contamination by steam or high-pressure water.
2. Remove oxidation with acid etch and solvent washing.
3. Apply etching primer immediately following cleaning.

H. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish:
1. Remove foreign particles to permit adhesion of finishing materials.
2. Apply latex-based compatible sealer or primer.

I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

J. Concrete Floors (new):
1. Remove contamination, acid etch, and rinse floors with clear water.
2. Verify that required acid-alkali balance is achieved.
3. Allow to dry.

K. Copper Surfaces Scheduled for Paint Finish:
1. Remove contamination by steam, high-pressure water, or solvent washing.

2. Apply vinyl-etch primer immediately following cleaning.

L. Gypsum Board Surfaces:
1. Fill minor defects with filler compound.
2. Spot-prime defects after repair.

M. Galvanized Surfaces:
1. Remove surface contamination and oils, and wash with solvent.
2. Apply coat of etching primer.

N. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish:
1. Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter.
2. Remove oil and grease with solution of tri-sodium phosphate, rinse well, allow to dry.
3. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water and allow to dry.

O. Plaster Surfaces:
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster.
2. Make smooth and flush with adjacent surfaces.
3. Wash and neutralize high-alkali surfaces.

P. Uncoated Steel and Iron Surfaces:
1. Remove grease, mill scale, weld splatter, dirt, and rust.
2. If heavy coatings of scale are evident, remove by power tool wire brushing or by sandblasting.
3. Clean by washing with solvent.
4. Apply treatment of phosphoric acid solution, ensuring that weld joints, bolts, and nuts are similarly cleaned.
5. Spot-prime paint after repairs.

Q. Shop-Primed Steel Surfaces:
1. Sand and scrape to remove loose primer and rust.
2. Feather edges to make touch-up patches inconspicuous.
3. Clean surfaces with solvent.
4. Prime bare steel surfaces.

R. Interior Wood Items Scheduled to Receive Paint Finish:
1. Wipe off dust and grit prior to priming.
2. Seal knots, pitch streaks, and sappy sections with sealer.
3. Fill nail holes and cracks after primer has dried.
4. Sand between coats.

S. Interior Wood Items Scheduled to Receive Transparent Finish:
1. (Floors) Sand to smooth finish
2. Wipe off dust and grit prior to sealing.
3. Seal knots, pitch streaks, and sappy sections with sealer.
4. Fill nail holes and cracks after sealer has dried.
5. Sand lightly between coats.

T. Exterior Wood Scheduled to Receive Paint Finish:
1. Remove dust, grit, and foreign matter.

2. Seal knots, pitch streaks, and sappy sections.
3. Fill nail holes with tinted exterior paintable calking compound after prime coat has been applied.

U. Exterior Wood Scheduled to Receive Transparent Finish:
1. Remove dust, grit, and foreign matter.
2. Seal knots, pitch streaks, and sappy sections with sealer.
3. Fill nail holes with tinted exterior calking compound after sealer has been applied.

V. Wood Doors Scheduled for Finish: Seal wood door top and bottom edge surfaces.

W. Metal Doors Scheduled for Painting: Prime metal door at top and bottom edge surfaces.

X. Existing Work:
1. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.3 APPLICATION

A. Comply with MPI - Architectural Painting Manual.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform appearance.

D. Apply each coat of paint slightly darker than preceding coat, unless specified otherwise.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Cleaning:
1. Vacuum surfaces to remove loose particles.
2. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Fillers:
1. If clear finishes are required, tint fillers to match wood.
2. Work fillers into grain before set, and wipe excess from surface.

H. Concealed Surfaces:
1. Prime concealed surfaces of interior and exterior woodwork with primer paint.
2. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

I. Finishing Mechanical and Electrical Equipment:
1. Schedule of Color-Coding and Identification Banding of Equipment, Ductwork, Piping, and Conduit: As specified in Section(s) 220553 - Identification for Plumbing Piping and Equipment, 230553 - Identification for HVAC Piping and Equipment, 260553 - Identification for Electrical Systems, 270553 - Identification for Communications Systems.
2. Paint shop-primed equipment.

3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components, and paint separately.
4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where these items are shop finished.
5. Paint interior surfaces of air ducts and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint to visible surfaces.
6. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
7. Paint exposed conduit and electrical equipment installed in finished areas.
8. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
9. Color-Coding:
    a. Color-code equipment, piping, conduit, and exposed duct work according to indicated requirements.
    b. Color band and identify with flow arrows, names, and numbering.
10. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Inspecting and Testing: Comply with MPI - Architectural Painting Manual.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Collect waste material that may constitute fire hazards, place in closed metal containers, and remove daily from Site.

3.6 ATTACHMENTS

A. Schedule - Exterior Surfaces:
1. Steel - Galvanized:
    a. One coat galvanize primer Sherwin Williams ProCryl Primer.
    b. Two coats of latex enamel, semigloss.
    c. ProCryl Top Coat, as manufactured by Sherwin Williams.

B. Schedule - Interior Surfaces:
1. Wood - Painted:
    a. One coat of latex prime sealer, Wall and Wood Primer.
    b. Two coats of latex enamel, satin, S-W ProClassic.
2. Wood - Transparent:
    a. Filler coat (for open grained wood only) Min Wax wood conditioner.

b. One coat of stain. S-W Wood Classics Oil Stain, A49 Series, Minwax or BAC wiping stain.
c. Two coats of water based polyurethane with satin finish: S-W A64 Series Wood Classics or Kem Aqua Lacquer T75-F527.

3. Steel – Unprimed:
   a. One coat of latex primer, S-W ProCryl.
   b. Two coats of latex enamel, semi-gloss SherCryl. (4 mils wet, 1.4 mils dry per).
4. Steel – Primed, unpainted:
   a. One coat DTM Primer.
   b. Two coats of SW-DTM (Direct to Metal) or approved equal, semi-gloss finish (4 mils wet, 1.4 mils dry per coat)
5. Steel – Primed, Exposed Structure and Deck:
   a. One coat water based flat Dryfall B42W, Black.
6. Gypsum Board Walls:
   a. One coat of latex primer sealer. S-W Latex Primer B28WF162.
   b. Two coats of latex enamel, eggshell.
   c. S-W ProMar 200 Latex Eg-Shell.
7. Gypsum Board in Bathrooms, Locker Rooms, Kitchen, and Janitor Rooms”
   a. One coat of latex primer sealer. S-W Contractor Latex Primer B28WF162.
   b. Two coats of latex enamel, semi-gloss, Industrial PreCat SemiGloss K46W151 (4 mils wet, 1.4 mils dry per coat).
8. Gypsum Board Ceilings:
   a. One coat of latex primer sealer. S-W ProMar 200 Latex Primer.
   b. Two coats of latex enamel, flat finish, S-W ProMar 200, extra white, flat (4 mils wet, 1.4 mils dry per coat).

END OF SECTION 099000

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior signs.

B. Related Requirements:

1. Section 220553 - Identification for Plumbing Piping and Equipment for nameplates, labeling, and identification methods for plumbing equipment and components.
2. Section 230553 - Identification for HVAC Piping and Equipment for nameplates, labeling, and identification methods for HVAC equipment and components.

1.2 DEFINITIONS

A. VHB Tape: Very High Bond tape.

1.3 ALLOWANCES

A. Section 012000 - Price and Payment Procedures: Cash or contingency allowance procedures.

B. Allowance Includes: Purchase, delivery, and installation of interior signs.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate sign styles, lettering font and size, foreground and background colors, locations, and overall dimensions of each sign.

C. Samples: Submit two material sample signs, 4 by 4 inches in size, illustrating type, style, letter font and size, colors, and method of attachment.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work according to manufacturer standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - 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. Storage:

1. Store materials according to manufacturer instructions.
2. Store adhesive attachment tape at ambient room temperatures.

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 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Minimum Conditions: Do not install signs when ambient temperature is lower than recommended by manufacturer.

C. Subsequent Conditions: Maintain temperatures above minimum during and after installation of signs.

PART 2 - PRODUCTS

2.1 INTERIOR SIGNS

A. Manufacturers:

1. ACE Sign Systems, Inc.
2. Advance Corporation.

3. Allen Markings.
4. APCO Graphics, Inc.
5. ASE, Inc.
6. ASI Sign Systems, Inc.
7. Best Sign Systems, Inc.
8. Bunting Graphics, Inc.
9. Clarke Systems.
10. Diskey Architectural Signage Inc.
11. Inpro Corporation.
12. Mohawk Sign Systems.
13. Nelson-Harkins Industries.
14. Poblocki Sign Company, LLC.
15. Stamprite Supersine; a division of Stamp Rite Inc.
16. Vista System.
17. Vomar Products, Inc.
18. Substitutions: As specified in Section 016000 - Product Requirements.

B. Engraved Signs:

1. Material: Laminated colored plastic.
2. Lettering: Engraved through face to expose core color.
3. Face Color: [**Clear**] [**Wood grain, walnut**] [**Wood grain, <_____>**] <_____> [**As selected**].
4. Core Color: <_____>.
5. Total Thickness: [1/16] [1/8] inch.
6. Total Height: [2] [3] <_____> inches.
7. Edges: [**Square**] [**Beveled**] [**Radiused**]; finish edges with no sawmarks visible.
8. Characters:

    a. Color: <_____>.
    b. Thickness: [1/8] <_____> inch.
    c. Height: [1] [1-1/2] <_____> inch.
    d. Font: [**Helvetica**] <_____>.

C. Sand-Blasted Signs:

1. Material: Acrylic high-gloss plastic.
2. Lettering: Sand blasted to dull sheen.
3. Color: [**Clear**] [**Solid**] [**As selected**].
4. Total Thickness: [1/8] <_____> inch.
5. Total Height: [2] [3] <_____> inches.
6. Edges: [**Square**] [**Beveled**] [**Radiused**]; finish edges with no sawmarks visible.
7. Characters:

    a. Color: <_____>.
    b. Thickness: [1/8] <_____> inch.
    c. Height: [1] [1-1/2] <_____> inch.
    d. Font: [**Helvetica**] <_____>.

D. Injection-Molded [**Cast**] Signs:

1. Material: [**Acrylic plastic**] [**Cast aluminum**].
2. Sign Color: [**Clear**] [**Solid**] [**As selected**].
3. Total Thickness: [1/8] <_____> inch.
4. Total Height: [2] [3] <_____> inches.
5. Edges: [**Square**] [**Beveled**] [**Radiused**].
6. Characters:

    a. Color: [**Contrasting color**] [**Ground-satin surface**] <**_____**>.
    b. Thickness: [1/8] <_____> inch.
    c. Height: [1] [1-1/2] <_____> inch.
    d. Font: [**Helvetica**] <**_____**>.

E. Raised-Letter Signs:

1. Material: Acrylic plastic.
2. Sign Color: [**Clear**] [**Solid**] [**As selected**].
3. Total Thickness: [1/8] <_____> inch.
4. Total Height: [2] [3] <_____> inches.
5. Edges: [**Square**] [**Beveled**] [**Radiused**]; finish edges with no sawmarks visible.
6. Characters:

    a. Material: Acrylic plastic, character adhered to base material.
    b. Color: [**Black**] <**_____**>.
    c. Thickness: [1/8] <_____> inch.
    d. Height: [1] [1-1/2] <_____> inch.
    e. Edges: [**Square**] [**Beveled**] [**Radiused**]; finish edges with no sawmarks visible.
    f. Font: [**Helvetica**] <**_____**>.
    g. Case: [**Upper**] [**and**] [**lower**].

F. Individual Graphics:

1. Style: [**Handicapped**] <**_____**>.
2. Material: Acrylic plastic.
3. Sign Color: [**Clear**] [**Solid**] [**As selected**].
4. Thickness: [1/8] <_____> inch.
5. Height: [2] [3] <_____> inches.
6. Edges: [**Square**] [**Beveled**] [**Radiused**]; finish edges with no sawmarks visible.
7. Characters:

    a. Color: [**Black**] <**_____**>.
    b. Font: [**Helvetica**] <**_____**>.
    c. Case: [**Upper**] [**and**] [**lower**].

2.2 ACCESSORIES

A. Mounting Hardware: Chrome screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use manufacturer's installation template and attachment devices.

B. Install signs after surfaces are finished.

C. Locations: As directed by Architect/Engineer.

END OF SECTION 101400

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid plastic toilet compartments.
2. Urinal screens.

B. Related Requirements:

1. Section 055000 - Metal Fabrications: Concealed steel support members.
2. Section 061000 - Rough Carpentry: Concealed wood framing and blocking for compartment support.
3. Section 102800 - Toilet, Bath, and Laundry Accessories: Execution requirements for accessories specified in this Section.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A666 - Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with placement of support framing and anchors in wall and ceiling.

1.4 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and ceiling supports, door swings.

D. Samples: Submit two compartment samples, 2 by 2 inch in size, illustrating panel finish, color, and sheen.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Instructions: Submit special procedures, perimeter conditions requiring special attention.

G. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.6 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify that the following products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project Site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Spare Parts:

1. Furnish two sets of manufacturer's recommended spare parts.

C. Tools: Furnish special wrenches and other devices required for Owner to maintain panels and hardware.

1.8 QUALITY ASSURANCE

A. Perform Work according to manufacturer standards.

B. Maintain 2 copies of each standard affecting the Work of this Section on-Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.10 MOCKUPS

A. Section 014000 - Quality Requirements: Requirements for mockups.

B. Size: Construct mockup of one complete toilet room. Include accessories and field-installed components.

C. Locate where indicated on Drawings.

D. Incorporate accepted mockup as part of Work.

1.11 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish fifteen-year manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SOLID PLASTIC TOILET COMPARTMENTS

A. Manufacturers:

1. Ampco by AJW.
2. ASI Accurate Partitions; ASI Group.
3. ASI Global Partitions; ASI Group.
4. Bradley Corporation. (Design Basis)

5. General Partitions Mfg. Corp.
6. Hadrian Manufacturing Inc.
7. Knickerbocker Partition Corporation.
8. Metpar Corp.
9. Partition Systems International of South Carolina.
10. Scranton Products.
11. Weis-Robart Partitions, Inc.
12. Substitutions: Section 016000 - Product Requirements.

B. Compartments and Screens: Ceiling hung and wall hung.

1. Refer to A602 for selections.

2.2 MATERIALS

A. Toilet Compartments: Solid, molded thermoset, and waterproof; high-density polyethylene (HDPE) plastic panels, doors, and pilasters,

2.3 ACCESSORIES

A. Head Rails: Hollow chrome-plated steel tube, [1 x 1-5/8] in size, with anti-grip profiles and cast socket wall brackets.

B. Brackets: Stainless steel.

C. Privacy:
1. Interlocking design of pilasters and panels to eliminate sight gap between doors and pilasters.

D. Attachments, Screws, and Bolts: Stainless steel, tamper-proof type.

1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hardware: Satin chrome-plated, non-ferrous cast metal.

1. Pivot hinges, gravity type, adjustable for door-close positioning; two for each door.
2. Nylon bearings.
3. Thumbturn door latch with exterior emergency access feature.
4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
5. Coat hook with rubber bumper; one for each compartment, mounted on door.
6. Door pull for out-swinging doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Requirements for installation examination.

B. Verify field measurements are as indicated on Shop Drawings.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Maintain maximum of 1/2 in space between wall and panels and between wall and end pilasters.

B. Attach panel brackets securely to walls using anchor devices.

C. Attach panels and pilasters to brackets. Locate head-rail joints at pilaster center lines.

3.3 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Position: 1/4 in.

C. Maximum Variation from Plumb: 1/8 in.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Review proposed field touch-up of scratches or damaged finish with Architect prior to initiating repair. Where conditionally approved, use manufacturer-provided repair materials and procedures. Replace all unacceptable field-repaired finishes with new materials.

3.5 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 in.

C. Adjust hinges to position doors in fully open position when unlatched. Return out-swinging doors to closed position.

D. Adjust adjacent components for consistency of line or plane.

3.6 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean partition and screen surfaces with materials and cleansers according to manufacturer's recommendations.

3.7 ATTACHMENTS

A. Toilet Room 204: Three toilet stalls of floor-mounted, head-rail-braced type; two urinal screens with pilaster bracing; two contrasting colors as selected.

B. Staff Washroom: One toilet stall of ceiling-mounted type; single color as selected.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Toilet accessories.

B. Related Requirements:
   1. Section 061053 - Miscellaneous Rough Carpentry: Concealed wood framing and blocking for support of accessories.
   2. Section 260503 – Equipment Wiring

1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM A123 - Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
   2. ASTM A153 - Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
   3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   4. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
   5. ASTM A666 - Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
   7. ASTM C1036 - Standard Specification for Flat Glass.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with placement of reinforcement of toilet partitions to receive anchor attachments.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures Requirements for submittals.

B. Product Data: Submit data on accessories, describing size, finish, details of function, and attachment methods.

C. Manufacturer's Instructions: Submit special installation procedures, conditions requiring special attention, and maintenance requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience.

1.6 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish ten-year manufacturer's warranty for electric hand dryers.

C. Furnish fifteen-year manufacturer's warranty for mirror glass and stainless steel mirror frames.

PART 2 - PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

A. Manufacturers:
1. American Dryer, Inc.
2. American Specialties, Inc. (Design Base)
3. Bobrick Washroom Equipment
4. Bradley Corporation (Design Base)
5. World Dryer Corporation
6. In Pro (Design Base)
7. Koala Kare (Design Base)
8. Global Industries. (Design Base)
9. Substitutions: Section 012500 - Product Requirements.

B. Performance and Design Criteria:
1. Design grab bars and attachments to resist minimum 250 lb concentrated load applied at any point in any direction.
2. Design shower seat and mounting to support a vertical or horizontal force of 250 pounds applied at any point on the seat, fastener mounting device, or supporting structure.

2.2 MATERIALS

A. Accessories: Shop assembled, free of dents and scratches, and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
1. Grind weld joints smooth.
2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Furnish two keys for each keyed accessory to Owner.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269, Type 304 stainless steel.

E. Galvanized Sheet Steel: ASTM A653, G90 zinc coating.

F. Mirror Glass (Type MR-F): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality Q2 mirror; type with copper and silver coating, and organic overcoating.

G. Adhesive: Two-component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot-dip galvanized, tamper-proof.

I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise indicated.

B. Chrome/Nickel Plating: ASTM B456, satin finish.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats baked enamel.

D. Galvanizing: ASTM A123; hot-dip galvanize after fabrication.

E. Galvanizing for Nuts, Bolts, and Washers: ASTM A153.

F. Shop-Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

G. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 TOILET ROOM ACCESSORIES

A. All model numbers and manufacturers listed are the Basis of Design. Substitutions may be permitted according to the Instructions to Bidders and Section 016000 of the specifications.

B. Toilet Paper Dispenser:
   1. Dalco, Tork 55 TR, #017086

C. Paper Towel Dispenser:
   1. Dalco, Tork H80, #771828

D. Hand Soap:
   1. Dalco, #044001

E. Mirrors:
   1. Size: as indicated on Drawings.
   2. Frame: 0.05 in channel shapes, with mitered, welded, and ground corners, and tamper-proof hanging system; bright annealed finish.

3. Backing: Full mirror sized, minimum 0.03 in galvanized steel sheet and nonabsorptive filler material.

F. Grab Bars: Stainless steel, 1-1/2” outside diameter, minimum 0.05” wall thickness, nonslip grasping surface, concealed flange mounting; 1-1/2” clear between wall and inside of grab bar.
1. Length and configuration: As indicated on Drawings.
2. Model: 812 Series, manufactured by Bradley.

G. Baby Changing Station Koala Kare KB200-01SS gray stainless steel horizontal baby changing station.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Requirements for installation examination.

B. Verify exact location of accessories for installation.

C. Verify field measurements and rough-in dimensions for recessed accessories are as instructed by manufacturer.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Deliver inserts and rough-in frames to Site for timely installation.

C. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Do not install accessories until after completion of all finishes to adjacent wall and ceiling surfaces.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Turn over to Owner all keys and special tools required for lockable or secured accessories.

D. Mounting Heights and Locations: As required by accessibility regulations.

E. Hand dryers: provide dedicated circuit with GFI protection.

3.4 REPAIR

A. Clean and repair existing toilet accessories that remain or are to be reinstalled.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean mirrors and exposed surfaces using procedures as recommended by accessory manufacturer.

END OF SECTION 102800

SECTION 107313 - AWNINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal framing and fittings.

1.2 ALLOWANCES

A. Section 012000 - Price and Payment Procedures: Cash or contingency allowance procedures.

B. Allowance Includes:

1. Purchase, delivery, and installation of awnings.

1.3 REFERENCE STANDARDS

A. American Architectural Manufacturers Association:

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
3. AAMA 2604 - Voluntary Specification, Performance Requirements, and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 - Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society of Civil Engineers:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. American Welding Society:

1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
2. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
5. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
6. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric).
7. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
8. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
9. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
10. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications.

E. Green Seal:

1. GC-03 - Environmental Criteria for Anti-Corrosive Paints.

F. National Fire Protection Association:

1. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

G. UL:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate awning profiles, sizes, connection attachments, anchorages, sizes and type of fasteners and accessories.

C. Samples:

Framing: Submit two samples of prefinished framing members and/or fascia w/ color

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 qualification within previous 12 months.

F. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

G. Qualifications Statements:

1. Submit qualifications for manufacturer.
2. Submit manufacturer's approval of installer.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificates:

    a. Certify source and origin for salvaged and/or reused products.
    b. Certify recycled material content for recycled content products.
    c. Certify source for regional materials and distance from Project Site.

C. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

    a. Salvaged, refurbished, and reused products.
    b. Products with recycled material content.
    c. Regional products.

1.6 QUALITY ASSURANCE

A. Welding: Comply with AWS D1.1/D1.1M and AWS D1.2/D1.2M.

B. Perform Work according to industry standards.

C. Maintain copies of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum 3 years' documented experience.

C. Fabricator: Company that employs skilled workers for custom-fabricated products similar to those required for Project, including providing professional engineering services as needed to assume engineering responsibility.

D. Installer: Company specializing in performing Work of this Section with minimum 3 years' documented experience and approved by manufacturer.

E. Welders: AWS qualified within previous 12 months for employed weld types.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Shipping: Fit and shop assemble components in largest practical sizes for delivery to Site.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

D. Store materials according to manufacturer instructions.

E. 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 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish 5-year manufacturer's warranty for awning construction.

C. Furnish 20-year warranty for metal framing finish.

PART 2 - PRODUCTS

2.1 AWNINGS

A. Manufacturers:

1. Mapes Architectural Canopies
   a. Lumishade, 2-Coat Kynar finish
      1) Extra Dark Bronze

2. Substitutions: As specified in Section 016000 - Product Requirements.
3. Furnish materials according to industry standards.

B. Performance and Design Criteria:

1. Design to resist live and dead loads.
2. Live Loads: As indicated on Drawings.
3. Snow Loads:

    a. Calculations: According to applicable code.
    b. Ground Snow Load: 70 psf.

4. Dead Loads: Actual weight of materials incorporated into Work.
5. Wind Loads:

    a. Design and size components to withstand positive and negative wind loads, including increased loads at building corners.
    b. Calculation: According to applicable code.
    c. Basic Wind Speed: 115 mph.
    d. Exposure: C

6. Wind Load: Design to pressure of 36 psf.
7. Wind-Uplift Resistance: Comply with UL 580, Class 90.

2.2 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

2.3 MATERIALS

A. Aluminum Framing:

1. Description:

    a. Per Mfr. Specifications.

2.4 FABRICATION

A. Framing:

1. Factory preassemble awning frames to greatest extent possible; and disassemble units only as necessary for shipping and handling limitations.
2. Furnish connections that maintain structural integrity of joined sections.
3. Fabricate components with joints tightly fitted and secured.
4. Exposed Fastenings:

    a. Hidden from view.
    b. Consistent with design of component.

5. Anchors:

    a. Furnish components required for anchorage.
    b. Fabricate of same material and finish as framing.

6. Continuously seal joined pieces by per Mfr.

7. Accurately form components to suit each other and to suit building structure.

2.5 FINISHES

A. Touchup Primer: Match shop primer.

B. Anticorrosive Paints: Maximum VOC content according to GC-03.

C. Aluminum:

1. Anodized Finish: Comply with AAMA 611, Class 1.
2. Powder Coating: Comply with AAMA
3. Color: Extra Dark Bronze

2.6 ACCESSORIES

A. Mounting Inserts and Brackets: by Mfr.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that wall substrate anchors are acceptable and are ready to receive Work of this Section.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Clean and strip primed steel items to bare metal where Site welding is required.

C. Furnish items required to be embedded in masonry with setting templates, to appropriate Sections.

3.3 INSTALLATION

A. Framing:

1. Install components plumb and level, accurately fitted, and free from distortion or defects.
2. Anchors:

    a. Provide anchors as required for connecting framing to structure.
    b. Anchor framing to structure.
    c. Field weld anchors as indicated on Shop Drawings, grind welds smooth, and touch up welds with primer.

3. Bolts and Screws:

    a. Conceal whenever possible.
    b. Where not concealed, use flush countersunk fasteners.

B. Covering:

1. Install covering over framing members, stretched taut without creases or folds.
2. Attach covering and fasten securely.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Plumb: ¼” inch per story, non-cumulative.

C. Maximum Misalignment from Indicated Position: ¼” inch.

3.5 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust awnings to produce uniform appearance and consistent in proper relation with adjacent Work.

3.6 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirement for cleaning.

B. Clean awning surfaces immediately after installation, according to fabric manufacturer instructions.

C. Touch up field connections and abraded metal finishes with coating manufacturer's touchup paint.

END OF SECTION 107313

SECTION 114000 – FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

NOTE: The abbreviation "FSEC" as herein used, shall be interpreted as the "Foodservice Equipment Contractor" and shall be a firm with not less than five (5) years of successful experience in supply and installation, similar in scope to that required for this project. The FSEC shall be a recognized distributor for the items of equipment specified herein, and shall have the financial resources to enable him to handle the work in a satisfactory manner and to deliver the required items of equipment, so as not to delay the progress of the work. The FSEC shall be fully capable of fulfilling the terms and conditions of the warranty provisions required by this contract.

1.2 DESCRIPTION OF WORK

1.3 EQUIPMENT

A. The work shall include all labor, materials, tools and appliances required for completely furnishing, delivering and erecting all Foodservice Equipment as shown on the accompanying drawings and as hereinafter specified, except for work and items noted under "Related Work Specified Elsewhere". All equipment herein specified shall be furnished complete: delivered to site where directed, uncrated, inspected and set in place.

1.4 SANITATION AND STANDARDS

A. All equipment specified hereinafter shall be fabricated to conform with the requirements and bear the seal of acceptance of the National Foundation Sanitary Standards, for the construction and installation of Foodservice Equipment, prepared by the Committee on Food Equipment Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan.

B. All Foodservice Equipment herein specified of standard manufacture or custom manufacture must comply with HACCP (Hazard Analysis Critical Control Point Program) design standards, outlined in the Federal Drug Administration (FDA) Code 97 and certified for sanitation by an American National Standards Institution (ANSI).

C. The following acts, rules and regulations shall be complied with:
1. Federal Occupational Safety and Health Act (Latest Edition)
2. All State, County, and Local Codes and/or Ordinances
3. Safety Orders of the State Accident Commission
4. Regulations of the State Fire Marshal
5. All prevailing Rules and Regulations pertaining to adequate protection and/or guarding of any moving parts, or otherwise hazardous locations.

D. All electrically operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of the National Electric Manufacturers Association and Underwriters Laboratories, Inc., where applicable to authorities having jurisdiction. All standard steam heated equipment shall be manufactured in accordance with A.S.M.E. code and carry A.S.M.E. stamp.

E. The materials and methods shall conform to the specifications, rules and regulations of the following, where specified or applicable to the work under this section of the Specifications:

ASTM	American Society for Testing Materials
AWS	American Welding Society
NBS	National Bureau of Standards
NFPS	National Fire Protection Association
FS	Federal Specifications
ASME	American Society of Mechanical Engineers
USDA	United States Department of Agriculture
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
AWI	American Woodworking Institute
NEC	National Electric Code
ANSI	American National Standard Institute

1.5 QUALITY ASSURANCE

A. Each item of Foodservice Equipment shall be constructed and installed as hereinafter specified, and/or in strict accordance with the latest and best engineering practices of the Foodservice Equipment Industry.

B. Each item of Foodservice Equipment shall be the size, shape and type as indicated, or shown on the Drawings and shall be as specified herein.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. Roughing in work for all equipment requiring electrical connections and equipment requiring water supply and drain, and the making of final mechanical and electrical connections, including all accessories, to such equipment shall be performed by respective building trades.

B. Piping for water, wastes and traps will be furnished and installed by the Mechanical Trades. All exposed piping (above countertop levels) from building service to point of final connection shall be chrome plated or stainless steel.

C. Mechanical Trades shall furnish grease traps, regulators, reduction valves, nipples, couplings, unions and shut-off valves for each piece of equipment and final connections from equipment to service lines. Mechanical Trades shall install all faucets called for in the Item Specifications. (All interconnections between component parts of equipment shall be by Mechanical Trades.) All exposed piping of equipment parts shall be chrome plated or stainless steel.

D. Electrical services for Food Service Equipment will be installed as shown on Drawings, in the building walls, floors or ceilings by Electrical Trades, terminating at a junction box suitably located for final electrical hookup of equipment in this section. Final hookup to equipment from building junction boxes shall be the responsibility of the Electrical Trades. All receptacles set into building walls and floors as required for mobile cord and plug equipped Foodservice Equipment will be installed by Electrical Trades. Provide slack wire for final connection to equipment when hard wired and provide suitable sized receptacles and cover plates when equipment is connected via cord and plug.

1.7 COORDINATION AND SUBMITTALS

A. Coordinate this work with the work of all other trades so that the installation of all work shall make a complete and finished job, meeting the approval of the Owner's Representative.

B. FSEC shall coordinate equipment as specified with the utilities installed at the construction site. FSEC shall submit for approval, dimensioned utility rough-in plans, prepared from the latest architectural plans available for all equipment. FSEC shall advise the Owner's Representative of any discrepancies noted in the field should any modifications be necessary.

C. All plumbing trim, electrical switches and other items required to make the utility connections for the complete installation, shall be plainly tagged and marked indicating the equipment each piece is required for.

D. The FSEC shall be responsible for making such field inspections as may be necessary to check the location of sleeves and conduits affecting the Foodservice Equipment, relative to the space in which each piece of equipment is to be located and its utility lines are run. Should any discrepancy between shop drawings and field locations be discovered, FSEC shall notify the Construction Manager or General Contractor for coordination and resolution of the discrepancy.

E. It shall be the responsibility of the FSEC to have a qualified representative at job meetings to assist the Architect and other Trades in coordination of the work or to answer questions so that the job can progress without any obstructions.

1.8 MANUFACTURERS

A. All standard factory constructed equipment, specified hereinafter by manufacturer and catalog number shall be the basis of the bid.

B. Where such catalog items are given for equipment, they should be complete as described and shown in the manufacturer's catalog unless exceptions are specifically mentioned hereinafter. The Architect, in exercising judgment as to the acceptability of products, will take into account all evidence available, whether or not submitted by the bidder, including that submitted by the Owner. The determination of the Architect shall apply only to the product under bid and shall have no force or effect applying to any other prior, concurrent or subsequent project.

1.9 CUSTOM MANUFACTURED EQUIPMENT

A. Custom manufactured equipment specified hereinafter shall be of, or equal to, the best grade of manufacture of one of the following.
   1. MCM Fixture Company; Hazel Park, Michigan
   2. American Stainless; Inglewood, Colorado
   3. Great Lakes Stainless; Traverse City, Michigan

B. Products of the foregoing fabricators which conform to the requirements of the plans and specifications, establish the "standards" required. Products of other manufacturers will be accorded consideration.

1.10 MEASUREMENTS

A. All measurements shall be verified at the building and full responsibility for their correctness shall be assumed by FSEC. No extra charge will be allowed on account of difference between actual dimensions and the measurements indicated on the Drawings. Any difference which may be found shall be submitted to the Construction Manager or General Contractor for consideration before proceeding with the work.

1.11 SHOP DRAWINGS

A. Shop drawings (electronic) shall be submitted for approval, showing complete details of construction and installation of all items, including information required for final connections to mechanical and electrical services. Provide a listing of loose components furnished in this section for installation by Mechanical and Electrical Trades.

B. Shop drawings shall be drawn to the following scale:

Equipment Layout Plan:	1/4" =1’0”
Equipment Electrical Rough-in Plan:	1/4" =1’0”
Equipment Plumbing Rough-in Pan:	1/4" =1’0”
Detail Drawings:	1-1/2"=1’0”

C. Shop drawings shall include complete data on the equipment, including physical dimensions and other information required for installation, performance capabilities and limitations, and schedules indicating locations when more than one type of an item is to be used. All shop drawings must be certified as being correct for the proposed work.

D. The Drawings indicate the arrangement and locations of equipment. Should it be necessary to deviate from this arrangement in order to meet structural conditions, such deviations shall be made without expense to the Owner.

E. The data given herein and on the Drawings are reasonably correct, but extreme accuracy is not guaranteed. Drawings and Specifications are for the assistance and guidance of the FSEC; exact locations, distances and levels will be governed by building conditions.

F. A brochure (electronic) of specification and catalog sheets with complete information on all items of standard manufacture shall be submitted for approval not later than thirty (30) days after Award of Contract.

G. Shop drawings submitted for approval shall be identified as to the specific equipment for which shop drawing relates. Identification shall be reference to equipment item numbers shown on the Drawings, or by reference to the appropriate article of the Specifications in which the equipment is specified.

H. Two (2) sets of instruction manuals shall be furnished after installation has been completed and prior to Owner acceptance of the project, each including the following:
1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished
2. Control, wiring, and operations diagrams
3. Installation, operation, lubrication and maintenance instructions
4. Manufacturer's recommended spare parts list
5. Complete lists of local service agencies

1.12 WARRANTY

A. Provide written warranty, signed by authorized representative of the FSEC agreeing to repair or replace defective materials and workmanship during a one (1) year warranty period. This one (1) year period shall begin from the date of Owner acceptance of the equipment installation. In addition to the one (1) year warranty, the FSEC shall provide a four (4) year parts warranty for the refrigeration compressor/condensers, covering those machines only. "Defective" is defined to include abnormal deterioration or discoloration of finishes and failure of equipment to meet performance requirements. Repairs or replacements required because of acts of God, exceeding performance requirements, vandalism, inadequate maintenance, alterations, failure of structure support or other causes beyond Manufacturer's, Fabricator's, Installer's control, shall be completed

by the FSEC and paid for by the Owner at prevailing rates. Warranty and enforcement shall not deprive the Owner of other available actions, rights or remedies.

1.13 OWNER FURNISHED EQUIPMENT

A. Equipment items designated in the Contract Documents as "By Owner" are shown for coordination purposes and the installation of these equipment items are solely the responsibility of the Owner. Coordination of these equipment items and their mechanical and/or electrical requirements is the responsibility of the FSEC.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All equipment specified shall be furnished complete, delivered to site where directed, inspected, uncrated, and set in place with all fittings as hereinafter listed.

B. Provide all necessary plumbing fittings, sink faucets, vacuum breakers, quick opening valves in sinks, sink strainers, tailpieces and other similar items as indicated or required, all chrome plated brass or stainless steel. Provide all valves required for accessibility to, and convenience of the operator, including pressure relief valves and vacuum breakers. Extension stems with suitable supports shall be provided as necessary.

C. Each item of equipment requiring electric current shall be fitted with heating elements, motors, switches, wiring and controls according to the performance needs.

D. When the work of this section has been completed, all equipment shall have been completely installed with all fittings hereinafter listed or required, ready for connection to the mechanical and electrical service lines necessary to complete the installation.

2.2 STAINLESS STEEL

A. Stainless steel shall conform to ASTM A167-70, Type 302. All exposed stainless steel surfaces shall be ground smooth and polished to either a No. 180 emory grit finish or to a No. 4 commercial mil finish. All unexposed portions shall be ground smooth with either a No. 2B finish or first-cut commercial finish.

2.3 GALVANIZED STEEL

A. Galvanized steel shall be used only where specified. And shall be of gauge shown with Coating Designation No. G165, minimized spangle, chemically treated, and in accordance with ASTM A525-71. Open cuts shall be treated in the field.

2.4 NAMEPLATES

A. Each item of equipment installed as specified herein shall bear a corrosion resisting metal nameplate of suitable size, permanently fastened to the equipment. Nameplates shall be riveted in position wherever possible and shall be proportionate to the size of the fixture. These nameplates shall bear the name of the manufacturer, model number and electrical load rating characteristics for fixture servicing.

B. Foodservice Equipment Installers, Fabricators or Service Agencies nameplate stickers shall not be fastened to any item, without the approval of the Architect.

2.5 SINKS

A. Sinks and drainboards shall be constructed of 14 gauge stainless steel. All corners shall be coved to at least 1/2 inch radius, with all corners and joints welded, ground and polished smooth.

B. In sinks of two or more compartments, install partitions, 1 inch wide, for full height. These partitions shall consist of two pieces of stainless steel, back-to-back, so fabricated that each compartment will be a deep bowl with coved corners. These partitions shall be welded in place at the bottom, front and back of sink, making smooth, rounded, coved corners. Top edges of the partitions shall be continuously welded. All welds shall be ground smooth and polished.

C. Where sinks are shown or specified in table top, they shall be of the same material as the table top, welded into top and furnished with rear overflow, strainer and lever handle waste.

D. Furnish 14 gauge stainless steel strainer plates on wastes, similar to Component Hardware #D50 Series, or equal, hardware polished, chrome plated.

E. Each sink compartment shall be provided with T & S splash mounted faucet with aerator; or T & S deck mounted faucet with aerator. When pre-rinse faucets or vacuum breaker piping are specified behind sinks or on dishtables, vertical pipe risers through tops or splashes shall be trimmed with a slip flange similar to that manufactured by, T & S ledge mount atmospheric vacuum breaker, or with pressure vacuum breaker, whichever is required by local authority.

2.6 CONDUIT AND FITTINGS

A. Conduit shall be hot dipped galvanized rigid steel, 3/4 inch minimum. Connections to motors or equipment subject to vibration shall be made by short length, 12 inches or 18 inches, or liquid tight flexible conduit.

B. Conduit fittings shall be malleable or cast iron threaded type, cadmium plated or hot dipped galvanized, equipped with metal or composition covers and gasketed where exposed to moist conditions.

2.7 ELECTRICAL RECEPTACLES

A. Receptacles built into Foodservice Equipment shall be Bryant #5261, where single, and #5262, where duplex, with matching caps on associated equipment as Bryant #5266; 30 amp outlets shall be 4 wire Hubbell #20403 receptacle, with matching cap Hubbell #20415 on associated equipment.

B. Receptacles shall be mounted in code gauge steel boxes, recessed with surface of equipment and equipped with brush finished stainless steel plates. Mount in Component Hardware Model #R-73, or equal, and stainless steel recessed housing.

2.8 SWITCHES AND PILOT LIGHTS

A. The FSEC shall supply on each motor driven appliance or electrically heated unit, an Under writer's Laboratories, Inc. listed control switch of proper type. All controls mounted on vertical surface of fixtures shall be recessed or otherwise indented to prevent damage. Mount in Component Hardware Model #R-73 or equal, recessed stainless steel housing.

B. Switches for lighting service shall be quiet-type, specification grade, recess mounted, rated 20 ampere, 120 volt, A.C. and equipped with brush finish stainless steel box, plate, and red glass jewel indicating light.

2.9 MOTORS AND MOTOR CONTROLS

A. Except where noted in the Item Specifications, current characteristics for motors less than 2 horsepower, for solenoid valves and lighting shall be 120 volt, single phase, 60 cycle, A.C. operation. Equipment requiring 120 volt control circuits shall be provided with integral pre-wired control circuit transformers.

B. Motors shall have ball bearings (thrust type) so motors can operate in vertical position, totally enclosed 55 degrees rise above 40 degrees ambient continuous duty. Motors shall have high torque, low starting current characteristics with NEMA frames. Verify voltage and current requirements on the job before ordering motors.

C. Standard motors furnished by manufacturers of equipment will be acceptable, if approved by Architect.

D. Motor controls for all Foodservice Equipment shall be supplied complete with necessary motor starters, control switches and remote control devices, as required. Three phase starters shall be combination fusible switch type magnetic starters, equipped with three (3) external manual reset overloads and low voltage protection as manufactured by Allen-Bradley, Cutler-Hammer, Square "D", or equal. Single phase starters shall be single pole, manually operated with one (1) thermal overload element.

E. Magnetic starters shall be equipped with control transformer 50 VA minimum size with fused secondary control circuit and 120 volt holding coil.

F. Push buttons, push to test, indicating lights and other control devices shall be compatible with starter requirement. Motor starter and control device enclosures shall be NEMA 1, 4, 12 or other, as required for satisfactory operation under the environmental conditions expected.

G. Equipment with factory built-in controls not conforming to the above must be specifically approved by the Construction Manager or Architect.

2.10 HEATING UNITS

A. Electrical heating units shall be supplied for operation in the following ranges and service characteristics, unless otherwise indicated or required:

1. Single or multiple element units under 1500 watt total, shall be 120 volt, single phase, 60 cycle service.

2. Single or multiple element units over 1500 watt total, shall be 208 volt, three phase, 60 cycle service.

B. Standard units supplied by manufacturers of Foodservice Equipment which differ in rating from that specified will be acceptable, provided that necessary revisions are coordinated by the FSEC, without additional cost to the Owner. Verify voltage and current requirements on the job before ordering heating units.

2.11 FABRICATION

A. It is required that all flat metal work items such as cafeteria counters, food serving units, tables, sinks, countertops and other similar items described in the Specifications, other than by name and catalog number, be manufactured by a Foodservice Equipment Fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacturer.

B. It shall be understood, that all fabricated equipment specified in the Item Specifications shall be sized per the Drawings and constructed in accordance with those General Requirement Specification which apply.

C. Field joints should be at a minimum, restricted only to the physical access into the building, and welded on the job with the use of adequate welding and clamping equipment to assure the quality of shop welding. Field welds shall be ground off, then polished to match the original finish of sheets with all graining to run in the same direction. Verify in the field how equipment may be brought into the building to the specified equipment location. Equipment shall be provided in largest sections possible with field welds minimized.

2.12 WELDING

A. The words "weld," "welded" or "welding" as used in this Specification shall mean the metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces.

B. Where spot welding is specified, the welds shall be at a maximum spacing of 3 inches.

C. Where tack welding is specified, the pieces welded shall have at least 1/2 inch of welding material at a maximum spacing of 4 inches.

D. All welding shall be done in a thorough manner with welding rod of same composition as sheets of parts welded. Welds shall be strong and ductile with excess metal and discoloration ground off the joints, finished smooth to match adjoining surface. Welds shall be free of imperfections such as pits, runs, splatter, crack, warping or discoloration. All welded joints shall be homogeneous with the parent metal itself.

E. All fabricated items, where metal to metal butt joints occur, shall have joints properly welded in accordance with these Specifications, unless otherwise noted.

F. Wherever a welding operation occurs on corrosion resisting steel, the choices of welding rods, and the welding procedures employed shall be such as to eliminate the possibility of corrosion . in the affected areas. Each joint of welding shall be suitably treated and finished to a bright finish to eliminate the possibility of progressive corrosion. Welding done by any process which minimizes carbide precipitation in connection with bolts and screws, need not be so treated. Wherever framing is specified to be galvanized angle or channel construction, welding shall be

G. done before galvanizing. If structural sections are used for a welded framework, the welded joints shall be suitably treated by means of a metallic coating to cover up all surfaces marred by the welding and grinding operation.

H. All grain patterns shall run uniformly in a horizontal direction. Where necessary to join sheets at 90 degrees, sheets shall be mitered so that grain patterns meet at 45 degrees.

2.13 BOLTS, SCREWS AND RIVETS

A. Where possible, exposed surfaces of equipment shall be free of bolts, screws, or rivet heads. Whenever bolts are used to fasten trim to the paneling and body of warmers, cabinets and similar equipment, and to fasten tops of counters or table tops to the top angle and framing, they shall be of the concealed type. Wherever threads of bolts and screws occur on the inside of fixtures and are either visible or might come in contact with a wiping cloth, the bolt and screw threads shall be capped with a suitable lock washer and chromium plated or bronze acorn nut (Component

Hardware #Q34, or equal). Wherever bolts are welded to underside of trim or tops, the reverse side of the weld shall be neatly finished and uniform with the adjoining surface to the trim or top.

2.14 GRINDING, POLISHING AND FINISHING

A. All exposed welded joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken in by a welding operation, such depression shall be hammered and peened flush with the surfaces adjoining and if necessary, ground again to eliminate low spots. All ground surfaces shall be polished or buffed to match the original finish of adjoining surfaces to a degree consistent with good workmanship.

B. The general finish of all equipment shall be of a high grade. Brake ends shall be free of open texture orange peel appearance, and where such brake work mars the uniform appearance of the material, the marks shall be removed by grinding, polishing and finishing. Sheared edges shall be free of burrs, projections and fins to eliminate all danger of cutting or laceration. Mitered or bullnosed corners shall be neatly finished with the under edge of the material and neatly ground to a uniform condition. In no case will overlapping material be acceptable. The equipment shall have a quality finish consistent with the highest grade of manufacturing practice in the industry. All exposed surfaces shall be commercial mil finish No. 4 for corrosion resisting steel. All cabinets, doors and shelves, where exposed shall be a satin finish. An exposed surface shall include an inside surface exposed to view when a hinged or sliding door is opened.

2.15 SOUND DEADENING

A. Sound deaden underside of tables and countertops with premium type mastic. Surface of mastic coating shall be smooth, equal to the standard for hot-rolled steel finish, 3M Coating #1000 E/C or equal. Coat with a lead free aluminum paint or coating to match color of item. Apply two (2) coatings of sound deadening material to underside of tops, drainboards, dishtables, counters, and sinks, applied during fabrication.

2.16 PAINTING

A. All metal of Foodservice Equipment that is not stainless steel and does not have factory finish shall be painted with two (2) coats of an approved rustproof paint such as Rust-O-Leum or as approved, highest quality gray enamel, air dried and applied in accordance with manufacturer's directions. Paint shall be self-leveling, showing no sags, cloudiness, runs or holidays, and shall be well sanded between coats.

B. Foodservice Equipment items on which painting will be required, shall be prime coated by the FSEC. Galvanized metal shall be neutralized before prime coat is applied with an approved acid resistant metal primer. Factory finished equipment shall not be painted, except as otherwise specified; but all damaged, scratched or refinished areas shall be touched up to match adjacent surfaces.

2.17 TABLES AND TOPS

A. All working tops shall be 34 inches above floor, unless otherwise indicated on the Drawings.

B. Unless otherwise specified, metal tops shall be provided for work tables, and enclosed base work counters and shall be 14 gauge stainless steel. Metal tops for work tables shall be reinforced and braced on the underside by a framework consisting of 1 inch x 1 inch x 4 inch, 12 gauge galvanized channels where concealed, and stainless steel where exposed.

C. All metal tops shall appear as one-piece with all field and shop joints reinforced and welded, ground smooth and polished. Metal tops shall be made of largest pieces obtainable. Short pieces of metal will not be acceptable. Stainless steel tops shall have 2 inch cove at re-entrant corners and where they are turned up in rear, or in rear and front such as dishtables. Solder filled corners will not be acceptable.

D. Metal edges shall be as follows (unless otherwise shown on Detail Drawings):
1. Work tables and enclosed base work counters: Rolled 180 degrees x 2 inches diameter.
2. Marine edge: Raised 1/2 inch at 45 degrees and rolled 180 degrees x 2 inches diameter.
3. Pot and pan washing sinks: Turned up 3 inches into a 2 inch x 180 degrees rolled rim.
4. Clean and soiled dish tables: Turned up 3 inches into a 2 inch x 180 degrees rolled rim.

E. Backsplashes and end splashes shall be as follows:
1. Work tables and enclosed base work counters: Turned up 6 inches at 90 degrees, back 2 inches at 45 degrees and down one inch parallel to wall
2. Pot and pan washing sinks: Turned up 6 inches at 90 degrees, back 2 inches at 45 degrees and down 1 inch parallel to wall.
3. Soiled and clean dishtables: Turned up 6 inches at 90 degrees, back 2 inches at 45 degrees and down 1 inch parallel to wall.

F. All backsplashes at walls shall be fastened with "Z" clips to wall, 24 inches on center minimum, and where exposed to view shall be finished in accordance with General Requirement Specifications.

G. All backsplashes shall have hollow ends closed and shall have enclosed rear, where exposed to view. Corners of all metal tops shall be bullnosed, unless otherwise specified.

2.18 WALL MOUNTED OVERSHELVES

A. Shelf shall be constructed of 16 gauge stainless steel with front edge rolled 1-1/2 inches at 180□. Rear and both ends shall be turned up 2 inches at 90 degrees with radiused corners.

B. Secure to wall with 12 gauge stainless steel support brackets below shelf and stainless steel bolts and expansion shields.

2.19 TABLE MOUNTED OVERSHELVES

A. Shelf shall be constructed of 16 gauge stainless steel with front edge rolled 1-1/2 inches at 180 degrees. Rear and both ends shall be turned up 2 inches at 90 degrees with radiused corners.

B. Where table is located in an "island" situation, away from walls, shelf shall have all edges rolled 1-1/2 inches at 180 degrees.

C. Mount shelf on extended table legs through openings in top or backsplash for support. Secure to uprights with 12 gauge stainless steel support brackets. Provide openings trimmed with slip flanges, Component Hardware Model #J52-0014, or equal.

2.20 UNDERSHELVES (In Open Type Work Tables)

A. Undershelves in open type work tables shall be constructed of 16 gauge stainless steel with front edge rolled 1-1/2 inches at 180 degrees and notched to fit legs to which shelf shall be welded from underside. Rear and ends of undershelves shall be turned up 2 inches at 90 degrees. Line up all edges of shelf with corner of the legs. Reinforce as required, to support a load of 40 pounds per square foot.

B. Where table is located in an "island" situation, away from walls, undershelf shall have all four edges rolled 1-1/2 inches at 180 degrees.

2.21 EQUIPMENT LEGS

A. Legs shall be constructed of 16 gauge (.064 inch thick) stainless steel tubing and shall be 15/8 inch outside diameter. Tubing shall be ground and polished to a No. 4 finish.

B. Legs shall slip into circular heavy duty stainless steel conical gussets (Component Hardware #A20-0206, or equal), which will be welded to a 12 gauge stainless steel triangular reinforcing plate that is welded to bottom of sink or table top. Legs shall be held in place in the gusset by means of stainless steel safety set screw.

C. Adjustable feet shall be stainless steel and slip inside tubular legs with no greater clearance than .01 inch. The adjustment shall be integrally threaded and at a maximum setting; no threads shall be exposed. Bottom of foot shall be flat and machine rounded slightly to straight sides, Component Hardware #A10-0852, or equal.

D. Where legs are not crossbraced in at least two directions, they shall be secured from movement by a 3/8 inch diameter stainless steel pin set into floor with quick drying marine type cement. Tables that are located in an "island" situation, away from walls, shall have all legs pinned to floor.

2.22 METAL DRAWERS

A. Drawers shall be constructed in two (2) sanitarily designed parts; a die stamped or fabricated and welded stainless steel removable drawer body and a stainless steel suitably welded reinforced drawer support frame, complete with 14 gauge stainless steel front liner. Drawers shall be 20 inches x 20 inches x 5 inches deep, unless otherwise specified.

B. Drawer front shall have Component Hardware #P63-1012, or equal recessed pull handle. Drawer support frame shall slide on Component Hardware #552, or equal, extension rollers. This mechanism must be so designed that drawer will not tilt when fully open. Drop type stainless steel drawer stops shall be welded to both sides of the framing and arranged so that drawer frame can be easily removed from the "Z" bar drawing supports. Construct supports for drawer slides of 12 gauge galvanized iron extending full width of table and welded to underside of table top. Equip drawer with rubber bumpers. Enclose entire drawer assembly with a stainless steel housing. Include a stainless steel removable drawer pan, Component Hardware #S81-2020, or equal.

C. When a "tier" of metal drawers is specified, they shall be two (2) or three (3) in number, as specified above and entirely enclosed with stainless steel, under cabinet bases, with openings for drawers and all joints flush welded, ground and polished smooth.

2.23 LOCKS AND OTHER HARDWARE

A. All hardware and other fittings used in connection with the equipment shall be cast nickel bronze or stainless steel, unless such fittings are unobtainable; then, chrome plated brass or bronze may be used, subject to approval. Handles shall be welded or conceal-bolted to the equipment. Hinges may be welded or bolted to the doors and bodies. Bolts shall be stainless steel, or the hinges may be welded or bolted to the doors and bodies, or the hinges may be fastened with stainless steel countersunk rivets, ground flush and polished smooth. Hinges shall be olive knuckle semi-concealed type, of nickel bronze or stainless steel, or heavy stainless steel piano type. (Use Component Hardware #P30 Series, or equal).

B. All hardware shall be identified with manufacturer's name and number so that broken or worn parts may be replaced.

C. All doors and drawers of fabricated equipment shall be fitted with cylinder locks, master-keyed as required.

2.24 WALL BACKER SUPPORT

A. For all wall-mounted equipment such as shelves, cabinets racks, etc., FSEC to insure adequate wall support for these items. Indicate to Architectural Trades required locations for plywood wall backer. All such backer material to be furnished and installed by Architectural Trades.

2.25 ITEM SPECIFICATIONS

ITEM #1 through #27D

See Escanaba Community Center Construction Documents, sheet A401 for complete list of Food Service Equipment and accessories.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

A. FSEC shall be responsible for assembly and erection of all equipment included herein and in required location as shown of Drawings

B. FSEC is to provide a competent Foreman to supervise erection and placing of equipment and to advise other Contractors in regard to connections at time of final installation.

C. FSEC is responsible for cutting all holes through tops, backsplashes, shelves and cabinets so that Building Trades can make connections to outlets in fixtures from roughing-in. All holes or openings must be cut, not torch burned, in a workmanlike manner with all edges ground smooth and free of sharp edges. Openings in rear of base cabinet must be no more than 1 inch larger than pipe extending through cabinet. Oversized cut-outs with rough edges will not be approved.

D. Spaces between equipment to walls, ceilings, floors and adjoining fixed equipment with enclosed bodies shall be completely sealed against entrance of food particles or vermin by means of stainless steel trim strips, welding or commercial joint material, suitable to the nature of the equipment. Sealer, when not exposed to extreme heat, shall be construction sealant in appropriate color and shall be Dow Corning #780, or approved, General Electric Sealant.

E. Ends of hollow sections to be closed.

F. All countertop equipment that is not specified with legs shall be sealed to countertop.

3.2 TESTING AND OPERATION INSTRUCTIONS

A. FSEC to provide a competent Service Representative to be present at the site when the equipment is put into operation and for a minimum of two (2) days thereafter during normal working hours. The Representative shall lubricate and put into proper operation, all of the installed equipment and shall instruct the Owner's personnel in its proper use and maintenance. Submit three (3) copies of the manufacturer's equipment maintenance schedule to the Owner prior to completion and final acceptance

3.3 ADJUST AND CLEAN

A. FSEC to perform the following:
   1. Adjust and lubricate all moving parts for smooth, quiet operation.
   2. Touch up scratched, marred, or abraded surfaces to restore equipment to original condition.
   3. Remove all crating and packing material from the job site.
   4. Remove protective coating, clean and polish finished surfaces to remove markings and fingerprints and leave equipment surfaces clean.
   5. Be responsible for missing items unless signed receipts can be produced from the Owner's personnel that the items were received and accounted for. The Owner cannot be responsible for items delivered to the job site which were dropped off without being signed for by the Owner's Personnel or representative. Installation will not be accepted by the owner until completion of a two (2) day adjust and service test use.

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

A. System to provide coverage for entire building.

B. Provide hydraulically designed system to NFPA 13 requirements.

C. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data become available prior to submittals.

D. Provide fire department connections.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Design Data: Submit design calculations.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish piping with temporary inlet and outlet caps until installation.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Manufacturers:
   1. Tyco.
   2. Ansul Incorporated.
   3. Automatic Sprinkler Corp..

4. Substitutions: Section 01 60 00 - Product Requirements.

B. Suspended Ceiling Type:
   1. Type: Standard or Concealed pendant type with matching escutcheon plate.
   2. Finish: Brass
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Exposed Area Type:
   1. Type: Standard upright type.
   2. Finish: Brass.
   3. Fusible Link: Fusible-solder link type temperature rated for specific area hazard.

2.2 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm , with pressure retard chamber and variable pressure trim.

B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts.

D. Fire Department Connections:
   1. Type: Siamese wall type with brass.
   2. Outlets: Two-way with fire department thread size. Threaded dust-cap and chain of matching material and finish.
   3. Drain: 3/4 inch automatic drip.
   4. Label: "Sprinkler - Fire Department Connection"

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13.

B. Install buried shut-off valves in valve box. Furnish post indicator.

C. Install approved double check valve or back-flow preventer assembly at sprinkler system water source connection.

D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

E. Locate outside alarm-gong on building wall.

F. Place pipe runs to minimize obstruction to other work.

G. Install piping in concealed spaces above finished ceilings.

H. Center sprinklers in two directions in ceiling tile and install piping offsets.

I. Hydrostatically test entire system.

J. Require test be witnessed by Fire Marshall.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting.

END OF SECTION

SECTION 21 13 16

DRY-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes dry-pipe sprinkler system, system design, installation, and certification.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

A. System to provide coverage for building areas where piping is subject to freezing ambient temperatures including the outdoor drive through canopy.

B. Provide hydraulically designed system to NFPA 13.

C. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data becomes available prior to submittals.

D. Provide Siamese fire department connections.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

C. Product Data: Submit data on sprinklers, valves, pumps, compressors and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Samples: Submit each style of sprinkler specified.

E. Design Data: Submit design calculations.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Manufacturers:
   1. Tyco.
   2. Ansul Incorporated.
   3. Grinnell Corp.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Suspended Ceiling Type: Refer to section 211313

C. Exposed Area Type: Refer to section 211313

2.2 PIPING SPECIALTIES

A. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, with accelerator.

B. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy gong and motor housing, nylon bearings, and inlet strainer.

C. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

D. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts.

2.3 AIR COMPRESSOR

A. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloading valve.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13.

B. Install buried shut-off valves in valve box. Install with post indicator.

C. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

D. Install air compressor on vibration isolators.

E. Hydrostatically test entire system.

F. Require test be witnessed by Fire Marshall.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Verify devices are installed and connected to fire alarm system.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements : Protecting installed construction.

B. Apply masking tape or paper cover to sprinklers, cover plates, and sprinkler escutcheons not receiving field painted finish. Remove after painting.

END OF SECTION

SECTION 21 23 00

WET CHEMICAL FIRE EXTINGUISHING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Materials and installation for pre-engineered wet chemical fire protection systems.

B. Related Sections:

1. Section 01 33 00 – Submittal Procedures.
2. Section 01 40 00 – Quality Requirements.
3. Section 01 70 00 – Closeout Requirements.
4. Section 11 40 21 – Food Service Equipment
5. Section 23 31 00 – HVAC Ducts and Casings.
6. Section 23 34 00 – HVAC Fans
7. Section 23 38 13 – Commercial – Kitchen Hoods
8. Section 23 55 00 – Fuel- Fired Heaters
9. Section 26 05 03 – Equipment Wiring Connections: Execution requirements for electrical connections specified by this section.
10. Section 28 31 11 – Fire Detection and Alarm System.

1.2 REFERENCES

A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

1. ANSI/NFPA 17A, Standard for Wet Chemical Extinguishing Systems.

B. Underwriters' Laboratories Inc. (UL)

1. UL 21, Standard for LP-Gas Hose.
2. UL 252, Standard for Compressed Gas Regulators.
3. UL 300, Standard for Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas.
4. UL 464, Standard for Audible Signal Appliances.
5. UL 569, Standard for Pigtails and Flexible Hose Connectors for LP-Gas.
6. UL 1254, Standard for Pre-Engineered Dry and Wet Chemical Extinguishing System Units.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

B. Provide UL listed maintenance data for incorporation into manual specified in Section 01 70 00 - Closeout Requirements.

1.5 QUALITY ASSURANCE

A. Meets requirements of NFPA 17A (Standard on Wet Chemical Extinguishing Systems).

B. The system is UL Listed under UL standard 300.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept units on site. Inspect for damage.

C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

PART 2 PRODUCTS

2.1 COMPONENTS

A. UL listed pre-engineered system.

B. Design to ANSI/NFPA 17A, to protect as indicated.

C. Design systems to UL 1254 requirements; include in operating manual the following:

1. Description of system operating details.
2. Description of fire risks to be protected.
3. Pipe and fitting limitations.
4. Nozzle limitations, including maximum dimensional and area coverage, and installation location.
5. Requirements for equipment maintenance.

2.2 STORAGE CONTAINERS

A. Main and connected reserve bank of extinguishing agent and expellant gas.

B. Pressure gauge on each container.

C. Approved container mounting and retaining system.

D. Main or reserve supply selector switch.

E. Directional flow valves.

F. Capacity: to be determined by system supplier.

G. Caps, plugs or valves connected to pressurized cylinder must have at least four full threads of engagement.

H. Provide means of relieving pressure when minimum of two full threads are engaged between device and cylinder, to prevent potential injury when cylinder valve assembly is pressurized while being serviced.

2.3 PIPING AND FITTINGS

A. To ANSI/NFPA 17A.

B. Finish: chrome plated or polished stainless steel in exposed areas.

C. Scarf or notch bottom of siphon tubes used to transport extinguishing agent through pressure vessel and valve to distribution piping to provide for uninterrupted flow of extinguishing agent.

D. Pressure regulators to comply with applicable requirements of UL 252.

E. Hose assemblies used for distributing extinguishing agent to comply with applicable requirements in UL 21 and UL 569.

2.4 NOZZLES

A. Stainless steel or non-ferrous with satin finish.

B. Provide frangible discs or blow-off caps as indicated or specified.

2.5 FIRE DETECTION SYSTEM

A. UL listed, automatic, to ANSI/NFPA 17A.

2.6 OPERATING DEVICES

A. UL listed operating system to ANSI/NFPA 17A.

B. Provide one manual control UL listed operating station to ANSI/NFPA 17A, located as indicated.

C. Shut down devices in accordance with manufacturer's listing.

2.7 BUILDING FIRE ALARM CONNECTIONS

A. Provide trouble and discharge terminal points for tying into building fire alarm system in accordance with Division 28.

B. Electrically operated alarms to UL 464.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with UL listing and by factory trained and certified installer.

3.2 SITE TESTS

A. Do site tests in accordance with Section 01 40 00 - Quality Requirements.

B. Test to acceptance in accordance with ANSI/NFPA 17A.

C. Testing to be witnessed by authority having jurisdiction.

D. Test system units for use with each type of cooking appliance referenced in manufacturer's installation instructions. Conduct tests in accordance with appropriate fire test method specified in UL 300.

3.3 RECHARGING

A. After completion of tests, ensure each cylinder in both initial and reserve banks contains correct chemical and weight of extinguishing agent and expellant gas. Restore systems to normal condition.

3.4 TRAINING

A. Provide training in accordance with Section 01 70 00 – Demonstration and Training.

END OF SECTION

SECTION 22 05 03

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Domestic water piping, within 5 feet of building.
   2. Sanitary sewer piping, within 5 feet of building.
   3. Storm water piping, within 5 feet of building.
   4. Equipment drains and over flows.
   5. Unions and flanges.
   6. Bedding and cover materials.

B. Related Sections:
   1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
   2. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this section.
   3. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
   4. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
   5. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
   6. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.
   7. Section 31 05 13 - Soils for Earthwork: Soils for backfill in trenches.
   8. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
   9. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
   10. Section 31 23 17 - Trenching: Execution requirements for trenching for underground piping systems.
   11. Section 31 23 23 - Fill: Execution requirements for backfilling required by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Gray Iron Threaded Fittings.
   3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   6. ASME B31.9 - Building Services Piping.
   7. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
   8. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
   1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   4. ASTM A536 - Standard Specification for Ductile Iron Castings.
   5. ASTM B32 - Standard Specification for Solder Metal.
   6. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
   7. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
   8. ASTM B75 - Standard Specification for Seamless Copper Tube.
   9. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   10. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
   11. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   12. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
   13. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
   14. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   15. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   16. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   17. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   18. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
   19. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   20. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
   21. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
   22. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
   23. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   24. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
   25. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
   26. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   27. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

28. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
29. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
30. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
31. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
32. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
33. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
34. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
35. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
36. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
37. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
38. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
39. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F (640 to 805 degrees C).

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

B. Copper Tubing: ASTM B88, Type L drawn, with Press Fittings.
   1. Press Fitting: Copper and Copper Alloy press fittings shall conform to the material and sizing requirements of ASME A312 or ASTM A554. O-rings for press fittings shall be EPDM, or FKM, depending on the application.

2. Press Connections: Copper and Copper Alloy press fittings shall be made in accordance with the manufacturer's installation instructions. The pipe shall be fully inserted into the fitting and the pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the pipe to assure the pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
3. Threaded Fittings: Pipe Threads shall conform to ASME B1.20.1.
4. Threaded Joints: Threaded joints shall have pipe joint compound or teflon tape applied to the male threads only. Tighten joint with a wrench and backup wrench as required.

C. Polyethylene Pipe: ASTM F877, cross-linked polyethylene non-barrier PEX-a (NSF) equal to "Uponor" – Aqua-PEX, 100 psig operating pressure at 180 degrees F.
1. Fittings: Brass and copper meeting performance and test methods of ASTM F877.
2. Joints: Mechanical meeting performance and test methods of ASTM F877.
a. F1960: Cold expansion fittings with PEX reinforcing rings
b F1961: Metal mechanical cold flare compression fittings with disc spring
c. F1807: Metal insert fittings utilizing a copper crimp ring
d. F1865: Mechanical cold expansion fittings with compression sleeve.

2.3 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
1. Fittings: PVC, ASTM D2665.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.4 SANITARY SEWER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
1. Fittings: ASTM D2665, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.5 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
1. Fittings: PVC, ASTM D2665 or ASTM D3034.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.6 STORM WATER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
1. Fittings: PVC, ASTM D2665 or ASTM D3034.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.7 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type M, drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.8 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. PVC Piping: PVC.
   5. CPVC Piping: CPVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.
   4. CPVC Piping: CPVC flanges.
   5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.9 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 31 05 16.

B. Cover: Fill Type as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 05 13. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements : Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 4 ft of cover.

C. Establish minimum separation from other services in accordance with codes.

D. Excavate pipe trench in accordance with Section 31 23 17.

E. Install pipe to elevation as indicated on Drawings.

F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

G. Install pipe on prepared bedding.

H. Route pipe in straight line.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install shutoff and drain valves at locations indicated on Drawings in accordance with Section 22 05 23.

K. Install plastic ribbon tape continuous over top of pipe; coordinate with Section 31 23 23; 31 23 17.

L. Install trace wire continuous over top of pipe; coordinate with Section 31 23 23; 31 23 17.

M. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Section 31 23 23.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 6 minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 21 05 16.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage according to code. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Protect piping systems from damage when installed along alleyways, driveways and parking garages or other locations exposed to damage by recessing into a wall or otherwise protected in an approved manner by authority having jurisdiction.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Install valves in accordance with Section 22 05 23.

O. Install piping specialties in accordance with Section 23 21 16.

P. Insulate piping. Refer to Section 22 07 00.

Q. Install pipe identification in accordance with Section 22 05 53.

3.5 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install bell and spigot pipe with bell end upstream.

3.6 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Install bell and spigot pipe with bell end upstream.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements; 01 70 00 - Execution and Closeout Requirements; Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with local authority having jurisdiction.

C. Test sanitary waste and vent piping system in accordance with local authority having jurisdiction.

D. Test storm drainage piping system in accordance with local authority having jurisdiction.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean and disinfect domestic water distribution system in accordance with local authority having jurisdiction.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flexible pipe connectors.
   2. Expansion joints.
   3. Expansion compensators.
   4. Pipe alignment guides.

B. Related Sections:
   1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for piping hangers and supports.
   2. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping used in domestic water systems.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.9 - Building Services Piping.
   2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

1.3 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:
   1. Installation Temperature: 50 degrees F.
   2. Domestic Hot Water: 140 degrees F .
   3. Safety Factor: 30 percent.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Steel Piping:
   1. Inner Hose: Stainless Steel.
   2. Exterior Sleeve: Single braided or double braided.
   3. Pressure Rating: 125 psig WSP and 450 degrees F.
   4. Size: Use pipe-sized units.

B. Copper Piping:
   1. Inner Hose: Bronze.
   2. Exterior Sleeve: Braided bronze.
   3. Pressure Rating: 125 psig WSP and 450 degrees F.
   4. Size: Use pipe sized units.

2.2 EXPANSION JOINTS

A. Stainless Steel Bellows Type:
   1. Pressure Rating: 125 psig WSP and 400 degrees F (.
   2. Maximum Compression: 1-3/4 inch.
   3. Maximum Extension: 1/4 inch.
   4. Size: Use pipe sized units.
   5. Application: Steel piping 3 inch and smaller.

B. Single Sphere, elbow or flexible compensators:
   1. Body: Teflon.
   2. Maximum Compression: 1/2 inch.
   3. Maximum Elongation: 3/8 inch.
   4. Maximum Offset: 3/8 inch.
   5. Maximum Angular Movement: 30 degrees.
   6. Size: Use pipe sized units.
   7. Application: Steel piping 2 inch and larger.

C. Two-ply Bronze Bellows Type:
   1. Construction: Bronze with anti-torque device, limit stops, internal guides.
   2. Pressure Rating: 125 psig WSP and 400 degrees F.
   3. Maximum Compression: 2 inch .
   4. Maximum Extension: 1/4 inch.
   5. Size: Use pipe sized units.
   6. Application: Copper piping.

2.3 ACCESSORIES

A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

C. Provide support and anchors for controlling expansion and contraction of piping. Provide expansion loops, pipe offsets, and swing joints, or expansion joints where required Refer to Section 22 05 29 for pipe hanger installation requirements.

3.2 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers’ field services.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves.
   2. Check valves.

B. Related Sections:
   1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
   3. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   3. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   5. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.4 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2 PRODUCTS

2.1 BALL VALVES

A. Manufacturers:
   1. Crane Valve, North America.
   2. Hammond Valve.
   3. Milwaukee Valve Company.
   4. NIBCO, Inc..
   5. Stockham Valves & Fittings.
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.

2.2 CHECK VALVES

A. Horizontal Swing Check Valves:
   1. Manufacturers:
      a. Crane Valve, North America.
      b. Hammond Valve.
      c. Milwaukee Valve Company.
      d. NIBCO, Inc..
      e. Stockham Valves & Fittings.
      f. Substitutions: Section 01 60 00 - Product Requirements

   2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
   3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

B. Spring Loaded Check Valves:
   1. Manufacturers:
      a. Crane Valve, North America.
      b. Hammond Valve.
      c. Milwaukee Valve Company.
      d. NIBCO, Inc..
      e. Stockham Valves & Fittings.
      f. Substitutions: Section 01 60 00 - Product Requirements

   2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.
   3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer or globe style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.

F. Refer to Section 22 05 29 for pipe hangers.

G. Refer to Section 22 07 00 for insulation requirements for valves.

H. Refer to Section 22 05 03 for piping materials applying to various system types.

3.3 VALVE APPLICATIONS

A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Install spring loaded check valves on discharge of water pumps.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.

B. Related Sections:
1. Section 03 10 00 - Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
2. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
4. Section 07 90 00 - Joint Protection: Product requirements for sealant materials for placement by this section.
5. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
6. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 SYSTEM DESCRIPTION

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Provide ventilation in areas to receive solvent cured materials.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Carpenter & Paterson Inc..
   2. Creative Systems Inc..
   3. Flex-Weld, Inc..
   4. Glope Pipe Hanger Products Inc..
   5. Michigan Hanger Co..
   6. Superior Valve Co..
   7. Substitutions: Section 01 60 00 - Product Requirements.

B. Plumbing Piping - DWV:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   7. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   8. Vertical Support: Steel riser clamp.

9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:
1. Hilti Corp..
2. ITW Buildex and Illinois Tool Works, Inc..
3. National Pipe Hanger Corporation.
4. Unistrut, Tyco International, Ltd..
5. US Strut, Unitron Products, Inc..
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: refer to Section 07 90 00.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc.
   2. NMP Corporation.
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp..
   2. B-Line Systems.
   3. Midland Ross Corporation, Electrical Products Division.
   4. Unistrut Corp..
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.8 FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Obtain permission before using powder-actuated anchors.

B. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME 31.9.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Install chrome plated steel escutcheons at finished surfaces.

3.7 INSTALLATION - FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

3.9 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Pipe markers.
   4. Ceiling tacks.
   5. Labels.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

B. Information Tags:
   1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

C. Tag Chart: Typewritten letter size list of applied tags and location plastic laminated.

2.3 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Tape Pipe Markers:
   1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Underground Pipe Markers:
   1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.4 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

B. Color code as follows:
   1. Plumbing valves: Green.

2.5 LABELS

A. Description: Polyester or Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09 90 00.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure when not nominal. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plumbing piping insulation, jackets and accessories.

B. Related Sections:
   1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
   2. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   3. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   4. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   5. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   6. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   7. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   8. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
   9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   10. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   3. Johns Manville.

4. Owens-Corning.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:
1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.
4. Substitutions: Section 01 60 00 - Product Requirements

2.2 PIPE INSULATION

A. ASTM C547, molded glass fiber pipe insulation.
1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:
1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 10 mil.
3. Connections: Pressure sensitive color matching vinyl tape.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

C. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

D. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

E. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify piping and equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Hot Piping Systems less than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

E. Inserts and Shields:
   1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
   2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
      a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
      b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

F. Insulation Terminating Points:
   1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
   2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
   3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping.
   2. Miter joints at elbows.
   3. Seal seams and butt joints with manufacturer's recommended adhesive.
   4. When application requires multiple layers, apply with joints staggered.
   5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

H. Pipe Exposed in Kitchens, Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

END OF SECTION

SECTION 22 34 00

FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial gas-fired water heaters.
   2. Circulating pumps.
   3. Diaphragm-type compression tanks.
   4. Thermometers.
   5. Flow control valves.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
   2. Section 23 05 03 – Pipes and Tubes for HVAC Piping and Equipment: Supply and Vent connections to domestic water heaters..
   3. Section 23 05 03 – Pipes and Tubes for HVAC Piping and Equipment: Execution requirements for gas piping connections specified by this section.
   4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:
   1. ASME PTC 25 - Pressure Relief Devices.
   2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.

E. United States Department of Energy:
   1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
   2. Pumps: Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

C. Manufacturer's Installation Instructions: Submit mounting and support requirements.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

A. Conform to ASME for construction of water heaters and storage tanks. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Products storage and handling requirements.

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 COMMERCIAL NATURAL GAS FIRED WATER HEATERS

A. Manufacturers:
   1. A.O. Smith.

2. Bradford White
3. Laars
4. Lochinvar
5. PVI
6. Rheem
7. Ruud
8. State
9. Substitutions: Section 01 60 00 - Product Requirements.

B. The water heater shall be design certified by CSA International (formerly AGA and CGA) for 180°F application, with a separate storage tank.

C. The tank shall be lined with a vitreous enamel and shall have a bolted hand hole cleanout.

D. The tank shall have four extruded magnesium anode rods installed in separate head couplings.

E. The water heater shall be equipped with stainless steel cold water inlet, and sediment reduction system.

F. The heater shall be insulated with Non-CFC foam.

G. This water heater shall be equipped with an electronic ignition system, an ASME rated T&P relief valve and a premix closed combustion system for direct venting using either PVC, CPVC or ABS vent pipe. (115V AC required).

H. The water heater shall be factory assembled and tested.

I. The water heater shall be approved for zero inch clearance to combustibles.

J. A digital LCD display shall be integrated into the front and be an adjustable electronic thermostat to any temperature up to 180°F.

K. A recycling Energy Cut Off (E.C.O.) shuts off all gas in the event of an overheat condition.

L. The entire installation shall be made in compliance with state and local codes and ordinances.

2.2 CIRCULATING PUMPS

A. Pump:
1. Type: All bronze, in-line circulation pump mounted between heater and storage tank, controlled by tank mounted immersion thermostat set at 140 degrees F.

2.3 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible diaphragm sealed into tank, and steel legs or saddles.

B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.4 STEM TYPE THERMOMETERS

A. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
   1. Size: 7 inch scale.
   2. Window: Clear Lexan.
   3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
   4. Accuracy: 2 percent.
   5. Calibration: Degrees F.

2.5 FLOW CONTROL VALVES

A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

PART 3 EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Section 03 30 00.

C. Connect natural gas piping in accordance with NFPA 54.

D. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

E. Connect domestic hot water and domestic cold water piping to inlet and outlet water heater connections.

F. Install the following piping accessories.
   1. On inlet:
      a. Shutoff valve.
   2. On return:
      a. Thermometer well and thermometer.
      b. Shutoff valve.

G. Install the following piping accessories on natural gas piping connections.
   1. Shutoff valve.

H. Install discharge piping from relief valves and drain valves to nearest drain.

I. Install circulator and diaphragm expansion tank on water heater.

J. Install water heater trim and accessories furnished loose for field mounting.

K. Install electrical devices furnished loose for field mounting.

L. Install control wiring between water heater control panel and field mounted control devices.

M. Connect flue to water heater outlet, full size of outlet.

END OF SECTION

DOCUMENT 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water closets.
   2. Urinals.
   3. Lavatories.
   4. Service sinks.
   5. Electric water coolers.
   6. Showers.

B. Related Sections:
   1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Supply and Waste connections to plumbing fixtures.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ANSI Z124.1 - Plastic Bathtub Units.
   3. ANSI Z124.2 - Plastic Shower Units.

B. Air-Conditioning and Refrigeration Institute:
   1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:
   1. ASME A112.18.1 - Plumbing Fixture Fittings.
   2. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
   3. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

A. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

B. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. Manufacturers:
   1. American Standard Plumbing, Model, Refer to plans.
   2. Kohler Co.
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Bowl: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

C. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with battery operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1.6 gallon flush volume.

D. Seat: Solid white plastic, open front, extended back, brass bolts.

E. Wall Mounted Carrier: ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.2 WALL HUNG URINALS

A. Manufacturers:
   1. American Standard Plumbing.
   2. Kohler Co..
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Urinal: ASME A112.19.2M or ANSI Z124.9, vitreous; vitreous china, wall hung washout urinal with shields, integral trap, 3/4 inch top spud, steel supporting hanger.

C. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with battery operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1 gallon flush volume.

D. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

E. Provide elastomeric gasket complying with ASME A112.4.3, or approved setting compound, for fixture to flange connection.

2.3 LAVATORIES

A. Manufacturers:
   1. American Standard Plumbing, Model, Refer to plans.
   2. Kohler Co.
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Vitreous China Wall Hung Basin: ASME A112.19.2M; vitreous china wall hung lavatory with 4 inch high back, drillings on 4 inch centers, rectangular basin with splash lip, front overflow, and soap depression.

C. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with pop-up waste.

D. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with battery operated solenoid operator and infrared sensor, aerator and cover plate, open grid strainer.

E. Waste Fittings: ASME A112.18.2 or ASTM F 409.

F. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.

G. Accessories:
   1. Trap and waste insulated and offset to meet ADA compliance.

H. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

2.4 LAVATORY INSULATION KIT

A. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.5 SERVICE SINKS

A. Manufacturers:
   1. Acorn
   2. American Standard
   3. E.L. Mustee
   4. Elkay
   5. Fiat
   6. Florestone
   7. Jones Stephens
   8. Just
   9. Stern-Williams
   10. Swan
   11. Zurn
   12. Substitutions: Section 01 60 00 - Product Requirements.

B. Bowl: 24 x 24 x 10 inch high white molded stone, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel strainer.

C. Trim: ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced [plastic] [rubber] hose.
   2. Hose clamp hanger.
   3. Mop hanger.

2.6 ELECTRIC WATER COOLERS

A. Manufacturers:
   1. Elkay
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Fountain:
   1. ARI 1010; electric water cooler with stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket, refrigerated with integral air cooled condenser and grille.

2.7 SHOWERS

A. Manufacturers:
   1. American Standard Plumbing.
   2. Bradley Corp.
   3. Delta Faucet Co., Commercial Div.
   4. Kohler Co.
   5. Substitutions: Section 01 60 00 - Product Requirements

B. Trim: ASME A112.18.1; concealed shower supply with pressure balanced or thermostatic mixing valves, integral service stops, bent shower arm with flow control and adjustable spray ball joint shower head with maximum 2.5 gpm flow, and escutcheon.

C. Trim: ASME A112.18.1; concealed shower supply with pressure balanced or thermostatic mixing valves, integral service stops, hand held shower with metal clad hose and slide bar, female inlet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Confirm millwork is constructed with adequate provision for installation of counter top sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures and escutcheons.

C. Install components level and plumb.

D. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 00, color to match fixture.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

F. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF DOCUMENT

SECTION 23 05 03

PIPES AND TUBES FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Equipment drains and over flows.
   2. Natural gas piping.
   3. Unions and flanges.
   4. Underground pipe markers.
   5. Bedding and cover materials.

B. Related Sections:
   1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
   2. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this section.
   3. Section 23 05 23 - General-Duty Valves for HVAC Piping: Product requirements for valves for placement by this section.
   4. Section 23 07 00 - HVAC Insulation: Product requirements for piping insulation for placement by this section.
   5. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
   6. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
   7. Section 31 23 17 - Trenching: Execution requirements for trenching for underground piping systems.
   8. Section 31 23 23 - Fill: Execution requirements for backfilling required by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Gray Iron Threaded Fittings.
   3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   6. ASME B31.9 - Building Services Piping.
   7. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
   8. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
   1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
5. ASTM B75 - Standard Specification for Seamless Copper Tube.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
8. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
11. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
12. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
13. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
14. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
15. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
16. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
17. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
18. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
19. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
20. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
22. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
23. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
24. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems.
25. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

D. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.

1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type DWV, drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
1. Fittings: ASTM D2466, Schedule 40, PVC, ASTM D2464 PVC, threaded.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. CPVC Pipe: ASTM F441/F441M, Schedule 80, chlorinated polyvinyl chloride (CPVC) material.
1. Fittings: [ASTM F439, CPVC, Schedule 80, socket type.] [ASTM F437, CPVC, Schedule 80, threaded.]
2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement. Prime joints with a contrasting color.

2.2 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M forged steel welding type.
2. Joints: ASME B31.9, welded.
3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

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. Anodeless Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
   b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
   c. Aboveground Portion: PE transition fitting.
   d. Outlet shall be threaded or flanged or suitable for welded connection.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. 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.

5. 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.
6. 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.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
8. Stainless-steel flanges and tube with epoxy finish.
9. Buna-nitrile seals.
10. Stainless-steel bolts, washers, and nuts.
11. Factory-installed anode for steel-body couplings installed underground.

2.3 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
   2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. PVC Piping: PVC.
   5. CPVC Piping: CPVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.
   4. CPVC Piping: CPVC flanges.
   5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.5 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with Service in large letters.

2.6 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 31 05 16.

B. Cover: Fill Type, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type, as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Install underground, PE, natural-gas piping according to ASTM D 2774.

C. Establish elevations of buried piping no less than code allows.

D. Establish minimum separation of other services in accordance with code.

E. Excavate pipe trench in accordance with Section 31 23 17.

F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

G. Install pipe on prepared bedding.

H. Route pipe in straight line.

I. When installing piping in PVC protector pipe install both carrier pipe and PVC pipe using long sweep elbows.

J. Install pipe to allow for expansion and contraction without stressing pipe or joints.

K. Install shutoff valves at locations indicated on Drawings in accordance with Section 23 05 23.

L. Install plastic ribbon tape continuous over top of metallic pipe; coordinate with Section 31 23 23; 31 23 17.

M. Install trace wire continuous over top of non-metallic pipe; coordinate with Section 31 23 23; 31 23 17.

N. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Section 31 23 23.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 00.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Protect piping systems from damage when installed along alleyways, driveways and parking garages or other locations exposed to damage by recessing into a wall or otherwise protected in an approved manner by authority having jurisdiction.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Install valves in accordance with Section 23 05 23.

O. Insulate piping. Refer to Section 23 07 00.

P. Install pipe identification in accordance with Section 23 05 53.

3.5 INSTALLATION - GAS PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide support for utility meters in accordance with requirements of utility company.

C. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

D. Install gas pressure regulator vent full size opening on regulator and terminate outdoors.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements; 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test heating water piping system, and glycol condenser water piping system in accordance with ASME B31.9.

C. Pressure test natural gas piping in accordance with NFPA 54.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. After completion, fill, clean, and treat heating water piping system and condenser water piping system.

END OF SECTION

SECTION 23 05 23

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves.
   2. Plug valves.

B. Related Sections:
   1. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
   2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for pipe hangers and supports.
   3. Section 23 07 00 - HVAC Insulation: Product and installation requirements for insulation for valves.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   2. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Underwriters Laboratories Inc.:
   1. UL 842 - Valves for Flammable Fluids.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

PART 2 PRODUCTS

2.1 BALL VALVES

A. Manufacturers:
1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc..
5. Stockham Valves & Fittings.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, lever handle.

C. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

D. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

2.2 PLUG VALVES

A. Manufacturers:
   1. DeZURIK, Unit of SPX Corp..
   2. Flow Control Equipment, Inc..
   3. Homestead Valve.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. 2 inches and Smaller: MSS SP 78, Class 150, semi-steel construction, round, square or rectangular port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150, semi-steel construction, round, square or rectangular port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install valves with clearance for installation of insulation and allowing access.

C. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.

D. Refer to Section 23 05 29 for pipe hangers.

E. Refer to Section 23 05 03 for piping materials applying to various system types.

3.3 VALVE APPLICATIONS

A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

B. Install ball or plug valves in natural gas systems for shut-off service.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Equipment curbs.
6. Sleeves.
7. Mechanical sleeve seals.
8. Formed steel channel.

B. Related Sections:
1. Section 03 10 00 - Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
2. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
4. Section 07 90 00 - Joint Protection: Product requirements for sealant materials for placement by this section.
5. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
6. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.5 - Refrigeration Piping.
2. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 SYSTEM DESCRIPTION

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Provide ventilation in areas to receive solvent cured materials.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Carpenter & Paterson Inc.
2. Creative Systems Inc.
3. Flex-Weld, Inc.
4. Glope Pipe Hanger Products Inc.
5. Michigan Hanger Co.
6. Superior Valve Co.
7. Substitutions: Section 01 60 00 - Product Requirements

B. Refrigerant Piping:
1. Conform to ASME B31.5.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:
   1. Hilti Corp.
   2. ITW Buildex and Illinois Tool Works, Inc.
   3. National Pipe Hanger Corporation.
   4. Unistrut, Tyco International, Ltd.
   5. US Strut, Unitron Products, Inc.
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb./sq. ft sheet lead.
   2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Manufacturers:
   1. AES Industries.
   2. Commercial Products Group; Hart & Cooley Inc..
   3. Custom Solution Roof and Metal Products.
   4. EZCurbAdapter.com.
   5. Lloyd Industries, Inc..
   6. Metalform Manufacturing, Inc..
   7. R & S Manufacturing and Sales Company, Inc..
   8. Roof Products, Inc..
   9. The Pate Company.
   10. Thybar Corporation.
   11. Substitutions: Section 01 60 00 - Product Requirements.

B. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, 1-1/2 inch thick insulation, factory installed wood nailer.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel.

E. Sealant: Refer to Section 07 90 00.

2.7 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc..
   2. NMP Corporation.
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp..
   2. B-Line Systems.
   3. Midland Ross Corporation, Electrical Products Division.
   4. Unistrut Corp..
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.9 FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

2.10 FIRESTOPPING ACCESSORIES

A. Installation Accessories: Comply with requirements of Section 07 84 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements : Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support vertical piping at every floor.

F. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Provide copper plated hangers and supports for copper piping.

I. Design hangers for pipe movement without disengagement of supported pipe.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

C. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Section 07 84 00.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

3.10 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

3.11 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect piping systems from damage when installed along alleyways, driveways and parking garages or other locations exposed to damage by recessing into a wall or otherwise protected in an approved manner by authority having jurisdiction.

C. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.

B. Related Sections:
1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.4 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags
    a. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags
    a. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags
    a. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
    1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
    2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
    3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
    4. Ductwork and Equipment: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.
    1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

B. Plastic Tape Pipe Markers
    1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 CEILING TACKS

A. Ceiling Tacks

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:
   1. HVAC equipment: Yellow.
   2. Fire dampers/smoke dampers: Red.
   3. Plumbing valves: Green.
   4. Heating/cooling valves: Blue.

2.6 LABELS

A. Description: Polyester, size 1.9 x 0.75 inches, adhesive backed with printed identification.

2.7 UNDERGROUND WARNING TAPE

A. Description: Polyethylene tape with metallic core for detection and location of piping with metal detector resistant to acids, alkalis and other soil components.
   1. Size: 0.004 inch; 6 inches.
   2. Color: As selected.
   3. Service Marking:Printed text as selected by Architect/Engineer in contrasting color and repeated at maximum 40 inches intervals.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09 90 00.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify air terminal units and radiator valves with numbered tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot spacing.

N. Identify ductwork with. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing adjusting, and balancing of air systems.
   2. Measurement of final operating condition of HVAC systems.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

B. Natural Environmental Balancing Bureau:
   1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on forms prepared following ASHRAE 111, NEBB Report forms or forms containing information indicated in Schedules.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of NEBB Certificate of Conformance Certification.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASHRAE 111, NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years experience Certified by NEBB.

B. Perform Work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor or registered professional engineer experienced in performance of this Work and licensed in State of Michigan.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.9 SCHEDULING

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. HVAC control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Service valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude.

B. Make air flow rate measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain:
   1. Space temperatures within 2 degrees F.
   2. Minimal objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches differential static pressure near building entries.

3.6 SCHEDULES

A. Partial list of Equipment Requiring Testing, Adjusting, and Balancing:
   1. Packaged Roof Top Heating/Cooling Units.
   2. Makeup air units
   3. Fans.
   4. Air Filters.
   5. Air Inlets and Outlets.

B. Report Forms
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date
   2. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence
      d. Summary of outdoor and exhaust flows to indicate building pressurization
      e. Nomenclature used throughout report
      f. Test conditions
   3. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date
   4. Electric Motors:
      a. Manufacturer
      b. Model/Frame
      c. HP/BHP and kW
      d. Phase, voltage, amperage; nameplate, actual, no load
      e. RPM
      f. Service factor
      g. Starter size, rating, heater elements
      h. Sheave Make/Size/Bore
   5. V-Belt Drive:
      a. Identification/location
      b. Required driven RPM
      c. Driven sheave, diameter and RPM
      d. Belt, size and quantity
      e. Motor sheave diameter and RPM
      f. Center to center distance, maximum, minimum, and actual
   6. Air Moving Equipment:
      a. Location
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Arrangement/Class/Discharge

f. Air flow, specified and actual
g. Return air flow, specified and actual
h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave Make/Size/Bore
m. Number of Belts/Make/Size
n. Fan RPM

7. Return Air/Outside Air Data:
   a. Identification/location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow
   h. Return air temperature
   i. Outside air temperature
   j. Required mixed air temperature
   k. Actual mixed air temperature
   l. Design outside/return air ratio
   m. Actual outside/return air ratio
8. Exhaust Fan Data:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Air flow, specified and actual
   f. Total static pressure (total external), specified and actual
   g. Inlet pressure
   h. Discharge pressure
   i. Sheave Make/Size/Bore
   j. Number of Belts/Make/Size
   k. Fan RPM
9. Duct Traverse:
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   i. Air temperature
   j. Air correction factor
10. Duct Leak Test:
    a. Description of ductwork under test

b. Duct design operating pressure
c. Duct design test static pressure
d. Duct capacity, air flow
e. Maximum allowable leakage duct capacity times leak factor
f. Test apparatus
    1) Blower
    2) Orifice, tube size
    3) Orifice size
    4) Calibrated
g. Test static pressure
h. Test orifice differential pressure
i. Leakage

11. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. HVAC piping insulation, jackets and accessories.
2. HVAC ductwork insulation, jackets, and accessories.

B. Related Sections:
1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.

1.2 REFERENCES

A. ASTM International:
1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
5. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
6. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
7. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

17. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
19. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
20. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
21. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
22. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
23. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:
   1. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   3. Johns Manville.
   4. Owens-Corning.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:
   1. Aeroflex. Aerocell.
   2. Armacell, LLC. Armaflex.
   3. Nomaco. K-flex.
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.2 PIPE INSULATION

1. Refer to schedules on the drawings.

2.3 PIPE INSULATION JACKETS

1. Refer to schedules on the drawings.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.

F. 449/C449M.

G. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

H. Adhesives: Compatible with insulation.

2.5 DUCTWORK INSULATION

A. Refer to schedules on the drawings.

2.6 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, self-adhesive pad, impact applied, or welded with integral or press-on head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Hot Piping Systems greater than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Insulate flanges and unions at equipment.

E. Inserts and Shields:
   1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
   2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.

a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

F. Insulation Terminating Points:
1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

J. Prepare pipe insulation for finish painting. Refer to Section 09 90 00.

3.3 INSTALLATION - DUCTWORK SYSTEMS

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. Insulated ductwork conveying air below ambient temperature:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket.

E. External Glass Fiber Duct Insulation:
   1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
   2. Secure insulation without vapor retarder with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. External Elastomeric Duct Insulation:
   1. Adhere to clean oil-free surfaces with full coverage of adhesive.
   2. Seal seams and butt joints with manufacturer's recommended adhesive.
   3. When application requires multiple layers, apply with joints staggered.
   4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
   5. Lift ductwork off trapeze hangers and insert spacers.

G. Duct and Plenum Liner:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

3.4 SCHEDULES

A. Refer to schedules on drawings.

END OF SECTION

SECTION 23 09 23

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Materials
2. Communication
3. Controller Software
4. Building Controllers
5. Application Specific Controllers
6. Auxiliary Control Devices
7. Wiring and Raceways
8. Examination
9. Protection
10. Coordination
11. General Workmanship
12. Field Quality Control
13. Wiring
14. Communication Wiring
15. Actuators
16. Controllers
17. Control System Checkout and Testing
18. Control System Demonstration and Acceptance
19. Training

B. Related Sections:
1. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation implemented using products specified in this section.
2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI MC85.1 - Terminology for Automatic Control.

1.3 SYSTEM DESCRIPTION

A. Automatic temperature controls field monitoring and control system using field programmable microprocessor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Provide controls for unit ventilators, energy recovery ventilator, radiation, reheat coil, unit heaters, fan coils, and hydronic ceiling cassette when directly connected to control units.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.

F. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate the following:
   1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
   2. Connected data points, including connected control unit and input device.
   3. List of system graphics of monitored systems, data (connected and calculated) point addresses, and operator notations.
   4. System configuration with new peripheral devices, diagrams, modems, routers, and interconnections.
   5. Description and sequence of operation for operating, user, and application software.
   6. Coordinate submittals with information requested in Section 23 09 93.

C. Product Data: Submit data for each system component and software module.

D. Manufacturer's Installation Instructions: Submit installation instruction for each control system component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Submit data specified in "Submittals" in final "Record Documents" form.

C. Operation and Maintenance Data:
   1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.

3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 100 miles of Project.

B. Installer: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for direct digital controls.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of control systems for one years from Date of Substantial Completion.

C. Furnish complete service of controls systems, including callbacks. Make minimum of two complete normal inspections of approximately 4 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls. Submit written report after each inspection.

D. Furnish two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls. Submit written report after each inspection.

E. Examine unit components bi-monthly. Clean, adjust, and lubricate equipment.

F. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

G. Perform work without removing units from service during building normal occupied hours.

H. Provide emergency call back service at all hours for this maintenance period.

I. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

J. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

K. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.11 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements.

PART 2 PRODUCTS

2.1 DIRECT DIGITAL CONTROLS

A. Manufacturers:
   1. Delta Controls, Inc..
   2. Substitutions: Not Permitted.

2.2 MATERIALS

A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

2.3 COMMUNICATION

A. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2001, BACnet.

B. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device as defined in this section.

C. The Contractor shall provide all communication media, connectors, repeaters, bridges, hubs, switches, and routers necessary for the internetwork.

D. All controllers shall have a communication port for connections with the Operator Workstations using the BACnet Data Link/ Physical layer protocol.

E. A device on the internetwork shall be provided with a 56k-baud modem that will allow for remote Operator Workstation using the BACnet PTP Data Link/ Physical layer protocol. Remote Operator Workstation via this modem shall allow for communication with any and all controllers on this network as described in Paragraph F below.

F. Communication services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:

1 Connection of an Operator Workstation device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.
2 All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.

G. The time clocks in all controllers shall be automatically synchronized daily. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the network.

H. The network shall have the following minimum capacity for future expansion:

1. Each Building Controller shall have routing capacity for 99 controllers.
2. The Building Controller network shall have capacity for 1000 Building Controllers.
3. The system shall have an overall capacity for 12,500 Building Controller, Advanced Application Controller, and Application Specific Controller input/output objects.

2.4 SYSTEM SOFTWARE

A. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications that operate under Microsoft Windows. Examples include Microsoft Excel, Microsoft Word, Microsoft Access. Acceptable operating systems are Windows 2000 Professional, Windows XP Pro and Windows 2003 Server.

B. System Graphics. The operator workstation software shall be a graphical user interface (GUI). The system shall allow display of up to 10 dynamic and animated graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.

C. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Visio or AutoCad

D. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program. Graphics shall be created by drag-and-drop selection of graphic symbols and drag-and-link with BACnet objects with dynamic and interactive display fields.

E. Multilingual. Software shall be supported in the following languages English, Spanish, French, German, Chinese.

F. Dynamic Data Exchange (DDE). Software shall support dynamic data sharing with other Windows-based programs for third party add-on functionality e.g. preventative maintenance, tenant billing, etc.

E. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation:

1. System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each Building Controller. This database shall be updated whenever an operator initiates a save command.

2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to save the database from any system panel. The operator shall be able to clear a panel database via the network and may initiate a download of a specified database to any panel in the system from the network.

3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection.

4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On- line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application.

6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers.

7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, alarm limit differentials, states, and reactions for each object in the system.

8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm, in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying upon acronyms or other mnemonics.

9. Alarm Reactions. The operator shall be able to determine (by object) what if any actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation.

10. Trend Logs. The operator shall be able to define a custom trend log for any data object in the system. This definition shall include change-of-value digital, change-of-value analog, time interval, start time, and stop time. Trend data shall be sampled and stored on the Building Controller panel, and be archivable on the hard disk and be retrievable for use in spreadsheets and standard database programs.

11. Alarm and Event Log. The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms.

12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.

13. Clock Synchronization. The real-time clocks in all building control panels and workstations shall be using the BACnet Time Synchronization service. The system also shall be able to automatically synchronize all system clocks daily from any operator-designated device in the system. The system shall automatically adjust for daylight savings and standard time, if applicable.

F. Workstation Applications Editors. Each PC workstation shall support editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at one or more of the controller panels.

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and setpoints for all controllers.

2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable from this master schedule.

2.5 REPORT MANAGEMENT

A The following reporting capability shall be provided at the operator workstation.

1. Reporting:

a. Internal reports built into operator workstation software
b. External reporting via ODBC

2. Internal Reports
   a. User definable query reports (support advanced multiple property, multiple object).
   b. Reports shall be scheduled for automatic generation by schedule or event.
   c. Manual execution to printing/file.
   d. Ability to save report in system report folder.
   e. Query controller hierarchy.
   f. Report to multiple destinations
      i. Email
      ii. Print
      iii. File (text, csv, xml)
      iv. Terminal

3. Enterprise Interface
   a. ODBC driver supporting common SQL statements (select, update, insert, where, order by, group by, etc.)
   b. Allow integration to Enterprise software
   c. Shall be capable of being used with third party software that supports ODBC connection such as: Microsoft Access, Excel, Crystal Reports, etc.
   d. All queries shall be real time into live controller network.
   e. Shall be able to both read and write using SQL.

A. Web Browser Interface

B. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™.

C. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BAS, shall not be acceptable.

D. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

E. The Web browser client shall support at a minimum, the following functions:

   a. User log-on identification and password shall be required. If an unauthorized user attempt access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

   b. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

c. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

d. Storage of the graphical screens shall be in the Server, without requiring any graphics to be stored on the client machine. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

e. User’s shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

1. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

f. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

g. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

h. The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

i. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.6 CONTROLLER SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation

B. System Security

1. User access shall be secured using individual security passwords and user names.

2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.

3. User Log On/Log Off attempts shall be recorded.

C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:

1. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop and optimal start. Each schedule may

consist of up to 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.

2. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

D. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions.

E. Remote Communication. The system shall have the ability to dial out in the event of an alarm using BACnet Point-To-Point at a minimum of 56K baud. Receivers shall be BACnet workstations.

F. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.

G. Sequencing. Provide application software to properly sequence the start and stop of chillers, boilers, and pumps to minimize energy usage in the facility.

H. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and PID gains shall be user-selectable.

I. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage.

J. Energy Calculations. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.

K. Anti-Short Cycling. All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

L. On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and setpoint. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.

M. Run-time Totalization. Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

2.7 BUILDING CONTROLLERS

A. General. Provide an adequate number of Building Controllers to achieve the performance specified in the Part 1 Article on “System Performance.” Each of these panels shall meet the following requirements.

1. The Energy Management and Control System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.

2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

3. Data shall be shared between networked Building Controllers.

4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

5. Controllers that perform scheduling shall have a real-time clock.

6. The Building Controller shall communicate with other BACnet objects on the internetwork using the Read (Execute and Initiate) and Write (Execute and Initiate) Property services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135-2001.

7. BACnet Functional Groups. The Building Controller shall support the following BACnet functional groups: Clock, Event Initiation, COV Event Response, Files, Device Communication and Time Master.

B. Communication

1. Each Building Controller shall support BACnet™ over Ethernet and BACnet™ over IP. The Building Controller shall be connected to the BACnet network using the ISO 8802-3 (Ethernet) Data L/ Physical layer protocol.

2. Each Building Controller with a communications card shall perform BACnet routing if connected to a network of Custom Application and Application Specific Controllers.

3. The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol P-T-P for connection to a hand-held workstation/ and/or modem.

4. The Building Controller secondary communication network shall support BACnet MS/TP.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 40°C [32°F to 100°F] and 10 to 90% RH.

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

D. Building Controllers shall be fully peer to peer.

E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field- removable, modular terminal strips — or to a termination card connected by a ribbon cable.

F. Memory. The Building Controller shall have as a minimum standard SRAM of 256 KB, standard DRAM of 1MB and standard non-volatile 1 MB of flash memory in lieu of EPROM. Memory shall be user extendible through RAM chip sockets and SIMMs for future memory expansion.

G. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. The Building Controller shall maintain all database information including BIOS and programming information in the event of a power loss for at least 72 hours. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

H. Inputs/Outputs.

1. Inputs. Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC- voltage, 4-20 mA- current and thermistor-resistive signal types on an individual basis for connecting any status or sensing device. Analog resolution shall be 10-bit A to D.

2. Ouputs. Controller input/output board shall support built in HOA modules configured with manual-auto-off override switch. Output supported shall be 0-10 VDC. All HOA's shall be supervised.

3. Diagnostics. Controller input/output board shall have red LEDs providing input status indication.

4. Building Controller shall have the capability to create, delete and support the following BACnet Objects:
   a. ANALOG INPUT, ANALOG OUTPUT AND ANALOG VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; COV Increment; Out of Service and Units. In addition, these objects shall support the properties: Device type; Reliability; Min./Max. Values; Update Interval and Resolution.
   b. BINARY INPUT, BINARY OUTPUT AND BINARY VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Default Value; Min On/Off and Out of Service. In addition, these objects shall support the properties: Device Type; Reliability; Active/Inactive Texts; Update Interval; Resolution; Change-of-State Time; Count Times and Time Reset.
   c. CALENDAR: This object shall have the following writeable properties: Object Name; Object Value; Description; and Date List.
   d. DEVICE: This object shall have the following writeable properties: Object Name; Description; Location; and UTC Offset.
   e. EVENT ENROLMENT: This object shall have the following writeable properties: Object Name; Object Value; Description;Out-of-Service; Event & Notify Types; Parameters; Property Ref; Enable; and Notification Class.
   f. FILE: This object shall have the following writeable properties: Object Name; Description; File Type; and File Access.

g. LOOP (PID): This object shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Output and Input Refs.; Input Value & Units; Setpoint Value; PID Values; Bias; Write Priority and COV Increment. In addition, this object shall support the properties: Reliablity; Update Interval; Proportional Constant & Units; Derviative Constant & Units.
h. NOTIFICATION CLASS: This object shall have the following writeable properties: Object Name; Object Value; Description; Priority and Ack Requried.
i. PROGRAM: This object shall have the following writeable properties: Object Name; Object Value and Description. In addition, this object shall support the property Reliablity.
j. SCHEDULE: This object shall have the following writeable properties: Object Name; Object Value and Description; Effective period; Schedule; Exception; Controlled Properties and Write Properties.
k. TREND LOG: This object shall have the following writeable properties: Object Name; Description; Log Enable; Start/stop Times; Log Device Object Property; Log Interval; Stop When Full; Buffer Size; and Record Count.

2.8 APPLICATION SPECIFIC CONTROLLERS

A. General. Application Specific Controllers (ASCs) are microprocessor-based DDC controllers which through hardware or firmware design are able to control a wide variety of equipment. They are fully user-programmable, and are not restricted to any one type of equipment.

1. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network

2. Each ASC will contain sufficient I/O capacity to control the target system.

3. Both firmware and controller database shall be loadable over the network

4. Application Specific Controllers shall be fully peer to peer

5. ASC's shall come with an integrated housing to allow for easy mounting and protection of the circuit board. Only wiring terminals shall be exposed.

6. Application Specific Controllers shall support the following BACnet Interoperability Building Blocks (BIBBs):

Data Sharing	Alarm & Event	Scheduling	Trending	Device & Network Mgmt.
DS-RP-B				DM-DDB-B
DS-WP-B				DM-DOB-B
				DM-DCC-B

B. Communication

1. The controller shall reside on a BACnet network using the MS/TP Data Link/ Physical layer protocol.

2. Each controller shall have a BACnet Data Link/ Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.

3. Each controller shall have a secondary sub network for communicating sensors or I/O expansion modules

C. Environment. The hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°C to 65°C [-40°F to 150°F] and/or suitably installed in a heated or fan cooled enclosure

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.

E. Memory. The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.

F. Immunity to power and noise. ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

G. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

H. Input/Output. ASC shall support as a minimum, directly connected, a combination of analog outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The Operator Workstations installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.9 AUXILIARY CONTROL DEVICES

A. Motorized control dampers, unless otherwise specified elsewhere, shall be furnished by the controls contractor.

B. Electric damper/valve actuators.

1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

2. Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing.

3. All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 N·m [60 in-lb] torque capacity shall have a manual crank for this purpose.

C. Control valves.

1. Control valves shall be two-way or three-way type for two-position or modulating service as shown.

2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
   a. Water Valves:
      i. Two-way: 150% of total system (pump) head.
      ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
   b. Steam Valves: 150% of operating (inlet) pressure.

3. Water Valves:

   a. Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.

4 Steam Valves:

   a. Body and trim materials shall be per manufacturer's recommendations for design conditions and service. Linear ports for modulating service.

D. Binary Temperature Devices

1 Low-limit thermostats. Low-limit thermostats shall be vapor pressure type with an element 6 m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any 30 cm [1 ft] section. The low-limit thermostat shall be manual reset only and be supplied as DPST.

E. Temperature sensors.

1. Temperature sensors shall be thermistors.

2. Space sensors shall be equipped with the following:

   a. Programmable buttons for setpoint adjustment and override
   b. 3-value, 96-segment LCD display

3. Provide matched temperature sensors for differential temperature measurement.

F. Humidity sensors.

1. Duct and room sensors shall have a sensing range of 20% to 80%.

2. Duct sensors shall be provided with a sampling chamber.

3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient conditions of -40°C to 75°C [-40°F to 170°F].

4. Humidity sensor's drift shall not exceed 3% of full scale per year.

G. Flow switches.

1 Flow-proving switches shall be either paddle or differential pressure type, as shown.

H. Pressure transducers

1. Transducer shall have linear output signal. Zero and span shall be field-adjustable.

2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage

3. Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 1 - 5vdc or 4 to 20 mA output, required mounting brackets, and block and bleed valves.

4. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 1 – 5vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.

I. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

J. Pressure-Electric (PE) Switches

1. Shall be metal or neoprene diaphragm actuated, operating pressure rated 0–175 kPa [0–25 psig], with calibrated scale setpoint range of 14–125 kPa [2–18 psig] minimum, UL listed

2. Provide one- or two-stage switch action SPDT, DPST, or DPDT, as required by application.

3. Shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified

4. Shall have a permanent indicating gauge on each pneumatic signal line to PE switches.

K. Electro-pneumatic (E/P) transducers

1. Electronic/pneumatic transducer shall provide a proportional 20 to 100 kPa [3 to 15 psig] output signal from a 0 to 10 VDC analog control input.

J. Local control panels

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with [hinged door], key-lock latch, removable sub-panels. A single key shall be common to all field panels and sub-panels

2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings

3. Provide 120v receptacle at each local panel location.

2.10 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 16.

B. All insulated wire to be copper conductors, UL labeled for 90C minimum service.

PART 3 EXECUTION

3.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started

B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started

C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.2 PROTECTION

A. The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused

B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects

3.3 COORDINATION

A. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge

2. Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.

B. Submittals. Refer to the “Submittals” Article in Part 1 of this specification for requirements

C. Test and Balance

1. The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes

2. The Contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours

3. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.

4. The tools used during the test and balance process will be returned at the completion of the testing and balancing

D. Life Safety

1. Duct smoke detectors required for air handler shutdown are supplied and installed under Division 16. The Division 16 Contractor shall interlock smoke detectors to air handlers for shutdown as described in Part 3: “Sequences of Operation”.

2. Smoke dampers and actuators required for duct smoke isolation are provided under another Division 15 Section

3. Fire/smoke dampers and actuators required for fire rated walls are provided under another Division 15 Section. Control of these dampers shall be by Division 16.

E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:

1. All communication media and equipment shall be provided as specified in Part 2: "Communication" of this specification.

2. Each supplier of controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions of this specification.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment

C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

D. All wiring shall be verified for its integrity to ensure continuity and freedom from shorts and grounds

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship

C. Contractor shall have work inspected by local and/or state/provincial authorities having jurisdiction over the work

3.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes and Division 16 of this specification. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 16 requirement.

C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

3.7 ACTUATORS

A. Mount and link control damper actuators per manufacturer's instructions.

To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage

Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic

1. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations

2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.8 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm [2"] of termination with the DDC address or termination number.

B. Permanently label or code each point/object of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum 1 cm [½"] letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

E. Identify room sensors relating to terminal box or valves with nameplates.

3.9 CONTROLLERS

A. Building Controllers and Advanced Application Controllers shall be selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. If outputs are not

universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.

1. Future use of spare capacity shall require providing the field device, field wiring, point/object database definition, and custom software. No additional controller boards or point/object modules shall be required to implement use of these spare points

B. Operator Interface

1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints

2. Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point/object show

3. The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all Operator Workstation software and their functions as described in this section. This includes any operating system software, the Operator Workstation database, and any third-party software installation and integration required for successful operation of the operator interface

3.10 CONTROL SYSTEM CHECKOUT AND TESTING

A. Start-up Testing: All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of the system demonstration.

1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations

4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct

5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel

6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.

7. Alarms and Interlocks

    a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm

    b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

    c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

3.11 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests

2. The tests described in this section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the "Control System Checkout and Testing" Article in Part 3 of this specification. The Engineer will be present to observe and review these tests. The Engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1: "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration

4. The Contractor shall provide at least two persons equipped with two-way communication, and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point/object and system. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.

6. Demonstrate compliance with Part 1: "System Performance

7. Demonstrate compliance with Sequences of Operation through all modes of operation

8. Demonstrate complete operation of Operator Workstation

9. Additionally, the following items shall be demonstrated:

a. DDC Loop Response. The Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
b. Demand limiting. The Contractor shall supply a trend data output showing the action of the demand-limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting setpoint, and the status of shed-able equipment outputs.
c. Optimum Start/Stop. The Contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas
d. Interface to the building fire alarm system
e. Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Architect/Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
f. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

3.12 TRAINING

A. General
1. Provide a minimum of one onsite training class 8 hours in length during the construction period for personnel designated by the owner.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. Packaged Rooftop Units
   2. Computer Room Cooling
   3. Zone Temperature Control

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Coordinate submittals with information requested in Section 23 09 23.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PACKAGED ROOFTOP UNITS (RTU'S):

A. RTU Occupied Period Operation

   1. Upon a call for heat, the outside air supply damper on the Packaged Rooftop unit (RTU) shall be driven open to its minimum position and the gas fired furnace shall begin firing when the space thermostat falls below desired setpoint. When the space temperature rises

above the thermostat desired setpoint the furnace shall stop firing and RTU supply fan shall continue to run with its outside air damper in its minimum position.

2. Upon a call for cooling, the outside air supply damper on the Packaged Rooftop unit (RTU) shall be driven open to its minimum position and mechanical cooling shall begin when the space thermostat rises above it's desired setpoint. When the space temperature falls below the thermostat desired setpoint mechanical cooling shall stop and RTU supply fan shall continue to run with its outside air damper in its minimum position.

3. Mixed air control:
   a. For cooling and outside air temperatures below 55 degrees F, modulate dampers to maintain supply air temperature of 55 degrees F or higher.
   b. For cooling and outside air temperatures above 55 degrees F; outside and relief dampers are open and return damper is closed.
   c. For cooling and outside air temperatures above 55 degrees F compare return and outside air enthalpies. When the return air enthalpy is lower, drive outside damper to minimum, close relief damper, and open return damper.
   d. For outside air temperatures above 75 degrees F, drive outside damper to minimum, close relief damper, and open return damper.
   e. For heating, drive outside damper to minimum, close relief damper, and open return damper.
   f. Modulate mixed air dampers in sequence to maintain supply air temperature.

B. RTU Unoccupied Period Operation.
   1. RTU Supply Fan
      a. Cycles on when the zone thermostat calls for cooling.
      b. Cycles on when the zone thermostat calls for heating.
      c. If the zone thermostat does not call for cooling or heating, the supply fan is off.
   2. Zone Thermostat Calls for Cooling
      a. Operation is the same as in the occupied period.
   3. Zone Thermostat Calls for Heating
      a. The RTU supply fan remains off. The zone temperature is maintained by the fin tube radiation heating.
   4. Zone Thermostats Do Not Call for Cooling or Heating
      a. The system is off.

C. RTU Low Limit Control
   1. A low limit thermostat located in the heating discharge air will de-energize the RTU supply fan if the temperature falls below 40°F (adjustable). The outdoor damper shall close, and an alarm will be initiated through the Metasys system. The low limit thermostat must be manually reset.

D. Demand Control Ventilation (DCV) CO2 Control:
   1. All spaces larger than 500 ft² with a design occupancy for ventilation of 25 people or more per 1000 ft² of floor area shall have demand-controlled ventilation using carbon dioxide sensing in the space. Areas served by economizer systems that are not practical for complete coverage with space CO2 sensors shall have CO2 sensors in the return duct.

2. Outside air damper and return air shall modulate to maintain code required minimum ventilation outside air flow rate as measured by airflow monitoring station. (incorporates DCV reductions)
3. Demand Control Ventilation: DDC shall monitor return CO2 level. When CO2 concentration setpoint (1025 ppm. adj.) is reached the outside air damper shall modulate open in small increments until the space air CO2 level is satisfied or the outside air damper reaches the design outdoor air flow setpoint. Once the space CO2 concentration setpoint is satisfied, the outside air damper shall modulate toward the minimum outdoor air setpoint. If the mixed air temperature drops below the mixed air low limit setpoint, the CO2 sensor input is overridden and modulates the outside air damper closed to maintain the mixed air temperature low limit setpoint. When the mixed air temperature rises above the mixed air low limit setpoint, CO2 operation is once again restored.
4. When the CO2 measured in the room is higher than the CO2 setpoint for 30 seconds the program forces the VAV box controller to the heating mode and takes over control of the flow setpoint using proportional integral loop statements. A space cooling loop starts its calculations at the box cooling loop output value and uses the room temperature and the day cooling setpoint to calculate flow. The CO2 loop is based on the CO2 measurement and setpoint. The box flow setpoint is set at the higher of the two loops. Any additional boxes that serve the same room are also forced to the heating mode and the flow setpoints are set to the same percentage as the master box. If the CO2 measurement is more than 100 PPM below the setpoint for more than five minutes, then control is returned to the box controllers.
5. VAV dampers shall close when the zone is unoccupied and room temperature set points have been met.

3.2 COMPUTER ROOM COOLING:

A. Thermostat set at 70 degrees F (adjustable) maintains constant space temperature 24 hours a day, 7 days a week, 365 days a year plus one day for leap year.
    1. Space temperature monitoring and alarm shall be signaled through the DDC.

3.3 ZONE TEMPERATURE CONTROL:

A. Unoccupied spaces (i.e. storage room): Single temperature room thermostat set at 65 degrees F (adjustable) maintains constant space temperature

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Pipe hangers and supports.
4. Refrigerant moisture and liquid indicators.
5. Valves.
6. Refrigerant strainers.
7. Refrigerant pressure regulators.
8. Refrigerant pressure relief valves.
9. Refrigerant filter-driers.
10. Refrigerant solenoid valves.
11. Refrigerant expansion valves.
12. Electronic expansion valves.
13. Refrigerant receivers.

B. Related Sections:
1. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
1. ARI 495 - Refrigerant Liquid Receivers.
2. ARI 710 - Liquid-Line Driers.
3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
4. ARI 750 - Thermostatic Refrigerant Expansion Valves.
5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers:
1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B31.5 - Refrigeration Piping.
4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

G. Underwriters Laboratories Inc.:
1. UL 429 - Electrically Operated Valves.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.5, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

1.4 SUBMITTALS

A. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.

C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

B. Perform Work in accordance with authority having jurisdiction for welding hanger and support attachments to building structure.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

1.13 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.14 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

1.15 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. 2 inches and Smaller:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. 2-1/2 inches and Larger:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.

C. Grooved and Shouldered Pipe End Couplings:
   1. Housing Clamps: Malleable iron [galvanized] to engage and lock designed to permit some angular deflection, contraction, and expansion.
   2. Sealing Gasket: C-shape elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
   3. Accessories: Steel bolts, nuts, and washers.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 VALVES

A. Manufacturers:
   1. Alco Controls Div, Emerson Electric Co..
   2. Parker Hannifin Corp., Refrig. & Air Cond. Div..
   3. Sporlan Valve Co..
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
   2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
   3. Stainless steel spring, nylon seats, disc with positive back seating.
   4. Maximum working pressure: 500 psig.
   5. Maximum working temperature: 275 degrees F.

C. Packed Angle Valves:
   1. Forged brass or nickel-plated forged steel, solder or flared ends.
   2. Forged brass seal caps with copper gasket, rising stem and seat, molded stem packing.
   3. Maximum working pressure: 500 psig.
   4. Maximum working temperature: 275 degrees F.

D. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass [bonnet and] seal cap, chrome plated ball, stem with neoprene ring stem seals, [soldered] [or] [threaded] ends.
   2. Maximum working pressure: 500 psig.
   3. Maximum working temperature: 300 degrees F.

E. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
   2. Maximum working pressure: 500 psig .

F. Refrigerant Check Valves:
   1. Manufacturers:
      a. Alco Controls Div, Emerson Electric Co..
      b. Parker Hannifin Corp., Refrig. & Air Cond. Div..
      c. Sporlan Valve Co..
      d. Substitutions: Section 01 60 00 - Product Requirements.
   2. Globe Type:
      a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc.
      b. Maximum working pressure: 425 psig.
      c. Maximum working temperature: 300 degrees F.
   3. Straight Through Type:
      a. Spring, neoprene seat.
      b. Maximum working pressure: 500 psig.
      c. Maximum working temperature: 200 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.5, ASTM F708, and MSS SP 89.

B. Support horizontal piping hangers as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Provide copper plated hangers and supports for copper piping.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Install pipe hangers and supports in accordance with Section 23 05 29.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

E. Install pipe identification in accordance with Section 23 05 53.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.

H. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Flood refrigerant piping system with nitrogen when brazing.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds. Refer to Section 05 12 00.

K. Install valves with stems upright or horizontal, not inverted.

L. Insulate piping; refer to Section 23 07 00.

M. Fully charge completed system with refrigerant after testing.

N. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

O. Install refrigerant piping in accordance with ASME B31.5.

3.6 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Valves:

1. Install service valves on compressor suction and discharge.
2. Install gage taps at compressor inlet and outlet.
3. Install gage taps at hot gas bypass regulators, inlet and outlet.
4. Install check valves on compressor discharge.
5. Install check valves on condenser liquid lines on multiple condenser systems.
6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and/or 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test refrigeration system with dry nitrogen to 200 psig. Perform final tests at 27 inches (92 kPa) vacuum and 200 psig using halide torch or electronic leak detector.

D. Repair leaks.

E. Retest until no leaks are detected.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Duct Materials.
2. Flexible ducts.
3. Insulated flexible ducts.
4. Single wall spiral round ducts.
5. Single wall spiral flat oval ducts.
6. Transverse duct connection system.
7. Ductwork fabrication.
8. Kitchen hood exhaust ductwork fabrication.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
3. Section 11 40 00 - Foodservice Equipment: Requirements for kitchen range hoods for placement by this Section.
4. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

A. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA 1767 - Kitchen Ventilation Systems and Food Service Equipment Guidelines.
   2. SMACNA - HVAC Air Duct Leakage Test Manual.
   3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
   1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 96.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A1008/A1008M.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36/A36M; steel , galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 FLEXIBLE DUCTS

A. Product Description: Two ply vinyl film supported by helical wound spring steel wire.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: -10 degrees F to 160 degrees F.

2.3 INSULATED FLEXIBLE DUCTS

A. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: -10 degrees F to 160 degrees F.
   4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.4 SINGLE WALL SPIRAL ROUND DUCTS

A. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

B. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

C. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.5 SINGLE WALL SPIRAL FLAT OVAL DUCTS

A. Product Description: Machine made from round spiral lockseam duct constructed of galvanized steel; rated for 10 inches wg pressure.

B. Joints: Either fully welded or bolted flange with gasket material in accordance with manufacturer's recommendations.

C. Construct duct with the following minimum gauges:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

D. Construct fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.6 TRANSVERSE DUCT CONNECTION SYSTEM

A. Product Description: SMACNA "E" rated, SMACNA "F" rated, or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.7 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and [as indicated on Drawings]. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

G. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
   1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.

H. Do not provide sealing products not bearing UL approval markings.

I. Kitchen Hood Exhaust Ducts:
   1. Comply with SMACNA 1767 and NFPA 96.
   2. Exposed Ducts:
      a. Material: Stainless steel, ASTM A240
      b. Material: ASTM 666, Type 304.
      c. Joints: Continuous external weld.
   3. Concealed Kitchen Hood Exhaust Ducts:
      a. Material: 16-gage carbon steel.
      b. Material: 18-gage stainless steel, ASTM A240 or ASTM 666, Type 304.
      c. Joints: Continuous external weld.

J. Grease Ducts: Factory-built commercial grease ducts labeled and listed according to UL 1978.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

D. Install duct hangers and supports in accordance with Section 23 05 29.

E. Use double nuts and lock washers on threaded rod supports.

F. Connect flexible ducts to metal ducts with liquid adhesive plus draw bands.

G. Where ducts pass exposed through finished interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus- insulation with sheet metal flanges of same gauge as duct. Overlap opening on all sides by at least 1-½".

H. Kitchen Range Hoods:
   1. According to NFPA 96 and as specified in Section 11 40 00 - Foodservice Equipment.
   2. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.
   3. Exhaust Ducts: Provide stainless-steel ductwork where exposed to view, and stainless steel or carbon steel where ducts are concealed.

I. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.

J. Exhaust Outlet Locations:
   1. Minimum Distance from Property Lines: 3 feet.
   2. Minimum Distance from Building Openings: 3 feet.
   3. Minimum Distance from Outside Air Intakes: 10 feet.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect air outlets and inlets to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Back-draft dampers.
   2. Duct access doors.
   3. Dynamic fire dampers.
   4. Static fire dampers.
   5. Ceiling fire dampers.
   6. Volume control dampers.
   7. Flexible duct connections.

B. Related Sections:
   1. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 555 - Standard for Safety for Fire Dampers.
   2. UL 555C - Standard for Safety for Ceiling Dampers.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers.
   2. Backdraft dampers.
   3. Flexible duct connections.

4. Volume control dampers.
5. Duct access doors.

C. Product Data: For fire dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

D. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access doors and test holes.

C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work where appropriate with building control Work.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each size and type of fusible link.

PART 2 PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6 inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
   1. Less than 12 inches square, secure with sash locks.
   2. Up to 18 inches Square: Furnish two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches.
   4. Larger Sizes: Furnish additional hinge.
   5. Access panels with sheet metal screw fasteners are not acceptable.

2.3 DYNAMIC FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555.

B. Fire Resistance: 1-1/2 hours.

C. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

D. Construction:
   1. Integral Sleeve Frame: Minimum 20 gage roll formed galvanized steel. Length: 12 inches.
   2. Blades:
      a. Style: Curtain type.
      b. Action: Spring or gravity closure upon fusible link release.
      c. Material: Minimum 24 gage roll formed, galvanized steel.
   3. Closure Springs: Type 301 stainless steel, constant force type, if required.

E. Fusible Link Release Temperature: 165 degrees F.

F. Mounting: Vertical or horizontal as indicated on Drawings.

G. Duct Transition Connection, Damper Style:
   1. B style - rectangular connection, blades out of air stream, high free area.
   2. G style - A style connection, grille mounting tabs at end of sleeve for grille.

H. Finish: Mill galvanized.

2.4 STATIC FIRE DAMPERS

A. Fire Rating: UL 555 classified and labeled as a 1-1/2 hour static fire damper.

B. Air Flow Rating: UL approved for dual directional air flow.

C. Integral Sleeve Frame: Minimum 20 gage by 12 inches roll formed, galvanized steel.
   1. Factory Sealant: Apply to dampers in HVAC systems with pressures to maximum 4 inches wg.

D. Blades:
   1. Style: Curtain type, in airstream.
   2. Action: Spring or gravity closure upon fusible link release.
   3. Orientation: Horizontal.
   4. Material: Minimum 24 gage roll formed, galvanized steel.

E. Closure Springs: Type 301 stainless steel, constant force type, if required.

F. Temperature Release Device:
   1. Fusible link, 165 degrees F.

G. Mounting: Vertical or horizontal as indicated on Drawings.

H. Duct Transition Connection, Damper Style:
   1. B style - rectangular connection, blades out of air stream, high free area.
   2. G style - A style connection, grille mounting tabs at end of sleeve for grille.

I. Finish: Mill galvanized.

J. Picture Frame Mounting Angles:
   1. One-piece, roll formed retaining angles 1-1/2 x 1-1/2 inches.
   2. Factory matched and shipped attached to damper.

2.5 CEILING FIRE DAMPERS

A. Fire Rating: UL 555C classified and labeled as a 1-1/2 hour ceiling damper.

B. Air Flow Rating: UL approved for dual directional air flow.

C. Frame: minimum 3 inches by minimum 20 gage galvanized steel with roll formed ridge for blade stop.

D. Blades:
   1. Style: Two-piece, single-thickness with blade insulation, hinged in center, and held open with fusible link.
   2. Action: Butterfly.
   3. Orientation: Horizontal.
   4. Material: Minimum 20 gage galvanized steel.

E. Hinge: Spring stainless steel, mechanically attached to blades.

F. Mounting: Horizontal.

G. Temperature Release Device: Fusible link, 165 degrees F.

H. Finish: Mill galvanized.

I. Performance Data:
   1. Pressure Drop: Maximum 0.1 inches w.g. at 500 fpm across 18 x 18 inch damper.

J. Fusible Volume Adjust: UL classified.

K. Extended Frame:
   1. Rectangular Dampers: 6 inches.
   2. Round Dampers: 6-1/2 inches.

2.6 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

D. Quadrants:
   1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Connector: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
   2. Net Fabric Width: Approximately 2 inches wide.
   3. Metal: 3 inch wide, 24 gage galvanized steel.

2.8 STATIC PRESSURE GAGES

A. Dial Gages: 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.

B. Inclined Manometer: Plastic with red liquid on white background with black figures, front calibration adjustment, 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installation are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Access Doors: Install access doors at the following locations and as indicated on Drawings:
   1. Spaced every 50 feet of straight duct.
   2. Upstream of each elbow.
   3. Upstream of each reheat coil.
   4. Before and after each duct mounted filter.
   5. Before and after each duct mounted coil.
   6. Before and after each duct mounted fan.
   7. Before and after each automatic control damper.
   8. Before and after each fire damper.

D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated on Drawings. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
   1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE DAMPER.

E. Install temporary duct test holes as required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

F. Install fire dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   1. Install dampers square and free from racking with blades running horizontally.
   2. Do not compress or stretch damper frame into duct or opening.
   3. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
   4. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.3 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Downblast centrifugal roof fans.
   2. Upblast centrifugal roof fans.
   3. Ceiling fans.

B. Related Sections:
   1. Section 23 07 00 - HVAC Insulation: Product requirements for power ventilators for placement by this section.
   2. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
   3. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
   4. Section 26 05 03 - Equipment Wiring Connections: Execution and product requirements for connecting equipment specified by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 99 - Standards Handbook.
   2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
   3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
   4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
   5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

B. American Refrigeration Institute:
   1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.

C. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.
   2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. Underwriters Laboratories Inc.:
   1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer’s warranty for fans.

1.11 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Furnish service and maintenance of fans for one years from Date of Substantial Completion.

C. Examine each fan components. Clean, adjust, and lubricate equipment.

D. Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

E. Perform work without removing fans from service during building normal occupied hours.

F. Provide emergency call back service during working hours for this maintenance period.

G. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

H. Perform maintenance work using competent and qualified personnel under supervision of manufacturer or original installer.

I. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two sets of belts for each fan.

PART 2 PRODUCTS

2.1 DOWNBLAST CENTRIFUGAL ROOF FANS

A. Manufacturers:
    1. Acme Engineering and Manufacturing Corp.
    2. Greenheck Corp.
    3. Loren Cook Company.
    4. Penn Ventilation.
    5. Substitutions: Section 01 60 00 - Product Requirements.

B. Fan Unit: Downblast type. Direct drive, with spun aluminum housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

C. Motor: ECM.

D. Roof Curb: 24 inch high self-flashing of galvanized steel construction with continuously welded seams, 1 inch insulation and curb bottom, and factory installed nailer strip.

E. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 Type 1 enclosure.

F. Accessories:
   1. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked [and line voltage motor drive, power open, spring return].
   2. Fan speed controller.

2.2 UPBLAST CENTRIFUGAL ROOF FANS

1. Acme Engineering and Manufacturing Corp.
2. Greenheck Corp.
3. Loren Cook Company.
4. Penn Ventilation.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Fan Unit: Upblast type. Direct drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

C. Motor: ECM.

D. Roof Curb: Self-flashing of galvanized steel construction with continuously welded seams, ventilated double wall, hinged curb adapter, and factory installed nailer strip.

E. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 Type 1 enclosure.

F. Accessories:
   1. Fan speed controller.

2.3 CEILING FANS

A. Manufacturers:
   1. Acme Engineering and Manufacturing Corp.
   2. Greenheck Corp.
   3. Loren Cook Company.
   4. Panasonic.
   5. Penn Ventilation.
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. Centrifugal Fan Unit: Direct driven with 26 gauge galvanized or zinc-aluminum-magnesium steel housing, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar suitable for installation in ceilings insulated up to R60.

C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.

D. Grille: Molded white polypropylene resin.

E. Wheel: Centrifugal forward curved type constructed of injection molded or polypropylene resin.

F. Motor: Removable permanently lubricated brushless ECM motor equipped with thermal cutoff fuse, engineered to run continuously. ECM motor speed shall automatically increase when the fan senses static pressure to maintain selected CFM.

G. Fan shall be UL and cUL listed for tub/shower enclosure when GFCI protected.

H. Accessories:
   1. Articulating and expandable installation bracket up to 24".
   2. Wall cap with damper, round duct inlet. Refer to drawings.
   3. Wall cap with rectangular duct inlet. Refer to drawings.
   4. Ceiling radiation damper and 24 gauge steel fire rated duct adapter when penetrating 1-hour rated horizontal assembly ceiling membrane. Refer to drawings.
   5. Built-in fan motor speed controller.
   6. Plug and Play modules provide up to three additional features. Provide Multi-Speed with Time Delay, Condensation Sensor, and Motion Sensor. Refer to drawing schedules.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance.

C. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit clearance requirements.

3.2 INSTALLATION

A. Secure roof fans with cadmium plated steel lag screws to roof curb and structure.

B. Suspended Fans: Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install backdraft dampers on inlet to roof exhaust fans except where prohibited such as Type I Kitchen Hood exhaust fans.

D. Provide backdraft dampers on outlet from ceiling fans and as indicated on Drawings.

E. Install safety screen where inlet or outlet is exposed.

F. Locate and orient unit to provide the shortest and most straight duct connections. Provide service and code required clearances and as indicated on the plans. Locate units distant from sound critical occupancies.

G. Provide structurally suitable support for the base of any wall mounted or hung units

H. To control sound associated with the two blower outlets:
   a. Provide straight, gradual transition ductwork for a minimum of 2-1/2 duct diameters downstream from the blower outlet for air velocities of less than 2,500 feet per minute.
   b. Provide continuous acoustic insulation treatment of the duct until after the first elbow or tee.

I. Provide sheaves required for final air balance.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of fan cabinet.

3.4 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not operate fans until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Diffusers.
   2. Registers
   3. Grilles.
   4. Door grilles.
   5. Roof hoods.

B. Related Sections:
   1. Section 09 90 00 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.

1.2 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers:
   1. Anemostat Air Products.
   2. E. H Price Company.
   3. Krueger.
   4. Nailor Industries, Inc..
   5. Titus.
   6. Tuttle and Bailey.
   7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Square, adjustable pattern, stamped, plaque diffuser to discharge air in 360 degree pattern with sector baffles where indicated.

C. Frame: Compatible with ceiling type.

D. Fabrication: Steel with baked enamel off-white finish.

E. Accessories: Opposed-blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.2 PERFORATED FACE CEILING DIFFUSERS

A. Manufacturers:
   1. Anemostat Air Products.
   2. E. H Price Company.
   3. Krueger.
   4. Nailor Industries, Inc..
   5. Titus.
   6. Tuttle and Bailey.
   7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Perforated face with fully adjustable pattern and removable face.

C. Frame: Compatible with ceiling type.

D. Fabrication: Steel with steel or aluminum frame and baked enamel off-white finish.

E. Accessories: Radial opposed-blade damper, less multi-louvered equalizing grid.

2.3 CEILING SLOT DIFFUSERS

A. Manufacturers:
1. Anemostat Air Products.
2. E. H Price Company.
3. Krueger.
4. Nailor Industries, Inc..
5. Titus.
6. Tuttle and Bailey.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Continuous 2 inch wide slot, two slots wide, with adjustable vanes for left, right or vertical discharge.

C. Fabrication: Aluminum extrusions with factory color to be selected.

D. Frame: 1-25/32 inch margin with concealed support clips for suspension system mounting and gasket cap.

E. Plenum: Integral, galvanized steel, insulated.

2.4 CEILING SUPPLY REGISTERS/GRILLES

A. Manufacturers:
1. Anemostat Air Products.
2. E. H Price Company.
3. Krueger.
4. Nailor Industries, Inc..
5. Titus.
6. Tuttle and Bailey.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

C. Frame: 1 inch margin with countersunk screw mounting and gasket.

D. Fabrication: Aluminum extrusions with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed-blade type with removable key operator, operable from face.

2.5 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:
   1. Anemostat Air Products.
   2. E. H Price Company.
   3. Krueger.
   4. Nailor Industries, Inc..
   5. Titus.
   6. Tuttle and Bailey.
   7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.

C. Frame: 1-1/4 inch margin with countersunk screw mounting.

D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.6 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:
   1. Anemostat Air Products.
   2. E. H Price Company.
   3. Krueger.
   4. Nailor Industries, Inc..
   5. Titus.
   6. Tuttle and Bailey.
   7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Fixed grilles of 1/2 x 1/2 x 1 inch louvers.

C. Fabrication: Aluminum with factory off-white enamel finish.

D. Frame: 1 inch margin with countersunk screw mounting or Channel lay-in frame for suspended grid ceilings.

E. Damper: Integral, gang-operated, opposed-blade type with removable key operator, operable from face.

2.7 WALL SUPPLY REGISTERS/GRILLES

A. Manufacturers:
   1. Anemostat Air Products.
   2. E. H Price Company.

3. Krueger.
4. Nailor Industries, Inc..
5. Titus.
6. Tuttle and Bailey.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

C. Frame: 1 inch margin with countersunk screw mounting and gasket.

D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.8 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:
1. Anemostat Air Products.
2. E. H Price Company.
3. Krueger.
4. Nailor Industries, Inc..
5. Titus.
6. Tuttle and Bailey.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.

C. Frame: 1 inch margin with countersunk screw mounting.

D. Fabrication: Steel and aluminum with 20 gage minimum frame, or Aluminum extrusions, with factory off-white enamel finish.

E. Damper: Integral, gang-operated, opposed-blade type with removable key operator, operable from face.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify ceiling and wall systems are ready for installation.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Section 09 90 00.

D. Do not locate air registers, diffusers or grilles in floors of toilet or bathing rooms.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 37 16

FABRIC AIR DISTRIBUTION DEVICES

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.
B. Types of non-metal ductwork required for this project include the following:
    1. Textile Air Dispersion Products.

1.2 QUALITY ASSURANCE:

A. Building Codes and Standards:
    1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and UL 2518.
    2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
B. Design & Quality Control
    1. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.
    2. Manufacturer's Environmental Product Declaration (EPD) must be inclusive of the following:
        a. Fabric
        b. Cutting, sewing, processing of DuctSox
        c. Zippers
        d. Metal suspension system parts and framework (if applicable)
        e. Energy, water, recycled & waste of plant processing fabric & suspension
        f. Complete packaging including boxes, bags & staples
        g. Transportation

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and UL 2518.
C. Provide detailed drawings confirming configuration of Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).
D. Provide detailed installation instructions for components to be installed.
E. Provide warranty and maintenance documentation.
F. Provide product's Environmental Product Declaration (EPD) that includes the following:
    1. Fabric
    2. Cutting, sewing, processing of DuctSox
    3. Zippers
    4. Metal suspension system parts and framework (if applicable)
    5. Energy, water, recycled & waste of plant processing fabric & suspension
    6. Complete packaging including boxes, bags & staples

7. Transportation

1.4 WARRANTY:

A. Manufacturer must provide a 15 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Protect textile air dispersion system and SkeleCore Pull-Tight components from damage during shipping, storage, and handling.
B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 - PRODUCTS

2.1 TEXTILE AIR DISPERSION SYSTEM:

A. Manufacturers:
1. DuctSox Corporation; SkeleCore Pull-Tight with Sedona-Xm.
2. Durkee America, Inc. - NanoSox
3. Prihoda North America
4. Substitutions: Section 01 60 00 - Product Requirements.

B. SkeleCore Pull-Tight System: Air diffusers shall be constructed with both internal retention and external tensioning.
1. System shall consist of internal tensioning baskets with cable or track stops that externally tension the system off of the suspension system selected below along with 360-degree internal retention hoops that are spaced 5’ on center between tensioning baskets.
2. Tensioning baskets are designed to self-lock when tension is applied to the system.
3. All straight sections utilize both internal retention hoops and external tensioning with the use of the tension baskets, all fittings (crosses, elbows, reducers, and tees) utilize internal retention hoops.
4. The distance between consecutive tensioning baskets should not be more than 40’.
5. System shall be installed with a one row suspension system located 1.5” above top-dead-center of the textile system.
6. System attachment to cable or U-Track shall be made using Gliders spaced no further than 12 inches apart.
7. Available for diameters from 8” – 60”.
8. Not available for natatorium applications.
9. One row suspension options (must specify if multiple on same project)
    a. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.
        i. Cable suspension options (must specify if multiple on same project)
            1. Galvanized steel cable
            2. Stainless steel cable
        ii. Support lengths available in 5’(standard), 10’, 15’, & 30’.
    b. U-Track suspension hardware to include 8’ sections of aluminum track, aluminum splice connectors, track endcaps and vertical cable support kits –

consisting of a length of cable with cable connectors. Radius aluminum track must be included for all horizontal/flat radius sections.

i. U-Track suspension options (must specify if multiple on same project)
    1. Galvanized steel cable
    2. Stainless steel cable
ii. Support lengths available in 5'(standard), 10', 15', & 30'.

2.2 TEXTILE

A. Sedona-Xm
    a. Textile Construction: Filament/filament twill polyester treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518.
    b. Air Permeability: 2 (+2/-1) CFM/ft^2 per ASTM D737, Frazier
    c. The air permeability of the fabric must NOT be created by perforating the fabric.
    d. The air permeability must be confirmed be third party testing to eliminate the formation of condensate on the fabric.
    e. Weight: 6.8 oz. /yd^2 per ASTM D3776
    f. Warranty: 15 years
B. Textile Color
C. Standard: blue, white, tan, red, green, silver, black
D. Custom
    1. Noise

2.3 TEXTILE SYSTEM FABRICATION REQUIREMENTS:

A. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps and mid-sections) and top access zippers for tension lock attachments.
B. Integrated air dispersion shall be specified and approved by the manufacturer. (select only those that apply)
    1. Linear Vents
        a. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
        b. Size of vent openings and location of linear vents to be specified and approved by manufacturer.
    2. Orifices – 2" & 3" SG's (Sewn-in Grommets)
        c. Air dispersion and extended throws are accomplished by reinforced orifices and permeable fabric. Reinforced orifices are to be installed to keep the integrity of opening and withstand laundry processes.
        d. Diameter, quantity, and location of reinforced orifices to be specified and approved by manufacturer.
    3. Fixed Nozzles
        e. Air dispersion accomplished by using conical aerodynamic nozzles and permeable fabric. Diameter of nozzles height to be minimum ½". Due to

exact requirements of throw and maximum level of noise alternative flow models are not acceptable.

f. Color of nozzles must match color of fabric. Unless otherwise specifically mentioned on drawings or otherwise in this specification, suppliers standard table is used for selection of color.

g. Location and number of nozzles to be specified and approved by manufacturer.

4. Adjustable Nozzles

a. Air dispersion accomplished by adjustable ball nozzles and permeable fabric. Adjustable ball nozzles shall be multiaxial rotation to redirect airflow to desired area. Adjustable ball nozzles can completely close off airflow without adding caps or plugs. Adjustable ball nozzles should lock into place once set, preventing constant adjustment. Adjustable ball nozzle should have inset design to be a condensation resistant product.

b. Colors of adjustable nozzles available are white and black. With white material receiving white adjustable nozzles and all other material colors receiving black adjustable nozzles unless otherwise specifically mentioned on drawings or otherwise in the specification.

c. Quantity and location of adjustable ball nozzles to be specified and approved by the manufacturer.

C. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.

D. Inlet connection includes zipper for easy removal / maintenance.

E. Lengths to include required intermediate zippers as specified by manufacturer.

F. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. The flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.

G. The end cap includes zipper for easy maintenance.

H. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

2.4 DESIGN PARAMETERS:

A. Textile air diffusers shall be designed from 0.25” water gage minimum to 3.1” maximum, with 0.5” as the standard.

B. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).

C. System overall design: diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.

D. Do not use textile diffusers in concealed locations.

E. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

PART 3 – INSTALLATION

3.1 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM:

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with the product.

3.2 CLEANING AND PROTECTION:

A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

SECTION 23 38 13

COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial Kitchen Hoods.
2. Perforated Supply Plenum.
3. Drop-in Perforated Supply Plenum

B. RELATED SECTIONS

1. Section 01 33 00 – Submittal Procedures.
2. Section 01 70 00 – Execution and Closeout Requirements.
3. Section 11 40 21 – Food Service Equipment
4. Section 23 31 00 – HVAC Ducts and Casings.
5. Section 21 23 00 – Wet Chemical Fire Extinguishing Systems
6. Section 23 34 00 – HVAC Fans
7. Section 23 55 00 – Fuel- Fired Heaters

1.2 REFERENCES

A. American Welding Society:

1. AWS D9.1M/D9.1 - Sheet Metal Welding Code.

B. ASTM International:

1. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. National Association of Architectural Metal Manufacturers:

1. NAAMM AMP500 - Metal Finishes Manual for Architectural and Metal Products.

D. National Fire Protection Association:

1. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
2. NFPA 17A - Standard for Wet Chemical Extinguishing Systems

E. NSF International/American National Standards Institute (NSF/ANSI):

1. Standard #2 - Food Service Equipment.
2. Standard #4 - Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Transport Equipment.

F. Sheet Metal and Air Conditioning Contractors' National Association

1. SMACNA 1767 - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines.

G. Underwriters Laboratories Inc.:

1. UL 710 - Exhaust Hoods for Commercial Cooking Equipment

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

C. Indicate the following: dimensions, capacities, hanging methods, installation procedures.

1.4 CLOSEOUT SUBMITTALS

A. Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Experienced in food service ventilation equipment installation or supervised by an experienced food service ventilation equipment installer.

B. Where required to complete equipment installation, mechanical, electrician and plumbing contractors shall be licensed in the jurisdiction where project is located.

C. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with applicable NSF standards, including NSF/ANSI 2, NSF 2-Supplement, and NSF/ANSI 4.

D. UL Listing: Equipment has been evaluated according to UL 710, is listed in UL "Heating, Cooling, Ventilating and Cooking Equipment Directory," and is labeled for intended use.

E. Fire-Protection Systems: Comply with NFPA 96 and NFPA 17A.

F. Welding: Perform welding according to AWS D9.1M/D9.1.

1.6 TRAINING

A. Provide training in accordance with Section 01 79 00.13 – Demonstration and Training for Building Commissioning.

PART 2 PRODUCTS

2.1 CANOPY HOOD – COMMERCIAL

A. The exhaust only canopy hoods are rated for all types of cooking equipment. The hoods shall have the size, shape and performance specified on drawings.

B. Construction shall be type 430 stainless steel with #3 or #4 polish where exposed. Individual component construction shall be determined by the manufacturer and ETL. Construction shall be dependent on structural application to minimize distortion and other defects. All seams, joints and penetrations of the hood’s enclosure to the lower outermost perimeter that directs and captures grease-laden vapor and exhaust gases shall have a liquid-tight continuous external weld in accordance with NFPA 96. Hood shall be wall type with a minimum of four connections for hanger rods. Corner hanging angles have a 5/8" x 1-1/2" slot pre-punched at the factory, allowing hanging rods to be used for quick and safe installation.

C. The hoods shall be furnished with U.L. classified filters, supplied in size and quantity as required by hoods.

D. Exhaust duct collar to be 4" high with 1" flange. Duct sizes, CFM and static pressure requirements shall be as shown on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate within 1-ft increments along the length of the hoods.

E. U.L. incandescent light fixtures and globes shall be installed and pre-wired to a junction box. The light fixtures shall be installed with a maximum of 4’0" spacing on center and allow up to a 100 watt standard light bulb.

F. The hoods shall be provided with:
1. A double wall insulated front to eliminate condensation and increase rigidity. The insulation shall have a flexural modulus of 475 EI, meet UL 181 requirements and be in accordance with NFPA 90A and 90B.
2. An integral front baffle to direct grease laden vapors toward the exhaust filter bank.
3. A built-in wiring chase provided for outlets and electrical controls on the hoods face and shall not penetrate the capture area or require an external chaseway.
4. Removable grease cup for easy cleaning.

G. The hoods shall be ETL Listed as "Exhaust Hood Without Exhaust Damper", ETL Sanitation Listed and built in accordance with NFPA 96. The hoods shall be listed for 450°F cooking surfaces at 150 CFM/ft, 600°F cooking surfaces at 200 CFM/ft, and 700°F cooking surfaces at 250 CFM/ft. The hoods shall be ETL Listed as "Exhaust Hood Without Exhaust Damper".

H. Optional Features
1. Utility Cabinet
2. Back Supply Plenum
3. End Panels
4. Enclosure Panels

I. Fire protection systems: Wet chemical with hoods or wall-mounted stainless-steel cabinet as shown on the drawings.

J. Fire-protection system to provide duct, plenum, and surface protection for hoods and cooking equipment located below hoods.

K. System interwired with shunt trip breaker or contactor and a gas solenoid valve supplying equipment located below the hoods for power and fuel shutoff during system actuation.

L. Options

1. Enclosure Panels: Stainless steel shall be installed; locate between hoods and top and ceiling on all exposed sides.

2. Back shall be finished. (ALL EXPOSED AREAS OF HOOD TO BE FINISHED)

3. Stainless-steel wall flashing shall be installed on wall behind [and on the side(s)] of hoods from wall curb to bottom of hoods.

4. Fresh air make-up plenum incorporated into the front face of the hoods or provided at ceiling line immediately in front of the hoods.

2.2 PERFORATED SUPPLY PLENUM

A. The perforated supply plenum shall provide make-up air through perforated stainless steel panels. All seams shall be welded and have stainless steel on exposed surfaces. Unexposed surfaces shall be constructed of aluminized steel. Perforated diffuser plates

shall be included in the design and to provide even air distribution and the plenum shall be insulated to prevent condensation.

B. The perforated supply plenum shall include but not be limited to the following features and benefits:
   1. Provide up to 90% make-up air.
   2. Stainless steel construction to match the ventilation hoods.
   3. Directs make-up air into the hood's capture area.
   4. Evenly distributes make-up air along the length of the hoods.
   5. Low make-up air discharge velocities, typical velocity is 140 to 160 ft. / min.
   6. Exceptional capture and containment of cooking vapors.

2.3 DROP-IN PERFORATED SUPPLY PLENUM

A. The drop-in perforated supply plenum shall deliver make-up replacement air in the vicinity of the exhaust hoods without affecting capture and containment. The double layer of perforated metal shall ensure a laminar air discharge pattern

B. The drop-in perforated supply plenum shall include but not be limited to the following features and benefits:
   1. Two Stainless steel removable perforation layers deliver uni-directional laminar airflow.
   2. Sliding radial volume damper with access plug in bottom face for damper adjustment.
   3. Compatible with 24" x 24" acoustic tile ceiling grid
   4. Plenum – galvanized steel
   5. Outer frame – stainless steel
   6. Fasteners & hardware – zinc-plated steel
   7. Corner hanging brackets for wire support to joists
   8. Fully insulated shell to prevent condensation

C. The perforated supply plenum shall provide make-up air through perforated stainless steel panels. All seams shall be welded and have stainless steel on exposed surfaces. Unexposed surfaces shall be constructed of aluminized steel. Perforated diffuser plates shall be included in the design and to provide even air distribution and the plenum shall be insulated to prevent condensation.

D. The perforated supply plenum shall include but not be limited to the following features and benefits:
   1. Provide up to 80% make-up air.
   2. Stainless steel construction to match the ventilation hoods.
   3. Directs make-up air into the hood's capture area.
   4. Evenly distributes make-up air along the length of the hoods.
   5. A low make-up air discharge velocity, typical velocity is 140 to 160 ft. / min.
   6. Exceptional capture and containment of cooking vapors.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install hoods in accordance with manufacturer's instructions. Install hoods level and plumb with access clearances required for operation, maintenance and cleaning and in accordance with the manufacturer's published documentation.

B. Coordinate installation of hoods with overhead supports; see Section 05 50 00, Metal Fabrications.

C. Interconnect hoods to service utilities.

3.2 FIELD TESTING

A. Field Testing, General: Following installation, test hoods for compliance with specified requirements and those of authorities having jurisdiction. Perform testing after air-handling systems have been balanced and adjusted.

B. Smoke Test:

1. Test Conditions:
   a. Perform tests with cooking equipment served by hoods turned off.
   b. Perform tests with supply and exhaust fans serving the food service kitchen area turned on.
2. Test Procedure: Move a smoke bomb around the perimeter of cooking equipment at the top surface.
3. Test-Performance Requirements: No visible smoke shall escape from the hoods canopy into the room.

C. Wet Fire Extinguishing System: Test system to verify that equipment operation complies with NFPA 96 and NFPA 17A. Fire condition operation sequences:

1. Fire condition wet chemical discharge
   a. Upon system discharge with fans operating
      i. Exhaust fan continues to run
      ii. Supply fan shuts down
      iii. Dry contacts of fire relay close.
   b. Upon system discharge with fans not operating
      i. Exhaust fan automatically starts
      ii. Supply fan remains off
      iii. Dry contacts of a fire relay reclose.

3.3 CLEAN-UP

A. At completion of the installation, clean and adjust equipment as required to produce ready-for-use condition.

B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

C. Install filter/filter media prior to acceptance.

END OF SECTION

SECTION 23 40 00

HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Disposable panel filters.
   2. Electric air purifier.

B. Related Sections:
   1. Section 23 08 00 – Commissioning of HVAC: Requirements for commissioning, systems readiness checklists, and training.
   2. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for wiring products for placement by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 850 - Commercial and Industrial Air Filter Equipment.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
   2. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size, including Appendix J

C. Underwriters Laboratories Inc.:
   1. UL 867 - Electrostatic Air Cleaners.
   2. UL 900 - Air Filter Units.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on filter media, filter performance data, dimensions, and electrical characteristics.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.8 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Provide entire building set of disposable panel filters for testing, adjusting, and balancing and system trial period. Furnish an additional entire building set of disposable panel filters prior to Owner acceptance.

PART 2 PRODUCTS

2.1 DISPOSABLE PANEL FILTERS

A. Manufacturers:
   A. Camfil Farr – AP Thirteen.
   B. Purolator.
   C. American Air Filter.
   D. Flanders Corporation.
   E. Eaton Corporation.
   F. Tri-Dim Filter Corporation.
   G. Substitutions: Section 01 60 00 - Product Requirements.

B. Media: UL 900 Class 2, MERV-13 high efficiency synthetic fibers, uniform lofted, radial pleated media, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   1. Thickness: 2 inch.
   2. Pleats per foot: 15

C. Performance Rating:
   1. Particle size: 0.3 to 1 Microns
   2. Face Velocity: 500 fpm maximum

3. Initial Resistance: 0.40 inch wg
4. Recommended Final Resistance: 1.00 inches wg @ 500 fpm.

D. Casing: Biodegradable Kraft board frame with welded metal wire retainer.

2.2 ELECTRIC AIR PURIFIER

A. Manufacturers:
   1. activTek Environmental – ActivePure INDUCT.
   2. EcoQuest
   3. Enviroaire
   4. ReSPR Technologies
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Assembly: UL 867

C. High intensity UVX light with a metal hydrophilic coating on an engineered matrix, the RCI Cell (Radiant Catalytic Ionization) shall reduce airborne and surface contaminants and odors while creating superoxide ions and hydroperoxides.

D. RCI Cell shall utilize 254nm hv germicidal UV light.

E. Microbe “kill” in entire structure shall be a minimum of 99.9%.

F. Microbe Reduction rating: 3 Exposure Hours @ 0.02 ppm.

G. Ozone Output shall not exceed recommended Federal Safety Limits of 0.04 ppm in recommended coverage area when properly installed.

H. Safety Accessories: Manual reset safety switches and warning lights for filter plenum access doors, signal lights and safety switching upstream and downstream of unit within duct, and enamel high voltage warning signs.

I. Electrical Characteristics: In accordance with Section 26 05 03 and the following:
   a. 120 volts, single phase, 60 Hz AC
   b. Disconnect Switch: Factory mount cord with grounded 15 amp straight blade plug on equipment.
   c. Pilot light indicating operating status.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not operate fan system until temporary filters are in place. Replace temporary filters used during construction and testing, with clean set.

B. Comply with electric air purifier manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

C. Install electric air purifier directly into supply air plenum in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

END OF SECTION

SECTION 23 55 00 - FUEL-FIRED HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gas fired unit heaters.
   2. Direct Fired Make-up Air Units

B. Related Sections:
   1. Section 23 11 23 - Pipes and Tubes for HVAC Piping and Equipment: Product requirements for natural gas piping connected to gas-fired heaters.
   2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers for placement by this section.
   3. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
   4. Section 23 33 00 - Air Duct Accessories: Product requirements for flexible duct connections.
   5. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electrical connections specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z83.4 - Direct Gas Fired Makeup Air Heaters
   2. ANSI Z83.8 - Gas Unit Heaters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.
   2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   3. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
   4. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittals procedures.

B. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.

C. Product Data: Submit manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of thermostats or other products not mounted on unit.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.5 QUALITY ASSURANCE

A. Gas-Fired Unit Heater Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with ANSI Z83.8.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept heaters and make-up air unit(s) and controls on site in factory packaging. Inspect for damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 GAS FIRED UNIT HEATERS

A. Manufacturers:
   1. Addison.
   2. Greenheck

3. Hastings
4. Cambridge Engineering, Inc
5. Modine,
6. Reznor,
7. Sterling HVAC Products,
8. Trane
9. Substitutions: Section 01 60 00 - Product Requirements.

B. UNIT CONSTRUCTION

1. Most cabinetry and trim pieces shall be fabricated of 20-gauge material and painted with a baked gray enamel finish.

2. Unit shall be insulated with foil faced insulation. Insulation shall have a fire hazard classification of 25/50 Flame Spread/Smoke Developed Rating per ASTM E 84, UL 723 and CAN/UCL S102-M88.

3. All line voltage wiring shall be completely enclosed in flexible conduit.

4. Unit heater shall have a minimum of (4) built in hanger brackets for suspension of unit.

5. Combustion chamber must be completely sealed to prevent infiltration of air from the space into the combustion burner.

C. HEAT EXCHANGER AND BURNER

1. The heat exchanger shall consists of aluminized steel tubes not lighter than 20-gauge. Tubes shall be of a curved, non-welded serpentine design.

2. Burner shall be constructed of aluminized steel.

3. Flue Collector shall be constructed of aluminized steel.

D. UNIT FAN

1. Unit fan shall be of the centrifugal blower type. Blower shall double width, double inlet with forward curved blades.

2. Motor sizes shall be minimum sizes as indicated on schedule. If not indicated, motor size shall be large enough so driven load will not require motor to operate in service factor range above 1.0.

3. Units will be equipped with 115/1/60 volt open drip proof motors which include internal automatic reset thermal overload protection. Motors Windings shall be rated Class B.

4. Bearing shall be ball bearing type with concentric locking collar and shall be permanently lubricated. Bearing shall have a cylindrical cartridge interliner made of conductive rubber to minimize noise and vibration, as well as dissipate static electricity.

5. All blower(s) shall be belt driven and provided with manufactures standard belt guard.

6. All blower(s) shall be statically and dynamically balanced by manufacture prior to shipment.

7. Units with inputs greater than 250,000 BTU's shall be equipped with dual blowers for optimum air distribution.

E. CONTROLS

1. The following gas control shall be provided with the unit.
    a. Provided 24 volt, single stage, redundant gas control valve. Valve shall be fast opening type.

2. A direct spark ignition system with integrated control shall be provided. Flame rectification shall be independent of the spark igniter allowing true indication of complete ignition of the burner. Standing pilot shall not be acceptable.

3. Integrated electronic control board shall be used to regulate the system sequence of operation, including an onboard LED indicator for ease of troubleshooting.

4. Control transformers - Heaters shall be equipped with a 120/24 volt transformer. The control transformer and pressure switch shall be factory mounted in a main control panel located on the side of the unit; this panel creates easy access and all wiring information will be indicated on the inside control panel door.

5. The following safeties shall be provided:
    a. High Limit Switch -Units shall be equipped with a low voltage automatic reset high temperature control, wired to de-energize the main gas valve and maintain fan operation until the high temperature control resets.
    b. Air Pressure Switch – Units shall be equipped with an air pressure switch to confirm power venter operation prior to beginning ignition sequence and during normal operation.
    c. Flame Sensor – shall monitor ignition and normal operation. If flame is not detected after 3 ignition periods, the control will de-energizes the gas valve and lockout the unit requiring manual reset.

6. Control Terminal strip shall be mounted on the exterior of the electrical control panel for ease of installation and wiring.

7. Thermostat – Unit shall be provided with a ship loose thermostat for field install. Thermostats shall be mercury free.
    a. Single stage heating only thermostat shall be provided. Subbase shall include fan switching relay. Temperature range: 50-100°F. range. Thermostat shall include tamper proof guard.

8. Factory wiring shall permit the use of blower for continuous air circulation when combined with thermostat with built in fan switch. (Option) Factory wiring shall permit the use of blower for continuous air circulation when combined with 24 volt summer/winter switch.

F. DISCHARGE LOUVERS:

1. Louvers shall be individually adjustable and removable with horizontal blades for directing air flow.

2.2 DIRECT FIRED MAKE-UP AIR UNITS

A. Description: A Direct-fired gas heating and ventilating unit(s), as indicated on the drawings shall be furnished. Unit(s) shall be tested in accordance with ANSI Standard Z83.4 and shall bear the ETL label. Orientation shall be horizontal, down or side discharge. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following:
   1. Gas burner
   2. Centrifugal blower (forward-curved double width/double inlet or backward inclined);
   3. Motor starter with thermal overload protection
   4. Motor and drive assembly
   5. Fuel burning and safety equipment
   6. Temperature control system
   7. Gas piping

B. Housing
   1. Unit housing shall be constructed of 20 Gauge G-90 galvanized steel. The wall panels and roof panels shall be fabricated by forming double-standing, self-locking seams that require no additional support. The floor and wall panels shall be caulked air tight with a silicone caulk. All casing panels shall be attached with sheet metal screws or rivets, which can be removed to field service large components. The unit base shall be suitable for curb or flat mount. Housing construction should be suitable for outdoor or indoor installation.
   2. An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the burner vestibule. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream.
   3. The vestibule full-size door shall provide easy access to controls and gas-train components. Blower door shall provide easy access to blower, motor and drives. Access doors shall be provided on both front and backside of unit providing full access to every part of the unit.
   4. Internal ridged board 1" x 1.5" foil face insulation shall be installed on roof, walls and base of casing.

C. Base

   1. The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.

D. Blower

1. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft with setscrews and keys. The blower assembly shall be isolated from the fan structure with vibration isolators.

2. Blower capacity shall be at 70 degrees F standard air.

3. External Static is the sum of duct loss, plus duct component static. All blowers shall be tested and set at rated speed after being installed in the factory-assembled unit.

   a. Belt Drive

      i. Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on application requirements), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft.

   b. Direct Drive

      i. Direct drive blower assembly shall consist of a centrifugal backward inclined, non-overloading wheel secured directly to a heavy duty, ball bearing type motor via two set screws. The motor and wheel assembly shall be mounted to a heavy gauge galvanized steel frame. The motor shall be controlled by a variable frequency drive, allowing for variable airflow without the need of belts and pulleys.

E. Motor & Motor Compartment

1. Motors shall be heavy-duty ball bearing type and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of the belt tension. Blower motor shall be suitable for operation on power available at the project. Blower motor shall be Open Drip Proof.

F. Shaft & Bearings

1. Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested, specifically for use in air handling applications.

G. Belts & Drives (Belt Drive Units Only)

1. Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed, and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys. All drives shall be a minimum of 2 grooves above 2 HP.

H. Burner

1. The gas burner shall be direct-fired, draw-through type, sized to provide an output using natural or propane gas at an inlet-supply pressure to the unit as specified.

2. The burner shall be capable of heating the entire air supply at the temperature rise as specified. The burner shall burn over its entire length at all times when the system is in operation.

3. The burner shall have non-clogging, 4302B stainless-steel combustion baffles attached to a ductile aluminum gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of up to 30 to 1.

4. The gas burner shall be furnished with a pilot package arranged so that the pilot flame lights the burner with instantaneous ignition. Pilot assembly includes a flame rod, spark rod and pilot, which is automatically ignited by ignition transformer. A flame-rod rectification system shall be used to prove pilot and main flame.

5. Rear access doors will provide complete access to burner and pilot assembly.

6. Burner profile plates shall be self-adjusting to operate across the complete CFM range of each model heater. Every unit shall be designed for Variable Air Volume capabilities.

I. Gas Equipment

1. Standard: All gas equipment should conform to local code requirements. All gas manifold components shall be piped and wired at the factory. Components Include:
   a. Pilot-gas shut-off valve
   b. Pilot-gas regulator
   c. Pilot-gas valve
   d. Main-gas shut-off valve
   e. Main-gas regulator
   f. Two solenoid valves
   g. Modulating-gas valve
   h. Burner

J. Safety Controls

1. Standard
   a. Motor starter with adjustable overloads
   b. Air-flow safety switch
   c. Electronic flame-safety relay
   d. High-temperature limit switch
   e. Main-gas regulator
   f. Two safety shutoff valves
   g. Modulating-gas valve
   h. Burner
   i. Adjustable burner ON/OFF inlet air duct-stat to shut off burner when inlet air is sufficiently warm to maintain space temperature.
   j. Non-Fused Disconnect.

k. Casing insulation shall be 1” x 1.5" density with a foil face.

K. Accessories

1. Inlet Dampers: Manufacturer shall provide and install on unit, when possible, a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16-gauge G-90 galvanized steel and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals used are flexible metal, compression type.

2. Filters: The filters shall be (2") thick, aluminum mesh coated with super-filter adhesive, aluminum mesh with polyester foam or pleated throw away. Aluminum-mesh filters shall have aluminum frames with media to be layers of slit and expanded aluminum, varying in pattern to obtain maximum depth loading. Washable 2" filters shall be enclosed in two-piece, die-cut frame with diagonal supports. Frame shall be constructed of heavy-duty beverage board. Filter media is supported on the air leaving side by a metal grid.

3. Fresh-Air Inlet Hood/Filter Combination: Shall be constructed of G-90 galvanized steel with bird screen and (2") cleanable filters supported by internal slides mounted in the inlet face of the hood.

4. Curb: 20" curb shall be constructed of 18-gauge aluminized steel as a completed welded assembly.

L. Wiring and Electrical

1. A single point electrical connection shall be supplied. The control circuit voltage shall be 115 volts. A control transformer shall be provided, when required. Wiring in control enclosures shall be in accordance with the National Electrical Code and the local code, as it may affect the installation. Motor starter shall be provided. Starter shall be line voltage, definite purpose type.

2. Unit(s) shall be complete with all items such as relays, starters, switches, safety controls, conduit and wire as previously mentioned, and as required for proper operation. All factory-mounted controls shall be factory pre-wired to the unit control panel. A safety disconnect switch shall be standard on all units and shall be sized according to the unit.

M. Factory Tested

1. Unit(s) shall be operated, tested and set at the factory using job-site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. Adjustable or fixed sheaves shall be set for proper RPM at specified conditions. Gas-pressure regulator shall be set for specified burning rate at specified inlet pressure.

N. Service and Parts

1. The supplier shall furnish as built wiring connection and control-circuit diagrams, dimension

sheets and a full description of the unit(s). Service manuals, showing service and maintenance requirements, shall be provided with each unit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify space is ready for installation of units and openings are as indicated on shop drawings.

3.2 INSTALLATION

A. Install units in accordance with NFPA 90A and NFPA 90B gas fired units to NFPA 54.

B. Installation - Natural Gas Piping:
   1. Connect natural gas piping in accordance with NFPA 54.
   2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
   3. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23.
      a. Strainer.
      b. Pressure gage.
      c. Shutoff valve.

C. Install make-up air units on roof as indicated on the drawings and in section 23 05 29. Install per the manufacturer's written instructions and in compliance with applicable codes. Provide hangers and supports for suspended units. Refer to Section 23 05 29.

D. Install units as shown on plans, as detailed and according to the manufacturer's installation instructions.

E. Install remote panels and thermostats where indicated on the drawings.

F. Provide all wiring between remote panels/thermostats and the gas fired item.

G. Provide connection to electrical power systems. Refer to Section 26 05 03.

END OF SECTION

SECTION 23 81 03

PACKAGED ROOFTOP AIR CONDITIONING UNITS - SMALL CAPACITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Packaged rooftop air conditioning unit.
   2. Roof curb.

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
   2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
   3. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
   2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
   3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
   2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
   3. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International:
   1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.
   2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 DEFINITIONS

A. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity in Btuh to total rate of electric input in watts under designated operating conditions.

B. Seasonal Energy Efficiency Ratio (SEER) - Total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by total electric energy input during the same period (in Wh).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating:
   1. Cooling and heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
   6. Electrical requirements with electrical characteristics and connection requirements.
   7. Controls.
   8. Accessories.

C. Field Reports: Submit start-up report for each unit.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 210/240.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Performance Requirements: Conform to minimum EER prescribed by ASHRAE 90.1 when tested in accordance with ARI 210/240.

E. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept units on site. Inspect for damage.

C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of filters and fan belts for each unit.

PART 2 PRODUCTS

2.1 ROOFTOP AIR CONDITIONING UNITS

A. Manufacturers:
   1. Aaon Incorporated.
   2. Carrier Corp..
   3. Johnson Controls, Inc.
   4. Lennox International.
   5. McQuay International.
   6. Rheem Manufacturing.

7. The Trane Company.
8. York International.
9. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, supply fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, gas-fired heating section, air filters, mixed air casing, controls, and accessories.

C. Configuration: Downflow air delivery.

D. Roof Mounting Curb: 14 inch high, galvanized steel, channel frame with gaskets, nailer strips. Full perimeter type for mounting under entire unit.

E. Cabinet:
1. Designed for outdoor installation with weatherproof construction.
2. Panels: Constructed of galvanized steel with baked enamel finish meeting salt spray test in accordance with ASTM B117. Furnish access doors or removable access panels.
3. Insulation: Factory applied to exposed vertical and horizontal panels. 1-inch-thick coated glass fiber with edges protected from erosion.

F. Supply Fan: Forward curved centrifugal type, resiliently mounted with direct drive. Motor permanently lubricated with built-in thermal overload protection.

G. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Galvanized drain pan with piping connection. Factory leak tested under water.

H. Compressor: Hermetically sealed, resiliently mounted with positive lubrication, and internal motor overload protection. Furnish internal vibration isolators, short cycle protection.

I. Refrigeration circuit: Independent fixed-orifice or thermally operated expansion devices. Solid core filter drier/strainer to eliminate any moisture or foreign matter. Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.

J. Condenser:
1. Coil: Copper tube aluminum fin coil assembly and coil guard. Factory leak tested under water.
2. Condenser Fan: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection.

K. Gas-Fired Heating Section:
1. Fuel: Natural gas.
2. Heat Exchangers: Aluminized or Stainless steel, welded construction for 40 degree entering air temperature.
3. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil

ignition, flame sensing device, and automatic 100 percent shut-off pilot. Require unit fan operation before allowing gas valve to open.

L. Air Filters: 2 inch thick glass fiber disposable media in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1.

M. Mixed Air Casing:

1. Outside Air Damper Leakage: Maximum 3.0 cfm per square foot at 1.0 inches wg pressure differential.
2. Economizer: Factory installed fully modulating motorized outside air and return air dampers controlled by enthalpy controller. Outside air damper normally closed and return air damper normally open. Furnish barometric relief damper with powered exhaust. Furnish rain hood with screen. Provide economizer components and controls in accordance with ICC IECC.

N. Controls:

1. Thermostat: Remote space thermostat with 2 stage heating and 2 stage cooling with automatic changeover.
2. Control and Status Panel: Furnish remote panel containing the following control and status indications:
   a. Cooling mode.
   b. Heating mode.
   c. Compressor 1.
   d. Compressor 2.
   e. Heating stage 1.
   f. Heating stage 2.
   g. Heating failure.
   h. Dirty filters.
   i. Fan only operation.
   j. Manual 12 hour timer to override night control.
   k. 7 day time clock for energizing night control.
   l. Remote damper control.
   m. Low limit manual reset.
   n. Remote thermostat temperature set point.
3. Furnish interface to Direct Digital Control System specified in Section 23 09 23.
4. Microprocessor Based Controls:
   a. Factory mounted with the following features:
      1) Monitor each mode of operation.
      2) Evaporator fan status.
      3) Filter status.
      4) Indoor air quality.
      5) Supply air temperature.
      6) Outdoor air temperature.
   b. Diagnostics for thermostat temperature sensor commands for staged heating, staged cooling, fan operation, and economizer operation.
   c. Zone space temperature sensor to interface with microprocessor controls with Automatic programmable with night setback.

O. Accessories:
1. Convenience Outlet: Factory installed, 115 volt, 15 amp, GFCI type, internally mounted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.2 PREPARATION

A. Furnish roof curbs to Roof Trades for installation.

3.3 INSTALLATION

A. Roof Curb:
1. Assemble roof curb.
2. Install roof curb level.
3. Coordinate curb installation and flashing with Roof Trades.
4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
5. Install gasket material between unit base and roof curb.

B. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.

C. Install condensate piping with trap and route from drain pan to splash block on roof or nearest roof drain.

D. Install components furnished loose for field mounting.

E. Install electrical devices furnished loose for field mounting.

F. Install control wiring between unit and field installed accessories.

G. Remove from roof and dispose off-site panels removed from units during installation of economizer and dampers.

H. Locate remote panels as indicated on Drawings.

3.4 INSTALLATION - NATURAL GAS HEATING SECTION

A. Connect natural gas piping in accordance with NFPA 54.

B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

C. Install the following piping accessories on natural gas piping connections.
    1. Strainer.
    2. Shutoff valve.

D. Install natural gas piping accessories above roof.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.6 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

END OF SECTION

SECTION 23 81 26

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Indoor unit.
   2. Condensing unit.

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
   2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
   3. Section 23 23 00 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
   4. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
   2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
   3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
   4. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
B. Product Data: Submit data indicating:
   1. Cooling and heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
   6. Electrical requirements with electrical characteristics and connection requirements.
   7. Controls.
   8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
E. Manufacturer’s Field Reports: Submit start-up report for each unit.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
B. Project Record Documents: Record actual locations of controls installed remotely from units.
C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Performance Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240.
B. Cooling Capacity: Rate in accordance with ARI 210/240.
C. Sound Rating: Measure in accordance with ARI 270.
D. Insulation and adhesives: Meet requirements of NFPA 90A.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
C. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
D. Protect units from weather and construction traffic by storing in dry, roofed location.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
B. Coordinate installation of condensing units with concrete pad and/or roof structure.
C. Coordinate installation of air handling units with building structure.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
B. Furnish five-year manufacturer’s warranty for compressors.

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Manufacturers:
1. Carrier
2. LG Electronics
3. Mitsubishi Electric.
4. Trane.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. OUTDOOR UNIT
1. General:
a. The outdoor units are specifically designed to work with the wall mounted, ducted, 4-way cassette, ceiling suspended and multi-position air handler indoor units. The connected indoor unit shall be of the same capacity as the outdoor unit. The outdoor units must have a thermally fused powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
b. Outdoor unit shall have a sound rating no higher than 53 dB(A). If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
c. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.
d. The outdoor unit shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.
e. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized wind baffle kit. The wind baffle kit shall include front, rear and side guards. The kit shall allow for continuous cooling to -40 degrees F DB without any additional modifications to the unit.
2. Unit Cabinet:
a. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance.
b. Cabinet color shall be Munsell 3Y 7.8/1.1.
c. Easy access shall be afforded to all serviceable parts by means of removable panel sections.
d. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished. Assembly shall withstand lateral wind gust up to 155 MPH to meet applicable weather codes.The casing(s) shall be fabricated of galvanized steel, bonderized and finished.
e. Fan:
f. 1, 1.5, 2 and 2.5 ton units shall be furnished with a single direct drive propeller type fan. 3, 3.5 ton units shall be furnished with a two (2) direct drive propeller type fans.

g. The outdoor unit fan motor(s) shall be a direct current (DC) motor and have permanently lubricated bearings.
h. The fan motor shall be mounted for quiet operation.
i. The fan shall be provided with a raised guard to prevent contact with moving parts.
j. The outdoor unit shall have horizontal discharge airflow.

3. Refrigerant and Refrigerant Piping
   a. R410A refrigerant shall be required for systems.
   b. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
   c. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the equipment manufacturer and installed in accordance with manufacturer recommendations.
   d. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.
   e. Refrigerant line sizing shall be in accordance with manufacturer specifications.
4. Coil:
   a. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
   b. The coil shall be protected with an integral metal guard.
   c. Refrigerant flow from the outdoor unit shall be regulated by means of an electronically controlled, precision, linear expansion valve.
   d. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.
   e. All refrigerant connections between outdoor and indoor units shall be flare type.
5. Compressor:
   a. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type manufactured by Mitsubishi Electric Corporation.
   b. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.

c. The compressor will be equipped with internal thermal overload protection.
d. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
e. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.
f. The compressor shall be mounted so as to avoid the transmission of vibration.
g. The outdoor unit shall have an accumulator and high pressure safety switch.

6. Electrical:
a. The outdoor unit electrical power supply shall be 208/230 volts, 1-phase, 60 hertz.
b. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
c. The outdoor unit shall be controlled by microprocessors located in the indoor unit and outdoor unit. A 12 to 24 volt DC data stream shall communicate between the units providing all necessary information for full function control.
d. The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control for maximum efficiency with minimum power consumption.

C. INDOOR UNIT
1. General:
a. The wall-mounted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
2. Unit Cabinet:
a. All casings, regardless of model size, shall have the same Munsell 1.0Y 9.2/0.4 white finish
b. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.
c. There shall be a separate back plate which secures the unit firmly to the wall.
3. Fan:
a. The indoor fan shall be statically and dynamically balanced to run on a single motor with permanently lubricated bearings.
b. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
c. An integral, motorized, multi-position, horizontal air sweep vane shall provide for uniform air distribution, up and down. Vane shall have 5 selectable positions plus AUTO (Controls position based upon mode, microprocessor shall automatically determine the vane angle to provide the

optimum room temperature distribution) and SWING (Continuously moves up and down). In OFF mode the horizontal vane shall return to the closed position.

d. The indoor unit shall include an AUTO fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller set-point and space temperature. The indoor fan shall be capable of five (5) speed settings, Low, Mid1, Mid2, High and Auto.

4. Filter:
   a. Return air shall be filtered by means of an easily removable, washable filter.
5. Coil:
   a. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.
   b. The tubing shall have inner groves for high efficiency heat exchange.
   c. All tube joints shall be brazed with silver alloy.
   d. The coils shall be pressure tested at the factory.
   e. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.
   f. A drain pan level switch (SS610E), designed to connect to the control board, shall be provided, if required, and installed in the condensate pan to prevent condensate from overflowing.
6. Electrical:
   a. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
   b. The system shall be equipped with A-Control – a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 gauge AWG connections plus ground.
   c. The indoor unit shall not have any supplemental electrical heat elements.
7. Controls:
   a. The unit shall include an IR receiver for wireless remote control flexibility
   b. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
   c. Control board shall include contacts for control of external heat source. External heat may be energized as second stage when the space temperature is 1.8°F from set point.
   d. The control system shall consist of a minimum of one microprocessor on each indoor unit and one in the outdoor unit, communicating via A-Control data over power transmission. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired or wireless controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN24 and a 12 VDC output.
   e. 5.For A-Control, a three (3) conductor 14 gauge AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. If code requires a disconnect mounted near the

indoor unit, a TAZ-MS303 3-Pole Disconnect shall be used – all three conductors must be interrupted.

f. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

G. A remote controller needs to be selected and ordered separately from the unit unless the indoor unit is a wall mounted (excludes PKA), floor mounted or one-way ceiling recessed unit.

2.2 REMOTE CONTROLLERS

A. Backlit Simple MA Remote Controller:

1. On wall mount (excludes PKA), floor mount and one-way ceiling recessed units the Backlit Simple MA Remote Controller shall require a MAC-334IF-E Interface for communication.
2. The Backlit Simple MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group). When grouping M-Series units each unit requires a MAC-334IF-E Interface.
3. The Backlit Simple MA Remote Controller shall only be used in same group with another Backlit Simple MA Remote Controller, with up to two remote controllers per group.

2.3 CMCN REMOTE CONTROLLERS: SYSTEM INTEGRATION

1. The CMCN shall be capable of supporting integration with Building Management Systems (BMS).

2.4 Condensing Unit Accessories:

A. Furnish the following accessories:

1. Controls to provide low ambient cooling to -20 degrees F.
2. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized wind baffle kit. The wind baffle kit shall include front, rear and side guards. The kit shall allow for continuous cooling to -40 degrees F DB without any additional modifications to the unit.
3. Wall mounting brackets.
4. Time delay relay.
5. Anti-short cycle timer.
6. Disconnect switch.
7. Vibration isolators.
8. Suction and discharge pressure gauges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify concrete pad for condensing unit is ready for unit installation.

3.2 INSTALLATION - INDOOR UNIT

A. Install indoor units fastened securely to structure using 3/8” threaded rod..
B. Install condensate piping with trap and route from drain pan to drainage system.
C. Install components furnished loose for field mounting.
D. Install connection to electrical power wiring in accordance with Section 26 05 03.

3.3 INSTALLATION - OUTDOOR UNIT

A. Install condensing units on vibration isolators.
B. Install units on concrete foundations.
C. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties furnished with unit.
D. Evacuate refrigerant piping and install initial charge of refrigerant.
E. Install electrical devices furnished loose for field mounting.
F. Install control wiring between air handling unit, condensing unit, and field installed accessories.
G. Install connection to electrical power wiring in accordance with Section 26 05 03.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
B. Vacuum clean coils and inside of unit cabinet.
C. Install new throwaway filters in units at Substantial Completion.
D. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.5 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.
B. Demonstrate air handling unit operation and maintenance.
C. Demonstrate starting, maintenance, and operation of condensing unit.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
B. Do not operate air handling units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 26 05 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

B. Provide all interior & exterior electric wiring including, but not limited to:

1. New Electrical Panels, Feeders to branch circuit panels, HVAC equipment, Owner provided equipment, and other equipment as detailed.
2. Branch circuit wiring from the distribution and branch circuit panels for lighting, receptacles, motors, and other detailed circuit wiring.
3. Luminaires, exits signs, control switches, disconnect switches, receptacles, relays, supports, and other accessory items.
4. All conduits, boxes, only for the network telecommunication (computer and telephone) system. **NOTE**: The cable, jacks, cover plates, labeling, termination and testing of telecommunications wiring is included in a separate bid that is not part of this contract. The electrical contractor for this contract shall coordinate with successful bidder of separate telecom bid.
5. Conduit, boxes, devices, wiring, and equipment for a complete new fire alarm system. Provide all equipment, devices, wiring, and connections necessary to make these systems fully functional in all spaces.

C. Obtain and pay for all electrical permits and inspections from the Authority Having Jurisdiction

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for additional submittal requirements.

B. Shop Drawings: Provide certified shop drawing submittals (approved by the Prime contractor) for the following items and any other items where indicated in other specification sections:
1. Panelboards,
2. Generator and Automatic Transfer Switch
3. Fire Alarm system layout, equipment and wiring.

C. Product Data: Provide certified submittals (approved by the Prime contractor) for the following items and any other items where indicated in other specification sections:
1. Switchboard/Panelboard
2. Branch Circuit Panelboards
3. Circuit Breakers
4. Disconnect Switches and Fuses
5. Conduit, boxes, fittings, and support items
6. Wire and Cable
7. Electrical Devices, including receptacles, switches, and device cover plates.
8. Motor Control equipment; starters, contactors, push-buttons, and the like
9. Light fixtures
10. Occupancy Sensors
11. Generator and Automatic Transfer Switch
12. Fire Alarm system equipment, components, wire/cable, and devices
13. For sleeve seals.

1.05 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways and cables will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide like items from one manufacturer; such as, luminaire types, switches, receptacles, breakers, panels, and the like.

B. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established.

C. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system or systems, in a safe and satisfactory working condition.

D. Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type, or catalog number, such designation is to establish standards of desired quality and style and shall be the basis of the bid.

2.02 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052-inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138-inch.

2.03 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1, NFPA 70 (National Electrical Code – current edition adopted by the Authority Having Jurisdiction), and any local amendments.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:
   1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Must be UL Listed and Labeled.

C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

D. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.4 EQUIPMENT CONNECTION SCHEDULE

A. Provide electrical connection of equipment (voltage, amperage, fusing, etc.) per equipment manufacturer’s requirements.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; metal clad cable; and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.
   2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:
   1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Stranded conductors.
   2. Conductor not smaller than 12 AWG for power and lighting circuits.
   3. Conductor not smaller than 16 AWG for control circuits.

B. Conduit:
   1. Wire shall be installed in conduit.
   2. Conduit may be used in exposed locations only in unfinished spaces (such as mechanical rooms). All conduit in finished spaces shall be concealed in walls and above ceilings.
   3. MC cable may be used as fixture whips when concealed.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper. DO NOT use aluminum wire.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Material information.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. Section 01 30 00 - Administrative.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 ft of length shown.

1.11 DEFINITIONS

A. Furnish: To supply and deliver, unload and inspect for damage.

B. Install: To unpack, assemble, erect, mount, apply, place, finish, cure, protect, clean, energize, program, adjust, test and make completely functional and operational.

C. Provide: To furnish and install.

PART 2 PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
1. General Cable Co.

2. Rome Cable.
3. Southwire.

B. Product Description: Single conductor insulated wire.

C. Conductor: Stranded copper.

D. Insulation Voltage Rating: 600 volts.

E. Insulation Temperature Rating: 90 degrees C.

2.2 METAL CLAD CABLE

A. Conductor: Copper.

B. Insulation Voltage Rating: 600 volts.

C. Insulation Temperature Rating: 90 degrees C.

D. Armor Material: Aluminum.

E. Armor Design: Interlocked metal tape or corrugated tube.

F. Jacket: None.

2.3 WIRING CONNECTORS

A. Split Bolt Connectors:

B. Solderless Pressure Connectors:

C. Spring Wire Connectors:

D. Compression Connectors:

2.4 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:
1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:
1. Protect exposed cable from damage.
2. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

G. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

I. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Wire.
   3. Mechanical connectors.
   4. Exothermic connections.
   5. Equipment grounding.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode (ufer).
   4. Ground ring.
   5. Metal underground gas piping system.
   6. Rod electrode.
   7. Plate electrode.

B. Equipment Ground.
   1. Provide separate insulated equipment grounding conductor in each conduit and raceway. DO NOT rely on conduit as the sole means of equipment grounding.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.6 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
   1. Erico, Inc.
   2. O-Z Gedney Co.
   3. Thomas & Betts, Electrical.

B. Product Description:
   1. Material: Copper-clad steel.
   2. Diameter: 3/4 inch.
   3. Length: 10 feet.

C. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: match size of service grounding conductor.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare or insulated.

2.3 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils and surface contaminants at connection points.

3.3 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install rod electrodes near the main electrical service location.

C. Install grounding and bonding conductors concealed from view.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings. Electrically bond steel together.

E. Bond together metal siding not attached to grounded structure; bond to ground.

F. Bond together each metallic raceway, pipe, duct and other metal objects.

G. Provide separate insulated equipment grounding conductor in each conduit and raceway. Conductor shall be sized per National Electrical Code requirements.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground resistance testing in accordance with IEEE 142.

D. Perform leakage current tests in accordance with NFPA 99.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479] to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
   1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor [and Roof] Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company.
3. O-Z Gedney Co.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single or Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

2.6 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:
1. Furnish UL listed products or products tested by independent testing laboratory.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors and preset inserts.
   2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
   3. Concrete Surfaces: Provide expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
   5. Solid Masonry Walls: Provide expansion anchors.
   6. Sheet Metal: Provide sheet metal screws.
   7. Wood Elements: Provide wood screws.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
   4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
   3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

B. Underslab conduit shall be 1 inch minimum.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit for the following:

1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Nonmetallic tubing.
6. Raceway fittings.
7. Conduit bodies.
8. Surface raceway.
9. Wireway.
10. Pull and junction boxes.
11. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents:
1. Record actual routing of conduits larger than 2 inch .
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements.

B. Coordinate installation of outlet boxes for equipment.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carlon Electrical Products.

B. Allied Tube.

C. Wheatland.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Rigid Aluminum Conduit: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid steel.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked aluminum construction with PVC jacket.

B. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.

2.5 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC as indicated on the drawings.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.6 SURFACE METAL RACEWAY

A. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

B. Acceptable Manufacturers:
   1. Thomas & Betts
   2. Wiremold

C. Size: as required for circuits, conductors, and cables to be installed. DO NOT exceed fill capacity as determined by the National Electrical Code and manufacturer’s requirements.

D. Finish: manufacturer’s standard primer, suitable for field painting.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.7 WIREWAY

A. Product Description: General purpose, oiltight and dust-tight or raintight type wireway as suited for location installed.

B. Knockouts: Manufacturer's standard on bottom only.

C. Size: As indicated on Drawings.

D. Cover: Hinged with full gaskets.

E. Connector: Flanged.

F. Finish: Rust inhibiting primer coating with gray enamel finish.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. Concrete composite Handholes: Die-molded:
   1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
   2. Cover: concrete composite, weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.1 EXAMINATION

Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes.

B. Fasten raceway and box supports to structure and finishes.

C. Identify raceway and boxes.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Do not use surface raceway (wiremold).

C. Utilize conduit concealed within walls, above ceilings, or below floors.

D. Surface conduit is only allowed in mechanical or electrical rooms.

E. Arrange raceway supports to prevent misalignment during wiring installation.

F. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

G. Group related raceway; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional raceways.

H. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

I. Do not attach raceway to ceiling support wires or other piping systems.

J. Construct wireway supports from steel channel.

K. Route exposed raceway parallel and perpendicular to walls.

L. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

M. Route conduit in and under slab from point-to-point.

N. Minimum Size Conduit under Slab: 1 inch.

O. Maintain clearance between raceway and piping for maintenance purposes.

P. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.

R. Bring conduit to shoulder of fittings; fasten securely.

S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

T. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

U. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

V. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

W. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

X. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

Y. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

A. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

B. Orient boxes to accommodate wiring devices.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

F. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

G. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

H. Install stamped steel bridges to fasten flush mounting outlet box between studs.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Do not fasten boxes to ceiling support wires or other piping systems.

L. Support boxes independently of conduit.

M. Install gang box where more than one device is mounted together. Do not use sectional box.

N. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

B. Locate outlet boxes to allow luminaires positioned as indicated.

C. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Labels.
   3. Wire markers.
   4. Conduit markers.
   5. Stencils.
   6. Underground Warning Tape.
   7. Lockout Devices.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data:
   1. Submit manufacturer’s catalog literature for each product required.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:
1. 1/8 inch high letters for identifying individual equipment and loads.
2. 1/4 inch high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

A. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

A. Description: Cloth tape, split sleeve, or tubing type wire markers.

B. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
2. Control Circuits: Control wire number as indicated on shop drawings.

2.4 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

B. Stencil Paint: semi-gloss enamel.

2.5 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic detectible type tape, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
4. Secure nameplate to equipment front using screws, rivets, or adhesive.
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
6. Install nameplates for the following:
   a. Main Breakers.
   b. Panelboards.
   c. Transfer Switches.
   d. Generator.
   e. Fire Pump and Jockey Pump Controllers.
   f. Service Disconnects.
   g. Motor and equipment disconnects.

C. Label Installation:
1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations.
3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes for each load connection.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation.

E. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 12 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Remote control lighting relays.
2. Lighting contactors.
3. Switches.
4. Switch plates.
5. Occupancy sensors.
6. Photocells.
7. Photocell control unit.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contractors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
6. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.3 SYSTEM DESCRIPTION

A. Distributed switching control using self contained individually mounted lighting relays.

B. Where indicated on drawings and in all renovated areas, as required by applicable energy code, provide automatic shutoff for all lighting inside of building. Control shutoff by method conforming to ICC IECC.

C. Where indicated on drawings and required by applicable code, provide automatic shutoff for lighting outside building. Control shutoff by method conforming to ICC IECC.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.

2. Include typical wiring diagrams for each component.

C. Product Data: Submit manufacturer’s standard product data for each system component.

D. Manufacturer's Installation Instructions: Submit for each system component.

E. O&M Manual: Submit programming manuals.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Record the following information:
1. Actual locations of components and record circuiting and switching arrangements.
2. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.

C. Operation and Maintenance Data:
1. Submit replacement parts numbers.
2. Submit manufacturer’s published installation instructions and operating instructions.
3. Recommended renewal parts list.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Accept components on site in manufacturer’s packaging. Inspect for damage.

C. Protect components by storing in manufacturer’s containers indoor protected from weather.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Furnish five year manufacturer warranty for components.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Furnish two of each switch type.

C. Furnish two of each occupancy sensor type.

D. Furnish two of each photocell type.

1.10 DEFINITIONS

A. Furnish: To supply and deliver, unload and inspect for damage.

B. Install: To unpack, assemble, erect, mount, apply, place, finish, cure, protect, clean, energize, program, adjust, test and make completely functional and operational.

C. Provide: To furnish and install.

PART 2 PRODUCTS

2.1 LIGHTING CONTACTORS

A. Product Description: NEMA ICS 2, magnetic lighting contactor.

B. Configuration: Mechanically held, with 3 wire control.

C. Coil Operating Voltage: as shown on the drawing or as determined by contractor to meet manufacturer’s requirements, 60 Hertz.

D. Poles: To match circuit configuration and control function.

E. Contact Rating: Conductor overcurrent protection, considering derating for continuous loads.

F. Accessories:
1. Cover Mounted Pilot Devices: NEMA ICS 5, heavy-duty oiltight type with Form C contacts.
2. Pushbutton: ON and OFF.
3. Selector Switch: ON/OFF/AUTOMATIC function, with rotary action.
4. Indicating Light: Red/Green lens, transformer type, with led lamp.
5. Auxiliary Contacts: One form C.
6. Control Power Transformers: 120 volt secondary, 150 VA minimum, in each enclosed contactor. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.

G. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R with gasketed door.

2.2 SWITCHES

A. Wall Switch: Specification Grade locator light, momentary pushbutton type for overriding relays.

B. Wall Switch: Industrial Grade non-pilot light toggle switches for overriding relays .

2.3 SWITCH PLATES

A. Product Description: Specification Grade.
   1. Material: Stainless steel.

2.4 OCCUPANCY SENSOR

A. Compatible with modular relay panels. Capable of being wired directly to Class 2P wiring without auxiliary components or devices.

B. Separate sensitivity and time delay adjustments with LED indication of sensed movement. User adjustable time-delay: 30 seconds to 12 minutes.

C. Furnish with manual override.

D. Operation: Silent.

E. Room Sensors: 180°, multi-technology.

F. Corridor and Hallway Sensors:
   1. Capable of detecting motion 14 feet wide and 80 feet long with one sensor mounted 10 feet above floor.
   2. Capable of detecting motion in warehouse aisle 10 feet wide and 60 feet long or 100 feet long when mounted 22 feet above floor.
   3. Capable of being wired in master-slave configuration to extend area of coverage.

2.5 PHOTOCELLS

A. General: Consist of sensor mounted with separate daylighting control module. Sensor connected to module via single shielded conductor with maximum distance of 500 feet.

B. Sensor Devices: Each sensor employs photo diode technology to allow linear response to daylight within illuminance range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings.

B. Label each low voltage wire clearly indicating connecting relay panel.

C. Mount relay as indicated on Drawings. Wire numbered relays in panel to control power to each load. Install relays to be accessible. Allow space around relays for ventilation and circulation of air.

D. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.

E. Label each low voltage wire with relay number at each switch or sensor.

3.2 ADJUSTING

A. Test each system component after installation to verify proper operation.

B. Test controls and switches after installation to confirm proper operation.

C. Confirm correct loads are recorded on directory card in each panel.

3.3 DEMONSTRATION

A. Demonstrate operation of the following system components:
   1. Operation of switches.
   2. Operation and adjustments of occupancy sensors.
   3. Operation and adjustments of photocell.
   4. Operation and setting parameters for control units.

B. Instruct Owner's personnel in operation and maintenance of system. Schedule training with Owner, provide at least 7 days notice to Architect of training date.

C. Allow for a minimum of four hours instructional time.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes distribution and branch circuit panelboards.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
   1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   2. NEMA FU 1 - Low Voltage Cartridge Fuses.
   3. Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   5. NEMA PB 1 - Panelboards.
   6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:
   1. UL 67 - Safety for Panelboards.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Product Data: Submit catalog data showing specified features of standard products.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Furnish two of each panelboard key. Panelboards keyed alike.

PART 2 PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

A. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

B. Acceptable Manufacturers:
1. Square-D (Schneider Electic)
2. Eaton (Cutler-Hammer)
3. General Electric (ABB)
4. Siemens

C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus and copper neutral bus in each panelboard.

D. Integrated short circuit rating: As shown on the drawings. 10,000 amperes rms symmetrical minimum.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.

F. Enclosure: NEMA PB 1, Type 1.

G. Cabinet Front: Flush or Surface cabinet front with concealed hinged trim, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

2.2 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6 feet to top of panelboard ; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.

G. Install engraved plastic nameplates.

H. Ground and bond panelboard enclosure. Connect equipment ground bars of panels in accordance with NFPA 70.

2.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; and device plates and decorative box covers.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Product Description: NEMA WD 1, Specification grade, AC only general-use snap switch.

B. Body and Handle: plastic with rocker handle, color to match existing.

C. Ratings:
   1. Voltage: 120-277 volts, AC.
   2. Current: 20 amperes.

2.2 RECEPTACLES

A. Product Description: NEMA WD 1, Heavy-duty general use receptacle.

B. Device Body: plastic, color to be selected by the Architect.

C. Configuration: NEMA WD 6, type.

D. Convenience Receptacle: Type 5-20.

E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 DEVICE PLATES

A. All device plates shall be of stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Connect wiring device grounding terminal to ground system.

D. Install cover plates on switch, receptacle, and blank outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install wall switch 48 inches above finished floor.

B. Install convenience receptacle 18 inches above finished floor.

C. Install convenience receptacle 6 inches above back splash of counter.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fuses.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.5 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials

B. Spare Parts:
   1. Furnish two fuse pullers.

C. Extra Materials:
   1. Furnish three spare fuses of each Class, size, and rating installed.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer List:
   1. Bussman

B. Substitution Limitations:
   1. Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

2.2 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and overcurrent protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

B. Select fuses to coordinate with time current characteristics of other overcurrent protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

2.3 FUSES

A. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.4 CLASS RK1 (TIME DELAY) FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.5 CLASS RK1 (NON-TIME-DELAY) FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.6 CLASS RK5 FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.7 CLASS J (TIME DELAY) FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.8 CLASS J (NON-TIME-DELAY) FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.9 CLASS T FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.10 CLASS L (FAST-ACTING) FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.11 CLASS L (TIME DELAY) FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.12 CLASS G FUSES

A. Dimensions and Performance: NEMA FU 1.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

PART 3 EXECUTION

3.1 DEMOLITION

A. Remove fuses from abandoned circuits.

B. Maintain access to existing fuses and other installations remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 28 19

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fusible and nonfusible switches.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings, 30A minimum.

B. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R fuses.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fuses for fusible disconnect switches.

B. Install engraved plastic nameplates.

C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

SECTION 26 28 23

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes molded-case and insulated-case circuit breakers in individual enclosures.

B. Related Sections:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. Underwriters Laboratories Inc.:
   1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations and continuous current ratings of enclosed circuit breakers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKER

A. Manufacturers:
   1. Square D Company.
   2. Eaton (Cutler-Hammer)
   3. General Electric (ABB)
   4. Siemens
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Enclosed, molded-case circuit breaker conforming to UL 489.

C. Accessories: Conform to UL 489.
   1. Grounding Lug: In each enclosure.

D. Enclosure: UL 489, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 05 29.

B. Height: 5 feet to operating handle.

C. Install grounding and bonding in accordance with requirements of Section 26 05 26.

D. Locate and install engraved plastic nameplates in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS.

END OF SECTION

SECTION 26 28 26

ENCLOSED TRANSFER SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes transfer switches in individual enclosures.

B. Related Sections:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 - Identification for Electrical Systems.
   4. Section 26 32 13 - Engine Generators for testing requirements.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. Underwriters Laboratories Inc.:
   1. UL 1008 - Transfer Switch Equipment.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed transfer switches.

C. Operation and Maintenance Data: Submit routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.5 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

A. Manufacturers:
   1. Kohler
   2. Cummins
   3. ASCO
   4. Substitutions: If approved (in writing) by Engineer.

B. Product Description: NEMA ICS 10, automatic transfer switch, closed transition. ATS shall perform closed transition for transfers from utility to generator (and back) during generator exercise and on return to utility after a normal power outage.

C. Configuration: Electrically operated, mechanically held transfer switch.

D. Rating: as indicated on drawings.

E. Interrupting Capacity: 42kAIC or as noted on drawings.

F. Product Features:
   1. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, switch position.
   2. Test Switch: Mount in cover of enclosure to simulate failure of normal source.
   3. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.

G. Automatic Sequence of Operation:
   1. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

H. Enclosure:
   1. Enclosure: ICS 10, Type 12.
   2. Finish: Manufacturer's standard.

2.2 MANUAL TRANSFER SWITCH

A. Manufacturers:
   1. Square-D
   2. Asco
   3. Cummins
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA ICS 10, manual transfer switch.

C. Configuration: Manually-operated, mechanically-held transfer switch.

D. Enclosure:
   1. Enclosure: ICS 10, Type 12.
   2. Finish: Manufacturer's standard.

2.3 SOURCE QUALITY CONTROL

A. Furnish shop inspection and testing of each transfer switch.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install housekeeping pads in accordance with Section 03 30 00.

B. Install engraved plastic nameplates in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements; 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.22.3.

3.3 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers’ field services.

B. Check out transfer switch connections and operations and place in service.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust control and sensing devices to achieve specified sequence of operation.

3.5 DEMONSTRATION AND TRAINING

A. Demonstrate operation of transfer switch in normal and emergency modes.

END OF SECTION

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes manual and magnetic motor controllers in individual enclosures.

B. Related Sections:
   1. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   2. NEMA FU 1 - Low Voltage Cartridge Fuses.
   3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   5. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
   6. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Test Reports: Indicate field test and inspection procedures and test results.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations and ratings of enclosed controllers.

C. Operation and Maintenance Data: Submit Replacement parts list for controllers.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MANUAL MOTOR CONTROLLER

A. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, 1-NO and 1-NC auxiliary contact and toggle operator.

B. Enclosure: NEMA ICS 6, Type 1.

2.2 FRACTIONAL-HORSEPOWER MANUAL CONTROLLER

A. Product Description: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, toggle operator.

B. Enclosure: NEMA ICS 6, Type 1.

2.3 FULL-VOLTAGE NON-REVERSING CONTROLLERS

A. Product Description: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Control Voltage: 120 volts, 60 Hertz.

C. Overload Relay: NEMA ICS 2; bimetal.

D. Product Features:
1. Auxiliary Contacts: NEMA ICS 2, 2 each normally open and normally closed contacts in addition to seal-in contact.
2. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty oiltight type.
3. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
4. Pushbuttons: Recessed type.
5. Indicating Lights: Transformer LED type.
6. Selector Switches: Rotary type Hand-Off-Auto.
7. Relays: NEMA ICS 2.
8. Control Power Transformers: 120 volt secondary, 150 VA minimum, in each motor starter. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.

E. Combination Controllers: Combine motor controllers with disconnect in common enclosure, using thermal magnetic circuit breaker conforming to NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.

F. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed controllers plumb.

B. Height:5 feet to operating handle.

C. Install fuses for fusible switches. Refer to Section 26 28 13 for product requirements.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Install engraved plastic nameplates.

F. Neatly type label and place inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION

SECTION 26 29 16

ENCLOSED CONTACTORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes enclosed contactors for lighting and general purposes.

B. Related Sections:
   1. Section 26 28 13 - Fuses.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   4. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
   5. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. Underwriters Laboratories Inc.:
   1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit dimensions, size, voltage ratings and current ratings.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations and ratings of enclosed contactors.

C. Operation and Maintenance Data: Submit instructions for replacing and maintaining coil and contacts.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 GENERAL PURPOSE CONTACTORS

A. Product Description: NEMA ICS 2, AC general purpose magnetic contactor.

B. Coil operating voltage: 24 or 120 volts, 60 Hertz; verify with controls contractor prior to ordering.

C. Poles: To match circuit configuration and control function.

D. Product Features:
1. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts.
2. Pushbutton: ON/OFF function, with shrouded configuration.
3. Selector Switch: ON/OFF/AUTOMATIC function, with rotary action.
4. Indicating Light: RED or GREEN lens, resistor type, with led lamp.
5. Auxiliary Contacts: Two, field convertible in addition to seal-in contact.
6. Relays: NEMA ICS 2.
7. Control Power Transformers: in each enclosed contactor. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.

E. Combination Contactors: Combine contactors with enclosed knife switch conforming to NEMA KS 1, with externally operable handle and fuse clips designed to accommodate NEMA FU 1, Class R or J fuses.

F. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

2.2 LIGHTING CONTACTORS

A. Product Description: NEMA ICS 2, magnetic lighting contactor.

B. Coil operating voltage: 24 or 120 volts, 60 Hertz, verify with controls contractor prior to ordering.

C. Poles: To match circuit configuration and control function.

D. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

E. Accessories:
1. Cover Mounted Pilot Devices: NEMA ICS 5, standard-duty type with Form Z contacts.

2. Pushbutton: ON/OFF function, with shrouded configuration.
3. Selector Switch: ON/OFF/AUTOMATIC function, with rotary action.
4. Indicating Light: RED or GREEN lens, resistor type, with led lamp.
5. Auxiliary Contacts: Two, field convertible in addition to seal-in contact.
6. Relays: NEMA ICS 2.
7. Control Power Transformers: in each enclosed contactor. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.

F. Combination Contactors: Combine contactors with enclosed knife switch conforming to NEMA KS 1, with externally operable handle and fuse clips designed to accommodate NEMA FU 1, Class R or J fuses.

G. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed contactors as indicated on Drawings, in accordance with NECA "Standard of Installation."

B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 ft to operating handle.

D. Install fuses for fusible switches. Refer to Section 26 28 13 for product requirements.

E. Install engraved plastic nameplates. Refer to Section 26 05 53 for product requirements and location.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.16.1.

END OF SECTION

SECTION 26 32 13

ENGINE GENERATORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes engine generator set, exhaust silencer and fittings, transfer switch, fuel fittings & regulator, enclosure, radiator, battery, charger, and related items.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   3. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.
   4. NEMA MG 1 - Motors and Generators.

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
   1. NFPA 30 - Flammable and Combustible Liquids Code.
   2. NFPA 110 - Standard for Emergency and Standby Power Systems.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Include plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.

C. Product Data: Submit data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams.

D. Test Reports: Indicate results of performance testing.

E. Manufacturer's Field Reports: Indicate inspections, findings, and recommendations.

F. Emissions Certifications: Provide Manufacturer’s Certifications that unit meets applicable EPA, Clean Air Act, and other regulatory requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions and service manuals for normal operation, routine maintenance, oil sampling and analysis for engine wear, and emergency maintenance procedures.

C. Provide two copies of full feature O&M manuals including parts and engine service.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and with service facilities within 100 miles of project.

B. Supplier: Factory trained & certified field service techs, maintain a stock of parts for the equipment, be fully authorized for all levels of service and repair for the entire package: Engine, Alternator, Controls, and ATS. Must have full time, dedicated 24/7 emergency field service available. Field service techs shall all have diagnostic tool for the packages engine, controls and ATS to allow diagnostics, troubleshooting, adjustment and program updates to be performed.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year comprehensive manufacturer warranty to include all parts, labor and travel expenses.

1.7 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one set of tools required for preventative maintenance of engine generator system. Package tools in adequately sized metal tool box.

C. Furnish two complete changes of fuel, oil and air filter elements.

1.8 SERVICE CONDITIONS

A. Ambient temperature: 95 degrees F

B. Altitude: 1000 feet.

PART 2 PRODUCTS

2.1 BASE MANUFACTURER

A. Kohler, Industrial rated generator, shall be the basis of design.

2.2 OPTIONAL MANUFACTURER

A. The base manufacturer sets the minimum standards expected by this specification. Other manufacturers are acceptable as listed when they meet the minimums set by this specification and the base manufacturer, and are approved by the Engineer at least 14 days prior to the bid due date.
   1. Cummins
   2. Caterpillar
   3. mtu (Rolls/Royce)
   4. Engineer Approved Equal.

2.3 ENGINE

A. Product Description: Water-cooled, spark-ignited, internal combustion engine.

B. Fuel System: Natural Gas.

C. Rating: Sufficient to operate under generator overload at service conditions.

D. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

E. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Furnish remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.

F. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC.

G. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F Radiator air flow restriction 0.5 inches of water maximum. Provide coolant overflow reservoir/expansion tank and piping to radiator.

H. Engine Accessories: Fuel filter, fuel regulators, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Furnish fuel pressure gage, water temperature gage, and lube oil pressure gage on engine/generator control panel.

I. Mounting: Furnish unit with suitable spring-type vibration isolators and mount on structural steel base.

2.4 GENERATOR

A. Product Description: NEMA MG1, three phase, brushless synchronous generator with brushless exciter.

B. Rating: ___ kW, at 0.80 power factor, 208/120 volts, 60 Hz, three-phase. Package shall operate continuously to full nameplate kW with specified fuel under service conditions. (NOTE: see plans for rating)

C. Insulation Class: H, rated at class F rise.

D. Provide 120VAC anti-condensate heater embedded within the windings.

E. Temperature Rise: 130 degrees C Standby.

F. Enclosure: NEMA MG1, see section 2.8.G.

G. Alternator: Alternator shall provide full rated output at class F temperature rise. Exciter shall be a Permanent Magnet (PMG) system capable of sustaining up to 250% overcurrent for up to 10 seconds.

H. Voltage Regulation: Furnish generator mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Furnish manual controls to adjust voltage droop, voltage level (plus or minus 5 percent) and voltage gain.

2.5 GOVERNOR

A. Product Description: Isochronous governor to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.

2.6 RADIATOR

A. Product Description: Unit mounted radiator, sized by engine generator manufacturer to match engine cooling capacity, and suitable for operation at design elevation and ambient air temperature. Provide coolant overflow reservoir/expansion tank and piping to radiator.

2.7 AUTOMATIC TRANSFER SWITCH – see specification section 26 28 26

A. Product Description: NEMA ICS 10, automatic transfer switch.

B. Manufacturers:
1. Kohler
2. ASCO
3. Cummins

2.8 ACCESSORIES

A. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.

B. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 170 ampere-hours minimum capacity. Heavy duty, Group 31, 900 cold-cranking-amps, 110 ampere-hours minimum capacity. Match battery voltage to starting system. Furnish cables and clamps.

C. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

D. Battery Charger: Current limiting, auto float equalizing type designed to float at 2.17 volts for each cell and equalize at 2.33 volts for each cell. Furnish overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input with alarms and indication for high/low AC input and high/low DC output. Furnish wall mounted enclosure to meet NEMA 250, Type 1 requirements.

E. Line Circuit Breaker: NEMA AB 1, molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole. Furnish battery voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements.

F. Engine-Generator Control Panel: NEMA 250, Type 1 generator-mounted control panel enclosure with engine and generator controls and indicators. Furnish provision for padlock and the following equipment and features:
   1. Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
   2. AC Output Voltmeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   3. AC Output Ammeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   4. Output voltage adjustment.
   5. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
   6. Engine start/stop selector switch.
   7. Engine running time meter.
   8. Oil pressure gage.
   9. Water temperature gage.
   10. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
   11. Additional visual indicators and alarms in accordance with by NFPA 110.
   12. Remote Alarm Contacts: Factory wire SPDT contacts to terminal strip for remote alarm functions in accordance with NFPA 110.

G. Sound-Attenuated and Weather-protective Enclosure: Reinforced sound-attenuated and insulated (“quiet-site”) steel or aluminum housing allowing access to control panel and service points, with lockable doors and panels. Furnish fixed louvers, and interior silencer.

H. Load Bank: Provide portable load bank for testing only. Place resistive load on generator at 100%, 75%, 50%, and 25% with minimum of 30 minutes per step.

2.9 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Make completed engine-generator assembly available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install engraved plastic nameplates in accordance with Section 26 05 53.

B. Ground and bond generator and other electrical system components in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.22.

3.3 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturer's field services.

B. Prepare and start up engine-generator assembly.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements:Testing, adjusting, and balancing.

B. Adjust generator output voltage and engine speed to meet specified ratings.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean engine and generator surfaces. Replace oil and fuel filters with new.

3.6 DEMONSTRATION AND TRAINING

A. Furnish 4 hours of instruction to be conducted at project site with manufacturer's representative.

B. Describe loads connected to standby system and restrictions for future load additions.

C. Simulate power outage by interrupting normal source, and demonstrate system operates to provide standby power.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, drivers, and accessories.

B. Related Sections:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
   3. Section 26 52 00 - Emergency Lighting.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI - American National Standard.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit dimensions, ratings, and performance data.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two of each plastic lens type and furnish two of each driver type.

PART 2 PRODUCTS

2.1 INTERIOR LUMINAIRES

A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.

B. Refer to Section 01 60 00 - Product Requirements for product options.

2.2 LED FIXTURES

A. Manufacturers:
   1. Cooper Lighting
   2. Lithonia
   3. Other manufacturers per fixture schedule on plans.
   4. Substitutions: When approved in writing prior to bidding by the Engineer.

B. Product Description: LED solid state lighting fixtures, complete with LED arrays, LED drivers, fixture disconnect per NEC, all required mounting hardware, accessories, wireguards, and similar components.

C. LED's (Light Emitting Diodes)
   1. 4000K.
   2. UL Listed

D. LED Drivers
   1. Universal Voltage (120-277 Volts, single-phase) input.
   2. UL Listed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

B. Support luminaires independent of ceiling framing.

C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Exposed Grid Ceilings: Support surface-mounted luminaires on grid ceiling directly from building structure.

F. Install recessed luminaires to permit removal from below.

G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Install clips to secure recessed grid-supported luminaires in place.

I. Install wall-mounted luminaires at height as indicated on Drawings.

J. Install accessories furnished with each luminaire.

K. Connect luminaires to branch circuit outlets provided under Section 26 05 33 using flexible conduit.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Provide disconnect in each fixture per National Electrical Code requirements.

N. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Aim and adjust luminaires.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Replace luminaires having failed LEDs and/or components at Substantial Completion.

END OF SECTION

SECTION 26 52 00

EMERGENCY LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes emergency lighting units and exit signs.

B. Related Sections:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
   3. Section 26 51 00 - Interior Lighting: Exit signs.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SYSTEM DESCRIPTION

A. Emergency lighting to comply with requirements.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit dimensions, ratings, and performance data.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 EMERGENCY LIGHTING UNITS

A. Manufacturers: per schedule on drawings
   1. Substitutions: Section 01 60 00 - Product Requirements.

B. TEST switch: Transfers unit from external power supply to integral battery supply.

C. Input Voltage: Universal 120-277 volts, single-phase, unless otherwise indicated.

2.2 EXIT SIGNS

A. Manufacturers: per schedule on drawings
   1. Substitutions: Section 01 60 00 - Product Requirements.

B. Face: plastic face with red letters on white background

C. Directional Arrows: Universal type for field adjustment.

D. Mounting: Universal, for field selection.

E. Battery:, with 1.5 hour capacity.

F. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.

G. Lamps: LED.

H. Input Voltage: Universal 120-277 volts, single-phase, unless otherwise indicated.

2.3 LED FIXTURE EMERGENCY POWER SUPPLY

A. Manufacturers: per schedule on drawings
   1. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Emergency battery power supply suitable for installation in driver compartment of LED luminaire.

C. Lumen Ratings: providing 1100 lumens, minimum.

D. Battery: Sealed type, rated for 10 year life.

E. Include TEST switch and AC ON indicator light, installed to be operable and visible from outside of assembled luminaire.

2.4 LED EMERGENCY POWER SUPPLY

A. Manufacturers: per schedule on drawings
   1. Substitutions: Section 01 60 00 – Product Requirements.

B. Product Description: Emergency battery power supply suitable for factory or field installation in driver compartment of LED luminaire.

C. Lumen Output Rating: per schedule on drawings.

D. Input Voltage: Universal 120-277 volt, single-phase, unless otherwise noted.

E. Battery: Sealed type, rated for 10 year life.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended exit signs using pendants supported from swivel hangers. Install pendant length required to suspend sign at indicated height.

B. Install surface-mounted emergency lighting units and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

C. Install wall-mounted emergency lighting units and exit signs at height as indicated on Drawings.

D. Install accessories furnished with each emergency lighting unit and exit sign.

E. Connect emergency lighting units and exit signs to branch circuit outlets provided in Section 26 05 33 as indicated on Drawings. Connect of any local switches.

F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.

G. Ground and bond emergency lighting units and exit signs in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Operate each unit after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Aim and adjust fixtures as indicated on Drawings.

C. Position exit sign directional arrows as indicated on Drawings.

3.4 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Replace emergency lighting units and exit signs having failed LED’s at Substantial Completion.

END OF SECTION

SECTION 28 31 11

FIRE DETECTION and ALARM SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. A project addendum may be supplied with this document which details any project-specific additions or deletions to this general specification document.

1.2 SYSTEM DESCRIPTION

A. Project consists of:

1. Complete fire alarm system (for entire building).

B. Digital and addressable fire alarm booster control panels with Intelligent Addressable initiating devices shall be provided for the entire building.

1. Provide main fire alarm panel to comply with the latest Michigan Building Code.

2. Provide booster panel(s) as required.

3. Include all interconnecting wiring for a complete fire alarm system.

C. Addressable Control Panels shall be non-coded, analog-addressable systems with manual and automatic alarm initiation, shall provide sensitivity control of certain smoke detectors, and shall have multiplexed signal transmission dedicated to fire alarm initiated system inputs and outputs.

1.3 BUILDING CODES and STANDARDS

A. National Fire Protection Association (NFPA):
1. NFPA-70 National Electrical Code (NEC)
2. NFPA-72 National Fire Alarm Code
3. NFPA 101 Life Safety Code
4. IBC International Building Code
5. IFC International Fire Code
6. IMC International Mechanical Code
7. State of Michigan Building Codes and Amendments
8. State of MI; Bureau of Fire Services; Fire Safety Board

B. National Electrical Manufacture's Association (NEMA)

C. Underwriters Laboratories, Inc. (UL)
1. UL-864 Control Units for Fire Protective Signaling Systems (9th Edition)

2. UL-268 Smoke Detector for Fire Protective Signaling Systems
3. UL-217 Smoke Detectors for Single and Multiple Station
4. UL-521 Heat Detectors for Fire Protective Signaling Systems
5. UL-464 Audible Signaling Appliances
6. UL-1971 Visual Signaling Appliances
7. UL-38 Manually Actuated Signaling Boxes
8. UL-1481 Power Supplies for Fire Protective Signaling Systems

1.4 SUBMITTALS

A. The Contractor shall purchase no equipment for the system specified herein until the Engineer & Owner has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications.

B. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the Contract Documents or clearly state that there are none. In addition, the Contractor shall provide specific notation on each Shop Drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Architect. Contractor is responsible for submitting complete shop drawings for review to the State of Michigan Bureau of Fire Services.
2. Shop Drawings shall be prepared by persons with the following qualifications:
    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level II minimum or Michigan registered Professional Engineer.
    c. Fire Alarm installer (company/firm) shall be Certified by the Bureau of Fire Services in accordance with Act 144
    d. Provide documentation of all certifications/registrations with submittals.

C. Product Data: Product Data sheets with the printed logo or trademark of the manufacturer of all equipment. Indicated in the documentation shall be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Owner.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include fire alarm panel layout, grounding schematic, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
8. Include all other items in submittal as required by section 907.1.2 of the 2015 Michigan Building Code and by the Michigan Bureau of Fire Services.

E. Operation and Maintenance Data: For fire-alarm systems and components to be included in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data, include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72.
2. Provide "Record of Completion Documents" according to NFPA72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software database file, hardcopy print-out and CD, with password for delivery to the owner. Proprietary system/service companies will not be acceptable.
4. Provide complete “as-built” plan for each building, in paper and AutoCad format with device addresses on plan for all devices.
5. Provide "Maintenance, Inspection and Testing Records" according to NFPA72 article of the same name and include the following:
    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals (hardcopy) and electronic on CD.
6. Manufacturer's required maintenance related to system warranty requirements.
7. Abbreviated operating instructions for mounting at fire-alarm control unit.
8. Copy of NFPA72.

F. Software and Firmware Operational Documentation:
1. CD of site-specific software database file with password, all product data sheets and AutoCAD files. Provide hard copy print-out of the software program. Proprietary system/service companies will not be acceptable.
2. Provide a list of global system settings
3. Provide a list of the contents of each system cabinet and their settings
4. Provide a list of all addressable devices with their addresses and settings

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm and Personnel shall be trained and certified by manufacturer for installation of units required for this Project. Firm and/or personnel shall also be certified by the Bureau of Fire Services in accordance with Act 144. Provide documentation of certification/compliance.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician. Provide documentation of certification/compliance.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA72 in the form of a placard by an approved alarm company.

1.6 WARRANTY and SOFTWARE SERVICE AGREEMENT

A. The contractor shall warranty all materials, installation and workmanship for five (5) years from date of acceptance, unless otherwise specified. A copy of the manufacturers' warranty shall be provided with closeout documentation and included with the operation and installation manuals.

B. The System Supplier shall maintain a service organization with adequate spare parts stocked within 150 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the Owner notifying the contractor.

C. Technical Support: Beginning with Substantial Completion, provide software support for five (5) years, shall be included in this project.

D. Detector Sensitivity Testing: During the warranty period, each year the contractor is to perform detector sensitivity testing and provide report to the Owner unless the system is UL Listed to perform automatic sensitivity testing without any manual intervention and should detector fall outside of sensitivity window, the system will automatically indicate a device’s trouble. A copy of UL letter is to be provided as proof of system operation.

E. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within five (5) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software at no added cost.
   1. Provide 30 days notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide quantity equal to 2% percent of amount of each type installed, but no fewer than 2 unit of each type.
      a. Smoke Detectors, heat detectors, manual pull stations, duct smoke detector, monitor modules and control modules:
      b. Notification appliances; horn-strobes and strobes.
   2. Keys: Ten extra sets for access to locked and tamper-proof components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling fire alarm system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. The Contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply with the requirements of these Specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

C. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the building Owner. All specified operational features must be met without exception.

D. All control panel assemblies and connected (new) field appliances shall be provided by the same System Supplier**,** and shall be designed and tested to ensure that the system operates as specified. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.

E. That equipment proposed to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

1. A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.
2. The supplier of alternate equipment shall furnish evidence that the proposed alternate system performance is equal to or superior than the system operation stated in the specification. Such evidence shall be submitted to the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.
3. The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph, as written, and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point-by-point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.
4. The supplier of alternate equipment shall submit a list from the alternate manufacturer on the manufacturer’s letterhead indicating the names and addresses of all authorized suppliers in the area. Proprietary products will not be considered.

5. The acceptability of any alternate proposed system shall be the sole decision of the Owner or his authorized representative.

F. Approved Products: All panels and peripheral devices shall be of the standard product of single manufacturer and shall display the manufacturer's name of each component. The catalog numbers specified under this section are those of EST, A UTC Fire & Security Company and shall constitute the type, product quality, material and desired operating features.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:
1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:
1. Activate multiple channel temporal tone alarm.
2. Continuously operate the visual notification appliances.
3. Identify alarm at fire-alarm control unit and remote annunciators.
4. Transmit an alarm signal to the remote alarm receiving station.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Record events in the system memory.
9. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. The main control panel or remote control panel(s) shall be a multi-processor based networked system designed specifically for detection and alarm applications. The control panel(s) shall be listed and approved for the application under the standard(s) as listed. The control panel shall be model EST iO64 or as approved by Engineer.

B. The control panel(s) shall include all required hardware, software and site-specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any applications can be configured, and modified using software provided by a single supplier. The control panel operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.

C. The network of control panels shall include the following features.

1. Ability to download all network applications and firmware from the configuration computer on the network or at any control panel (network node) location.
2. Each control panel (network node) shall have an LCD display with common controls. The display shall be configurable to display the status of any and all combinations of alarm, supervisory, trouble, monitor, or group event messages.
3. From each LCD display on the system shall be capable of being programmed for control functions of any node or the entire network. The LCD display shall reside on the network as a node and continue to operate with fault on the network. An LCD can be programmed to be only operation when a node is operational in stand-alone mode, with a network fault.
4. The system program shall have a minimum of 100 system definable Service Groups to facilitate the testing of installed system based on the physical layout of the system. Service groups that disable entire circuits serving multiple floors or fire zones shall not be allowed.
5. Advanced Windows based programming with Program Version Reporting to document any and all changes made during system start-up or system commissioning. Time and date stamps of all modifications made to the program must be included to allow full retention of all previous program version data. The operator display shall clearly identify unacknowledged and acknowledged alarm, supervisory, trouble, and monitor status messages. The system shall provide the ability to download data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The downloaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.
6. Provide system reports that list a detailed description of the status of system parameters for corrective action or for preventive maintenance. Reports shall be displayed on the operator interface and be capable of being sent to a printer.
7. Provide an authorized operator with the ability to operate or modify system functions such as system time, date, passwords, holiday dates, restart the system and clear the control panel event history file.
8. Provide an authorized operator the ability to perform test functions within the installed system.
9. Supervision of system components, wiring, initiating devices and software shall be provided by the control panel. Failure or fault of system component or wiring shall be indicated by type and location on the LCD display. Software and

processor operation shall be independently monitored for failure. The system shall provide fail-safe operation, with multiple-levels of system operation

D. Each network control panel shall be capable of:
1. Supporting up to 2500 intelligent analog/addressable points.
2. Supporting up to ten (10) intelligent addressable loops, each loop supporting 125 detectors and 125 modules, total of 250 points.
3. Supporting network connections up to 63 other control panels and annunciators.
4. Supporting up to 124 (security/access control) Keypad/Displays.
5. Supporting up to ten network digital dialers with Contact ID or SIA format and TAP Pager protocol.
6. Supporting multiple RS-232 communication ports and protocol.
7. Supporting up to 1740 chronological history events.
8. Total network response shall not exceed 3 seconds.

E. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, monitor, trouble and component status messages and control menu.
1. The common control switches and with corresponding LEDs provided as minimum will be; Reset Alarm Silence, Panel Silence, and Drill. It shall be able to add additional switches/LEDs as required.
2. The main control panel shall have display that is 24 lines by 40 character graphic LCD and backlit when active.
3. Each point shall have custom event message of up to 40 charters, for total of 80 charters. In addition to instructional text message support a maximum of 2,000 characters each.
4. Provide 8 simultaneous events to be displayed. The first seven (7) highest priority events in addition to the most recent event. The events shall be automatically placed in event types (Alarm, Supervisory, Monitor & Trouble) for easy access and shall be possible to view the specific event type separately. Having to scroll through a mixed list of event types is not acceptable.
5. Provide an internal audible signal with different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
6. This display shall be an EST 3-LCDXL1.
7. Systems not capable of such a display on the main panel faceplate shall include a CRT/Monitor display meeting the above requirements and battery stand-by.

F. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions

G. Circuits Requirements:
1. Signaling Line Circuits for Network Communications:
   a. Class A, Style 7.
2. Signaling Line Circuits for Intelligent Analog Addressable Loop:
   a. Class B, Style 4.
   b. No more than 100 detectors or 100 modules installed on a loop.
3. Initiating Device Circuit:
   a. Class B, Style B

4. Notification Appliance Circuits:
   a. Class B, Style Y.
   b. Maximum circuit loading to 2 amps for visuals.
5. Activation of alarm notification appliances and other functions shall occur within 3 seconds after the activation of an initiating device.

H. Smoke-Alarm Verification:
1. Initiate an audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

I. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

J. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change to alternate settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, shall be powered by nominal 24-V dc source.

L. Secondary Power: Shall provide 24 hours supervisory and 15 minutes of alarm with batteries, automatic battery charger, and automatic transfer switch.

2.4 REMOTE ANNUNCIATOR

A. Annunciator shall match those of fire-alarm control unit LCD display functions for alarm, supervisory, monitor and trouble indications and common system controls including; acknowledging, silencing, resetting, and testing. See section 2.3 E for specific requirements.
1. This display shall be EST, model 3-LCDXL1 or 3-LCDANN.

2.5 NAC Power Supply:

A. The NAC power supply shall be independent unit that will provide power to visual strobe notification appliances. It shall be possible to configure the NAC’s to follow the main panel’s NAC or activate from intelligent synchronized modules. The booster NAC’s must be configurable to operate independently at any one of the following rates: continuous synchronized, or 3-3-3 temporal. Fault conditions on the power supply shall not impede alarm activation of host NAC circuits or other power supplies. The NAC power supply must be able to provide concurrent power for notification devices, security devices, access control equipment and auxiliary devices such as door holders. . All the NAC

Power Supplies shall be synchronized. The power supply shall support up to 24 amp hour batteries.

1. Power supply shall be minimum of 10 amps and UL 864 Listed.
2. Four independent 3amp NAC circuits. Each being configurable as auxiliary power.
3. All circuits shall be synchronized.
4. Shall be EST, model BPS10A

2.6 INTELLIGENT ANALOG SYSTEM SMOKE DETECTORS

A. General Requirements for Intelligent Analog Detectors

1. Integral Microprocessor: All decision are made at the detector determining if the device is in the alarm or trouble condition.
2. Non-Volatile Memory: Permanently stores serial number and type of device. Automatically updates historic information including hours of operation, last maintenance date, number of alarms and troubles, time of last alarm, and analog signal patterns for each sensing element just before last alarm.
3. Electronic Addressing: Permanently stores programmable system address. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using switches for addressing shall not be acceptable.
4. Automatic Device Mapping: Each detector transmits wiring information regarding its location with respect to other devices on the circuit, creating an As-Built wiring diagram. This will also provide enhanced supervision of the device physical location and the device message shall reside with the location and not the device address. Devices installed in the wrong location will always report the correct message of the physical location.
5. Sensitivity Range: Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. It shall be possible to program control panel activity to each level.
6. Pre-Alarm: Detector stores 20 pre-alarm sensitivity values to alert local personnel prior to the sensor reaching full evacuation sensitivity. Sensitivity values can be set in 5% increments.
7. Environmental Compensation: The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal when the detector reaches 75% (Dirty) to 99% (More Dirty) compensation has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.
8. Twin Status LEDs: Flashing Green LED shows normal; flashing RED shows alarm state; steady RED and steady GREEN show alarm state in stand-alone mode, visible from any direction.
9. UL Sensitivity Testing: The detector shall utilize a supervised microprocessor that is capable of monitoring the sensitivity of the detector. If the detector sensitivity shifts outside of the UL limits, a trouble signal is sent to the panel.
10. Device Replacement: The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System

shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

B. Intelligent 4D Multi-sensor Detector (Photo/Ion/Thermal and Time)
1. Provide intelligent analog addressable 4D multi-sensor smoke detectors at the locations shown on the drawings. The 4D Intelligent detector gathers analog information from each of its three fire sensing elements and converts it into digital signals. The detector's on-board microprocessor measures and analyzes these signals separately with respect to a fourth element – Time. It compares the information to historical readings, time patterns and known fire characteristics to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.
2. Separately mounted combinations of photoelectric detectors, ionization detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is an acceptable alternative.
3. Provide EST, model SIGA-IPHS.

C. Intelligent 3D Multi-sensor Detector (Photo/Thermal and Time)
1. Provide intelligent analog addressable 3D multi-sensor smoke detectors at the locations shown on the drawings. The 3D Intelligent detector gathers analog information from each of its two fire sensing elements and converts it into digital signals. The detector's on-board microprocessor measures and analyzes these signals separately with respect to a third element – Time. It compares the information to historical readings, time patterns and known fire characteristics to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.
2. Provide EST, model SIGA-PHS.

D. Intelligent Photoelectric Detector
1. Provide intelligent analog addressable photoelectric smoke detectors at the locations shown on the drawings.
2. Provide EST, model SIGA-PS.

E. Intelligent 135 Degree Fixed Temperature / Rate of Rise Heat Detector
1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors at the locations shown on the drawings. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
2. Provide EST, model SIGA-HRS.

F. Fixed Temperature Heat Detector

1. Provide intelligent fixed temperature heat detectors at the locations shown on the drawings. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
2. Provide EST, model SIGA-HFS.

G. Detector Base Types

1. Provide standard detector mounting bases suitable for mounting on 1-gang, or 4inch octagon box and 4 inch square box. The base shall, contain no electronics and support all series detector types. Bases with electronics or dip-switches are not acceptable.
   a. Provide EST, model SIGA-SB or SB4.
2. Provide relay detector mounting bases suitable for mounting on 1-gang, or 4" octagon box and 4" square box. The relay base shall support all Signature Series detector types and have the following minimum requirements:
   a. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
   b. The position of the contact shall be supervised.
   c. The relay shall automatically de-energize when a detector is removed.
   d. The operation of the relay base shall be controlled by its respective detector processor or under program control as required by the application. Detector relays not capable of operational programming independent of the detector shall not be considered equal. Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for "pilot duty".
   e. Removal of the respective detector shall not affect communications with other detectors.
   f. Provide EST, model SIGA-RB or RB4
3. Provide audible detector mounting bases suitable for mounting on 4" x 4" octagonal concrete ring (mud box) and 4" square x 2-1/8" (54 mm) deep box.
   a. The base shall support all Signature Series detector types and be capable of single or group operation. The audible base shall emit a temporal alarm tone and be selectable for low or high output.
   b. The operation of the audible base shall be controlled by its respective detector processor or under program control as required by the application. Detector audible base not capable of operational programming independent of the detector shall not be considered equal.
   c. The audible bases shall be UL268 and UL464 Listed, and provide a reverberant room sound output per UL464 of 81 dBA at 10ft (3m). and an average anechoic sound output of 90 dBA at 10 ft.(3m).
   d. Provide EST, model SIGA-AB4G.

H. Intelligent Duct Smoke Detector -Photoelectric

1. Provide intelligent photoelectric duct smoke detector at the locations shown on the drawings.

    a. One form C auxiliary alarm relay rated at 2amps @ 30Vdc.
    b. The operating range shall be 100ft/min to 4,000ft/min air velocity and temperature range of –20 to 158F.
    c. Sample tube can be installed with or without the cover place and be rotated in 45degree increments to ensure proper alignment with duct airflow.
    d. Local magnet-activated test switch.
    e. Provide EST, model SIGA-SD

2. Provide remote test station with Alarm LED and Key Switch.
    a. Provide EST, model SD-TRK.
3. Relay Fan Shutdown: Rated to interrupt fan motor control circuit. Furnish and install separate device for each motor start. Connect to motor start as required for fan shutdown during alarm condition.
    a. Provide EST, model SIGA-CR.

2.7 INTELLIGENT MODULES

A. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller.

1. Integral Microprocessor: All decisions are made at the module determining if the device is alarm or trouble condition.
2. Non-Volatile Memory: Permanently stores serial number, and type of device. Automatically updates historic information including hours of operation, number of alarms and troubles, time of last alarm.
3. Automatic Device Mapping: Each detector transmits wiring information regarding its location with respect to other devices on the circuit, creating an As-Built wiring diagram. This will also provide enhanced supervision of the device physical location. The device message shall reside with the location and not the device address. Devices installed in the wrong location will always report the correct message of the physical location.
4. Twin Status LEDs: The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status.
5. Input and output circuit wiring shall be supervised for open and ground faults.
6. Two styles of modules shall be available, those designed for gang box mounting, and where multiple modules are required in a single location, plug in modules shall be provided with a Universal Input/Output motherboard.

B. Intelligent Input Module. The Input Module shall provide one or two supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang

boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:

1. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
3. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
4. Normally-Open Active Latching (Supervisory, Tamper Switches)
5. Provide EST model SIGA-CT1 or CT2 or SIGA-MCT2

C. Intelligent Relay Module. Provide addressable control relay circuit modules shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

1. Provide EST, model SIGA-CR or SIGA-MCR.

D. NAC Control Module: Provide intelligent NAC control module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. The gang box -mounted version shall be suitable for mounting in North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The plug-In version shall plug into a universal multi-module motherboard. The NAC control module shall support the following operations:

1. 24volt NAC circuit
2. Audio notification circuit 25v or 70v
3. Telephone Power Selector with Ring Tone (Firefighter's Telephone)
4. Visual Synchronized Output to Genesis appliances or to NAC Power Supply.
5. Provide EST, model SIGA-CC1 or –CC1S or SIGA-MCC1 or MCC1S.

2.8 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box. All Manual Fire Alarm Boxes shall be metal construction.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. The manual pull station will have an intelligent module integral of the unit.
3. Station Reset: key operated switch shall match the control panel key.
4. Manual pull stations that initiated an alarm condition by opening the unit are not acceptable.
5. Provide EST, model SIGA.

B. Indoor Protective Shield: Factory-fabricated clear plastic enclosure. Hinged at the top to permit lifting for access to initiate alarm. Lifting the cover actuates an integral battery powered audible horn (when noted on the drawings) intended to discourage false-alarm operation.

C. Weatherproof manual pull station shall be provided of red metal construction with special weatherproof gasket metal red box.

1. Single-action operation.
2. Station Reset: key operated switch shall match the control panel key.
3. The intelligent monitor module will be located within the building and not with the station
4. Provide EST, model MPSR1.

2.9 NOTIFICATION APPLIANCES

A. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.

B. Any appliances, which do not meet the above requirements, and are submitted, for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended. All appliances shall be UL listed Fire Protective Service and shall be UL 1971.

C. Notification Appliances – Visual (Fire – Evacuation)
1. Provide wall or ceiling mounted clear lens strobes with white body and "FIRE" markings. Strobes shall provide a smooth light distribution pattern field selectable candela 15 cd, 30 cd, 75 cd, and 110 cd flash output rating, UL1971 listed with in-out screw terminals shall be provided for wiring. The strobe (15, 30, 75, 110) candela rating shall be view from the side window to verify the setting. All strobes shall be synchronized to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules. The strobes shall mount to one-gang electrical box.
2. The device shall have plastic protective cover for during installation.
3. The actual candela setting on the visual shall be marked on the appliance.
4. Provide EST, model Genesis Series devices.

D. Notification Appliance –Combination Horn/Strobe:
1. Provide wall or ceiling mounted clear lens horn/strobes with white body and "FIRE" markings. Strobes shall provide a smooth light distribution pattern field selectable candela 15 cd, 30 cd, 75 cd, and 110 cd flash output rating, UL1971 listed with in-out screw terminals shall be provided for wiring. The strobe (15, 30, 75, 110) candela rating shall be view from the side window to verify the setting. All strobes shall be synchronized to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules. The strobes shall mount to one-gang electrical box.
2. Speaker operation of device shall be in accordance with NFPA 72 and shall have a field-selectable output/wattage rating for sound level.
3. Combination horn/strobes shall meet both sections of above.
4. The device shall have plastic protective cover for during installation.
5. The actual wattage and candela settings shall be marked on the face of the appliance.
6. Provide EST, model Genesis Series devices.

E. Notification Appliance – Horn:

1. Provide wall or ceiling mounted horn with white body and “FIRE” markings. The speakers shall mount to one-gang electrical box.
2. Speaker operation of device shall be in accordance with NFPA 72 and shall have a field-selectable wattage/output rating.
3. The device shall have plastic protective cover for during installation.
4. The actual wattage settings shall be marked on the face of the appliance.
5. Provide EST, model Genesis Series devices.

F. Notification Appliance – Outdoor Horn or Speaker:

1. Provide outdoor weatherproof rated wall mounted loud speaker.
2. Speaker operation shall adjustable; up to 15 watts.
3. Device color shall be gray.
4. Provide Edwards, model HPSA15G2570

G. Notification Appliance – Outdoor Strobe:

1. Provide outdoor weatherproof rated wall mounted strobe.
2. Strobe shall be 110cd unless otherwise noted.
3. Include outdoor surface mount box where required, Edwards # 449.
4. Provide Edwards, model CS405-8A-T

2.10 GUARDS FOR PHYSICAL PROTECTION

A. Provide welded mesh of size and shape for the manual pull stations, smoke detectors, notification appliances at location noted on the drawings.

2.11 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or ceiling mounting as indicated and are complete with matching doorplate.
1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 120-V ac, 24-V ac or dc.
4. Provide EST, model 1500 series or DH Series.

2.12 WIRE AND CABLE

A. Signaling Line Circuits – Network Data: Twisted pair, not less than No. 18Awg or as recommended by the manufacturer.

B. Signaling Line Circuits – Intelligent Loop: Non-Twisted pair, not less than No. 16Awg or as recommended by the manufacturer.
1. Circuit Integrity Cable: Provide as required to meet NFPA or Local Code requirements.
2. CI Cable shall meet article 760, power limited fire alarm service.

C. Notification Appliance Circuits –
   1. Audio: Twisted pair, not less than No. 16Awg or as recommended by the manufacturer.
   2. Visual. Twisted pair, not less than No. 14Awg or as recommended by the manufacturer.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

C. Smoke-or Heat-Detector Spacing:
   1. Comply with NFPA72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
   2. Comply with NFPA72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
   3. Smooth ceiling spacing shall not exceed 30 feet.
   4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
   5. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.
   6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA72 and NFPA90A. Install sampling tubes so they extend the full width of duct.

E. Notification Appliance Devices: Install between 80 and 96 inches on the wall.

F. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

G. Annunciator: Install with top of panel not more than 56 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 8 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
   1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Supervisory connections at valve supervisory switches.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect, Engineer and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
1. Visual Inspection: Conduct visual inspection prior to testing.
   a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form"

in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: During the 5 year warranty period, each year test fire-alarm system complying with visual and testing inspection requirements in NFPA72. Use forms developed for initial tests and inspections.

J. Detector Sensitivity Testing: During the 5 year warranty period, each year the contractor is to perform detector sensitivity testing and provide report to the Owner. Unless, the system is UL Listed to perform automatic sensitivity testing without any manual intervention and should detector fall outside of sensitivity window, the system will automatically indicated a devices trouble. A copy of UL letter is to be provided as proof of system operation

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.
B. Provide for minimum of 4 hours of on-site training for owner employees. Include instructions for responding to alarms, troubleshooting system alarm/trouble signals, maintenance intervals, and system reporting procedures.
C. Provide copies of and utilize the project/building Operation and Maintenance Manual (O&M) during owner training.
D. Provide attendance sheet for each participant with check boxes for all areas of training. Instructor shall sign all forms.
E. Provide complete attendance sheet for all participants and instructor to sign.

END OF SECTION

DIVISION 31

EARTHWORK

SECTION

31 05 13	SOILS FOR EARTHWORK
31 05 16	AGGREGATES FOR EARTHWORK
31 10 00	SITE CLEARING
31 22 13	ROUGH GRADING
31 23 16	EXCAVATION
31 23 17	TRENCHING
31 23 18	ROCK REMOVAL
31 23 19	DEWATERING
31 23 23	FILL
31 25 13	EROSION CONTROLS

SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 32 91 19 - Landscape Grading.
   6. Section 32 92 19 - Seeding.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Materials Source: Submit name of imported materials source.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Provide current test results verifying materials meet requirements.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil material from single source throughout the Work.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1 - Embankment: Conforming to current MDOT Standard Specifications for Construction.

B. Subsoil Type S2:
   1. Excavated and re-used material.
   2. Clean granular and graded.
   3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

2.2 TOPSOIL MATERIALS

A. Topsoil Type S4:
   1. Excavated and reused material.
   2. Graded.
   3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
      a. Screening: Single screened.

B. Topsoil Type S5:
   1. Imported borrow.
   2. Friable loam.
   3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
      a. Screening: Single screened.
   4. Acidity range (pH) of 5.5 to 7.5.
   5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

C. Topsoil materials shall conform to current MDOT Standard Specifications for Construction.

2.3 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698, ASTM D1557, AASHTO T180.

B. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698, ASTM D1557, AASHTO T180.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at an Owner/Engineer approved location. A 1-on-3 maximum slope shall be required at all times.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 8 feet high maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 32 11 23 - Aggregate Base Courses.
   6. Section 32 91 19 - Landscape Grading.
   7. Section 33 05 13 – Manholes and Structures.
   8. Section 33 31 00 – Sanitary Sewerage Utility Piping.
   9. Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Materials Source: Submit name of imported materials suppliers.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Provide test results within the last 12 months that verify materials meet requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work. Change of source requires Engineer approval.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type A1, 6A Gradation: Conforming to current MDOT Standard Specifications for Construction.

B. Type A2, 22A Gravel: Conforming to current MDOT Standard Specifications for Construction.

C. Type A3, 23A Gravel: Conforming to current MDOT Standard Specifications for Construction.

D. Type A4 Material, Plain Riprap: Conforming to current MDOT Standard Specifications for Construction.

E. Type A5, Class II: For pipe bedding envelope, special backfill, pavement subbase, conforming to current MDOT Standard Specifications for Construction. For pipe bedding envelope, only materials up to 1-1/2" diameter are allowable within a minimum of 6" of the installed pipe.

F. Type A6, Class III: Conforming to current MDOT Standard Specifications for Construction.

G. Type A7, 21 AA: Conforming to current MDOT Standard Specifications for Construction.

2.2 SOURCE QUALITY CONTROL

A. Testing and Analysis: Performed by Owner in accordance with ASTM D698, ASTM D1557, AASHTO T180, ASTM D4318, ASTM C136.

B. Submit sample of aggregate materials from stock piles or from source of native material. Resubmit if product change.

C. When tests indicate materials do not meet specified requirements, change material and retest. Owner is responsible for all material verification and testing. Results for material compliance with specified requirements shall be provided to Architect/Engineer upon completion.

PART 3 EXECUTION

3.1 EXCAVATION

A. Remove excess excavated materials not intended for reuse, from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations that do not interfere with proposed construction or owner's operations. Area shall be approved by Owner/ Engineer. A 1-on-3 maximum slope shall be required at all times.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Stockpile soils 8 feet high maximum.

E. Prevent intermitting of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.4 RIP RAP PLACEMENT

A. Shape and compact slope to required grade and cross section.

B. Place on geotextile liner if required on plans.

C. Machine place and compact a uniform layer to thickness and configuration as shown on the plan.

D. Finished surface shall be tight and even.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Removing designated trees, shrubs, and other plant life.
   3. Excavating topsoil.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 18 - Rock Removal.

1.2 QUALITY ASSURANCE

A. Conform to applicable Federal, State, and local code for environmental requirements, and disposal of debris. No burning of debris permitted on site.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area for placing removed materials.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Contractor shall also be responsible to contact any utilities that do not participate in MISS DIG system for location of utility lines.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain. Repair/replace any damage at no expense to Owner.

C. Protect bench marks, survey control points, and existing structures from damage or displacement. Repair/replace any damage at no expense to Owner.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 12 inches within the limits shown on the plan.

B. Remove trees and shrubs within marked areas. Remove stumps, main root ball, root system to depth of 12 inches, and surface rock.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.5 REMOVAL

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

B. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

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

3.6 DISPOSAL

A. The CONTRACTOR shall make his own arrangements for disposal of materials resulting from clearing and grubbing. Disposal shall be off the facility site and/or right-of-way and written permits for such disposal shall be obtained by the CONTRACTOR from the Owner of the property on which the material is placed. Contractor shall supply Owner/Engineer a copy of all written permit(s).

B. All waste material generated by the clearing and grubbing operation must be disposed of in a safe and environmentally sound manner which meets the requirements of all of the applicable State of Michigan Rules and Regulations; such as, the Clean Air Act, the Solid Waste Act, the Wetlands Protection Act, Etc.

3.7 ENVIRONMENTAL REQUIREMENTS

A. The CONTRACTOR shall comply with all requirements of the Department of Natural Resources which permit the open burning of weeds, brush, logs, limbs, stumps, roots and other debris which results from clearing and grubbing.

B. The CONTRACTOR shall also comply with all applicable local laws and ordinances regarding the disposal of trees (especially elm and ash) after removal, including their logs, stumps, branches and bark.

C. All waste generated from the burning of the clearing and/or grubbing material shall be disposed of in a safe and environmentally acceptable manner which meets the requirements of all the applicable State of Michigan Rules and Regulations, such as the Clean Air Act, the Solid Waste Act, the Inland Lakes and Streams Act, the Wetlands Protection Act, Soil Erosion and Sedimentation Act, Notice to Public Utilities Act, and the National Historic Preservation Act.

3.8 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over, until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.9 SCHEDULES

A. None.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting site for site structures, concrete pads, and parking areas.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 10 00 – Site Clearing.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.
6. Section 31 23 18 – Rock Removal.
7. Section 31 23 23 - Fill.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
7. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Submit test results for proposed aggregates and fill materials to be used as specified in individual specification sections.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Subsoil Fill: Type S1 or S2, as specified in Section 31 05 13 or A6, as specified in Section 31 05 16.

B. Structural Fill: Type A1 or A5 as specified in Section 31 05 16.

C. Granular Fill: Type A5 as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Comply with utility company requirements.

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

C. Notify utility company to remove or relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, and paving from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from designated areas, without mixing with foreign materials for use in finish grading, prior to any site excavation.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Remove excess subsoil not intended for reuse, from site.

E. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

F. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.

G. Stability: Replace damaged or displaced subsoil as specified for fill.

H. Any over excavation for the proposed construction shall be at the Contractor’s expense, unless approved by Engineer/Architect. Contractor shall notify Engineer of differing site conditions prior to over-excavating.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place material in continuous layers as follows:
1. Subsoil Fill: Maximum 12 inches compacted depth.
2. Structural Fill: Maximum 8 inches compacted depth.
3. Granular Fill: Maximum 8 inches compacted depth.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Repair or replace items indicated to remain damaged by excavation or filling.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.7 FIELD QUALITY CONTROL

A. Owner to provide laboratory material testing in accordance with ASTM D1557, ASTM D698, AASHTO T180.

B. Owner to provide in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D6938.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

D. Frequency of Tests:
   1. Owner's tester shall perform density testing of underlying (native) material prior to placement of backfill at a frequency of 1 test per 5000 square feet.
   2. Owner's tester shall perform density testing of subsequent backfill layers at a frequency of 1 test per 5000 square feet per lift of material placed.

3.8 SCHEDULES

A. Structural Fill:
   1. Fill Type A1 or A5: To subgrade elevation. 8 inch thick layers.
   2. Compact uniformly to minimum 98 percent of maximum density.

B. Subsoil Fill:
   1. Fill Type S1, S2 or A6: To subgrade elevation. 12 inch thick layers.
   2. Compact uniformly to minimum 95 percent of maximum density.

C. Granular Fill:
   1. Fill Type A5: 6 inch thick layers.
   2. Compact uniformly to minimum 98 percent of maximum density.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving and parking areas.
4. Excavating for slabs-on-grade.
5. Excavating for site structures.
6. Excavating for landscaping.
7. Excavation for underground utilities.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork: Stockpiling excavated materials.
2. Section 31 05 16 - Aggregates for Earthwork: Stockpiling excavated materials.
3. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 31 23 17 - Trenching: Excavating for utility trenches.
5. Section 31 23 18 – Rock Removal.
6. Section 31 23 23 - Fill.
7. Section 33 31 00 – Sanitary Utility Sewerage Piping.
8. Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Section 205 of the current MDOT Standard Specifications for Construction.

1.5 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Michigan.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work, and comply with all requirements. Request underground utilities to be located and marked within and surrounding construction areas.

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

C. Protect utilities indicated to remain from damage.

D. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, and paving from excavating equipment and vehicular traffic.

3.2 SOIL DENSIFICATION - VIBRO-COMPACTION

A. Densify existing subsoils with relative density rating of compact to dense to attain relative density rating of very dense prior to construction of foundations.
   1. Densify subsoils to depth of 2 feet.

3.3 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures, and construction operations.

C. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, waterproofing, when called for, and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against the excavated surface.

D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17 and 31 23 23.

E. Unless so directed by the Engineer, excavation shall not be carried below the elevations indicated on the drawings. Where the excavation is made below the elevations indicated on the drawings or directed by the Engineer due to fault of the Contractor, the excavations, if under slabs, shall be restored to the proper elevations; if under footings, the heights of the walls or footings shall be increased and the cost of such additional work shall be borne by the Contractor.

F. Slope banks with machine to angle of repose or less until shored.

G. Do not interfere with 45 degree bearing splay of foundations.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Trim excavation. Remove loose matter.

J. Remove lumped subsoil, boulders, and rock up to 1 cu yd measured by volume. Remove larger material as specified in Section 31 23 18.

K. Notify Architect/Engineer of unexpected subsurface conditions.

L. Correct areas over excavated with structural fill Type A1 or A5 specified in Section 31 23 23, as directed by Architect/Engineer.

M. Remove excess and unsuitable material from site.

N. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

O. Repair or replace items indicated to remain damaged by excavation at no cost to Owner.

P. Contractor shall excavate for proposed foundations to bottom of footing excavation such that footings bear on natural undisturbed soil. If bedrock is encountered at a higher elevation, then Contractor shall remove rock to 6” below proposed bottom of footing elevation and place Type A5 aggregate according to Section 31 23 23. Footings shall not bear directly on bedrock.

Q. Contractor shall coordinate with Owner for disposal of excavated material. The Contractor is responsible for the disposal of all excess excavated material unless Owner wishes to retain ownership of it. All excess excavated materials shall become property of the Contractor and disposed of according to State and local requirements..

3.4 FIELD QUALITY CONTROL

A. Owner’s tester shall perform inspection of excavation and controlled fill operations in accordance with current MDOT Standard Specifications for Construction.

3.5 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities from outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 22 13 - Rough Grading.
4. Section 31 23 16 - Excavation.
5. Section 31 23 18 – Rock Removal.
6. Section 31 23 19 – Dewatering.
7. Section 31 23 23 - Fill.
8. Section 33 11 16 - Site Water Utility Distribution Piping.
9. Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

B. Materials Source: Submit name of imported fill materials suppliers. Supplier shall collect test results for aggregate materials provided, certifying that products meet or exceed requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.6 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Michigan.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify that horizontal and vertical control for the work is as shown on construction documents.

C. Establish utility line and grade from the control points.

1.8 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1 or S2 as specified in Section 31 05 13.

B. Structural Fill: Type A1 or A5 as specified in Section 31 05 16.

C. Granular Fill: Type A5 as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, and paving from excavating equipment and vehicular traffic. Contractor is responsible for restoration of any items disturbed outside of the trench/project limits, at no cost to Owner.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control when trenching is performed within public right-of-way. Relocate controls as required during progress of work.

3.3 TRENCHING

A. Excavate surface and subsoil required for installation of utilities.

B. Remove lumped subsoil, boulders, and rock up of 1cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18.

C. Perform excavation within 24 inches of existing utility service in accordance with utility’s requirements.

D. Do not advance open trench more than 100 feet ahead of installed pipe.

E. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.

H. Bedding envelope material shall be Type A5 as specified in Section 33 05 16.

I. Do not interfere with 45 degree bearing splay of foundations.

J. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.

K. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Architect/Engineer until suitable material is encountered.

L. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type A5 and compact to density equal to or greater than requirements for subsequent backfill material.

M. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

N. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with structural fill Type A1 as directed by Architect/Engineer.

O. Remove excess subsoil not intended for reuse, from site.

P. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

Q. Pipe bedding envelope material to be compacted in 6 inch layers. Remove excess subsoil not intended for re-use, from site.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Provide shoring necessary to protect the work, banks, paving, structures of all kinds, utilities and human life. The Contractor shall obey the latest of the following publications relative to the requirements for the installing of shoring:
   1. Manual Accident Prevent in Construction – The Associated General Contractors of America, Inc.
   2. OSHA Excavation Standards as required by 29 CFR.

C. All structures, excavations and trenches shall be properly shored to meet the requirements of the State codes and local ordinances where the work is being performed. Shoring, as defined above, shall be so arranged as not to place any strain on portion of completed work until the general construction has proceeded far enough to provide ample strength in the opinion of the Engineer. Any damage to new or existing structures, including underground mains, whatsoever, occurring through settlement due to failure or lack of adequate support, shall be repaired by the Contractor at his own expense.

D. Support trenches more than 4 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

E. In general, timbering, sheathing, and bracing shall be removed as the trench or excavation is refilled in such manner as to avoid the caving-in of the work. The voids left by withdrawal of the sheathing shall be carefully filled. The Engineer may order the sheathing left in place, when in his opinion it is necessary for the protection of the work. In such cases, a charge will be allowed for the actual cost of the material left in place and the Contractor shall furnish delivery slips or invoices for the same as the basis for the additional charge.

F. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil, at no cost to Owner.

G. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing, at no cost to Owner.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

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

C. Place geotextile fabric over Fill Type A1 prior to placing subsequent fill materials.

D. Place material in continuous layers as follows:
1. Subsoil Fill: Maximum 12 inches compacted depth.
2. Structural Fill: Maximum 8 inches compacted depth.
3. Granular Fill: Maximum 8 inches compacted depth.

E. Employ placement method that does not disturb or damage, utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Do not leave more than 50 feet of trench open at end of working day. Contractor shall be responsible for timely backfill of trenches and compaction of trench material. Changes in soil properties due to over-exposure to weather and natural elements, which affect backfill and compaction, is the responsibility of the Contractor.

H. Protect open trench to prevent danger to Owner and public.

I. Remove surplus backfill materials from site.

J. When working within a State Trunk Highway right-of-way, comply with MDOT Standard Specifications for Construction.

3.6 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Owner to provide laboratory material testing in accordance with ASTM D1557. ASTM D698. AASHTO T180.

B. Owner to provide in place compaction testing in accordance with the following:
   1. Density Tests: ASTM D1556 or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest, at no cost to Owner.

D. Frequency of Tests:
   1. Owner's tester shall perform density testing at a frequency of one test per backfill layer per 250 feet of trench.

3.8 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.9 SCHEDULE

A. Water, Storm and Sanitary Piping:
   1. Cover pipe and bedding with Fill Type A5: To subgrade elevation.
   2. Compact uniformly to minimum 95 percent of maximum density.

B. Refer to Plan Details.

END OF SECTION

SECTION 31 23 18

ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing discovered rock during excavation.
   2. Expansive tools or explosives to assist rock removal.

B. Related Sections:
   1. Section 312213 - Rough Grading.
   2. Section 312316 – Excavation.
   3. Section 312323 – Fill.
   4. Section 312317 - Trenching.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 495 - Explosive Materials Code.

1.3 DEFINITIONS

A. Site Rock: Solid mineral material with volume in excess of 1 cu yd or solid material that can’t be removed with 1 cu yd capacity excavator without drilling or blasting.

B. Trench Rock: Solid mineral material that cannot be removed by trenching with a tracked trenching excavator (similar to a JD 790) in good working condition, using a ripper attachment, and without drilling or blasting or mechanical hammering.

1.4 SUBMITTALS

A. Photography of external physical conditions of existing adjacent building, including internal walls, foundations and windows.

B. Shop Drawings: Indicate proposed method of blasting, delay pattern, explosive types, and type of blasting mat or cover, and intended rock removal method.

C. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

D. Drilling Logs: Submit rock profile drilling logs to engineer within 2 days of rock profiling.

1.5 QUALITY ASSURANCE

A. Seismic Survey Firm: Shall be a licensed company specializing in seismic surveys with five years documented experience.

B. Explosives Firm: Shall be a company specializing in explosives for disintegration of rock, with five years documented experience.

1.6 PROJECT CONDITIONS

A. Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting.

B. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.

C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable OSHA code for explosive disintegration of rock and to NFPA 495 for handling storage and protection of explosion materials.

B. Obtain permits from authorities having jurisdiction before explosions are brought to site or drilling is started.

1.8 SCHEDULING

A. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS

2.1 MATERIALS

A. Explosives: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.

B. Delay Device: Type recommended by explosives firm.

C. Blast Mat Materials: Type recommended by explosives firm.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Notify Engineer 24 hours in advance of rock profiling. Contractor to immediately notify engineer when encountering rock in the excavation process for documentation as required for measurement purposes.

3.2 PREPARATION

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

B. Conduct survey and document conditions of buildings near locations of rock removal prior to blasting.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method, drill holes and utilize expansive tools or wedges to fracture rock, or use pneumatic hammer.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for foundations.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

E. In detention ponds and drainage ditches, excavate to 6 inches below plan grade.

F. Remove excavated materials from site and dispose of at an approved location.

G. All rock removal within trench shall be replaced with backfill material in accordance with backfilling and compacting requirements of Section 31 23 23.

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS

A. When rock is uncovered requiring explosives method for rock disintegration, notify Engineer.

B. Present certificate of “Blasters Insurance”. Advise Owners of adjacent buildings or structures in writing. Explain planned blasting and seismic operations.

C. Provide seismographic monitoring during progress of blasting operations.

D. Drill blasting holes within 12 feet of finished slope.

E. Disintegrate rock and remove from excavation.

F. Remove rock at excavation bottom to form level bearing.

G. Remove shaled layers to provide sound and unshattered base for foundations.

H. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

I. In detention ponds and drainage ditches, excavate to 6 inches below plan grade.

J. Remove excavated material from site and dispose of at an approved location.

K. All rock removal within trench shall be replaced with backfill material in accordance with backfilling and compacting requirements of Section 31 23 23.

3.5 FIELD QUALITY CONTROL

A. Request visual inspection of foundation bearing surfaces by Engineer and inspection agency before installing subsequent work.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall provide and maintain ample means and devices with which to promptly remove all water entering excavations, trenches, and other parts of the work and shall keep said excavations dry until the piping and/or structures to be built therein are completed. No masonry shall be laid in water nor shall water be allowed to rise over masonry and concrete until the mortar and concrete has attained its final set. In no event shall water be allowed to rise over masonry or concrete if there is danger of flotation or of setting up unequal pressures in the concrete until the concrete has set at least 24 hours and any danger of flotation has been removed. The Contractor must also guard against flotation of installed piping and appurtenances/ structures. When the water cannot be removed by the commonly used methods, such as in water bearing sand, the Contractor shall furnish and install a well point system with vacuum pump and self-jetting points and all other appurtenances of amply capacity to keep the excavation and/or trenches dry.

B. The Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property, utilities, or sewers. All removal of water and handling of water necessary to keep excavation, trenches and the work dry shall be at the expense of the Contractor.

C. The Contractor shall be responsible for keeping all pumps, motors and electrical equipment dry until the work is accepted by the Owner. If at any time previous to acceptance the pumps, motors, and electrical equipment become submerged, the Contractor shall have the electrical equipment and motors baked out and pumps taken apart by the pump manufacturer's field representative and checked by him for possible damage to bearings, etc. Damaged bearings shall be replaced with new bearing. Pumps shall be reassembled by the factory representative and checked by him for proper operation. The factory representative shall give the Engineer a letter stating that all pumping equipment is in first class working order. All expenses of any kind necessary to put the equipment mentioned in first class working order shall be paid for by the Contractor at no extra cost to the Owner.

D. In the event that the Contractor’s operations shall in any way adversely affect the proper performance of individual wells or wastewater disposal facilities, the Contractor shall assume the cost and responsibility for taking such measures as are necessary to assure the continued supply of ample quantities of potable water and the adequate provision of sanitary facilities during the course of such operations, and until the facilities proper operation has been restored.

E. Sedimentation Control shall be used with all discharges and any contaminants will be treated, if necessary, at no cost to the Owner.

F. Dewatering is considered incidental to the work.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backfilling site structures to subgrade elevations.
2. Fill under slabs-on-grade.
3. Fill under paving.
4. Fill for over-excavation.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 22 13 - Rough Grading.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
6. ASTM D4253 – Standard test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 SUBMITTALS

A. Materials Source: Submit name of imported fill materials suppliers. Aggregate supplier shall provide current test results of materials supplied verifying that supplied products meet product requirements.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1 or S2 as specified in Section 31 05 13.

B. Structural Fill: Type A1 or A5 as specified in Section 31 05 16.

C. Granular Fill: Type A5 as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify subdrainage, damp proofing, or waterproofing installation has been inspected.

B. Verify underground equipment are secured to avoid flotation after backfilling.

C. Verify that forms are removed and excavation is free of trash and debris.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

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

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular A5 fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6 inches.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

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

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

C. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 12 inches compacted depth.
   2. Structural Fill: Maximum 8 inches compacted depth.
   3. Granular Fill: Maximum 8 inches compacted depth.

D. Employ placement method that does not disturb or damage other work.

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

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

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

H. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

I. Make gradual grade changes. Blend slope into level areas.

J. Remove surplus backfill materials from site.

K. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Top Surface of Backfilling Within Building Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Owner to provide laboratory material testing in accordance with ASTM D1557, ASTM D698, AASHTO T180.

B. Owner to provide in place compaction testing in accordance with the following:
   1. Density Tests: ASTM D1556 or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest, at no cost to Owner.

D. Frequency of Tests:
   1. Owner’s tester shall perform density testing of backfill materials prior to subsequent layer at a frequency of 1 test per 5000 square feet per layer (lift).

E. Proof roll compacted fill surfaces under slabs-on-grade and paving.

3.6 PROTECTION OF FINISHED WORK

A. Re-shape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

A. Interior Slab-On-Grade:
   1. Fill Type A5, 8 inches thick layers, compacted to 95 percent.

B. Exterior Side of Foundation Walls (Non-paved areas only):
   1. Fill Type A5, to subgrade elevation, each lift, compact uniformly to 95 percent of maximum density.

C. Fill Under Grass Areas:
   1. Fill Type S1 or S2, to 6 inches below finish grade, compact uniformly to 90 percent of maximum density.

D. Fill Under Asphalt Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
   2. Fill Type A5, to 11 inches below finish paving elevation, compact uniformly to 95 percent of maximum density.

E. Fill Under Concrete Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
   2. Fill Type A7 or A5, to 6 inches below finish paving elevation, compact uniformly to 95 percent of maximum density.

F. Pipe Bedding:
   1. Fill Type A5, 6 inch lifts, compacted uniformly to 95 percent of maximum density.

G. Area of Peat Excavation:
   1. Fill Type A1, 6 inch lifts, compacted uniformly to 98 percent of maximum density.

END OF SECTION

SECTION 31 25 13

EROSION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silt Fence.
   2. Site Stabilization.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 05 16 - Aggregates for Earthwork.
   3. Section 31 10 00 - Site Clearing.
   4. Section 31 23 16 - Excavation.
   5. Section 31 23 17 – Trenching.
   6. Section 31 23 23 - Fill.
   7. Section 32 13 13 – Concrete Paving.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:
   1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Product Data: Product Data: Submit data on geotextile.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.5 PRE-INSTALLATION MEETINGS

A. Convene one week prior to commencing work of this section.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

C. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

PART 2 PRODUCTS

2.1 GEOTEXTILE MATERIALS

A. Geotextile Fabric: Furnish in accordance with current MDOT Standard Specifications for construction.

2.2 PLANTING MATERIALS

A. Seeding and Soil Supplements: As specified in Section 32 92 19.

B. Mulch: As specified in Section 32 92 19.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other work are correct.

D. Install Work in accordance with current MDOT Standard Specifications for Construction.

3.2 GEOTEXTILE SEDIMENTATION FENCING

A. Install geotextile silt fence to extent of disturbance of existing soil, in accordance with current MDOT Standard Specifications for Construction.

B. Install geotextile silt fence around all stockpiled, excavated and filled areas.

C. Mulch seeded areas as specified in Section 32 92 19.

3.3 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 8 feet. Slope stockpile sides at 1: 3 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 32 92 19 at 50 percent of permanent application rate with no topsoil
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 92 19 permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.4 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

3.5 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

B. Do not damage structure or device during cleaning operations.

C. Do not permit sediment to erode into construction or site areas or natural waterways.

D. Clean channels when depth of sediment reaches approximately 1/3 channel depth.

E. Repair/Replace damaged areas of sediment device immediately upon inspection.

3.6 PROTECTION

A. Protect sedimentation control devices throughout duration of work, or until seeding is established.

END OF SECTION

SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 32 91 19 - Landscape Grading.
   6. Section 32 92 19 - Seeding.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Materials Source: Submit name of imported materials source.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Provide current test results verifying materials meet requirements.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil material from single source throughout the Work.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1 - Embankment: Conforming to current MDOT Standard Specifications for Construction.

B. Subsoil Type S2:
   1. Excavated and re-used material.
   2. Clean granular and graded.
   3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

2.2 TOPSOIL MATERIALS

A. Topsoil Type S4:
   1. Excavated and reused material.
   2. Graded.
   3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
      a. Screening: Single screened.

B. Topsoil Type S5:
   1. Imported borrow.
   2. Friable loam.
   3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
      a. Screening: Single screened.
   4. Acidity range (pH) of 5.5 to 7.5.
   5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

C. Topsoil materials shall conform to current MDOT Standard Specifications for Construction.

2.3 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698, ASTM D1557, AASHTO T180.

B. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698, ASTM D1557, AASHTO T180.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at an Owner/Engineer approved location. A 1-on-3 maximum slope shall be required at all times.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 8 feet high maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 32 11 23 - Aggregate Base Courses.
   6. Section 32 91 19 - Landscape Grading.
   7. Section 33 05 13 – Manholes and Structures.
   8. Section 33 31 00 – Sanitary Sewerage Utility Piping.
   9. Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Materials Source: Submit name of imported materials suppliers.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Provide test results within the last 12 months that verify materials meet requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work. Change of source requires Engineer approval.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type A1, 6A Gradation: Conforming to current MDOT Standard Specifications for Construction.

B. Type A2, 22A Gravel: Conforming to current MDOT Standard Specifications for Construction.

C. Type A3, 23A Gravel: Conforming to current MDOT Standard Specifications for Construction.

D. Type A4 Material, Plain Riprap: Conforming to current MDOT Standard Specifications for Construction.

E. Type A5, Class II: For pipe bedding envelope, special backfill, pavement subbase, conforming to current MDOT Standard Specifications for Construction. For pipe bedding envelope, only materials up to 1-1/2" diameter are allowable within a minimum of 6" of the installed pipe.

F. Type A6, Class III: Conforming to current MDOT Standard Specifications for Construction.

G. Type A7, 21 AA: Conforming to current MDOT Standard Specifications for Construction.

2.2 SOURCE QUALITY CONTROL

A. Testing and Analysis: Performed by Owner in accordance with ASTM D698, ASTM D1557, AASHTO T180, ASTM D4318, ASTM C136.

B. Submit sample of aggregate materials from stock piles or from source of native material. Resubmit if product change.

C. When tests indicate materials do not meet specified requirements, change material and retest. Owner is responsible for all material verification and testing. Results for material compliance with specified requirements shall be provided to Architect/Engineer upon completion.

PART 3 EXECUTION

3.1 EXCAVATION

A. Remove excess excavated materials not intended for reuse, from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations that do not interfere with proposed construction or owner's operations. Area shall be approved by Owner/ Engineer. A 1-on-3 maximum slope shall be required at all times.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Stockpile soils 8 feet high maximum.

E. Prevent intermitting of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.4 RIP RAP PLACEMENT

A. Shape and compact slope to required grade and cross section.

B. Place on geotextile liner if required on plans.

C. Machine place and compact a uniform layer to thickness and configuration as shown on the plan.

D. Finished surface shall be tight and even.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Removing designated trees, shrubs, and other plant life.
   3. Excavating topsoil.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 18 - Rock Removal.

1.2 QUALITY ASSURANCE

A. Conform to applicable Federal, State, and local code for environmental requirements, and disposal of debris. No burning of debris permitted on site.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area for placing removed materials.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Contractor shall also be responsible to contact any utilities that do not participate in MISS DIG system for location of utility lines.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain. Repair/replace any damage at no expense to Owner.

C. Protect bench marks, survey control points, and existing structures from damage or displacement. Repair/replace any damage at no expense to Owner.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 12 inches within the limits shown on the plan.

B. Remove trees and shrubs within marked areas. Remove stumps, main root ball, root system to depth of 12 inches, and surface rock.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.5 REMOVAL

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

B. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

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

3.6 DISPOSAL

A. The CONTRACTOR shall make his own arrangements for disposal of materials resulting from clearing and grubbing. Disposal shall be off the facility site and/or right-of-way and written permits for such disposal shall be obtained by the CONTRACTOR from the Owner of the property on which the material is placed. Contractor shall supply Owner/Engineer a copy of all written permit(s).

B. All waste material generated by the clearing and grubbing operation must be disposed of in a safe and environmentally sound manner which meets the requirements of all of the applicable State of Michigan Rules and Regulations; such as, the Clean Air Act, the Solid Waste Act, the Wetlands Protection Act, Etc.

3.7 ENVIRONMENTAL REQUIREMENTS

A. The CONTRACTOR shall comply with all requirements of the Department of Natural Resources which permit the open burning of weeds, brush, logs, limbs, stumps, roots and other debris which results from clearing and grubbing.

B. The CONTRACTOR shall also comply with all applicable local laws and ordinances regarding the disposal of trees (especially elm and ash) after removal, including their logs, stumps, branches and bark.

C. All waste generated from the burning of the clearing and/or grubbing material shall be disposed of in a safe and environmentally acceptable manner which meets the requirements of all the applicable State of Michigan Rules and Regulations, such as the Clean Air Act, the Solid Waste Act, the Inland Lakes and Streams Act, the Wetlands Protection Act, Soil Erosion and Sedimentation Act, Notice to Public Utilities Act, and the National Historic Preservation Act.

3.8 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over, until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.9 SCHEDULES

A. None.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting site for site structures, concrete pads, and parking areas.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 10 00 – Site Clearing.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.
6. Section 31 23 18 – Rock Removal.
7. Section 31 23 23 - Fill.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
7. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Submit test results for proposed aggregates and fill materials to be used as specified in individual specification sections.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Subsoil Fill: Type S1 or S2, as specified in Section 31 05 13 or A6, as specified in Section 31 05 16.

B. Structural Fill: Type A1 or A5 as specified in Section 31 05 16.

C. Granular Fill: Type A5 as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Comply with utility company requirements.

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

C. Notify utility company to remove or relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, and paving from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from designated areas, without mixing with foreign materials for use in finish grading, prior to any site excavation.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Remove excess subsoil not intended for reuse, from site.

E. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

F. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.

G. Stability: Replace damaged or displaced subsoil as specified for fill.

H. Any over excavation for the proposed construction shall be at the Contractor’s expense, unless approved by Engineer/Architect. Contractor shall notify Engineer of differing site conditions prior to over-excavating.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place material in continuous layers as follows:
1. Subsoil Fill: Maximum 12 inches compacted depth.
2. Structural Fill: Maximum 8 inches compacted depth.
3. Granular Fill: Maximum 8 inches compacted depth.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Repair or replace items indicated to remain damaged by excavation or filling.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.7 FIELD QUALITY CONTROL

A. Owner to provide laboratory material testing in accordance with ASTM D1557, ASTM D698, AASHTO T180.

B. Owner to provide in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D6938.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

D. Frequency of Tests:
   1. Owner's tester shall perform density testing of underlying (native) material prior to placement of backfill at a frequency of 1 test per 5000 square feet.
   2. Owner's tester shall perform density testing of subsequent backfill layers at a frequency of 1 test per 5000 square feet per lift of material placed.

3.8 SCHEDULES

A. Structural Fill:
   1. Fill Type A1 or A5: To subgrade elevation. 8 inch thick layers.
   2. Compact uniformly to minimum 98 percent of maximum density.

B. Subsoil Fill:
   1. Fill Type S1, S2 or A6: To subgrade elevation. 12 inch thick layers.
   2. Compact uniformly to minimum 95 percent of maximum density.

C. Granular Fill:
   1. Fill Type A5: 6 inch thick layers.
   2. Compact uniformly to minimum 98 percent of maximum density.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving and parking areas.
4. Excavating for slabs-on-grade.
5. Excavating for site structures.
6. Excavating for landscaping.
7. Excavation for underground utilities.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork: Stockpiling excavated materials.
2. Section 31 05 16 - Aggregates for Earthwork: Stockpiling excavated materials.
3. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 31 23 17 - Trenching: Excavating for utility trenches.
5. Section 31 23 18 – Rock Removal.
6. Section 31 23 23 - Fill.
7. Section 33 31 00 – Sanitary Utility Sewerage Piping.
8. Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Section 205 of the current MDOT Standard Specifications for Construction.

1.5 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Michigan.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work, and comply with all requirements. Request underground utilities to be located and marked within and surrounding construction areas.

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

C. Protect utilities indicated to remain from damage.

D. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, and paving from excavating equipment and vehicular traffic.

3.2 SOIL DENSIFICATION - VIBRO-COMPACTION

A. Densify existing subsoils with relative density rating of compact to dense to attain relative density rating of very dense prior to construction of foundations.
   1. Densify subsoils to depth of 2 feet.

3.3 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures, and construction operations.

C. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, waterproofing, when called for, and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against the excavated surface.

D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17 and 31 23 23.

E. Unless so directed by the Engineer, excavation shall not be carried below the elevations indicated on the drawings. Where the excavation is made below the elevations indicated on the drawings or directed by the Engineer due to fault of the Contractor, the excavations, if under slabs, shall be restored to the proper elevations; if under footings, the heights of the walls or footings shall be increased and the cost of such additional work shall be borne by the Contractor.

F. Slope banks with machine to angle of repose or less until shored.

G. Do not interfere with 45 degree bearing splay of foundations.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Trim excavation. Remove loose matter.

J. Remove lumped subsoil, boulders, and rock up to 1 cu yd measured by volume. Remove larger material as specified in Section 31 23 18.

K. Notify Architect/Engineer of unexpected subsurface conditions.

L. Correct areas over excavated with structural fill Type A1 or A5 specified in Section 31 23 23, as directed by Architect/Engineer.

M. Remove excess and unsuitable material from site.

N. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

O. Repair or replace items indicated to remain damaged by excavation at no cost to Owner.

P. Contractor shall excavate for proposed foundations to bottom of footing excavation such that footings bear on natural undisturbed soil. If bedrock is encountered at a higher elevation, then Contractor shall remove rock to 6” below proposed bottom of footing elevation and place Type A5 aggregate according to Section 31 23 23. Footings shall not bear directly on bedrock.

Q. Contractor shall coordinate with Owner for disposal of excavated material. The Contractor is responsible for the disposal of all excess excavated material unless Owner wishes to retain ownership of it. All excess excavated materials shall become property of the Contractor and disposed of according to State and local requirements..

3.4 FIELD QUALITY CONTROL

A. Owner’s tester shall perform inspection of excavation and controlled fill operations in accordance with current MDOT Standard Specifications for Construction.

3.5 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities from outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 22 13 - Rough Grading.
4. Section 31 23 16 - Excavation.
5. Section 31 23 18 – Rock Removal.
6. Section 31 23 19 – Dewatering.
7. Section 31 23 23 - Fill.
8. Section 33 11 16 - Site Water Utility Distribution Piping.
9. Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

B. Materials Source: Submit name of imported fill materials suppliers. Supplier shall collect test results for aggregate materials provided, certifying that products meet or exceed requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.6 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Michigan.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify that horizontal and vertical control for the work is as shown on construction documents.

C. Establish utility line and grade from the control points.

1.8 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1 or S2 as specified in Section 31 05 13.

B. Structural Fill: Type A1 or A5 as specified in Section 31 05 16.

C. Granular Fill: Type A5 as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, and paving from excavating equipment and vehicular traffic. Contractor is responsible for restoration of any items disturbed outside of the trench/project limits, at no cost to Owner.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control when trenching is performed within public right-of-way. Relocate controls as required during progress of work.

3.3 TRENCHING

A. Excavate surface and subsoil required for installation of utilities.

B. Remove lumped subsoil, boulders, and rock up of 1cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18.

C. Perform excavation within 24 inches of existing utility service in accordance with utility’s requirements.

D. Do not advance open trench more than 100 feet ahead of installed pipe.

E. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.

H. Bedding envelope material shall be Type A5 as specified in Section 33 05 16.

I. Do not interfere with 45 degree bearing splay of foundations.

J. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.

K. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Architect/Engineer until suitable material is encountered.

L. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type A5 and compact to density equal to or greater than requirements for subsequent backfill material.

M. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

N. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with structural fill Type A1 as directed by Architect/Engineer.

O. Remove excess subsoil not intended for reuse, from site.

P. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

Q. Pipe bedding envelope material to be compacted in 6 inch layers. Remove excess subsoil not intended for re-use, from site.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Provide shoring necessary to protect the work, banks, paving, structures of all kinds, utilities and human life. The Contractor shall obey the latest of the following publications relative to the requirements for the installing of shoring:
   1. Manual Accident Prevent in Construction – The Associated General Contractors of America, Inc.
   2. OSHA Excavation Standards as required by 29 CFR.

C. All structures, excavations and trenches shall be properly shored to meet the requirements of the State codes and local ordinances where the work is being performed. Shoring, as defined above, shall be so arranged as not to place any strain on portion of completed work until the general construction has proceeded far enough to provide ample strength in the opinion of the Engineer. Any damage to new or existing structures, including underground mains, whatsoever, occurring through settlement due to failure or lack of adequate support, shall be repaired by the Contractor at his own expense.

D. Support trenches more than 4 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

E. In general, timbering, sheathing, and bracing shall be removed as the trench or excavation is refilled in such manner as to avoid the caving-in of the work. The voids left by withdrawal of the sheathing shall be carefully filled. The Engineer may order the sheathing left in place, when in his opinion it is necessary for the protection of the work. In such cases, a charge will be allowed for the actual cost of the material left in place and the Contractor shall furnish delivery slips or invoices for the same as the basis for the additional charge.

F. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil, at no cost to Owner.

G. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing, at no cost to Owner.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

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

C. Place geotextile fabric over Fill Type A1 prior to placing subsequent fill materials.

D. Place material in continuous layers as follows:
1. Subsoil Fill: Maximum 12 inches compacted depth.
2. Structural Fill: Maximum 8 inches compacted depth.
3. Granular Fill: Maximum 8 inches compacted depth.

E. Employ placement method that does not disturb or damage, utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Do not leave more than 50 feet of trench open at end of working day. Contractor shall be responsible for timely backfill of trenches and compaction of trench material. Changes in soil properties due to over-exposure to weather and natural elements, which affect backfill and compaction, is the responsibility of the Contractor.

H. Protect open trench to prevent danger to Owner and public.

I. Remove surplus backfill materials from site.

J. When working within a State Trunk Highway right-of-way, comply with MDOT Standard Specifications for Construction.

3.6 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Owner to provide laboratory material testing in accordance with ASTM D1557. ASTM D698. AASHTO T180.

B. Owner to provide in place compaction testing in accordance with the following:
   1. Density Tests: ASTM D1556 or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest, at no cost to Owner.

D. Frequency of Tests:
   1. Owner's tester shall perform density testing at a frequency of one test per backfill layer per 250 feet of trench.

3.8 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.9 SCHEDULE

A. Water, Storm and Sanitary Piping:
   1. Cover pipe and bedding with Fill Type A5: To subgrade elevation.
   2. Compact uniformly to minimum 95 percent of maximum density.

B. Refer to Plan Details.

END OF SECTION

SECTION 31 23 18

ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing discovered rock during excavation.
   2. Expansive tools or explosives to assist rock removal.

B. Related Sections:
   1. Section 312213 - Rough Grading.
   2. Section 312316 – Excavation.
   3. Section 312323 – Fill.
   4. Section 312317 - Trenching.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 495 - Explosive Materials Code.

1.3 DEFINITIONS

A. Site Rock: Solid mineral material with volume in excess of 1 cu yd or solid material that can’t be removed with 1 cu yd capacity excavator without drilling or blasting.

B. Trench Rock: Solid mineral material that cannot be removed by trenching with a tracked trenching excavator (similar to a JD 790) in good working condition, using a ripper attachment, and without drilling or blasting or mechanical hammering.

1.4 SUBMITTALS

A. Photography of external physical conditions of existing adjacent building, including internal walls, foundations and windows.

B. Shop Drawings: Indicate proposed method of blasting, delay pattern, explosive types, and type of blasting mat or cover, and intended rock removal method.

C. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

D. Drilling Logs: Submit rock profile drilling logs to engineer within 2 days of rock profiling.

1.5 QUALITY ASSURANCE

A. Seismic Survey Firm: Shall be a licensed company specializing in seismic surveys with five years documented experience.

B. Explosives Firm: Shall be a company specializing in explosives for disintegration of rock, with five years documented experience.

1.6 PROJECT CONDITIONS

A. Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting.

B. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.

C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable OSHA code for explosive disintegration of rock and to NFPA 495 for handling storage and protection of explosion materials.

B. Obtain permits from authorities having jurisdiction before explosions are brought to site or drilling is started.

1.8 SCHEDULING

A. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS

2.1 MATERIALS

A. Explosives: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.

B. Delay Device: Type recommended by explosives firm.

C. Blast Mat Materials: Type recommended by explosives firm.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Notify Engineer 24 hours in advance of rock profiling. Contractor to immediately notify engineer when encountering rock in the excavation process for documentation as required for measurement purposes.

3.2 PREPARATION

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

B. Conduct survey and document conditions of buildings near locations of rock removal prior to blasting.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method, drill holes and utilize expansive tools or wedges to fracture rock, or use pneumatic hammer.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for foundations.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

E. In detention ponds and drainage ditches, excavate to 6 inches below plan grade.

F. Remove excavated materials from site and dispose of at an approved location.

G. All rock removal within trench shall be replaced with backfill material in accordance with backfilling and compacting requirements of Section 31 23 23.

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS

A. When rock is uncovered requiring explosives method for rock disintegration, notify Engineer.

B. Present certificate of “Blasters Insurance”. Advise Owners of adjacent buildings or structures in writing. Explain planned blasting and seismic operations.

C. Provide seismographic monitoring during progress of blasting operations.

D. Drill blasting holes within 12 feet of finished slope.

E. Disintegrate rock and remove from excavation.

F. Remove rock at excavation bottom to form level bearing.

G. Remove shaled layers to provide sound and unshattered base for foundations.

H. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

I. In detention ponds and drainage ditches, excavate to 6 inches below plan grade.

J. Remove excavated material from site and dispose of at an approved location.

K. All rock removal within trench shall be replaced with backfill material in accordance with backfilling and compacting requirements of Section 31 23 23.

3.5 FIELD QUALITY CONTROL

A. Request visual inspection of foundation bearing surfaces by Engineer and inspection agency before installing subsequent work.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall provide and maintain ample means and devices with which to promptly remove all water entering excavations, trenches, and other parts of the work and shall keep said excavations dry until the piping and/or structures to be built therein are completed. No masonry shall be laid in water nor shall water be allowed to rise over masonry and concrete until the mortar and concrete has attained its final set. In no event shall water be allowed to rise over masonry or concrete if there is danger of flotation or of setting up unequal pressures in the concrete until the concrete has set at least 24 hours and any danger of flotation has been removed. The Contractor must also guard against flotation of installed piping and appurtenances/ structures. When the water cannot be removed by the commonly used methods, such as in water bearing sand, the Contractor shall furnish and install a well point system with vacuum pump and self-jetting points and all other appurtenances of amply capacity to keep the excavation and/or trenches dry.

B. The Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property, utilities, or sewers. All removal of water and handling of water necessary to keep excavation, trenches and the work dry shall be at the expense of the Contractor.

C. The Contractor shall be responsible for keeping all pumps, motors and electrical equipment dry until the work is accepted by the Owner. If at any time previous to acceptance the pumps, motors, and electrical equipment become submerged, the Contractor shall have the electrical equipment and motors baked out and pumps taken apart by the pump manufacturer's field representative and checked by him for possible damage to bearings, etc. Damaged bearings shall be replaced with new bearing. Pumps shall be reassembled by the factory representative and checked by him for proper operation. The factory representative shall give the Engineer a letter stating that all pumping equipment is in first class working order. All expenses of any kind necessary to put the equipment mentioned in first class working order shall be paid for by the Contractor at no extra cost to the Owner.

D. In the event that the Contractor’s operations shall in any way adversely affect the proper performance of individual wells or wastewater disposal facilities, the Contractor shall assume the cost and responsibility for taking such measures as are necessary to assure the continued supply of ample quantities of potable water and the adequate provision of sanitary facilities during the course of such operations, and until the facilities proper operation has been restored.

E. Sedimentation Control shall be used with all discharges and any contaminants will be treated, if necessary, at no cost to the Owner.

F. Dewatering is considered incidental to the work.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backfilling site structures to subgrade elevations.
2. Fill under slabs-on-grade.
3. Fill under paving.
4. Fill for over-excavation.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 22 13 - Rough Grading.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
6. ASTM D4253 – Standard test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 SUBMITTALS

A. Materials Source: Submit name of imported fill materials suppliers. Aggregate supplier shall provide current test results of materials supplied verifying that supplied products meet product requirements.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1 or S2 as specified in Section 31 05 13.

B. Structural Fill: Type A1 or A5 as specified in Section 31 05 16.

C. Granular Fill: Type A5 as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify subdrainage, damp proofing, or waterproofing installation has been inspected.

B. Verify underground equipment are secured to avoid flotation after backfilling.

C. Verify that forms are removed and excavation is free of trash and debris.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

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

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular A5 fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6 inches.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

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

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

C. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 12 inches compacted depth.
   2. Structural Fill: Maximum 8 inches compacted depth.
   3. Granular Fill: Maximum 8 inches compacted depth.

D. Employ placement method that does not disturb or damage other work.

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

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

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

H. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

I. Make gradual grade changes. Blend slope into level areas.

J. Remove surplus backfill materials from site.

K. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Top Surface of Backfilling Within Building Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Owner to provide laboratory material testing in accordance with ASTM D1557, ASTM D698, AASHTO T180.

B. Owner to provide in place compaction testing in accordance with the following:
   1. Density Tests: ASTM D1556 or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest, at no cost to Owner.

D. Frequency of Tests:
   1. Owner’s tester shall perform density testing of backfill materials prior to subsequent layer at a frequency of 1 test per 5000 square feet per layer (lift).

E. Proof roll compacted fill surfaces under slabs-on-grade and paving.

3.6 PROTECTION OF FINISHED WORK

A. Re-shape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

A. Interior Slab-On-Grade:
   1. Fill Type A5, 8 inches thick layers, compacted to 95 percent.

B. Exterior Side of Foundation Walls (Non-paved areas only):
   1. Fill Type A5, to subgrade elevation, each lift, compact uniformly to 95 percent of maximum density.

C. Fill Under Grass Areas:
   1. Fill Type S1 or S2, to 6 inches below finish grade, compact uniformly to 90 percent of maximum density.

D. Fill Under Asphalt Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
   2. Fill Type A5, to 11 inches below finish paving elevation, compact uniformly to 95 percent of maximum density.

E. Fill Under Concrete Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
   2. Fill Type A7 or A5, to 6 inches below finish paving elevation, compact uniformly to 95 percent of maximum density.

F. Pipe Bedding:
   1. Fill Type A5, 6 inch lifts, compacted uniformly to 95 percent of maximum density.

G. Area of Peat Excavation:
   1. Fill Type A1, 6 inch lifts, compacted uniformly to 98 percent of maximum density.

END OF SECTION

SECTION 31 25 13

EROSION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silt Fence.
   2. Site Stabilization.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 05 16 - Aggregates for Earthwork.
   3. Section 31 10 00 - Site Clearing.
   4. Section 31 23 16 - Excavation.
   5. Section 31 23 17 – Trenching.
   6. Section 31 23 23 - Fill.
   7. Section 32 13 13 – Concrete Paving.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:
   1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Product Data: Product Data: Submit data on geotextile.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.5 PRE-INSTALLATION MEETINGS

A. Convene one week prior to commencing work of this section.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

C. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

PART 2 PRODUCTS

2.1 GEOTEXTILE MATERIALS

A. Geotextile Fabric: Furnish in accordance with current MDOT Standard Specifications for construction.

2.2 PLANTING MATERIALS

A. Seeding and Soil Supplements: As specified in Section 32 92 19.

B. Mulch: As specified in Section 32 92 19.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other work are correct.

D. Install Work in accordance with current MDOT Standard Specifications for Construction.

3.2 GEOTEXTILE SEDIMENTATION FENCING

A. Install geotextile silt fence to extent of disturbance of existing soil, in accordance with current MDOT Standard Specifications for Construction.

B. Install geotextile silt fence around all stockpiled, excavated and filled areas.

C. Mulch seeded areas as specified in Section 32 92 19.

3.3 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 8 feet. Slope stockpile sides at 1: 3 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 32 92 19 at 50 percent of permanent application rate with no topsoil
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 92 19 permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.4 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

3.5 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

B. Do not damage structure or device during cleaning operations.

C. Do not permit sediment to erode into construction or site areas or natural waterways.

D. Clean channels when depth of sediment reaches approximately 1/3 channel depth.

E. Repair/Replace damaged areas of sediment device immediately upon inspection.

3.6 PROTECTION

A. Protect sedimentation control devices throughout duration of work, or until seeding is established.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION

32 11 23	AGGREGATE BASE COURSES
32 12 16	ASPHALT PAVING
32 13 13	CONCRETE PAVING
32 17 23	PAVEMENT MARKINGS

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate subbase.
   2. Aggregate base course.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 32 12 16 - Asphalt Paving.(not used)
   6. Section 32 13 13 - Concrete Paving.
   7. Section 32 91 19 - Landscape Grading.
   8. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
   6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. Michigan Department of Transportation – current Standard Specifications for Construction.

1.3 SUBMITTALS

A. Samples: Submit one five gallon pail samples of each aggregate type for laboratory testing.

B. Materials Source: Submit name of aggregate materials suppliers. Supplier shall provide current test results verifying that supplied materials meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Base Coarse Aggregate: Fill Type A7 as specified in Section 31 05 16.

B. Surface Coarse Aggregate: Fill Type A3 as specified in Section 31 05 16.

2.2 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23.

B. Verify substrate has been inspected, gradients and elevations are correct, free of ruts or high spots.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

C. Cut abutting pavement edges to be vertical and in straight lines.

D. The Contractor shall dispose of all waste bituminous material and similar debris at an approved disposal area approved by proper authority.

3.3 AGGREGATE PLACEMENT

A. Place base aggregate and aggregate surface in maximum 6-inch layers.

B. Roller compact aggregate to specified maximum density.

C. Level and contour surfaces to elevations, profiles, and gradients indicated.

D. Add small quantities of fine aggregate or moisture to coarse aggregate when required to assist compaction.

E. Maintain optimum moisture content of fill materials to attain specified compaction density.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum Variation From Flat Surface: 3/8 inch measured with 10 foot straight edge.

B. Maximum Variation From Thickness: 1/4 inch.

C. Maximum Variation From Elevation: 3/8 inch.

3.5 FIELD QUALITY CONTROL

A. Owner will provide compaction testing. It will be performed in accordance with ASTM D1556, ASTM D1557, ASTM D698, AASHTO T180, ASTM D2167, ASTM D2922, or ASTM D3017.

B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest, at no cost to Owner.

C. Frequency of Tests: Owner’s Tester shall perform one test for every 2000 square feet of each layer of compacted aggregate.

D. Contractor is required to provide a 3 business day notice prior to paving, but subsequent to the installation, grading and compaction of all aggregate base course scheduled to be paved.

E. Contractor shall meet density requirements without impeding the cross section or elevation of the finished base course. The Contractor, at no expense to the Owner, shall correct any variation from tolerances resulting in compaction efforts. Under no circumstances shall Contractor proceed with paving prior to base course approval by Engineer.

3.6 SCHEDULES

A. Asphalt Paving Base Course:
   1. Compact placed aggregate material Type A5, in one 12 inch lift, uniformly to achieve minimum 95 percent of maximum density.
   2. Compact placed aggregate material Type A7, in one 8 inch lift, uniformly to achieve minimum 98 percent of maximum density. Material to be placed in a maximum lift of 8 inches.

B. Concrete Base Course:
   1. Sidewalk: Compact placed aggregate material Type A5, in one 12 inch lift, uniformly to achieve minimum 95 percent of maximum density.

C. Surface Aggregate:
   1. Compact placed aggregate material Type A3 in 6” thick lifts, uniformly to achieve 95 percent of maximum density.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.
6. Pavement Removal.

B. Related Requirement:
1. Section 31 22 13 - Rough Grading
2. Section 31 23 23 - Fill
3. Section 32 11 23 - Aggregate Base Courses
4. Section 32 17 23 – Pavement Markings

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

C. ASTM International:
1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.

4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results, from within the last 12 months, supporting design.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Conform to current MDOT Standard Specifications for Construction..

B. Obtain materials from same source throughout.

C. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt mixture between November 1 and June 1.

B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

PART 2 PRODUCTS

2.1 ASPHALT MATERIALS

A. Asphalt Binder: performance grade PG 58-28.

B. Asphalt Binder: In accordance with current MDOT Standard Specifications for Construction.

C. Tack Coat: In accordance with current MDOT Standard Specifications for Construction.

D. Oil: In accordance with current MDOT Standard Specifications for Construction.

2.2 AGGREGATE MATERIALS:

A. Coarse Aggregate: In accordance with current MDOT Standard Specifications for Construction.

B. Fine Aggregate: In accordance with current MDOT Standard Specifications for Construction.

C. Mineral Filler: ASTM D242 or AASHTO M17; finely ground mineral particles, free of foreign matter.

2.3 MIXES

A. Asphalt Paving Mixtures: Designed in accordance with current MDOT Standard Specifications for Construction. Highways, Public Work's standards.
   1. Base Course: HMA, 4E1.
   2. Wearing Course: HMA, 4E1.

2.4 SOURCE QUALITY CONTROL

A. Submit proposed mix design of each class of mix for review prior to beginning of Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

B. Verify compacted granular base is dry and ready to support paving and imposed loads.
   1. Proof roll subbase with minimum two perpendicular passes to identify soft spots.
   2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23.

C. Verify gradients and elevations of base are correct.

D. Contractor shall notify Owner and Engineer 3 business days prior to placing pavement.

E. Verify manhole frames and covers are installed in correct position and elevation.

3.2 INSTALLATION

A. Base:
   1. Prepare 8” aggregate base in accordance with current MDOT Standard Specifications for Construction.

B. Subbase:
   1. Prepare 12” subbase in accordance with current MDOT Standard Specifications for Construction.

C. Tack Coat:
   1. Apply tack coat in accordance with current MDOT Standard Specifications for Construction, at a rate of 0.1 gal/SYD.
   2. Apply tack coat to contact surfaces of curbs and gutters.
   3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

D. Single Course Asphalt Paving
   1. Install work in accordance with MDOT Standard Specifications for Construction.
   2. Place asphalt within 24 hours of applying tack coat.
   3. Place wearing course to compacted thickness indicated on Drawings.
   4. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
   5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

E. Double Course Asphalt Paving:
   1. Place asphalt binder course within 24 hours of applying primer or tack coat.
   2. Place binder course to 1.5 inches compacted thickness.
   3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

4. Place wearing course to 1.5 inches compacted thickness.
5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.3 PAVEMENT REMOVAL

A. Remove curb, gutter, and sidewalk to nearest joint.

B. All existing pavement within the proposed asphalt paving limits shall be removed by saw cutting vertically in straight lines at the locations shown on the plans. The pavement shall be carefully removed without disturbing the pavement that is to remain. If there is an existing transverse joint in the pavement within 10 feet of the plan limits, the pavement will be removed to that joint to prevent multiple joints in close proximity.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from Indicated Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Owner’s tester shall take samples and perform test procedures in accordance with current MDOT Standard Specifications for Construction for verification of construction prior to payment.

B. Asphalt Paving Mix Temperature: Measure temperature at time of placement.

C. Owner shall provide Asphalt Paving Density testing using ASTM D2950 nuclear method; test one location for every 2000 square feet compacted paving.

D. Core samples may be taken by the Engineer. These core samples will be used to verify the final pavement thickness. Any pavement less than 1/4 inch of the specified thickness as determined by core sampling shall be paid at the unit price bid less 25% for each area determined to be insufficient in thickness. Additional core samples at 100' x 100’ grid pattern in the pavement may be taken as directed by the Engineer to determine the extent of area that is found to be deficient in thickness. Any area that is found to be less than 2 1/2" in thickness shall either be removed and replaced with a pavement of the proper thickness or shall be milled and capped with a 1" minimum thickness as directed by the Engineer. There shall be no extra payment for any necessary repaving.

3.6 PROTECTION OF FINISHED WORK

A. Immediately after placement, protect paving from mechanical injury for 8 hours or until surface temperature is less than 140 degrees F.

3.7 SCHEDULES

A. 3 inch Asphalt Pavement: Place in two separate lifts. The initial lift is to follow leveling course requirements with an application rate of 165#/square yard and the second lift shall follow top course requirements with an application rate of 165#/square yard. Compaction shall be 97% maximum density on all Asphalt Pavement.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course.
   2. Concrete paving for:
      a. Concrete sidewalks.
      b. Concrete stair steps.
      c. Concrete curbs and gutters.
      d. Concrete parking lots.
      e. Concrete driveways.

B. Related Sections:
   1. Section 03 30 00 – Cast-in-Place Concrete.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 23 - Fill.
   4. Section 32 11 23 – Aggregate Base Courses.
   5. Section 32 12 16 – Asphalt Paving.
   6. Section 32 92 19 - Seeding.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
   1. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   7. ASTM C33 - Standard Specification for Concrete Aggregates.

8. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
10. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
11. ASTM C150 - Standard Specification for Portland Cement.
12. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
13. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
15. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
16. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
17. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
20. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
21. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
22. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
23. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
24. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

A. Product Data:
   1. Submit data on concrete materials, joint filler, admixtures, and curing compounds.

B. Design Data:
   1. Submit concrete mix design and break results from within the last 12 months for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Obtain cementitious materials from same source throughout.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form Materials: Conform to ACI.

B. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/2 inch thick.

2.2 REINFORCING

A. Deformed Reinforcing: Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, uncoated finish.

B. Welded Plain Wire Fabric: ASTM A185; in flat sheets or coiled rolls; unfinished.

C. Dowels: ASTM A615; 60 ksi yield strength, plain steel bars; cut to length indicated on Drawings, square ends with burrs removed; unfinished.

D. Tie Wire: Minimum 16 gage annealed type.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I – Normal, Type IA - Air Entraining, gray color.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: ASTM C94; potable, without deleterious amounts of chloride ions.

D. Air Entrainment: ASTM C260.

E. Chemical Admixture: ASTM C494.
   1. Type A - Water Reducing.
   2. Type B - Retarding.
   3. Type C - Accelerating.

F. Fly Ash: ASTM C618.

G. Plasticizing: ASTM C1017 Type I, plasticizing.

2.4 ACCESSORIES

A. Curing Compound: ASTM C309.

2.5 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Provide concrete to the following mix design:

Unit	Measurement
Compressive Strength (7 day)	2800 psi
Compressive Strength (28 day)	4000 psi
Cement Content (minimum)	564 pounds/cu yd (6 sack)
Coarse Aggregate	1700-1900 lbs
Fine Aggregate	1500-1600 lbs
Water/cement ratio (maximum)	0.4-0.5
Aggregate Size (maximum)	MDOT 6A
Aggregate Size (minimum)	MDOT 2NS
Slump	Less than 4 inches plus or minus 1 inch
Air Entrainment	4-6 percent

B. Do not use calcium chloride.

2.6 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.

B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 32 33 – Photographic Documentation: Verification of existing conditions before starting work.

B. Verify compacted subbase is dry and ready to support paving and imposed loads.
   1. Proof roll subbase in minimum two perpendicular passes to identify soft spots.
   2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23.

C. Verify gradients and elevations of base are correct.

D. Remove tree roots under walks to a depth of 6” below finished grade.

3.2 SUBBASE

A. Prepare subbase in accordance with current MDOT Standard Specifications for Construction.

3.3 PREPARATION

A. Moisten substrate to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms and screeds to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

3.5 REINFORCING

A. Place reinforcing as indicated on Drawings.

B. Interrupt reinforcing at expansion joints.

C. Place dowels to achieve paving and curb alignment as detailed.

3.6 PLACING CONCRETE

A. Place concrete in accordance with ACI 301, as specified in Section 03 30 00.

B. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Place concrete to pattern indicated.

3.7 JOINTS

A. Place expansion joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch.

C. Provide sawn joints at 5 feet intervals.

D. Provide keyed joints as indicated.

E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.8 FINISHING

A. Driveway and Sidewalk Paving: Light broom, radius to1/2 inch radius, and trowel joint edges.

B. Curbs and Gutters: Light broom.

C. Inclined Vehicular Ramps: Broomed perpendicular to slope.

D. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 301.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/2 inch.

3.11 FIELD QUALITY CONTROL

A. Inspect reinforcing placement for size, spacing, location, support.

B. Owner's testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

C. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens, standard cured.
   3. Tester shall perform one set of cylinders per concrete pour for sidewalk and entry aprons.
   4. Make one additional cylinder during cold weather concreting, and field cure on-site under same conditions as concrete it represents.

D. Field Testing:
   1. Slump Test Method: ASTM C143.

2. Air Content Test Method: ASTM C173, ASTM C231.
3. Temperature Test Method: ASTM C1064.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

E. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39.
2. Test Acceptance: Average compressive strength of three consecutive test maximum 500 psi less than specified compressive strength.
3. Test one cylinder at 7 days.
4. Test two cylinders at 28 days.
5. Dispose remaining cylinders when testing is not required.

F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit vehicular traffic over paving for 7 days minimum after finishing.

3.13 SCHEDULE

A. Thickness of concrete drive entrances at parkinglot
1. Drive Entrance: 8 inches.

B. Thickness of concrete Delivery Ramp
1. Delivery Ramp: 8 inches

C. Thickness of concrete sidewalks
1. Delivery Ramp: 5 inches

D. Concrete Curb per detail

E. Width, unless otherwise notes, match existing.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Traffic lines and markings.
   2. Parking Stalls and Pedestrian Markings
   3. Legends.
   4. Paint.

B. Related Sections:
   1. Section 32 12 16 - Asphalt Paving.
   2. Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D34 - Standard Guide for Chemical Analysis of White Pigments.
   2. ASTM D126 - Standard Test Methods for Analysis of Yellow, Orange, and Green Pigments Containing Lead Chromate and Chromium Oxide Green.
   3. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
   4. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
   5. ASTM D713 - Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials.
   6. ASTM D969 - Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
   7. ASTM D1301 - Standard Test Methods for Chemical Analysis of White Lead Pigments.
   8. ASTM D1394 - Standard Test Methods for Chemical Analysis of White Titanium Pigments.
   9. ASTM D1475 - Standard test Method for Density of Liquid Coatings, Inks, and Related Products.
   10. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
   11. ASTM D2202 - Standard Test Method for Slump of Sealants.
   12. ASTM D2371 - Standard Test Method for Pigment Content of Solvent-Reducible Paints.
   13. ASTM D2621 - Standard Test Method for Infrared Identification of Vehicle Solids From Solvent-Reducible Paints.
   14. ASTM D2743 - Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography.

1.3 PERFORMANCE REQUIREMENTS

A. Paint Adhesion: Adhere to road surface forming smooth continuous film one minute after application.

B. Paint Drying: Tack free by touch so as not to require coning or other traffic control devices to prevent transfer by vehicle tires within two minutes after application.

1.4 SUBMITTALS

A. Product Data: Submit paint formulation for each type of paint.

B. Test Reports: Submit source and acceptance test results in accordance with AASHTO M247.

C. Manufacturer's Installation Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, and any other data on proper installation.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

C. Do not apply paint when temperatures are expected to fall below 50 degrees F for 24 hours after application.

D. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

1.9 WARRANTY

A. Furnish three year manufacturer's warranty for traffic paints.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of traffic paints for three years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Furnish materials in accordance with current MDOT Standard Specifications for Construction.

B. Paint: Sherwin Williams products as specified on plans.

2.2 EQUIPMENT

A. Equipment:
1. For application of pavement markings by walk behind stripers, hand spray, or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers. Optionally apply glass beads by hand.

2.3 EXAMINATION

A. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

2.4 PREPARATION

A. Maintenance and Protection of Traffic:
1. Provide short term traffic control as needed.
2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.
3. Maintain access to existing businesses and other properties requiring access.

B. Surface Preparation.
1. Clean and dry paved surface prior to painting.
2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet on center.
4. Notify Architect/Engineer after placing pavement spots and minimum 3 days prior to applying traffic lines.

2.5 DEMOLITION

A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with blank paint. Remove by methods that will cause least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.

B. Clean and repair existing remaining lines and legends, within the project limits.

2.6 APPLICATION

A. Agitate paint for 1-15 minutes prior to application to ensure even distribution of paint pigment.

B. Dispense paint at ambient degrees F to wet-film thickness of 15 mils, except dispense edge markings to wet-film thickness of 12 mils.

C. Apply markings to indicated dimensions at indicated locations.

D. Prevent splattering and over spray when applying markings.

E. Unless material is track free at end of paint application convoy, use traffic cones to protect markings from traffic until track free. When vehicle crosses a marking and tracks it or when splattering or over spray occurs, eradicate affected marking and resultant tracking and apply new markings.

F. Collect and legally dispose of residues from painting operations.

G. Install Work in accordance with current MDOT Standard Specifications for Construction.

2.7 APPLICATION TOLERANCES

A. Maximum Variation from Wet Film Thickness: 1 mil.

B. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch.

C. Maximum Variation from Specified Application Temperature: Plus or minus 5 degrees F

2.8 FIELD QUALITY CONTROL

A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

B. Repair lines and markings, which after application and curing do not meet following criteria:
   1. Incorrect Location: Remove and replace incorrectly placed patterns.
   2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.

3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

C. Replace defective pavement markings as specified throughout 1year warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, snow plowing or other loss of marking material regardless of cause. When markings are damaged by pavement failure or by Owner's painting, crack sealing, or pavement repair operations, Contractor is released from warranty requirements for damaged work.

D. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need replaced. Provide traffic control as necessary if markings require more detailed evaluation.

E. Replace pavement marking material under warranty using original or better type material. Continue warranty to end of original 1 year period even when replacement materials have been installed as specified.

F. When eradication of existing paint lines is necessary, eradicate by shot blast or water blast method. Do not gouge or groove pavement more than 1/16 inch during removal. Limit area of removal to area of marking plus 1 inch on all sides. Prevent damage to transverse and longitudinal joint sealers, and repair any damage according to requirements in Section 32 13 13 or Section 32 12 16.

G. Maintain daily log showing work completed, results of above inspections or tests, pavement and air temperatures, relative humidity, presence of any moisture on pavement, and any material or equipment problems. Make legible entries in log in ink, sign and submit by end of each work day. Enter environmental data into log prior to starting work each day and at two additional times during day.

2.9 PROTECTION OF FINISHED WORK

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

2.10 MAINTENANCE

A. Furnish service and maintenance of traffic paints for one year from Date of Substantial Completion.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate subbase.
   2. Aggregate base course.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 32 12 16 - Asphalt Paving.(not used)
   6. Section 32 13 13 - Concrete Paving.
   7. Section 32 91 19 - Landscape Grading.
   8. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
   6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. Michigan Department of Transportation – current Standard Specifications for Construction.

1.3 SUBMITTALS

A. Samples: Submit one five gallon pail samples of each aggregate type for laboratory testing.

B. Materials Source: Submit name of aggregate materials suppliers. Supplier shall provide current test results verifying that supplied materials meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Base Coarse Aggregate: Fill Type A7 as specified in Section 31 05 16.

B. Surface Coarse Aggregate: Fill Type A3 as specified in Section 31 05 16.

2.2 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23.

B. Verify substrate has been inspected, gradients and elevations are correct, free of ruts or high spots.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

C. Cut abutting pavement edges to be vertical and in straight lines.

D. The Contractor shall dispose of all waste bituminous material and similar debris at an approved disposal area approved by proper authority.

3.3 AGGREGATE PLACEMENT

A. Place base aggregate and aggregate surface in maximum 6-inch layers.

B. Roller compact aggregate to specified maximum density.

C. Level and contour surfaces to elevations, profiles, and gradients indicated.

D. Add small quantities of fine aggregate or moisture to coarse aggregate when required to assist compaction.

E. Maintain optimum moisture content of fill materials to attain specified compaction density.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum Variation From Flat Surface: 3/8 inch measured with 10 foot straight edge.

B. Maximum Variation From Thickness: 1/4 inch.

C. Maximum Variation From Elevation: 3/8 inch.

3.5 FIELD QUALITY CONTROL

A. Owner will provide compaction testing. It will be performed in accordance with ASTM D1556, ASTM D1557, ASTM D698, AASHTO T180, ASTM D2167, ASTM D2922, or ASTM D3017.

B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest, at no cost to Owner.

C. Frequency of Tests: Owner’s Tester shall perform one test for every 2000 square feet of each layer of compacted aggregate.

D. Contractor is required to provide a 3 business day notice prior to paving, but subsequent to the installation, grading and compaction of all aggregate base course scheduled to be paved.

E. Contractor shall meet density requirements without impeding the cross section or elevation of the finished base course. The Contractor, at no expense to the Owner, shall correct any variation from tolerances resulting in compaction efforts. Under no circumstances shall Contractor proceed with paving prior to base course approval by Engineer.

3.6 SCHEDULES

A. Asphalt Paving Base Course:
   1. Compact placed aggregate material Type A5, in one 12 inch lift, uniformly to achieve minimum 95 percent of maximum density.
   2. Compact placed aggregate material Type A7, in one 8 inch lift, uniformly to achieve minimum 98 percent of maximum density. Material to be placed in a maximum lift of 8 inches.

B. Concrete Base Course:
   1. Sidewalk: Compact placed aggregate material Type A5, in one 12 inch lift, uniformly to achieve minimum 95 percent of maximum density.

C. Surface Aggregate:
   1. Compact placed aggregate material Type A3 in 6” thick lifts, uniformly to achieve 95 percent of maximum density.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.
6. Pavement Removal.

B. Related Requirement:
1. Section 31 22 13 - Rough Grading
2. Section 31 23 23 - Fill
3. Section 32 11 23 - Aggregate Base Courses
4. Section 32 17 23 – Pavement Markings

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

C. ASTM International:
1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.

4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results, from within the last 12 months, supporting design.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Conform to current MDOT Standard Specifications for Construction..

B. Obtain materials from same source throughout.

C. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt mixture between November 1 and June 1.

B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

PART 2 PRODUCTS

2.1 ASPHALT MATERIALS

A. Asphalt Binder: performance grade PG 58-28.

B. Asphalt Binder: In accordance with current MDOT Standard Specifications for Construction.

C. Tack Coat: In accordance with current MDOT Standard Specifications for Construction.

D. Oil: In accordance with current MDOT Standard Specifications for Construction.

2.2 AGGREGATE MATERIALS:

A. Coarse Aggregate: In accordance with current MDOT Standard Specifications for Construction.

B. Fine Aggregate: In accordance with current MDOT Standard Specifications for Construction.

C. Mineral Filler: ASTM D242 or AASHTO M17; finely ground mineral particles, free of foreign matter.

2.3 MIXES

A. Asphalt Paving Mixtures: Designed in accordance with current MDOT Standard Specifications for Construction. Highways, Public Work's standards.
   1. Base Course: HMA, 4E1.
   2. Wearing Course: HMA, 4E1.

2.4 SOURCE QUALITY CONTROL

A. Submit proposed mix design of each class of mix for review prior to beginning of Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

B. Verify compacted granular base is dry and ready to support paving and imposed loads.
   1. Proof roll subbase with minimum two perpendicular passes to identify soft spots.
   2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23.

C. Verify gradients and elevations of base are correct.

D. Contractor shall notify Owner and Engineer 3 business days prior to placing pavement.

E. Verify manhole frames and covers are installed in correct position and elevation.

3.2 INSTALLATION

A. Base:
   1. Prepare 8” aggregate base in accordance with current MDOT Standard Specifications for Construction.

B. Subbase:
   1. Prepare 12” subbase in accordance with current MDOT Standard Specifications for Construction.

C. Tack Coat:
   1. Apply tack coat in accordance with current MDOT Standard Specifications for Construction, at a rate of 0.1 gal/SYD.
   2. Apply tack coat to contact surfaces of curbs and gutters.
   3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

D. Single Course Asphalt Paving
   1. Install work in accordance with MDOT Standard Specifications for Construction.
   2. Place asphalt within 24 hours of applying tack coat.
   3. Place wearing course to compacted thickness indicated on Drawings.
   4. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
   5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

E. Double Course Asphalt Paving:
   1. Place asphalt binder course within 24 hours of applying primer or tack coat.
   2. Place binder course to 1.5 inches compacted thickness.
   3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

4. Place wearing course to 1.5 inches compacted thickness.
5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.3 PAVEMENT REMOVAL

A. Remove curb, gutter, and sidewalk to nearest joint.

B. All existing pavement within the proposed asphalt paving limits shall be removed by saw cutting vertically in straight lines at the locations shown on the plans. The pavement shall be carefully removed without disturbing the pavement that is to remain. If there is an existing transverse joint in the pavement within 10 feet of the plan limits, the pavement will be removed to that joint to prevent multiple joints in close proximity.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from Indicated Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Owner’s tester shall take samples and perform test procedures in accordance with current MDOT Standard Specifications for Construction for verification of construction prior to payment.

B. Asphalt Paving Mix Temperature: Measure temperature at time of placement.

C. Owner shall provide Asphalt Paving Density testing using ASTM D2950 nuclear method; test one location for every 2000 square feet compacted paving.

D. Core samples may be taken by the Engineer. These core samples will be used to verify the final pavement thickness. Any pavement less than 1/4 inch of the specified thickness as determined by core sampling shall be paid at the unit price bid less 25% for each area determined to be insufficient in thickness. Additional core samples at 100' x 100’ grid pattern in the pavement may be taken as directed by the Engineer to determine the extent of area that is found to be deficient in thickness. Any area that is found to be less than 2 1/2" in thickness shall either be removed and replaced with a pavement of the proper thickness or shall be milled and capped with a 1" minimum thickness as directed by the Engineer. There shall be no extra payment for any necessary repaving.

3.6 PROTECTION OF FINISHED WORK

A. Immediately after placement, protect paving from mechanical injury for 8 hours or until surface temperature is less than 140 degrees F.

3.7 SCHEDULES

A. 3 inch Asphalt Pavement: Place in two separate lifts. The initial lift is to follow leveling course requirements with an application rate of 165#/square yard and the second lift shall follow top course requirements with an application rate of 165#/square yard. Compaction shall be 97% maximum density on all Asphalt Pavement.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course.
   2. Concrete paving for:
      a. Concrete sidewalks.
      b. Concrete stair steps.
      c. Concrete curbs and gutters.
      d. Concrete parking lots.
      e. Concrete driveways.

B. Related Sections:
   1. Section 03 30 00 – Cast-in-Place Concrete.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 23 - Fill.
   4. Section 32 11 23 – Aggregate Base Courses.
   5. Section 32 12 16 – Asphalt Paving.
   6. Section 32 92 19 - Seeding.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
   1. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   7. ASTM C33 - Standard Specification for Concrete Aggregates.

8. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
10. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
11. ASTM C150 - Standard Specification for Portland Cement.
12. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
13. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
15. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
16. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
17. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
20. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
21. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
22. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
23. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
24. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

A. Product Data:
   1. Submit data on concrete materials, joint filler, admixtures, and curing compounds.

B. Design Data:
   1. Submit concrete mix design and break results from within the last 12 months for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Obtain cementitious materials from same source throughout.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form Materials: Conform to ACI.

B. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/2 inch thick.

2.2 REINFORCING

A. Deformed Reinforcing: Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, uncoated finish.

B. Welded Plain Wire Fabric: ASTM A185; in flat sheets or coiled rolls; unfinished.

C. Dowels: ASTM A615; 60 ksi yield strength, plain steel bars; cut to length indicated on Drawings, square ends with burrs removed; unfinished.

D. Tie Wire: Minimum 16 gage annealed type.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I – Normal, Type IA - Air Entraining, gray color.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: ASTM C94; potable, without deleterious amounts of chloride ions.

D. Air Entrainment: ASTM C260.

E. Chemical Admixture: ASTM C494.
   1. Type A - Water Reducing.
   2. Type B - Retarding.
   3. Type C - Accelerating.

F. Fly Ash: ASTM C618.

G. Plasticizing: ASTM C1017 Type I, plasticizing.

2.4 ACCESSORIES

A. Curing Compound: ASTM C309.

2.5 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Provide concrete to the following mix design:

Unit	Measurement
Compressive Strength (7 day)	2800 psi
Compressive Strength (28 day)	4000 psi
Cement Content (minimum)	564 pounds/cu yd (6 sack)
Coarse Aggregate	1700-1900 lbs
Fine Aggregate	1500-1600 lbs
Water/cement ratio (maximum)	0.4-0.5
Aggregate Size (maximum)	MDOT 6A
Aggregate Size (minimum)	MDOT 2NS
Slump	Less than 4 inches plus or minus 1 inch
Air Entrainment	4-6 percent

B. Do not use calcium chloride.

2.6 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.

B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 32 33 – Photographic Documentation: Verification of existing conditions before starting work.

B. Verify compacted subbase is dry and ready to support paving and imposed loads.
   1. Proof roll subbase in minimum two perpendicular passes to identify soft spots.
   2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23.

C. Verify gradients and elevations of base are correct.

D. Remove tree roots under walks to a depth of 6” below finished grade.

3.2 SUBBASE

A. Prepare subbase in accordance with current MDOT Standard Specifications for Construction.

3.3 PREPARATION

A. Moisten substrate to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms and screeds to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

3.5 REINFORCING

A. Place reinforcing as indicated on Drawings.

B. Interrupt reinforcing at expansion joints.

C. Place dowels to achieve paving and curb alignment as detailed.

3.6 PLACING CONCRETE

A. Place concrete in accordance with ACI 301, as specified in Section 03 30 00.

B. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Place concrete to pattern indicated.

3.7 JOINTS

A. Place expansion joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch.

C. Provide sawn joints at 5 feet intervals.

D. Provide keyed joints as indicated.

E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.8 FINISHING

A. Driveway and Sidewalk Paving: Light broom, radius to1/2 inch radius, and trowel joint edges.

B. Curbs and Gutters: Light broom.

C. Inclined Vehicular Ramps: Broomed perpendicular to slope.

D. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 301.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/2 inch.

3.11 FIELD QUALITY CONTROL

A. Inspect reinforcing placement for size, spacing, location, support.

B. Owner's testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

C. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens, standard cured.
   3. Tester shall perform one set of cylinders per concrete pour for sidewalk and entry aprons.
   4. Make one additional cylinder during cold weather concreting, and field cure on-site under same conditions as concrete it represents.

D. Field Testing:
   1. Slump Test Method: ASTM C143.

2. Air Content Test Method: ASTM C173, ASTM C231.
3. Temperature Test Method: ASTM C1064.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

E. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39.
2. Test Acceptance: Average compressive strength of three consecutive test maximum 500 psi less than specified compressive strength.
3. Test one cylinder at 7 days.
4. Test two cylinders at 28 days.
5. Dispose remaining cylinders when testing is not required.

F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit vehicular traffic over paving for 7 days minimum after finishing.

3.13 SCHEDULE

A. Thickness of concrete drive entrances at parkinglot
1. Drive Entrance: 8 inches.

B. Thickness of concrete Delivery Ramp
1. Delivery Ramp: 8 inches

C. Thickness of concrete sidewalks
1. Delivery Ramp: 5 inches

D. Concrete Curb per detail

E. Width, unless otherwise notes, match existing.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Traffic lines and markings.
   2. Parking Stalls and Pedestrian Markings
   3. Legends.
   4. Paint.

B. Related Sections:
   1. Section 32 12 16 - Asphalt Paving.
   2. Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D34 - Standard Guide for Chemical Analysis of White Pigments.
   2. ASTM D126 - Standard Test Methods for Analysis of Yellow, Orange, and Green Pigments Containing Lead Chromate and Chromium Oxide Green.
   3. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
   4. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
   5. ASTM D713 - Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials.
   6. ASTM D969 - Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
   7. ASTM D1301 - Standard Test Methods for Chemical Analysis of White Lead Pigments.
   8. ASTM D1394 - Standard Test Methods for Chemical Analysis of White Titanium Pigments.
   9. ASTM D1475 - Standard test Method for Density of Liquid Coatings, Inks, and Related Products.
   10. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
   11. ASTM D2202 - Standard Test Method for Slump of Sealants.
   12. ASTM D2371 - Standard Test Method for Pigment Content of Solvent-Reducible Paints.
   13. ASTM D2621 - Standard Test Method for Infrared Identification of Vehicle Solids From Solvent-Reducible Paints.
   14. ASTM D2743 - Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography.

1.3 PERFORMANCE REQUIREMENTS

A. Paint Adhesion: Adhere to road surface forming smooth continuous film one minute after application.

B. Paint Drying: Tack free by touch so as not to require coning or other traffic control devices to prevent transfer by vehicle tires within two minutes after application.

1.4 SUBMITTALS

A. Product Data: Submit paint formulation for each type of paint.

B. Test Reports: Submit source and acceptance test results in accordance with AASHTO M247.

C. Manufacturer's Installation Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, and any other data on proper installation.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

C. Do not apply paint when temperatures are expected to fall below 50 degrees F for 24 hours after application.

D. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

1.9 WARRANTY

A. Furnish three year manufacturer's warranty for traffic paints.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of traffic paints for three years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Furnish materials in accordance with current MDOT Standard Specifications for Construction.

B. Paint: Sherwin Williams products as specified on plans.

2.2 EQUIPMENT

A. Equipment:
1. For application of pavement markings by walk behind stripers, hand spray, or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers. Optionally apply glass beads by hand.

2.3 EXAMINATION

A. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

2.4 PREPARATION

A. Maintenance and Protection of Traffic:
1. Provide short term traffic control as needed.
2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.
3. Maintain access to existing businesses and other properties requiring access.

B. Surface Preparation.
1. Clean and dry paved surface prior to painting.
2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet on center.
4. Notify Architect/Engineer after placing pavement spots and minimum 3 days prior to applying traffic lines.

2.5 DEMOLITION

A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with blank paint. Remove by methods that will cause least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.

B. Clean and repair existing remaining lines and legends, within the project limits.

2.6 APPLICATION

A. Agitate paint for 1-15 minutes prior to application to ensure even distribution of paint pigment.

B. Dispense paint at ambient degrees F to wet-film thickness of 15 mils, except dispense edge markings to wet-film thickness of 12 mils.

C. Apply markings to indicated dimensions at indicated locations.

D. Prevent splattering and over spray when applying markings.

E. Unless material is track free at end of paint application convoy, use traffic cones to protect markings from traffic until track free. When vehicle crosses a marking and tracks it or when splattering or over spray occurs, eradicate affected marking and resultant tracking and apply new markings.

F. Collect and legally dispose of residues from painting operations.

G. Install Work in accordance with current MDOT Standard Specifications for Construction.

2.7 APPLICATION TOLERANCES

A. Maximum Variation from Wet Film Thickness: 1 mil.

B. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch.

C. Maximum Variation from Specified Application Temperature: Plus or minus 5 degrees F

2.8 FIELD QUALITY CONTROL

A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

B. Repair lines and markings, which after application and curing do not meet following criteria:
   1. Incorrect Location: Remove and replace incorrectly placed patterns.
   2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.

3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

C. Replace defective pavement markings as specified throughout 1year warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, snow plowing or other loss of marking material regardless of cause. When markings are damaged by pavement failure or by Owner's painting, crack sealing, or pavement repair operations, Contractor is released from warranty requirements for damaged work.

D. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need replaced. Provide traffic control as necessary if markings require more detailed evaluation.

E. Replace pavement marking material under warranty using original or better type material. Continue warranty to end of original 1 year period even when replacement materials have been installed as specified.

F. When eradication of existing paint lines is necessary, eradicate by shot blast or water blast method. Do not gouge or groove pavement more than 1/16 inch during removal. Limit area of removal to area of marking plus 1 inch on all sides. Prevent damage to transverse and longitudinal joint sealers, and repair any damage according to requirements in Section 32 13 13 or Section 32 12 16.

G. Maintain daily log showing work completed, results of above inspections or tests, pavement and air temperatures, relative humidity, presence of any moisture on pavement, and any material or equipment problems. Make legible entries in log in ink, sign and submit by end of each work day. Enter environmental data into log prior to starting work each day and at two additional times during day.

2.9 PROTECTION OF FINISHED WORK

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

2.10 MAINTENANCE

A. Furnish service and maintenance of traffic paints for one year from Date of Substantial Completion.

END OF SECTION

SECTION 32 91 19

LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final grade topsoil for finish landscaping.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 17 - Trenching.
   3. Section 31 23 23 - Fill.
   4. Section 32 92 19 - Seeding.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Samples: Submit in air-tight container, one five-gallon pail sample of each type of topsoil to Engineer for approval.

C. Materials Source: Submit name of imported materials source.

1.3 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. Perform Work in accordance with current MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil: Fill Type S4 or S5 as specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

D. Verify Engineer has approved topsoil samples prior to starting work or placing any topsoil.

3.2 PREPARATION

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

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

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of ½ inch in size. Remove contaminated subsoil.

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

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding is required, to nominal depth of 6 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material, buildings, and paving to prevent damage.

E. Roll placed topsoil.

F. Shape and blend surplus topsoil to site as directed by Engineer or remove per Section 31 05 13.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01 40 00 – Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus ½ inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 – Contract Closeout: Requirements for protecting finished work.

B. Prohibit construction traffic over topsoil.

C. Reshape if rutted by vehicular traffic or washouts, at no cost to Owner.

3.7 SCHEDULES

A. Compacted, screened topsoil thicknesses:
1. Seeded Grass: ~~6~~ **4** inches.

END OF SECTION

DIVISION 33

UTILITIES

SECTION

33 05 23	DIRECTIONAL BORE TRENCHLESS PIPE INSTALLATION
33 05 13	MANHOLES AND STRUCTURES
33 11 16	WATER DISTRIBUTION PIPING
33 13 00	WATER MAIN DISENFECTION
33 31 00	SANITARY UTILITY SEWERAGE PIPING
33 41 00	STORM UTILITY DRAINAGE PIPING
33 71 73	ELECTRICAL UTILITY SERVICES

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular precast reinforced concrete manhole and structure sections with tongue-and-groove joints, eccentric cone section, covers, anchorage, and accessories for manholes, catch basins and inlet structures.
2. Modular precast reinforced concrete sections with tongue-and-groove joints, flat top, cover and accessories for lift stations and valve manholes.
3. Bedding and cover materials.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork: Soil for backfill in trenches.
2. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
3. Section 31 23 16 - Excavation: Excavating for manholes and structures.
4. Section 31 23 19 - Dewatering:
5. Section 31 23 23 - Fill: Backfilling after manhole and structure installation.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 318 - Building Code Requirements for Structural Concrete.
2. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C55 - Standard Specification for Concrete Brick.
4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
6. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
7. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
8. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
9. ASTM D3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells.

1.3 SUBMITTALS

A. Shop Drawings: Indicate manhole and structure locations, I.D. number, elevations, piping, and sizes and elevations of penetrations.

B. Product Data: 1) Provide certification of quality for manhole covers, steps, boots, component construction. 2) Provide data on features, configuration, and dimensions with reference to internal valves, piping, etc. as appropriate.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.

B. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

C. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: ACI 530.

PART 2 PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. Manufacturers:
1. U.P. Concrete Pipe Products, Inc.
2. E.J. (Formerly East Jordan Iron Works Co.)
3. Engineer Approved Equal

B. Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478, with boots in accordance with ASTM C923. The base and bottom manhole and structure section shall be of monolithic construction.

2.2 FRAMES AND COVERS

A. Manhole and Structure Lid and Frame: ASTM A48, Class 30B Cast iron construction, machined flat bearing surface, removable lid with concealed pick hole, indented lid design; watertight sealing gasket; bolted to frame, lid molded with identifying utility name, frame clear opening 24".

2.3 COMPONENTS/ACCESSORIES

A. Manhole and Structure Steps: Formed integral with manhole and structure sections. May be ductile iron or copolymer polypropylene plastic with 1/2" diameter, grade 60 steel reinforcement.

B. Boots: ASTM C923 factory installed.

C. Chimney Seals: As required by engineer.

D. Design of Lifting Devices for Precast Components: In accordance with ASTM C913.

E. Mortar: Mortar for manhole block and for setting frames and grates shall be commercial mortar mix, supplemented with Type S concrete as an additive for additional strength. Provide mix design to Engineer for approval.

2.4 CONFIGURATION

A. Shaft Construction: Concentric barrel sections with eccentric cone top section; lipped male/female joints grooved for "o" ring; sleeved to receive pipe.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48 inch or as indicated on plans for special cases. Manhole clear opening must span at least 24 inches.

D. Design Depth: As indicated on plans.

E. Pipe Entry: Provide openings with rubber, watertight boots as indicated or required on plans. Contractor shall fill the void between the rubber boot/manhole wall and pipe with mortar so that there is a smooth transition between the pipe and manhole wall, bench/flowline. Mortar shall be broomed/troweled smooth to eliminate voids that may trap sewage or other debris.

F. Steps: 12 inches wide, 16 inches on center vertically, set into manhole/ structure wall.

2.5 BEDDING AND COVER MATERIALS

A. Bedding and Cover: A5 as specified in Section 31 05 16.

B. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1 or S2, as specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify penetrations provided for other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes and structures is correct.

D. Verify all manholes and structures are constructed with flexible waterproof joints at the pipe to manhole/structure connection. This joint shall meet the physical requirements of ASTM C-443, and the performance requirements of ASTM C-425 and C-443. The annular space between the pipe and the manhole/structure wall shall be filled with a flexible material prior to pouring the manhole/structure invert to maintain the seal flexibility. The invert channels, where not consisting of the pipe passing through the manhole/structure, shall be smooth and accurately shaped a semicircular bottom conforming to the inside of the adjacent sewer section.

E. Manhole sections shall be subject to rejection on account of failure to conform to any of the specification requirements.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Excavation and Backfill:
   1. Excavate for manholes and structures in accordance with Section 31 23 16 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes and structures in dry trench.
   3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.

B. Install manholes and structures supported at proper grade and alignment on 6-8” of Aggregate Type A1, or as shown on Drawings.

C. Backfill excavations for manholes and structures in accordance with Section 31 23 23.

D. Form and place manhole and structures/sections/cylinders plumb and level, to correct dimensions and elevations.

E. Cut and fit for pipe, conduit and sleeves.

F. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings. Base of manhole/structure to be free of water and mud or any deleterious substances.

G. Manhole bases must contain smooth, rounded flow lines and transitions, as detailed on the plans.

H. Set cover frames and covers level without tipping, to correct elevations.

I. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Lift precast components at lifting points designated by manufacturer.

B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 16.

D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections. Align manhole steps vertically with 1-inch horizontal tolerance from center.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Joint sealing materials may be installed on site or at manufacturer’s plant.

G. Verify manholes and structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.

I. Cut pipe to finish flush with interior of structure.

J. Shape inverts through manhole and structures as shown on Drawings.

K. Plug lifting holes with non-shrink grout seal, inside and out. Mortar inside joints of manhole to a smooth finish.

L. Provide adjusting rings, per plan.

M. Verify that boots are securely fastened to manhole and to pipe to provide a watertight seal.

N. Install chimney seal as recommended by the manufacture.

O. The completed manhole shall be watertight.

P. Refer to Sections 31 23 17 and 31 23 23 for trenching, backfilling and compaction requirements.

3.5 FRAME AND COVER INSTALLATION

A. Set frames using mortar and masonry. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.6 FIELD QUALITY CONTROL

A. Test concrete manhole and structure sections in accordance with ASTM C497.

B. Contractor shall notify local utility for review of constructed work for final acceptance.

3.7 SCHEDULES

A. Storm Sewer Manholes: Precast concrete sections, galvanized steel steps inside dimensions per plan, to depth indicated. Sizes as indicated and detailed on plans.

END OF SECTION

SECTION 33 05 23

DIRECTIONAL BORE TRENCHLESS PIPE INSTALLATION

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Horizontal directional drilling.

1.2 RELATED SECTIONS

A. Section 01 50 00 - Temporary Facilities and Controls

B. Section 33 11 16 – Site Water Utility Distribution Piping

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves, tracer wire and all associated accessories.

C. Submit additional information as required by DNR, ACOE, and WisDOT permit conditions.

1.4 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the work are as shown on the drawings.

B. Verify the location and elevation of the existing utilities.

C. Establish proposed utility line and grade from the control points.

1.5 REFERENCES

A. N/A

PART 2 PRODUCTS

2.1 MATERIALS

A. Polyethylene Pipe
   1. AWWA C906, SDR 11 pipe and fittings for 200 psi.
   2. ANSI/NSF Standard 14 and 61, the exterior wall must bear the NSF-PW identification or otherwise show conformance with ANSI/NSF Standards 14 and 61.
   3. Pipe – High density PE340 polyethylene resin

4. Joints – Butt fusion, flanged adapter, electrofusion coupler, compression or mechanical joint adapter with stainless steel stiffener to connect to other water main.
5. Install tracer wire with all polyethylene pipe.

B. Tracer Wire

1. Tracer wire shall be 10 gauge insulated copper clad ~~stainless~~ steel wire. It shall have a blue coating with a minimum thickness of 45 mils. If one tracer wire is to be pulled, tracer wire shall have a minimum breaking load (tensile) of 2000 pounds. If two tracer wires are pulled, tracer wires shall have a minimum breaking load (tensile) of 1100 pounds.
2. All tracer wire accessories (i.e. direct bury wire connectors) shall be approved by the tracer wire manufacturer. This approval must be documented and provided to Engineer.
3. Tracer wire box shall have a blue cast iron lid.
4. Gate Valve Box Tracer Wire Clips KIT# GVTC-8000 by Vait Products, or Engineer approved equal product.

PART 3 EXECUTION

3.1 HORIZONTAL DIRECTIONAL DRILL

A. DIRECTIONAL DRILLING

1. The drilling process shall be by mechanical cutting using a drill bit (cutting head) capable of drilling in rock and cobble.
2. A bentonite slurry shall be used to transport drill cuttings to the surface, stabilize the hole against collapse, lubricate and cool the cutting head.
3. The cutting head shall provide directional steering and monitoring of the actual position for a pipeline that is not straight.
4. During drilling of the pilot hole, continuously monitor the location of the cutting head and record depths and locations at a maximum of 50 foot (20 foot when crossing US-41 and M-38) intervals to be used for as-built information. Depths and locations shall be painted on the ground in paved areas. Depths and locations shall be marked on/ with stakes (provided by Engineer) when not drilling beneath a paved surface.
5. The pilot hole exit shall provide an accuracy of 2 feet left or right from that shown on the drawings.
6. Vertical deviations from the water main profile of more than 1’ shallower and 2’ deeper, without Engineer’s approval, shall be reinstalled.
7. For Gravity Sewer Pipe, vertical divergence from plan grade by 50% or more of nominal pipe diameter along the pipe, or pipe sags with more than ½ full pipe will be unacceptable and will not be paid for. Vertical Divergence from plan grade at manhole locations by one nominal pipe diameter or greater will be unacceptable and will not be paid for. The Contractor shall remove such bored sewer pipe and reinstall the directionally bored sewer pipe.
8. Fill the annular space between the borehole and the carrier pipe with bentonite slurry.
9. Bentonite Slurry and Cuttings:
    a. Collect slurry and cuttings by mobile spoils recovery equipment and remove from the site.
    b. Dispose of spoils at an upland site acceptable to the Owner, Engineer, and DNR.

Spoils shall be disposed of in a manner to protect local, state and federal wetlands, streams, and all other bodies of water from potential bentonite contamination caused by erosion.

c. Do not dispose of drill cuttings (spoils) into sanitary, storm or other public drainage system.

d. Do not permit spoils to flow over land and contain all materials within the work area.

e. Upon completion of the boring and pipe installation, remove all spoils from the starting and termination pits. Restore pits to their original condition.

f. Cover stockpiled material when not being used to prevent runoff.

g. The pilot hole, preream and pullback operations shall be in one continuous operation.

10. Insulated 10 gauge copper clad steel trace wire is to be pulled back with the water pipe. A minimum of one tracer wire shall be pulled when installing pipe via directional drilling method. Two may be used to ensure successful tracing operations. See Section 2.1 B.
11. Tracer wire handholes shall be manufacturer approved trace wire boxes, and shall be installed at each curb stop.
12. Tracer wire connections shall be manufacturer approved terminal ends and 3-way direct bury connectors; twist connections are not acceptable.
13. Tracer wire shall be taped to the open cut water main, hydrant leads, and water services at 10’ intervals to ensure accurate locating.
14. Tracer wire shall be installed up one valve box at each valve cluster and at each hydrant valve. The tracer wire shall be secured to the side of the valve box using Gate Valve Box Tracer Wire Clips to keep it out of the way of valve wrench entry and exit.

3.2 Additional Requirements

A. N/A

3.3 FIELD QUALITY CONTROL

A. Horizontal Directional Drilling Accuracy Verification

1. For horizontal directional drilling activities that are in excess of 200 lineal feet in length, accuracy verification of the drill heads location shall be required. The Contractor shall excavate a test pit to compare the actual horizontal and vertical locations of the drill to the readings given by the Contractors equipment. The Contractor shall verify accuracy within 75 lineal feet from the drill entry hole, and then at approximately 500’ intervals after that. Test pits shall be excavated in unimproved areas only, and their locations shall be approved by the Owner/Engineer.

END OF SECTION

SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for site water.
2. Valves.
3. Hydrants.
4. Underground pipe markers.
5. Bedding and cover materials.
6. Testing.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 19 - Dewatering
7. Section 31 23 23 - Fill
8. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
6. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
7. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
9. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

10. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
12. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

D. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C502 - Dry-Barrel Fire Hydrants.
7. AWWA C504 - Rubber-Sealed Butterfly Valves.
8. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS.
9. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
10. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
13. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
14. AWWA C702 - Cold-Water Meters - Compound Type.
15. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
17. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
18. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

E. Underwriters Laboratories Inc.:
1. UL 246 - Hydrants for Fire - Protection Service.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual depths and locations of piping mains, valves, connections, thrust restraints, and invert elevations. Provide witness measurements for each valve, corporation, curb stop and hydrant.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Provide four (4) copies of operation and maintenance manuals for equipment which requires such information.

1.5 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Perform work in accordance with owner utility standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver, store, protect and handle products to site under manufacturer recommended procedures.

C. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 WATER PIPING

A. Ductile Iron Pipe: AWWA C151, Class 350
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111, rubber gasket.
   3. Lining/Coating: Cement mortar lining and real coating.
   4. Conductivity straps: Copper. Straps also required around all valves.
   5. Factory install continuity straps, field install straps by cad weld as needed.
   6. Gaskets with conductivity wedges will not be accepted.
   7. ANSI/NSF Standard 61, the exterior wall must bear the proper ANSI/NSF identification.
   8. Install all ductile iron pipe in 8 mil polywrap.

B. Copper Tubing: ASTM B88, Type K, annealed:
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection with conductivity accessories.

C. Polyethylene Pipe
   1. See Specification Section 33 05 23, Section 2.1

D. Accessories:
1. Tapping sleeves shall be stainless steel by Romac, Smith Blair, or approved equal.
2. Couplings shall be Romac, Smith Blair, or approved equal.
3. Flange adaptors (buried) – Romac, American Ductile, or approved equal.

2.2 GATE VALVES – 3 INCHES AND OVER

A. Buried Valves: AWWA C515, ductile iron body, bronze trim, non-rising stem with square nut, single wedge, with full encapsulation – elastomer covering, resilient seat, stainless steel bolts, mechanical joint ends, control rod, extension box and valve key.

B. Waterous 2500, American Series 2500, EJ (formerly East Jordan Iron Works) Flowmaster, or approved equal.

C. Three piece, cast iron, adjustable type valve box marked “water” – American Flow Control No. 6, E.J. 8550 series, 5-1/4 inch lid, or approved equal.

D. Provide carsonite markers for valves installed in off-road locations.

E. Provide three (3) steel T-handle wrenches for operating square nut on valves.

2.3 CORPORATION STOP AND CURB STOP VALVES, COUPLINGS

A. Corporation Stops
1. First quality bronze with conductive compression connections for copper pipe Mueller Co., Cat. #H15008N, Hays Mfg. Co., or equal, no gasket.

B. Curb Stop – Minneapolis Style
1. First quality bronze pipe connections (conductive compression) the same size as body for copper pipe - Mueller Co. Cat. #H-15155N, Hays Mfg. Co., or equal.
a. Curb stops over 1" size Mueller Co. Cat. #H-15151N Oriseal curb valve, Hays Mfg. Co., or equal.
b. Each curb stop shall be furnished with a Mueller Co. Cat. #83299 stationary rod, Hays Mfg. Co., or equal.

C. Curb Stop Boxes – Minneapolis Style
1. Close grain cast iron, standard design adjustable to 7-1/2 feet - Mueller Cat. #H-10302, Hays Mfg. Co., or equal.
a. Shut-off rods - Mueller Cat. #H-10321, Hays Mfg. Co., or equal.
b. Keys - pentagon style - Mueller Cat. #H-10323, Hays Mfg. Co., or equal.

D. Couplings and Connections
1. Couplings and connections shall be copper by copper, copper by IP, and copper by plastic, as needed.
2. All fittings shall be conductive compression.

2.4 HYDRANTS (Not Used)

A. Manufacturers:
1. American Flow Control model “Waterous Pacer"; or East Jordan EJ 5BR250.

2. Or Engineers Approved Equal.

B. Hydrant: AWWA C502, UL 246, dry barrel type, inside dimension of 7-3/8 inches minimum, with minimum 5-1/4 inches diameter valve seat opening; minimum net water area of barrel not less than 190 percent of valve opening; 6 inch mechanical joint bell inlet connection with accessories, gland bolts, and gaskets. 28” break off “traffic section”. Two tapped and plugged weep holes, opens left. 1-1/2” pentagon nut with weather shield.

C. Hydrant Extensions: Fabricate for 7' 0" trench depth with rod and coupling to increase barrel length if necessary to fit field conditions per plans.

D. Hose and Pumper Connection: Two 2 1/2" hose nozzles, one 4 1/2" pumper nozzle, with National Standard Fire Hose Coupling Screw Threads. Chain keepers for nozzle caps.

E. Finish: Primer and two coats of enamel, red color.

F. Hydrant Marker Flag: 5’ long, high visibility, corrosion free, UV resistant shaft attached to spring.

G. Water Valves: For valves located off of travel way, marked “water valve”, manufactured by Carsonite International, Model CUM-375 with auxiliary barb.

2.5 PIPE INSULATION/POLYWRAP

A. When required, insulation shall be rigid 2” thick extruded polystyrene (EPS) with an “R” value of 9 or greater, 25 psi minimum compressive strength.

B. All ductile iron pipe installed by open trench method shall be encased with 8 mil linear low density (LLD) polywrap meeting AWWA C105-05.

2.6 TRACER WIRE

A. Tracer wire shall be 10 gauge insulated copper clad stainless steel wire with minimum breaking load (tensile) of 650 pounds. It shall have a blue coating with a minimum thickness of 30 mils.

B. One tracer wire shall be used when installing any none metallic pipe type.

C. All tracer wire accessories (i.e. tracer boxes, 3-way direct bury wire connectors) shall be approved by the tracer wire manufacturer. This approval must be documented and provided to Engineer.

D. Tracer wire box shall have a blue cast iron lid.

E. Gate Valve Box Tracer Wire Clips KIT# GVTC-8000 by Vait Products, or Engineer approved equal product.

2.7 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A5 as specified in Section 31 05 16.

B. Cover: Fill Type A5 as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1 or S2, as specified in Section 31 05 13. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.8 SURGE SUPPRESSOR

A. Buried Surge Suppressor: Stainless Steel body, mechanical joint connection.

B. JCM Series 800 Surge Suppressor, or Engineer approved equal.
1. Stainless steel body, carbon steel mechanical joint 6" connection.
2. Cut-in mechanical joint tee on new or existing watermain.

C. Provide carsonite marker for notification of buried surge suppressor. Surge suppressors shall not be installed under roadway.

2.9 ACCESSORIES

A. Joint restraints shall be Meg-a-Lugs or approved equal with stainless steel nuts and bolts.

B. All exposed nuts and bolts on valves and hydrants must be stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify water main size, location, and inverts are as indicated on Drawings.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions, as specified by the pipe manufacturer.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for bell, accurate barrel placement and bedding of pipe to elevations indicated.

B. Form and place concrete for pipe thrust restraints at change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil according to table on construction plans.

C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent.

D. Backfill around sides and to 12” above top of pipe with cover fill, tamp in place and compact to 95 percent.

E. Maintain optimum moisture content of fill material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with code.

B. Install pipe to indicated elevation.

C. Install ductile iron piping and fittings to AWWA C600, HDPE pipe and fittings to AWWA 906.

D. Route pipe in straight line except where shown on plans.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

G. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

H. Establish elevations of buried utility with 30 inches of cover.

I. All water main and services shall be accompanied by a copper clad stainless steel tracer wire. A single tracer wire shall be taped to open cut water main and water services at 10’ intervals to ensure accurate locating.

J. Backfill trench in accordance with Section 31 23 23.

K. Compaction effort in accordance with Section 31 23 23.

L. Restoration in accordance with Sections 32 91 19 and 32 92 19.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

D. Set hydrants to grade, with nozzles at least 36 inches above ground.

E. Locate control valve 30 inches away from hydrant.

F. Backfill and compaction in accordance with Section 31 23 23.

G. Restoration in accordance with Sections 31 91 19 and 32 91 19.

H. FIRE HYDRANTS which are in place, but not available for service shall be identified as "OUT OF SERVICE" by covering the head with a plastic bag or similar.

I. All fire hydrants shall be flushed, pumped out, and certified for use by the contractor prior to payment. Contractor shall certify in writing that hydrant is available for service. Certification shall include date, location, action taken, comments, witnesses, and space for witness (Engineer or Owner) to attest to certification.

J. When groundwater is encountered, prevent accumulation of water in the trench (Section 31 23 19). Install pipe and fittings in dry conditions.

K. All hydrant weep holes are to be plugged.

L. Tracer wire shall be installed up one valve box at each valve cluster and at each hydrant valve. The tracer wire shall be secured to the side of the valve box using Gate Valve Box Tracer Wire Clips to keep it out of the way of valve wrench entry and exit.

M. Tracer wire handholes shall be manufacturer approved trace wire boxes, and shall be installed at each curb stop.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.7 INSTALLATION – PIPE REPAIRS

A. If leaks are discovered on sections of pipe designated to remain the main shall be repaired at a negotiated price.

B. Expose leaking sections of pipe carefully, taking care not to damage pipe.

C. Dewater leaking section by isolating from upper sections to minimize loss of water.

D. Repair sections of pipe by cutting out and replacing defective sections of pipe.

3.8 REACTION BACKING

A. Mechanical joint anchors for ductile iron pipe. Welded butt or standard flange for HDPE pipe.

B. Placement of reaction backing shall be as detailed. Bearing area shall be as follows: (Square feet against trench wall in sand).

Pipe Size	Tees & Plugs	90° Els.	45° Els.	22-½° Els.	11-¼° Els.
4"	1	2	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
10"	7	9	5	3	2
12"	9	11	6	3	2
14"	11	15	8	5	3
16"	13	20	10	6	3

18"	16	25	12	7	4
20"	20	28	14	8	4
24"	28	40	20	11	6

Other Soil Conditions:

Cemented sand or hardpan: multiply above by 0.5
Gravel: multiply above by 0.7
Hard dry clay: multiply above by 0.7
Soft clay: multiply above by 2.0
Muck: Secure all fittings with the rod clamps with concrete reaction backing the same as for sand conditions.

C. When approved by the Owner, locked joint pipe, joint retainer glands, joint anchoring systems, or rod fitting types may be used instead of concrete thrust blocks.

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

3.9 TESTING

A. This work shall be considered incidental to and included in the unit price for water main. Employ experienced people or subcontractor with minimum 3 years experience.

B. Pressure test report; record:
1. Type and form of method used.
2. Date, time of start, and time of completion.
3. Test locations.
4. Initial residuals (pressures) for each outlet tested. Name of person conducting the test and inspector.
5. Indicate test passed or failed.

C. Leakage test report; record:
1. Project name, section being tested.
2. Time and date of test.
3. Name of persons conducting testing and inspecting.
4. Test locations.
5. Initial and 2 hour residual values for each outlet tested.
6. Certification that test passed or failed.

D. Continuity test; record:
1. Project name, section being testing.
2. Time and date of testing.
3. Contact points (Hydrant, valve).
4. Amperes applied at source and recorded at gage.
5. Name of persons testing and inspecting.
6. Indication if test passed or failed.

E. Pressure test system to 150 psi minimum or per minimum of this section. Repair leaks and re-test.
1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Architect/Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.

2. Provide equipment required to perform leakage and hydrostatic pressure tests.
3. Test Pressure: Not less than 150 psi or 50 psi in excess of maximum static pressure, whichever is greater.
4. Conduct hydrostatic test for at least two-hour duration.
5. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
6. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks and plug resulting piping openings.
7. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
8. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch (gauge)

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

F. Continuity Testing
1. The pipeline and hydrants shall be tested for electrical continuity and current capacity.
2. The test shall be made after hydrostatic testing is completed and while the line is at normal operating pressure.
3. A direct current of 200 amperes ± 10%, shall be passed through the section under test for a period of five minutes.
4. Current flow shall be continuously monitored with a suitable ammeter.
5. Insufficient current, excessive fluctuation, or arcing shall be indicative of defective electrical contact, and the cause shall be isolated and corrected.
6. Caution: In order to prevent inadvertent hazardous electrical grounding paths through customer's water services, the continuity test shall be conducted using a non-grounded current circuit.

G. Testing Polyethylene Pipe (per ASTM F 2164 - 13)
1. All pipeline sections under test shall be backfilled and restrained against movement if failure occurs. If failure of watermain under test occurs the result may include sudden, violent, uncontrolled, and dangerous movement of system piping or components, so personnel involved with the watermain testing must be fully informed of the hazards of field pressure testing, and all other persons should be kept a safe distance away.
2. Fill installed pipeline with potable water, bleed off any trapped air.

3. Liquid filling and pressurizing equipment such as pumps shall be provided by Contractor as necessary. Filling equipment shall be capable of filling and pressurizing the watermain to the maximum test pressure in a reasonable time. Use at least one calibrated pressure gauge or sensor accurate to within two percent (2%) of the full scale value. The full scale value shall not to be more than twice the test pressure, and the scale graduations shall not be more than 2% of the full scale value. Using a valved tee, a gauge cock for bleeding, a pressure snubber, and a duplicate, back-up pressure gauge are recommended. A continuous pressure-recording device is also recommended but not required.
4. Locate the test pressure gauge or sensor to monitor test pressure at the lowest point in the test section.
5. The maximum test pressure for the polyethylene watermain shall be equal to 150% of the system design pressure as measured at the lowest point of the test segment (110 psi minimum), and shall not exceed the pressure of the lowest pressure-rated component on the test segment (the test segment shall be selected to avoid inclusion of watermain with drastic elevation changes exceeding 10% of the design pressure, or as approved by Engineer, and if possible, low pressure-rated components shall be isolated or removed as not to influence the maximum test pressure).
6. To compensate for initial stretch, sufficient make-up water must be added to the system to maintain maximum test pressure for 4 hours.
7. Reduce test pressure by 10 psi and monitor for one (1) hour. Do not increase pressure or add make-up water.
8. If no visible leakage is observed, and pressure during the test phase remains steady (within 5% of the test phase pressure) for the 1 hour test phase period, a passing test is indicated.
9. If retesting is necessary, depressurize the test section and correct any faults or leaks in the test section.
10. Prior to testing, all curb stop valves shall be closed.
11. Initial Service Line Leak Testing (if required). The piping system should be gradually brought up to normal operating pressure, and held at normal operating pressure for at least ten (10) minutes. During this time, joint and connections may be examined for leakage.
12. If test is not completed within 8 hours, the pipe must be relaxed for 8 hours before the next testing sequence.
13. CONTRACTOR shall correct defects and repeat test until acceptable, incidental to project.
14. If maximum test pressure does not exceed design pressure, refer to ASTM F2164 – 13 for test procedure.
15. If high temperatures are affecting the test results, contact pipe manufacturer for assistance with elevated temperature pressure ratings and coordinate test revisions with Engineer.

H. The Contractor shall make necessary arrangements with the OWNER for source, measurement and payment for the water needed for these tests.

3.10 FIELD QUALITY CONTROL

A. Contractor shall prepare and submit a “Backfill Compaction” plan for approval under Sections 01 30 00, 01 33 00 and 01 40 00. The plan shall indicate how he intends to meet the compaction requirements for the various areas of backfilling (paved or unpaved) and various increments of work (backfill, paved subbase, paved base, pavement). Include methods and equipment that will be utilized.

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

C. Contractor shall contact Owner prior to performing final testing, inspection and approval of work.

END OF SECTION

SECTION 33 13 00

DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
   1. Section 33 11 16 – Site Water Utility Distribution Piping.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B301 – Liquid Chlorine
   3. AWWA B303 – Sodium Chlorite
   4. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   5. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds MDEQ – Water Division Requirements in the safe drinking water standards.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Disinfectant residuals in treated water in ppm for each sample tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological Report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Disinfectant residuals in ppm for each sample tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certify water conforms, or fails to conform, to bacterial standards of MDEQ.
   8. Two (2) consecutive negative bacteriological samples, taken as outlined below, shall constitute a passing test sequence.

D. Water Quality Certificate: Certify water conforms to quality MDEQ standards, suitable for human consumption.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651-14 (effective February 1, 2015)

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years experience.

B. Testing Firm: Company specializing in testing potable water systems, certified and approved by State of Michigan.

C. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:
   1. AWWA B300, Hypochlorite.
   2. AWWA B301, Liquid Chlorine.
   3. AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping system has been cleaned, inspected, and pressure tested.

B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. After pressure testing but prior to disinfection, the system shall be flushed at maximum intervals as determined by hydrant spacing. Flushing shall be accomplished at a pipe velocity in excess of 3.0 feet per second until the discharge is clean.

B. Provide and attach required equipment to perform the Work of this section.

C. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 11 16.

D. Inject treatment disinfectant into piping system using AWWA C651-14 continuous feed system. Prevent cross connection to existing potable water system.

E. Maintain disinfectant in system for 24 hours at not less than 25 parts per million.

F. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water. Operate valves to disinfect them.

G. Replace permanent system devices removed for disinfection.

H. Two consecutive safe bacteriological samples shall be taken in one of two ways:
   1. Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hours using the sampling site procedures outlined in AWWA C651-14. Both sets of samples must pass for the main to be approved for release.
   2. Option B: Before approving a main for release, let it sit for a minimum of 16 hours without any water use. Then collect, using the sampling procedures outlined in AWWA C651-14 and without flushing the main, two sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

I. After the main has been disinfected and accepted, flush hydrants and service lines until clean.

J. Prevent soil erosion at discharge points.

K. Contractor shall make arrangement with water supplier (Village, Township, Utility, etc.) for source, measurement and payment for water required for construction, flushing and disinfection.

L. Disinfect all cut in pipe and appurtenances prior to completing installations.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:
   1. Disinfect pipeline installation in accordance with AWWA C651-14. Use of liquid chlorine is not permitted except as used per AWWA C651-14 methods of continuous injection.
   2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
   3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
   4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.
   5. Provide analysis reports of treated and discharged water to the owner.

END OF SECTION

SECTION 33 31 00

SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewage pipe.
2. Underground pipe markers.
3. Manholes.
4. Bedding and cover materials.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 31 05 13 - Soils for Earthwork.
3. Section 31 05 16 - Aggregates for Earthwork.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.
6. Section 31 23 23 - Fill.
7. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
5. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
6. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
8. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
9. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
10. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

11. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
12. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
13. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 DEFINITIONS

A. Bedding or Bedding Envelope: Aggregate material placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating pipe materials and pipe accessories used.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Bypass pumping plan if required.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Contract Closeout: Requirements for submittals.

B. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, invert elevations and any other pertinent as-built information of value to the Owner for future reference.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the Adams Township Standards and as specified in the plans and specifications.

B. Maintain one copy of each document on site.

C. Minimum sewer and water main horizontal separation is ten feet.

D. Whenever sewer must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. If existing conditions prevent vertical separation as described above, the water main shall be relocated pursuant to detail drawings.

E. Water mains shall not be relocated below sewer lines without prior approval from the Engineer. If it is necessary, as determined by the Engineer, to relocate a water main below a sewer line, the

sewer shall be constructed of a slip-on or mechanical-joint ductile iron pipe, or PVC water main pressure pipe (SDR 18).

1.7 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated by the manufacturer.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with protection of existing utilities and restoration work of this contract.

PART 2 PRODUCTS

2.1 SANITARY SEWAGE PIPE

A. Plastic Pipe for gravity installations:

1. Plastic Pipe 8": ANSI/ASTM D3034, SDR 35, Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style rubber ring sealed gasket joints.

2. For gravity lateral installations: Plastic Pipe 6": ANSI/ASTM D3034, SDR 26, Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style for solvent cemented or gasketed joints.

3. For gravity lateral installations within 50' of a potable water well: Plastic Pipe 6": ANSI/ASTM D3034, Sch40 Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style or straight pipe end and couplings with solvent cemented or gasketed joints rated for pressure water service.

4. Plastic Pipe: ANSI/ASTM D2241, SDR 18 (pipe meeting requirements for potable water pressure pipe, where indicated on Plans) Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style for solvent cemented or gasketed joints. Pipe must be stamped either:
   a. 'NSF-PW
   b. 'NSF-61' and 'NSF-14'.

5. Plastic Pipe: ASTM D3035 High Density Polyethylene (HDPE) pipe SDR 11, 1 1/2" to 16".

6. Fittings/Wyes: PVC, AWWA C900

   a. HDPE Sanitary Main Wyes: Fernco Flexible Tap Saddles, TSW-6 or approved equal.
      1) Pressure Kit for Flexible Tap Saddle, TSPK-46 or approved equal required for all HDPE Sanitary Main Wyes.

7. Joints: ASTM F477, elastomeric gaskets.

8. Stainless steel band clamps for securing boots to pipe.

9. SDR 18 PVC pipe (C900 pressure pipe) installed to meet isolation distance requirements in a gravity sewer system must be pressure tested to 100 psi minimum per specification 33 34 00 section 3.7.F.

2.2 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed marked “Sewer”, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service, where directed by Engineer.

2.3 MANHOLES

A. In accordance with Section 33 05 13.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A5 or A1 as specified in Section 31 05 16.

B. Bedding Special: Where directed by Engineer, typically in saturated areas, use Type A1 material as specified in Section 31 05 16. Incidental to the cost of Sanitary Sewer.

C. Cover: Fill Type A5, as specified in Section 31 05 16.

D. Soil Backfill from above Pipe Bedding Envelope to one (1) foot above Pipe Bedding Envelope: Soil Type S2, as specified in Section 31 05 13. Subsoil with no rocks over 2 inches in diameter, frozen earth or foreign matter.

E. Soil Backfill from one (1) foot above Pipe Bedding Envelope to Finish Grade (or subgrade): Suitable excavated material with no rocks over 12 inches in diameter, frozen earth, or frozen matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify trench cut or excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95% optimum moisture.

C. Place pipe bedding material around sides and up to 12” above top of pipe. Compact to 95%.

D. Maintain optimum moisture content of bedding material to attain required compaction density. Keep trench dry during placement and compaction of bedding envelope, in accordance with Section 01 12 00 and Section 31 23 19.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321 and manufacturer’s instructions. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings.

C. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches above top of pipe; compact to 95%.

D. Refer to Section 31 23 17 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

E. Connect to existing sewer systems as indicated and detailed on drawings. Provide sanitary sewer services through installed wyes.

F. Pipe installation shall proceed upgrade with spigot ends pointing in the direction of flow. Pipe shall be placed so that each pipe rests upon the full length of its barrel with holes excavated to accommodate bells. Except by special permission, no pipe shall have its grade or joint disturbed after placement. All gasket pipe joints shall be manually pushed in place, with no machine assistance. All openings along the line of the sewer shall be securely closed, as directed, and suitable stoppers shall be placed to prevent earth or other substances from entering the sewer at any time.

G. Install plastic ribbon tape continuous over top of pipe 24 inches below finish grade, above pipe line; coordinate with Section 31 23 17, where directed by Engineer.

H. Install Work in accordance with Township Standards.

3.5 INSTALLATION - MANHOLES

A. Excavate for manholes in accordance with Section 31 23 16.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated, ½” lower than finished pavement grade.

F. Manhole steps shall be aligned with maximum 1” tolerance from centerline.

G. Manhole steps shall be aligned with casting and plumb to the point where the rim/opening is closest to the manhole barrel.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Deflection Test: Test in accordance with this section.

C. Gravity Sewer Lamping: Test in accordance with this section.

D. Request inspection prior to and immediately after placing bedding.

E. Compaction Testing: In accordance with ASTM D1557, ASTM D698, AASHTO T180, ASTM D2922 and ASTM D3017.

F. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

G. Frequency of Compaction Tests: One test per lift per 250 feet of trench.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 – Contract Closeout: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

C. Contractor and Engineer to verify that the completed sewer pipe is free of dirt, mud, rocks or other deleterious materials. It is the responsibility of the Contractor to remove any such materials, which may impede proper sewage flow through pipes or manholes, by jetting, flushing, etc.

3.8 TESTING AND INSPECTION OF SANITARY PIPELINE CONSTRUCTION

A. Infiltration Testing

1. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.

2. Sewers and manholes below the groundwater table shall be tested for infiltration by measuring the infiltrated flow of water over a measured weir set up in the invert of the sewer a known distance from a temporary bulkhead or other limiting point of infiltration. After the sewer has been pumped out if necessary, no test shall be started until normal infiltration conditions are established in the work to be tested. If the groundwater level at the item of testing is below the centerline of the sewer, the sewer will be tested for leakage by bulkheading the manhole at the lower end of the section under test, and filling the sewer with water until it is at least two (2) feet above the crown at the section. Leakage will be measured by the amount of water added to maintain the water at that level. Tests shall be carried for a minimum of four hours with readings at thirty minute intervals. The Contractor shall furnish labor, material and equipment necessary to make these leakage tests.

3. The allowable maximum amount of infiltration shall be 50 gallons per inch of diameter, per mile of pipe, per twenty-four hours.

4. When infiltration or leakage occurs in excess of the specified amount, defective pipe, pipe joints and manholes shall be located and repaired at the expense of the Contractor. If the defective work cannot be located, the Contractor, at his own expense, shall remove and reconstruct as much as the original work as necessary to obtain a sewer within the allowable infiltration (leakage) limit upon retesting as necessary.

B. Low Pressure Air Test

1. General

a. This test shall be conducted no sooner than 30 days after the sanitary sewers, including appurtenances and sanitary laterals have been installed, backfilled, compacted, and cleaned.

b. Provide either the low pressure air test or the water infiltration test for sanitary sewers submerged by ground water.

c. All Low Pressure Air Testing shall be in accordance with ASTM F1417.

d. This test method provides procedures for testing plastic pipe sewer lines, using low-pressure air to prove the integrity of the installed material and the construction procedures.

e. This test method shall be performed on lines after all connections and service laterals have been plugged and braced adequately to withstand the test pressure.

2. For diameters of sewer pipe, between 4 inches and 24 inches inclusive, the pipe shall be tested between adjacent manholes. The test time for the air pressure to drop the specified one pound shall be in accordance with the following table:

TABLE 1: LOW PRESSURE AIR TEST TIME (MANHOLE TO MANHOLE)

Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q = 0.0015

Pipe Dia., in.	Min-imum Time, min:s	Length for Min-imum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

Testing shall include the following:

3. Pressurize pipeline to 4.0 psi and allow to stabilize (stabilization of air temperature may cause pressure drop).

4. When pressure has stabilized, start test at 3.5 psi and record time.

5. If pressure drops more than 1.0 psi during the determined test time, the test will be considered failed.

6. If the test section is below the groundwater level, determine the height of the groundwater above the spring line of the pipe at each end of the test section and compute the average. For every foot of groundwater above the pipe spring line, increase the gage test by 0.43 pounds per square inch.

7. If the ground water level is 2 ft or more above the top of pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gage, the low pressure air test should not be used.

C. Inspection of gravity pipelines by lamping

1. The test shall be conducted no sooner than:
   a. 14 days after the base course has been placed, compacted and the density accepted, but before paving is constructed, if under a road or within 45 degrees of shoulder hinge point, or;
   b. 30 days after all backfill has been placed and consolidated, if outside of road/shoulder limits.

   Any section of the completed sewer failing to pass that test shall be repaired and retested, at the Contractor's expense.

2. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.

3. Equipment to include, but not limited to:
   a. Battery operated light
   b. Mirror capable of projecting down from surface reaching the invert of deepest sewer to conduct lamping without entering the manhole.

4. Whether televised or not, gravity pipelines shall be lamped and a record of the results of lamping furnished to the Engineer.

5. Check vertical and horizontal alignment by sighting through newly constructed pipeline after illuminating opposite end with a flashlight.

6. Light beam should be full throughout the section, but no less than two-thirds full under any circumstances.

7. Relay any section of pipe found to be out of alignment.

8. If Contractor wishes not to provide the above equipment for this test, then the proper confined entry equipment (i.e. tripod, harness, gas meter, barricades on surface, etc.) must be supplied. If all proper confined entry equipment is not provided, UPEA staff is prohibited from entering manhole, which results in no test, therefore a failed pipe section.

D. Deflection Testing

1. The entire length of the installed main line pipe shall be tested for acceptance with an approved go/no-go acceptance testing device to measure the deflection of the installed pipe. The maximum allowed deflection shall be 5%. Required mandrel sizes are listed in Table 2.

Table 2
Mandrel Sizes

Nominal Size	Base ID	SDR 35 5% Deflection Mandrel Size	Base ID	SDR 26 5% Deflection Mandrel Size
4"	3.895	3.70	3.811	3.62
6"	5.742	5.45	5.612	5.33
8"	7.665	7.28	7.488	7.11
10"	9.563	9.08	9.342	8.87
12"	11.361	10.79	11.102	10.55
15"	13.898	13.20	13.575	12.90
18"	16.976	16.13	16.586	15.76
21"	20.004	19.00	19.545	18.57
24"	22.48	21.36	21.964	20.87
27"	25.327	24.06	24.744	23.51
30"	29.132	27.68	28.461	27.04
36"	34.869	33.13	34.120	32.41

2. The test shall be conducted no sooner than:
   a. 14 days after the base course has been placed, compacted and the density accepted, but before paving is constructed, if under a road or within 45 degrees of shoulder hinge point, or;

   b. 30 days after all backfill has been placed and consolidated, if outside of road/shoulder limits.

   Any section of the completed sewer failing to pass that test shall be repaired and retested, at the Contractor's expense.

3. For acceptance, the device must pass through the entire section between manholes or other structures in one pass when pulled by hand without the use of excessive force.

4. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.

5. The testing device shall be a rigidly constructed cylinder or other approved shape, which will not change shape or size when subjected to forces exerted on it by the pipe wall. The device shall have a certificate indicating tolerances and date of last calibration. Engineer reserves the right to confirm dimension prior to any test.

6. All testing shall be done under the observation of the Engineer.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm drainage piping and fittings.
2. Accessories.
3. Underground pipe markers.
4. Catch basins and plant area drains.
5. Cleanouts.
6. Bedding and cover materials.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 23 16 - Excavation.
4. Section 31 23 17 - Trenching.
5. Section 31 23 19 - Dewatering.
6. Section 31 23 23 - Fill.
7. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
7. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
8. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

10. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. Michigan Department of Transportation – current Standard Specifications for construction.

1.3 SUBMITTALS

A. Product Data: Submit data indicating pipe, pipe accessories, manholes and catch basins.

B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Provide copy of MDOT MTM 723 pressure testing approval.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, and invert elevations.

1.5 COORDINATION

A. Verify that field measurements and elevations are as indicated.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. High Density Polyethylene Pipe (HDPE): AASHTO M-294, smooth lined interior, corrugated pipe and fittings, bell and spigot style with gaskets. (ADS N-12 WT IB or approved equal).
   1. Manufacturer shall use only virgin resins in the manufacture of this pipe.
   2. Maximum burial depth 10'. Minimum burial depth 3'.
   3. Shall meet and provide certification of MDOT M723.

B. Reinforced Concrete Pipe: ANSI/ASTM C76, Class IV with Wall Type B; mesh reinforcement; inside nominal diameter of 12-30 inches, bell and spigot end joints with ANSI/ASTM C443, rubber compression gasket joint.
   1. Utilize MDOT table 402-1 for Class.
   2. Meet and provide certification of MDOT M-723 compliance.

C. Plastic Pipe: ANSI/ASTM D3034, SDR 35, Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style rubber ring sealed gasket joints.

2.2 ACCESSORIES

A. Filter Fabric: Non-biodegradable, woven or non-woven; manufactured by Mirafi or equal.

B. Fittings shall be same material as pipe molded or formed to suit pipe size and end design.

2.3 CATCH BASINS

A. Catch Basin Lid and Frame Co.
   1. EJ (formerly East Jordan Iron Works)
   2. Engineer Approved Equal.

B. Catch Basin Lid and Frame:
   1. Construction: Cast iron construction, as specified in section 33 05 13.
   2. Lid Design: As detailed on plans. Lids in curb sections to match the curb profile.
   3. Nominal Lid and Frame Size: As shown on detail.

C. Shaft Construction: Reinforced precast concrete section per tongue and groove ASTM C478, Concentric barrel sections with eccentric cone top section; lipped joints per ASTM C443 or ASTM C990 grooved for "O" ring; sleeved to receive pipe, nominal shaft diameter of 48 inches, 24" sump; manufactured by U.P. Concrete Pipe Company, or equal.

D. Base Pad: Pre-cast or cast-in-place concrete per ASTM C478. The base and bottom section shall be of monolithic construction.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A5 (or Type A1, as directed by Engineer) as specified in Section 31 05 16.

B. Cover: Fill Type A5, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1, S2, or A5 as specified in Section 31 05 13 and Section 31 05 16. Subsoil with no rocks over 2 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with Type A1 or A5 aggregate.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, gaskets and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Place pipe on minimum 6 inch deep bed of Type A5 aggregate.

C. Lay pipe to slope gradients and elevations noted on drawings.

D. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches, compact to 95 percent.

E. Refer to Section 31 23 23 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 33 05 13 for manhole and structure requirements.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount lid and frame as specified in Section 33 05 13.

3.6 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing aggregate cover over pipe.

B. Compaction Testing: In accordance with ASTM D1557.

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

D. Frequency of Compaction Tests: Contractor tester shall test bedding and backfill at a frequency of (1) test per lift per 200 feet of trench.

E. Infiltration Test: Test in accordance with ASTM 969.

3.7 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Repair or replace pipe that is damaged or displaced from construction operations, at no cost to Owner.

END OF SECTION

SECTION 337173 - ELECTRICAL UTILITY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Arrangements with Utility Company for permanent electric service.
2. Payment of Utility Company for service charges.
3. Utility metering equipment.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete pads.

1.2 DEFINITIONS

A. Utility Company: Escanaba Electric Department.

Contact: Jerry Pirkola

Phone # (906) 786-0061

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with Utility Company, including relocation of overhead or underground lines interfering with construction.

C. If power lines are to be relocated, bill utility costs directly to Owner.

D. Service Installation:

1. Contact Utility Company regarding charges related to service installation, and include charges in Contract.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Submit drawings prepared by Utility Company.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

1.5 QUALITY ASSURANCE

A. Perform Work according to Utility Company written requirements, and maintain one copy at Site.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company Drawings.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. System Characteristics: 120/208 Volts, three phase, four wire, 60 Hz.

B. Service Entrance: Underground.

2.2 UTILITY METERS

A. Furnished by Utility Company.

2.3 UTILITY METER BASE

A. Provided by the Electrical Contractor, in accordance with the Utility Company specifications and requirements.

2.4 C/T CONNECTION CABINET

A. Equipment: As shown on drawings, per Utility Company Requirements

B. Include provisions for padlocking and sealing.

2.5 TRANSFORMER PAD

A. As detailed on plans.

B. Material: Cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete.

C. Size: As indicated on Drawings.

D. Furnish cut-out for conduits, per detail.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Disconnect and remove abandoned service equipment.

C. Maintain access to existing service equipment, boxes, metering equipment, and other installations remaining active and requiring access, by modifying installation or by providing access panel.

3.3 INSTALLATION

A. Service Entrance Conduits:

1. Provide and install 6” conduit for utility primary conductors as shown on site utility plan. Include bore under roadway as indicated.

2. Provide and install service entrance conduit and wires from new pad-mount transformer to new electrical service equipment.

B. Install cast-in-place concrete pad for Utility Company transformer, as specified in Section 033000 - Cast-in-Place Concrete.

END OF SECTION 337173

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular precast reinforced concrete manhole and structure sections with tongue-and-groove joints, eccentric cone section, covers, anchorage, and accessories for manholes, catch basins and inlet structures.
2. Modular precast reinforced concrete sections with tongue-and-groove joints, flat top, cover and accessories for lift stations and valve manholes.
3. Bedding and cover materials.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork: Soil for backfill in trenches.
2. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
3. Section 31 23 16 - Excavation: Excavating for manholes and structures.
4. Section 31 23 19 - Dewatering:
5. Section 31 23 23 - Fill: Backfilling after manhole and structure installation.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 318 - Building Code Requirements for Structural Concrete.
2. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C55 - Standard Specification for Concrete Brick.
4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
6. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
7. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
8. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
9. ASTM D3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells.

1.3 SUBMITTALS

A. Shop Drawings: Indicate manhole and structure locations, I.D. number, elevations, piping, and sizes and elevations of penetrations.

B. Product Data: 1) Provide certification of quality for manhole covers, steps, boots, component construction. 2) Provide data on features, configuration, and dimensions with reference to internal valves, piping, etc. as appropriate.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with current MDOT Standard Specifications for Construction.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.

B. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

C. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: ACI 530.

PART 2 PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. Manufacturers:
1. U.P. Concrete Pipe Products, Inc.
2. E.J. (Formerly East Jordan Iron Works Co.)
3. Engineer Approved Equal

B. Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478, with boots in accordance with ASTM C923. The base and bottom manhole and structure section shall be of monolithic construction.

2.2 FRAMES AND COVERS

A. Manhole and Structure Lid and Frame: ASTM A48, Class 30B Cast iron construction, machined flat bearing surface, removable lid with concealed pick hole, indented lid design; watertight sealing gasket; bolted to frame, lid molded with identifying utility name, frame clear opening 24".

2.3 COMPONENTS/ACCESSORIES

A. Manhole and Structure Steps: Formed integral with manhole and structure sections. May be ductile iron or copolymer polypropylene plastic with 1/2" diameter, grade 60 steel reinforcement.

B. Boots: ASTM C923 factory installed.

C. Chimney Seals: As required by engineer.

D. Design of Lifting Devices for Precast Components: In accordance with ASTM C913.

E. Mortar: Mortar for manhole block and for setting frames and grates shall be commercial mortar mix, supplemented with Type S concrete as an additive for additional strength. Provide mix design to Engineer for approval.

2.4 CONFIGURATION

A. Shaft Construction: Concentric barrel sections with eccentric cone top section; lipped male/female joints grooved for "o" ring; sleeved to receive pipe.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48 inch or as indicated on plans for special cases. Manhole clear opening must span at least 24 inches.

D. Design Depth: As indicated on plans.

E. Pipe Entry: Provide openings with rubber, watertight boots as indicated or required on plans. Contractor shall fill the void between the rubber boot/manhole wall and pipe with mortar so that there is a smooth transition between the pipe and manhole wall, bench/flowline. Mortar shall be broomed/troweled smooth to eliminate voids that may trap sewage or other debris.

F. Steps: 12 inches wide, 16 inches on center vertically, set into manhole/ structure wall.

2.5 BEDDING AND COVER MATERIALS

A. Bedding and Cover: A5 as specified in Section 31 05 16.

B. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1 or S2, as specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify penetrations provided for other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes and structures is correct.

D. Verify all manholes and structures are constructed with flexible waterproof joints at the pipe to manhole/structure connection. This joint shall meet the physical requirements of ASTM C-443, and the performance requirements of ASTM C-425 and C-443. The annular space between the pipe and the manhole/structure wall shall be filled with a flexible material prior to pouring the manhole/structure invert to maintain the seal flexibility. The invert channels, where not consisting of the pipe passing through the manhole/structure, shall be smooth and accurately shaped a semicircular bottom conforming to the inside of the adjacent sewer section.

E. Manhole sections shall be subject to rejection on account of failure to conform to any of the specification requirements.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Excavation and Backfill:
   1. Excavate for manholes and structures in accordance with Section 31 23 16 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes and structures in dry trench.
   3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.

B. Install manholes and structures supported at proper grade and alignment on 6-8” of Aggregate Type A1, or as shown on Drawings.

C. Backfill excavations for manholes and structures in accordance with Section 31 23 23.

D. Form and place manhole and structures/sections/cylinders plumb and level, to correct dimensions and elevations.

E. Cut and fit for pipe, conduit and sleeves.

F. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings. Base of manhole/structure to be free of water and mud or any deleterious substances.

G. Manhole bases must contain smooth, rounded flow lines and transitions, as detailed on the plans.

H. Set cover frames and covers level without tipping, to correct elevations.

I. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Lift precast components at lifting points designated by manufacturer.

B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 16.

D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections. Align manhole steps vertically with 1-inch horizontal tolerance from center.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Joint sealing materials may be installed on site or at manufacturer’s plant.

G. Verify manholes and structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.

I. Cut pipe to finish flush with interior of structure.

J. Shape inverts through manhole and structures as shown on Drawings.

K. Plug lifting holes with non-shrink grout seal, inside and out. Mortar inside joints of manhole to a smooth finish.

L. Provide adjusting rings, per plan.

M. Verify that boots are securely fastened to manhole and to pipe to provide a watertight seal.

N. Install chimney seal as recommended by the manufacture.

O. The completed manhole shall be watertight.

P. Refer to Sections 31 23 17 and 31 23 23 for trenching, backfilling and compaction requirements.

3.5 FRAME AND COVER INSTALLATION

A. Set frames using mortar and masonry. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.6 FIELD QUALITY CONTROL

A. Test concrete manhole and structure sections in accordance with ASTM C497.

B. Contractor shall notify local utility for review of constructed work for final acceptance.

3.7 SCHEDULES

A. Storm Sewer Manholes: Precast concrete sections, galvanized steel steps inside dimensions per plan, to depth indicated. Sizes as indicated and detailed on plans.

END OF SECTION

SECTION 33 05 23

DIRECTIONAL BORE TRENCHLESS PIPE INSTALLATION

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Horizontal directional drilling.

1.2 RELATED SECTIONS

A. Section 01 50 00 - Temporary Facilities and Controls

B. Section 33 11 16 – Site Water Utility Distribution Piping

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves, tracer wire and all associated accessories.

C. Submit additional information as required by DNR, ACOE, and WisDOT permit conditions.

1.4 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the work are as shown on the drawings.

B. Verify the location and elevation of the existing utilities.

C. Establish proposed utility line and grade from the control points.

1.5 REFERENCES

A. N/A

PART 2 PRODUCTS

2.1 MATERIALS

A. Polyethylene Pipe
   1. AWWA C906, SDR 11 pipe and fittings for 200 psi.
   2. ANSI/NSF Standard 14 and 61, the exterior wall must bear the NSF-PW identification or otherwise show conformance with ANSI/NSF Standards 14 and 61.
   3. Pipe – High density PE340 polyethylene resin

4. Joints – Butt fusion, flanged adapter, electrofusion coupler, compression or mechanical joint adapter with stainless steel stiffener to connect to other water main.
5. Install tracer wire with all polyethylene pipe.

B. Tracer Wire

1. Tracer wire shall be 10 gauge insulated copper clad ~~stainless~~ steel wire. It shall have a blue coating with a minimum thickness of 45 mils. If one tracer wire is to be pulled, tracer wire shall have a minimum breaking load (tensile) of 2000 pounds. If two tracer wires are pulled, tracer wires shall have a minimum breaking load (tensile) of 1100 pounds.
2. All tracer wire accessories (i.e. direct bury wire connectors) shall be approved by the tracer wire manufacturer. This approval must be documented and provided to Engineer.
3. Tracer wire box shall have a blue cast iron lid.
4. Gate Valve Box Tracer Wire Clips KIT# GVTC-8000 by Vait Products, or Engineer approved equal product.

PART 3 EXECUTION

3.1 HORIZONTAL DIRECTIONAL DRILL

A. DIRECTIONAL DRILLING

1. The drilling process shall be by mechanical cutting using a drill bit (cutting head) capable of drilling in rock and cobble.
2. A bentonite slurry shall be used to transport drill cuttings to the surface, stabilize the hole against collapse, lubricate and cool the cutting head.
3. The cutting head shall provide directional steering and monitoring of the actual position for a pipeline that is not straight.
4. During drilling of the pilot hole, continuously monitor the location of the cutting head and record depths and locations at a maximum of 50 foot (20 foot when crossing US-41 and M-38) intervals to be used for as-built information. Depths and locations shall be painted on the ground in paved areas. Depths and locations shall be marked on/ with stakes (provided by Engineer) when not drilling beneath a paved surface.
5. The pilot hole exit shall provide an accuracy of 2 feet left or right from that shown on the drawings.
6. Vertical deviations from the water main profile of more than 1’ shallower and 2’ deeper, without Engineer’s approval, shall be reinstalled.
7. For Gravity Sewer Pipe, vertical divergence from plan grade by 50% or more of nominal pipe diameter along the pipe, or pipe sags with more than ½ full pipe will be unacceptable and will not be paid for. Vertical Divergence from plan grade at manhole locations by one nominal pipe diameter or greater will be unacceptable and will not be paid for. The Contractor shall remove such bored sewer pipe and reinstall the directionally bored sewer pipe.
8. Fill the annular space between the borehole and the carrier pipe with bentonite slurry.
9. Bentonite Slurry and Cuttings:
    a. Collect slurry and cuttings by mobile spoils recovery equipment and remove from the site.
    b. Dispose of spoils at an upland site acceptable to the Owner, Engineer, and DNR.

Spoils shall be disposed of in a manner to protect local, state and federal wetlands, streams, and all other bodies of water from potential bentonite contamination caused by erosion.

c. Do not dispose of drill cuttings (spoils) into sanitary, storm or other public drainage system.

d. Do not permit spoils to flow over land and contain all materials within the work area.

e. Upon completion of the boring and pipe installation, remove all spoils from the starting and termination pits. Restore pits to their original condition.

f. Cover stockpiled material when not being used to prevent runoff.

g. The pilot hole, preream and pullback operations shall be in one continuous operation.

10. Insulated 10 gauge copper clad steel trace wire is to be pulled back with the water pipe. A minimum of one tracer wire shall be pulled when installing pipe via directional drilling method. Two may be used to ensure successful tracing operations. See Section 2.1 B.
11. Tracer wire handholes shall be manufacturer approved trace wire boxes, and shall be installed at each curb stop.
12. Tracer wire connections shall be manufacturer approved terminal ends and 3-way direct bury connectors; twist connections are not acceptable.
13. Tracer wire shall be taped to the open cut water main, hydrant leads, and water services at 10’ intervals to ensure accurate locating.
14. Tracer wire shall be installed up one valve box at each valve cluster and at each hydrant valve. The tracer wire shall be secured to the side of the valve box using Gate Valve Box Tracer Wire Clips to keep it out of the way of valve wrench entry and exit.

3.2 Additional Requirements

A. N/A

3.3 FIELD QUALITY CONTROL

A. Horizontal Directional Drilling Accuracy Verification

1. For horizontal directional drilling activities that are in excess of 200 lineal feet in length, accuracy verification of the drill heads location shall be required. The Contractor shall excavate a test pit to compare the actual horizontal and vertical locations of the drill to the readings given by the Contractors equipment. The Contractor shall verify accuracy within 75 lineal feet from the drill entry hole, and then at approximately 500’ intervals after that. Test pits shall be excavated in unimproved areas only, and their locations shall be approved by the Owner/Engineer.

END OF SECTION

SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for site water.
2. Valves.
3. Hydrants.
4. Underground pipe markers.
5. Bedding and cover materials.
6. Testing.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 19 - Dewatering
7. Section 31 23 23 - Fill
8. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
6. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
7. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
9. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

10. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
12. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

D. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C502 - Dry-Barrel Fire Hydrants.
7. AWWA C504 - Rubber-Sealed Butterfly Valves.
8. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS.
9. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
10. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
13. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
14. AWWA C702 - Cold-Water Meters - Compound Type.
15. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
17. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
18. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

E. Underwriters Laboratories Inc.:
1. UL 246 - Hydrants for Fire - Protection Service.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual depths and locations of piping mains, valves, connections, thrust restraints, and invert elevations. Provide witness measurements for each valve, corporation, curb stop and hydrant.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Provide four (4) copies of operation and maintenance manuals for equipment which requires such information.

1.5 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Perform work in accordance with owner utility standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver, store, protect and handle products to site under manufacturer recommended procedures.

C. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 WATER PIPING

A. Ductile Iron Pipe: AWWA C151, Class 350
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111, rubber gasket.
   3. Lining/Coating: Cement mortar lining and real coating.
   4. Conductivity straps: Copper. Straps also required around all valves.
   5. Factory install continuity straps, field install straps by cad weld as needed.
   6. Gaskets with conductivity wedges will not be accepted.
   7. ANSI/NSF Standard 61, the exterior wall must bear the proper ANSI/NSF identification.
   8. Install all ductile iron pipe in 8 mil polywrap.

B. Copper Tubing: ASTM B88, Type K, annealed:
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection with conductivity accessories.

C. Polyethylene Pipe
   1. See Specification Section 33 05 23, Section 2.1

D. Accessories:
1. Tapping sleeves shall be stainless steel by Romac, Smith Blair, or approved equal.
2. Couplings shall be Romac, Smith Blair, or approved equal.
3. Flange adaptors (buried) – Romac, American Ductile, or approved equal.

2.2 GATE VALVES – 3 INCHES AND OVER

A. Buried Valves: AWWA C515, ductile iron body, bronze trim, non-rising stem with square nut, single wedge, with full encapsulation – elastomer covering, resilient seat, stainless steel bolts, mechanical joint ends, control rod, extension box and valve key.

B. Waterous 2500, American Series 2500, EJ (formerly East Jordan Iron Works) Flowmaster, or approved equal.

C. Three piece, cast iron, adjustable type valve box marked “water” – American Flow Control No. 6, E.J. 8550 series, 5-1/4 inch lid, or approved equal.

D. Provide carsonite markers for valves installed in off-road locations.

E. Provide three (3) steel T-handle wrenches for operating square nut on valves.

2.3 CORPORATION STOP AND CURB STOP VALVES, COUPLINGS

A. Corporation Stops
1. First quality bronze with conductive compression connections for copper pipe Mueller Co., Cat. #H15008N, Hays Mfg. Co., or equal, no gasket.

B. Curb Stop – Minneapolis Style
1. First quality bronze pipe connections (conductive compression) the same size as body for copper pipe - Mueller Co. Cat. #H-15155N, Hays Mfg. Co., or equal.
a. Curb stops over 1" size Mueller Co. Cat. #H-15151N Oriseal curb valve, Hays Mfg. Co., or equal.
b. Each curb stop shall be furnished with a Mueller Co. Cat. #83299 stationary rod, Hays Mfg. Co., or equal.

C. Curb Stop Boxes – Minneapolis Style
1. Close grain cast iron, standard design adjustable to 7-1/2 feet - Mueller Cat. #H-10302, Hays Mfg. Co., or equal.
a. Shut-off rods - Mueller Cat. #H-10321, Hays Mfg. Co., or equal.
b. Keys - pentagon style - Mueller Cat. #H-10323, Hays Mfg. Co., or equal.

D. Couplings and Connections
1. Couplings and connections shall be copper by copper, copper by IP, and copper by plastic, as needed.
2. All fittings shall be conductive compression.

2.4 HYDRANTS (Not Used)

A. Manufacturers:
1. American Flow Control model “Waterous Pacer"; or East Jordan EJ 5BR250.

2. Or Engineers Approved Equal.

B. Hydrant: AWWA C502, UL 246, dry barrel type, inside dimension of 7-3/8 inches minimum, with minimum 5-1/4 inches diameter valve seat opening; minimum net water area of barrel not less than 190 percent of valve opening; 6 inch mechanical joint bell inlet connection with accessories, gland bolts, and gaskets. 28” break off “traffic section”. Two tapped and plugged weep holes, opens left. 1-1/2” pentagon nut with weather shield.

C. Hydrant Extensions: Fabricate for 7' 0" trench depth with rod and coupling to increase barrel length if necessary to fit field conditions per plans.

D. Hose and Pumper Connection: Two 2 1/2" hose nozzles, one 4 1/2" pumper nozzle, with National Standard Fire Hose Coupling Screw Threads. Chain keepers for nozzle caps.

E. Finish: Primer and two coats of enamel, red color.

F. Hydrant Marker Flag: 5’ long, high visibility, corrosion free, UV resistant shaft attached to spring.

G. Water Valves: For valves located off of travel way, marked “water valve”, manufactured by Carsonite International, Model CUM-375 with auxiliary barb.

2.5 PIPE INSULATION/POLYWRAP

A. When required, insulation shall be rigid 2” thick extruded polystyrene (EPS) with an “R” value of 9 or greater, 25 psi minimum compressive strength.

B. All ductile iron pipe installed by open trench method shall be encased with 8 mil linear low density (LLD) polywrap meeting AWWA C105-05.

2.6 TRACER WIRE

A. Tracer wire shall be 10 gauge insulated copper clad stainless steel wire with minimum breaking load (tensile) of 650 pounds. It shall have a blue coating with a minimum thickness of 30 mils.

B. One tracer wire shall be used when installing any none metallic pipe type.

C. All tracer wire accessories (i.e. tracer boxes, 3-way direct bury wire connectors) shall be approved by the tracer wire manufacturer. This approval must be documented and provided to Engineer.

D. Tracer wire box shall have a blue cast iron lid.

E. Gate Valve Box Tracer Wire Clips KIT# GVTC-8000 by Vait Products, or Engineer approved equal product.

2.7 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A5 as specified in Section 31 05 16.

B. Cover: Fill Type A5 as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1 or S2, as specified in Section 31 05 13. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.8 SURGE SUPPRESSOR

A. Buried Surge Suppressor: Stainless Steel body, mechanical joint connection.

B. JCM Series 800 Surge Suppressor, or Engineer approved equal.
1. Stainless steel body, carbon steel mechanical joint 6" connection.
2. Cut-in mechanical joint tee on new or existing watermain.

C. Provide carsonite marker for notification of buried surge suppressor. Surge suppressors shall not be installed under roadway.

2.9 ACCESSORIES

A. Joint restraints shall be Meg-a-Lugs or approved equal with stainless steel nuts and bolts.

B. All exposed nuts and bolts on valves and hydrants must be stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify water main size, location, and inverts are as indicated on Drawings.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions, as specified by the pipe manufacturer.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for bell, accurate barrel placement and bedding of pipe to elevations indicated.

B. Form and place concrete for pipe thrust restraints at change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil according to table on construction plans.

C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent.

D. Backfill around sides and to 12” above top of pipe with cover fill, tamp in place and compact to 95 percent.

E. Maintain optimum moisture content of fill material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with code.

B. Install pipe to indicated elevation.

C. Install ductile iron piping and fittings to AWWA C600, HDPE pipe and fittings to AWWA 906.

D. Route pipe in straight line except where shown on plans.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

G. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

H. Establish elevations of buried utility with 30 inches of cover.

I. All water main and services shall be accompanied by a copper clad stainless steel tracer wire. A single tracer wire shall be taped to open cut water main and water services at 10’ intervals to ensure accurate locating.

J. Backfill trench in accordance with Section 31 23 23.

K. Compaction effort in accordance with Section 31 23 23.

L. Restoration in accordance with Sections 32 91 19 and 32 92 19.

3.5 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

D. Set hydrants to grade, with nozzles at least 36 inches above ground.

E. Locate control valve 30 inches away from hydrant.

F. Backfill and compaction in accordance with Section 31 23 23.

G. Restoration in accordance with Sections 31 91 19 and 32 91 19.

H. FIRE HYDRANTS which are in place, but not available for service shall be identified as "OUT OF SERVICE" by covering the head with a plastic bag or similar.

I. All fire hydrants shall be flushed, pumped out, and certified for use by the contractor prior to payment. Contractor shall certify in writing that hydrant is available for service. Certification shall include date, location, action taken, comments, witnesses, and space for witness (Engineer or Owner) to attest to certification.

J. When groundwater is encountered, prevent accumulation of water in the trench (Section 31 23 19). Install pipe and fittings in dry conditions.

K. All hydrant weep holes are to be plugged.

L. Tracer wire shall be installed up one valve box at each valve cluster and at each hydrant valve. The tracer wire shall be secured to the side of the valve box using Gate Valve Box Tracer Wire Clips to keep it out of the way of valve wrench entry and exit.

M. Tracer wire handholes shall be manufacturer approved trace wire boxes, and shall be installed at each curb stop.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.7 INSTALLATION – PIPE REPAIRS

A. If leaks are discovered on sections of pipe designated to remain the main shall be repaired at a negotiated price.

B. Expose leaking sections of pipe carefully, taking care not to damage pipe.

C. Dewater leaking section by isolating from upper sections to minimize loss of water.

D. Repair sections of pipe by cutting out and replacing defective sections of pipe.

3.8 REACTION BACKING

A. Mechanical joint anchors for ductile iron pipe. Welded butt or standard flange for HDPE pipe.

B. Placement of reaction backing shall be as detailed. Bearing area shall be as follows: (Square feet against trench wall in sand).

Pipe Size	Tees & Plugs	90° Els.	45° Els.	22-½° Els.	11-¼° Els.
4"	1	2	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
10"	7	9	5	3	2
12"	9	11	6	3	2
14"	11	15	8	5	3
16"	13	20	10	6	3

18"	16	25	12	7	4
20"	20	28	14	8	4
24"	28	40	20	11	6

Other Soil Conditions:

Cemented sand or hardpan: multiply above by 0.5
Gravel: multiply above by 0.7
Hard dry clay: multiply above by 0.7
Soft clay: multiply above by 2.0
Muck: Secure all fittings with the rod clamps with concrete reaction backing the same as for sand conditions.

C. When approved by the Owner, locked joint pipe, joint retainer glands, joint anchoring systems, or rod fitting types may be used instead of concrete thrust blocks.

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

3.9 TESTING

A. This work shall be considered incidental to and included in the unit price for water main. Employ experienced people or subcontractor with minimum 3 years experience.

B. Pressure test report; record:
1. Type and form of method used.
2. Date, time of start, and time of completion.
3. Test locations.
4. Initial residuals (pressures) for each outlet tested. Name of person conducting the test and inspector.
5. Indicate test passed or failed.

C. Leakage test report; record:
1. Project name, section being tested.
2. Time and date of test.
3. Name of persons conducting testing and inspecting.
4. Test locations.
5. Initial and 2 hour residual values for each outlet tested.
6. Certification that test passed or failed.

D. Continuity test; record:
1. Project name, section being testing.
2. Time and date of testing.
3. Contact points (Hydrant, valve).
4. Amperes applied at source and recorded at gage.
5. Name of persons testing and inspecting.
6. Indication if test passed or failed.

E. Pressure test system to 150 psi minimum or per minimum of this section. Repair leaks and re-test.
1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Architect/Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.

2. Provide equipment required to perform leakage and hydrostatic pressure tests.
3. Test Pressure: Not less than 150 psi or 50 psi in excess of maximum static pressure, whichever is greater.
4. Conduct hydrostatic test for at least two-hour duration.
5. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
6. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks and plug resulting piping openings.
7. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
8. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch (gauge)

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

F. Continuity Testing
1. The pipeline and hydrants shall be tested for electrical continuity and current capacity.
2. The test shall be made after hydrostatic testing is completed and while the line is at normal operating pressure.
3. A direct current of 200 amperes ± 10%, shall be passed through the section under test for a period of five minutes.
4. Current flow shall be continuously monitored with a suitable ammeter.
5. Insufficient current, excessive fluctuation, or arcing shall be indicative of defective electrical contact, and the cause shall be isolated and corrected.
6. Caution: In order to prevent inadvertent hazardous electrical grounding paths through customer's water services, the continuity test shall be conducted using a non-grounded current circuit.

G. Testing Polyethylene Pipe (per ASTM F 2164 - 13)
1. All pipeline sections under test shall be backfilled and restrained against movement if failure occurs. If failure of watermain under test occurs the result may include sudden, violent, uncontrolled, and dangerous movement of system piping or components, so personnel involved with the watermain testing must be fully informed of the hazards of field pressure testing, and all other persons should be kept a safe distance away.
2. Fill installed pipeline with potable water, bleed off any trapped air.

3. Liquid filling and pressurizing equipment such as pumps shall be provided by Contractor as necessary. Filling equipment shall be capable of filling and pressurizing the watermain to the maximum test pressure in a reasonable time. Use at least one calibrated pressure gauge or sensor accurate to within two percent (2%) of the full scale value. The full scale value shall not to be more than twice the test pressure, and the scale graduations shall not be more than 2% of the full scale value. Using a valved tee, a gauge cock for bleeding, a pressure snubber, and a duplicate, back-up pressure gauge are recommended. A continuous pressure-recording device is also recommended but not required.
4. Locate the test pressure gauge or sensor to monitor test pressure at the lowest point in the test section.
5. The maximum test pressure for the polyethylene watermain shall be equal to 150% of the system design pressure as measured at the lowest point of the test segment (110 psi minimum), and shall not exceed the pressure of the lowest pressure-rated component on the test segment (the test segment shall be selected to avoid inclusion of watermain with drastic elevation changes exceeding 10% of the design pressure, or as approved by Engineer, and if possible, low pressure-rated components shall be isolated or removed as not to influence the maximum test pressure).
6. To compensate for initial stretch, sufficient make-up water must be added to the system to maintain maximum test pressure for 4 hours.
7. Reduce test pressure by 10 psi and monitor for one (1) hour. Do not increase pressure or add make-up water.
8. If no visible leakage is observed, and pressure during the test phase remains steady (within 5% of the test phase pressure) for the 1 hour test phase period, a passing test is indicated.
9. If retesting is necessary, depressurize the test section and correct any faults or leaks in the test section.
10. Prior to testing, all curb stop valves shall be closed.
11. Initial Service Line Leak Testing (if required). The piping system should be gradually brought up to normal operating pressure, and held at normal operating pressure for at least ten (10) minutes. During this time, joint and connections may be examined for leakage.
12. If test is not completed within 8 hours, the pipe must be relaxed for 8 hours before the next testing sequence.
13. CONTRACTOR shall correct defects and repeat test until acceptable, incidental to project.
14. If maximum test pressure does not exceed design pressure, refer to ASTM F2164 – 13 for test procedure.
15. If high temperatures are affecting the test results, contact pipe manufacturer for assistance with elevated temperature pressure ratings and coordinate test revisions with Engineer.

H. The Contractor shall make necessary arrangements with the OWNER for source, measurement and payment for the water needed for these tests.

3.10 FIELD QUALITY CONTROL

A. Contractor shall prepare and submit a “Backfill Compaction” plan for approval under Sections 01 30 00, 01 33 00 and 01 40 00. The plan shall indicate how he intends to meet the compaction requirements for the various areas of backfilling (paved or unpaved) and various increments of work (backfill, paved subbase, paved base, pavement). Include methods and equipment that will be utilized.

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

C. Contractor shall contact Owner prior to performing final testing, inspection and approval of work.

END OF SECTION

SECTION 33 13 00

DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
   1. Section 33 11 16 – Site Water Utility Distribution Piping.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B301 – Liquid Chlorine
   3. AWWA B303 – Sodium Chlorite
   4. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   5. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds MDEQ – Water Division Requirements in the safe drinking water standards.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Disinfectant residuals in treated water in ppm for each sample tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological Report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Disinfectant residuals in ppm for each sample tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certify water conforms, or fails to conform, to bacterial standards of MDEQ.
   8. Two (2) consecutive negative bacteriological samples, taken as outlined below, shall constitute a passing test sequence.

D. Water Quality Certificate: Certify water conforms to quality MDEQ standards, suitable for human consumption.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651-14 (effective February 1, 2015)

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years experience.

B. Testing Firm: Company specializing in testing potable water systems, certified and approved by State of Michigan.

C. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:
   1. AWWA B300, Hypochlorite.
   2. AWWA B301, Liquid Chlorine.
   3. AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping system has been cleaned, inspected, and pressure tested.

B. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. After pressure testing but prior to disinfection, the system shall be flushed at maximum intervals as determined by hydrant spacing. Flushing shall be accomplished at a pipe velocity in excess of 3.0 feet per second until the discharge is clean.

B. Provide and attach required equipment to perform the Work of this section.

C. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 11 16.

D. Inject treatment disinfectant into piping system using AWWA C651-14 continuous feed system. Prevent cross connection to existing potable water system.

E. Maintain disinfectant in system for 24 hours at not less than 25 parts per million.

F. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water. Operate valves to disinfect them.

G. Replace permanent system devices removed for disinfection.

H. Two consecutive safe bacteriological samples shall be taken in one of two ways:
   1. Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hours using the sampling site procedures outlined in AWWA C651-14. Both sets of samples must pass for the main to be approved for release.
   2. Option B: Before approving a main for release, let it sit for a minimum of 16 hours without any water use. Then collect, using the sampling procedures outlined in AWWA C651-14 and without flushing the main, two sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

I. After the main has been disinfected and accepted, flush hydrants and service lines until clean.

J. Prevent soil erosion at discharge points.

K. Contractor shall make arrangement with water supplier (Village, Township, Utility, etc.) for source, measurement and payment for water required for construction, flushing and disinfection.

L. Disinfect all cut in pipe and appurtenances prior to completing installations.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:
   1. Disinfect pipeline installation in accordance with AWWA C651-14. Use of liquid chlorine is not permitted except as used per AWWA C651-14 methods of continuous injection.
   2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
   3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
   4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.
   5. Provide analysis reports of treated and discharged water to the owner.

END OF SECTION

SECTION 33 31 00

SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewage pipe.
2. Underground pipe markers.
3. Manholes.
4. Bedding and cover materials.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 31 05 13 - Soils for Earthwork.
3. Section 31 05 16 - Aggregates for Earthwork.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.
6. Section 31 23 23 - Fill.
7. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
4. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
5. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
6. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
8. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
9. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
10. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

11. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
12. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
13. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 DEFINITIONS

A. Bedding or Bedding Envelope: Aggregate material placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating pipe materials and pipe accessories used.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Bypass pumping plan if required.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Contract Closeout: Requirements for submittals.

B. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, invert elevations and any other pertinent as-built information of value to the Owner for future reference.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the Adams Township Standards and as specified in the plans and specifications.

B. Maintain one copy of each document on site.

C. Minimum sewer and water main horizontal separation is ten feet.

D. Whenever sewer must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. If existing conditions prevent vertical separation as described above, the water main shall be relocated pursuant to detail drawings.

E. Water mains shall not be relocated below sewer lines without prior approval from the Engineer. If it is necessary, as determined by the Engineer, to relocate a water main below a sewer line, the

sewer shall be constructed of a slip-on or mechanical-joint ductile iron pipe, or PVC water main pressure pipe (SDR 18).

1.7 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated by the manufacturer.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with protection of existing utilities and restoration work of this contract.

PART 2 PRODUCTS

2.1 SANITARY SEWAGE PIPE

A. Plastic Pipe for gravity installations:

1. Plastic Pipe 8": ANSI/ASTM D3034, SDR 35, Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style rubber ring sealed gasket joints.

2. For gravity lateral installations: Plastic Pipe 6": ANSI/ASTM D3034, SDR 26, Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style for solvent cemented or gasketed joints.

3. For gravity lateral installations within 50' of a potable water well: Plastic Pipe 6": ANSI/ASTM D3034, Sch40 Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style or straight pipe end and couplings with solvent cemented or gasketed joints rated for pressure water service.

4. Plastic Pipe: ANSI/ASTM D2241, SDR 18 (pipe meeting requirements for potable water pressure pipe, where indicated on Plans) Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style for solvent cemented or gasketed joints. Pipe must be stamped either:
   a. 'NSF-PW
   b. 'NSF-61' and 'NSF-14'.

5. Plastic Pipe: ASTM D3035 High Density Polyethylene (HDPE) pipe SDR 11, 1 1/2" to 16".

6. Fittings/Wyes: PVC, AWWA C900

   a. HDPE Sanitary Main Wyes: Fernco Flexible Tap Saddles, TSW-6 or approved equal.
      1) Pressure Kit for Flexible Tap Saddle, TSPK-46 or approved equal required for all HDPE Sanitary Main Wyes.

7. Joints: ASTM F477, elastomeric gaskets.

8. Stainless steel band clamps for securing boots to pipe.

9. SDR 18 PVC pipe (C900 pressure pipe) installed to meet isolation distance requirements in a gravity sewer system must be pressure tested to 100 psi minimum per specification 33 34 00 section 3.7.F.

2.2 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed marked “Sewer”, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service, where directed by Engineer.

2.3 MANHOLES

A. In accordance with Section 33 05 13.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A5 or A1 as specified in Section 31 05 16.

B. Bedding Special: Where directed by Engineer, typically in saturated areas, use Type A1 material as specified in Section 31 05 16. Incidental to the cost of Sanitary Sewer.

C. Cover: Fill Type A5, as specified in Section 31 05 16.

D. Soil Backfill from above Pipe Bedding Envelope to one (1) foot above Pipe Bedding Envelope: Soil Type S2, as specified in Section 31 05 13. Subsoil with no rocks over 2 inches in diameter, frozen earth or foreign matter.

E. Soil Backfill from one (1) foot above Pipe Bedding Envelope to Finish Grade (or subgrade): Suitable excavated material with no rocks over 12 inches in diameter, frozen earth, or frozen matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify trench cut or excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95% optimum moisture.

C. Place pipe bedding material around sides and up to 12” above top of pipe. Compact to 95%.

D. Maintain optimum moisture content of bedding material to attain required compaction density. Keep trench dry during placement and compaction of bedding envelope, in accordance with Section 01 12 00 and Section 31 23 19.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321 and manufacturer’s instructions. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings.

C. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches above top of pipe; compact to 95%.

D. Refer to Section 31 23 17 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

E. Connect to existing sewer systems as indicated and detailed on drawings. Provide sanitary sewer services through installed wyes.

F. Pipe installation shall proceed upgrade with spigot ends pointing in the direction of flow. Pipe shall be placed so that each pipe rests upon the full length of its barrel with holes excavated to accommodate bells. Except by special permission, no pipe shall have its grade or joint disturbed after placement. All gasket pipe joints shall be manually pushed in place, with no machine assistance. All openings along the line of the sewer shall be securely closed, as directed, and suitable stoppers shall be placed to prevent earth or other substances from entering the sewer at any time.

G. Install plastic ribbon tape continuous over top of pipe 24 inches below finish grade, above pipe line; coordinate with Section 31 23 17, where directed by Engineer.

H. Install Work in accordance with Township Standards.

3.5 INSTALLATION - MANHOLES

A. Excavate for manholes in accordance with Section 31 23 16.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated, ½” lower than finished pavement grade.

F. Manhole steps shall be aligned with maximum 1” tolerance from centerline.

G. Manhole steps shall be aligned with casting and plumb to the point where the rim/opening is closest to the manhole barrel.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Deflection Test: Test in accordance with this section.

C. Gravity Sewer Lamping: Test in accordance with this section.

D. Request inspection prior to and immediately after placing bedding.

E. Compaction Testing: In accordance with ASTM D1557, ASTM D698, AASHTO T180, ASTM D2922 and ASTM D3017.

F. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

G. Frequency of Compaction Tests: One test per lift per 250 feet of trench.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 – Contract Closeout: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

C. Contractor and Engineer to verify that the completed sewer pipe is free of dirt, mud, rocks or other deleterious materials. It is the responsibility of the Contractor to remove any such materials, which may impede proper sewage flow through pipes or manholes, by jetting, flushing, etc.

3.8 TESTING AND INSPECTION OF SANITARY PIPELINE CONSTRUCTION

A. Infiltration Testing

1. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.

2. Sewers and manholes below the groundwater table shall be tested for infiltration by measuring the infiltrated flow of water over a measured weir set up in the invert of the sewer a known distance from a temporary bulkhead or other limiting point of infiltration. After the sewer has been pumped out if necessary, no test shall be started until normal infiltration conditions are established in the work to be tested. If the groundwater level at the item of testing is below the centerline of the sewer, the sewer will be tested for leakage by bulkheading the manhole at the lower end of the section under test, and filling the sewer with water until it is at least two (2) feet above the crown at the section. Leakage will be measured by the amount of water added to maintain the water at that level. Tests shall be carried for a minimum of four hours with readings at thirty minute intervals. The Contractor shall furnish labor, material and equipment necessary to make these leakage tests.

3. The allowable maximum amount of infiltration shall be 50 gallons per inch of diameter, per mile of pipe, per twenty-four hours.

4. When infiltration or leakage occurs in excess of the specified amount, defective pipe, pipe joints and manholes shall be located and repaired at the expense of the Contractor. If the defective work cannot be located, the Contractor, at his own expense, shall remove and reconstruct as much as the original work as necessary to obtain a sewer within the allowable infiltration (leakage) limit upon retesting as necessary.

B. Low Pressure Air Test

1. General

a. This test shall be conducted no sooner than 30 days after the sanitary sewers, including appurtenances and sanitary laterals have been installed, backfilled, compacted, and cleaned.

b. Provide either the low pressure air test or the water infiltration test for sanitary sewers submerged by ground water.

c. All Low Pressure Air Testing shall be in accordance with ASTM F1417.

d. This test method provides procedures for testing plastic pipe sewer lines, using low-pressure air to prove the integrity of the installed material and the construction procedures.

e. This test method shall be performed on lines after all connections and service laterals have been plugged and braced adequately to withstand the test pressure.

2. For diameters of sewer pipe, between 4 inches and 24 inches inclusive, the pipe shall be tested between adjacent manholes. The test time for the air pressure to drop the specified one pound shall be in accordance with the following table:

TABLE 1: LOW PRESSURE AIR TEST TIME (MANHOLE TO MANHOLE)

Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q = 0.0015

Pipe Dia., in.	Min-imum Time, min:s	Length for Min-imum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

Testing shall include the following:

3. Pressurize pipeline to 4.0 psi and allow to stabilize (stabilization of air temperature may cause pressure drop).

4. When pressure has stabilized, start test at 3.5 psi and record time.

5. If pressure drops more than 1.0 psi during the determined test time, the test will be considered failed.

6. If the test section is below the groundwater level, determine the height of the groundwater above the spring line of the pipe at each end of the test section and compute the average. For every foot of groundwater above the pipe spring line, increase the gage test by 0.43 pounds per square inch.

7. If the ground water level is 2 ft or more above the top of pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gage, the low pressure air test should not be used.

C. Inspection of gravity pipelines by lamping

1. The test shall be conducted no sooner than:
   a. 14 days after the base course has been placed, compacted and the density accepted, but before paving is constructed, if under a road or within 45 degrees of shoulder hinge point, or;
   b. 30 days after all backfill has been placed and consolidated, if outside of road/shoulder limits.

   Any section of the completed sewer failing to pass that test shall be repaired and retested, at the Contractor's expense.

2. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.

3. Equipment to include, but not limited to:
   a. Battery operated light
   b. Mirror capable of projecting down from surface reaching the invert of deepest sewer to conduct lamping without entering the manhole.

4. Whether televised or not, gravity pipelines shall be lamped and a record of the results of lamping furnished to the Engineer.

5. Check vertical and horizontal alignment by sighting through newly constructed pipeline after illuminating opposite end with a flashlight.

6. Light beam should be full throughout the section, but no less than two-thirds full under any circumstances.

7. Relay any section of pipe found to be out of alignment.

8. If Contractor wishes not to provide the above equipment for this test, then the proper confined entry equipment (i.e. tripod, harness, gas meter, barricades on surface, etc.) must be supplied. If all proper confined entry equipment is not provided, UPEA staff is prohibited from entering manhole, which results in no test, therefore a failed pipe section.

D. Deflection Testing

1. The entire length of the installed main line pipe shall be tested for acceptance with an approved go/no-go acceptance testing device to measure the deflection of the installed pipe. The maximum allowed deflection shall be 5%. Required mandrel sizes are listed in Table 2.

Table 2
Mandrel Sizes

Nominal Size	Base ID	SDR 35 5% Deflection Mandrel Size	Base ID	SDR 26 5% Deflection Mandrel Size
4"	3.895	3.70	3.811	3.62
6"	5.742	5.45	5.612	5.33
8"	7.665	7.28	7.488	7.11
10"	9.563	9.08	9.342	8.87
12"	11.361	10.79	11.102	10.55
15"	13.898	13.20	13.575	12.90
18"	16.976	16.13	16.586	15.76
21"	20.004	19.00	19.545	18.57
24"	22.48	21.36	21.964	20.87
27"	25.327	24.06	24.744	23.51
30"	29.132	27.68	28.461	27.04
36"	34.869	33.13	34.120	32.41

2. The test shall be conducted no sooner than:
   a. 14 days after the base course has been placed, compacted and the density accepted, but before paving is constructed, if under a road or within 45 degrees of shoulder hinge point, or;

   b. 30 days after all backfill has been placed and consolidated, if outside of road/shoulder limits.

   Any section of the completed sewer failing to pass that test shall be repaired and retested, at the Contractor's expense.

3. For acceptance, the device must pass through the entire section between manholes or other structures in one pass when pulled by hand without the use of excessive force.

4. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.

5. The testing device shall be a rigidly constructed cylinder or other approved shape, which will not change shape or size when subjected to forces exerted on it by the pipe wall. The device shall have a certificate indicating tolerances and date of last calibration. Engineer reserves the right to confirm dimension prior to any test.

6. All testing shall be done under the observation of the Engineer.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm drainage piping and fittings.
2. Accessories.
3. Underground pipe markers.
4. Catch basins and plant area drains.
5. Cleanouts.
6. Bedding and cover materials.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 23 16 - Excavation.
4. Section 31 23 17 - Trenching.
5. Section 31 23 19 - Dewatering.
6. Section 31 23 23 - Fill.
7. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
7. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
8. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

10. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D6938 - Standard Test Method for Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. Michigan Department of Transportation – current Standard Specifications for construction.

1.3 SUBMITTALS

A. Product Data: Submit data indicating pipe, pipe accessories, manholes and catch basins.

B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements. Provide copy of MDOT MTM 723 pressure testing approval.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, and invert elevations.

1.5 COORDINATION

A. Verify that field measurements and elevations are as indicated.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. High Density Polyethylene Pipe (HDPE): AASHTO M-294, smooth lined interior, corrugated pipe and fittings, bell and spigot style with gaskets. (ADS N-12 WT IB or approved equal).
   1. Manufacturer shall use only virgin resins in the manufacture of this pipe.
   2. Maximum burial depth 10'. Minimum burial depth 3'.
   3. Shall meet and provide certification of MDOT M723.

B. Reinforced Concrete Pipe: ANSI/ASTM C76, Class IV with Wall Type B; mesh reinforcement; inside nominal diameter of 12-30 inches, bell and spigot end joints with ANSI/ASTM C443, rubber compression gasket joint.
   1. Utilize MDOT table 402-1 for Class.
   2. Meet and provide certification of MDOT M-723 compliance.

C. Plastic Pipe: ANSI/ASTM D3034, SDR 35, Polyvinyl Chloride (PVC) material; inside nominal diameter, bell and spigot style rubber ring sealed gasket joints.

2.2 ACCESSORIES

A. Filter Fabric: Non-biodegradable, woven or non-woven; manufactured by Mirafi or equal.

B. Fittings shall be same material as pipe molded or formed to suit pipe size and end design.

2.3 CATCH BASINS

A. Catch Basin Lid and Frame Co.
   1. EJ (formerly East Jordan Iron Works)
   2. Engineer Approved Equal.

B. Catch Basin Lid and Frame:
   1. Construction: Cast iron construction, as specified in section 33 05 13.
   2. Lid Design: As detailed on plans. Lids in curb sections to match the curb profile.
   3. Nominal Lid and Frame Size: As shown on detail.

C. Shaft Construction: Reinforced precast concrete section per tongue and groove ASTM C478, Concentric barrel sections with eccentric cone top section; lipped joints per ASTM C443 or ASTM C990 grooved for "O" ring; sleeved to receive pipe, nominal shaft diameter of 48 inches, 24" sump; manufactured by U.P. Concrete Pipe Company, or equal.

D. Base Pad: Pre-cast or cast-in-place concrete per ASTM C478. The base and bottom section shall be of monolithic construction.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A5 (or Type A1, as directed by Engineer) as specified in Section 31 05 16.

B. Cover: Fill Type A5, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1, S2, or A5 as specified in Section 31 05 13 and Section 31 05 16. Subsoil with no rocks over 2 inches in diameter, frozen earth or foreign matter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with Type A1 or A5 aggregate.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, gaskets and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Place pipe on minimum 6 inch deep bed of Type A5 aggregate.

C. Lay pipe to slope gradients and elevations noted on drawings.

D. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches, compact to 95 percent.

E. Refer to Section 31 23 23 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 33 05 13 for manhole and structure requirements.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Mount lid and frame as specified in Section 33 05 13.

3.6 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing aggregate cover over pipe.

B. Compaction Testing: In accordance with ASTM D1557.

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

D. Frequency of Compaction Tests: Contractor tester shall test bedding and backfill at a frequency of (1) test per lift per 200 feet of trench.

E. Infiltration Test: Test in accordance with ASTM 969.

3.7 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Repair or replace pipe that is damaged or displaced from construction operations, at no cost to Owner.

END OF SECTION

SECTION 337173 - ELECTRICAL UTILITY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Arrangements with Utility Company for permanent electric service.
2. Payment of Utility Company for service charges.
3. Utility metering equipment.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete pads.

1.2 DEFINITIONS

A. Utility Company: Escanaba Electric Department.

Contact: Joshua Krajniak

Phone # (906) 786-0061

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with Utility Company, including relocation of overhead or underground lines interfering with construction.

C. If power lines are to be relocated, bill utility costs directly to Owner.

D. Service Installation:

1. Contact Utility Company regarding charges related to service installation, and include charges in Contract.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Submit drawings prepared by Utility Company.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

1.5 QUALITY ASSURANCE

A. Perform Work according to Utility Company written requirements, and maintain one copy at Site.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company Drawings.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. System Characteristics: 120/208 Volts, three phase, four wire, 60 Hz.

B. Service Entrance: Underground.

2.2 UTILITY METERS

A. Furnished by Utility Company.

2.3 UTILITY METER BASE

A. Provided by the Electrical Contractor, in accordance with the Utility Company specifications and requirements.

2.4 C/T CONNECTION CABINET

A. Equipment: As shown on drawings, per Utility Company Requirements

B. Include provisions for padlocking and sealing.

2.5 TRANSFORMER PAD

A. As detailed on plans.

B. Material: Cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete.

C. Size: As indicated on Drawings.

D. Furnish cut-out for conduits, per detail.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Disconnect and remove abandoned service equipment.

C. Maintain access to existing service equipment, boxes, metering equipment, and other installations remaining active and requiring access, by modifying installation or by providing access panel.

3.3 INSTALLATION

A. Service Entrance Conduits:

1. Provide and install 6” conduit for utility primary conductors as shown on site utility plan. Include bore under roadway as indicated.

2. Provide and install service entrance conduit and wires from new pad-mount transformer to new electrical service equipment.

B. Install cast-in-place concrete pad for Utility Company transformer, as specified in Section 033000 - Cast-in-Place Concrete.

END OF SECTION 337173

CITY OF ESCANABA

SPECIFICATIONS

SECTION

DIV. IV	WATERMAIN CONSTSRUCTION
DIV. VII	STORM SEWER CONSTRUCTION
DIV. III	ROAD CONSTRUCTION
DIV. V	SANITARY SEWER CONSTRUCTION

CITY OF ESCANABA

DIVISION IV DETAILED SPECIFICATIONS

WATERMAIN CONSTRUCTION CONTRACT

ESCANABA MICHIGAN

2015

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DIVISION IV

4.01 WATERMAIN CONSTRUCTION

4.01.01 GENERAL

A. Scope of Work

This work will be subject to the General Requirements and Covenants of the Contract, requirements contained herein, and details shown on the Plans. The Contractor shall provide all the labor, material, tools, equipment, accessories and services necessary to install the items called for on the contract documents, and will be responsible for producing a complete and workable installation in keeping with the intent of the Contract.

B. Applicable Standards

Unless otherwise specified herein, materials and methods for the construction of the watermain will conform to the standards set forth by the American Water Works Association (AWWA) and the American National Standards Institute (ANSI), including the latest revisions of any of those standards.

C. Work Included Under This Section

The work shall consist of furnishing and installing watermains, valves, hydrants, and fittings and other connections, of the type and size specified and at the locations shown on the plans. The work shall also include the necessary excavations, pipe bedding, backfill, testing and sterilization.

D. Shop Drawings

The Contractor shall furnish to the Engineer, as prescribed under the General Requirements, shop drawings of the various pieces of equipment to be incorporated into the work. Shop drawings will indicate design details of the items to be furnished, their location and function in the project, furnish operating details and other such information as will indicate to the Engineer their suitability for use under this Contract. The Engineer will approve shop drawings or request revisions or re-submittal as necessary to assure that a particular item is acceptable and conforms to the specifications.

E. Certification and Inspection

The manufacturer of pipe, fittings and other such items shall furnish a certified statement that all materials provided by him have been inspected and tested in accordance with the applicable standards. Each piece of pipe

and each fitting shall have its weight and class designation conspicuously cast or painted on it. All other pipe materials shall have the class designation painted thereon. Where required, other designation marks shall be painted on pipe and fittings to indicate correct location in the pipeline to conform to a detailed layout.

Upon delivery of pipe and other materials to the job site, it will be inspected and approved by the Engineer or his representative, at which time the Engineer will receive a copy of the manufacturer's certified statement. No cracked, broken, damaged or otherwise defective pipe or fittings will be incorporated into the work. Any item that is found to be defective after it has been placed shall be removed by the Contractor and replaced with a new piece.

F. Use of Public Water Supply

Unless specifically authorized by the Engineer or by special provisions elsewhere in this document, the Contractor shall not take water from an un-metered connection for use in the course of his work. Where water is to be drawn from City fire hydrants, the Contractor shall make an application with the City for a permit and issuance of a hydrant meter. The Contractor will be billed for water used at a rate determined by the City of Escanaba.

G. Equipment and Material Supplied by City

The Contractor shall not seek to purchase equipment or materials for use under this contract from the City Water Department, unless special provisions have been made elsewhere in this document for the purchase of specific items from City supplies.

4.01.02 MATERIALS FOR WATERMAIN CONSTRUCTION

A. General

The allowable types of pipe, fittings, joints and other items for watermain construction are specified herein. No leaded pipe, leaded pipe joints or other items containing lead will be allowed of any kind. All pipe shall have clear inside diameter not less than the dimensions called for in the plans and specifications. Wall thickness, class designation, and material of construction shall conform to these requirements and other such standards as are called for in these specifications.

B. Pipe Material

1. Ductile Iron Pipe (Class 52)

Ductile iron pipe (special thickness class 52) or (standard pressure class 52) for watermain construction shall meet all the requirements of the American National Standards Institute (ANSI) Specification A 21.51 and the American Water Works Association Specification C151, or the latest revisions thereof. Pipe shall be designated for a minimum working pressure of 250 pounds per square inch (psi), and shall be coated on the outside with a coating of coal tar varnish or asphalt base paint one mil thick applied at the point of manufacture in accordance with AWWA specifications. The inside of all ductile iron pipe shall be cement lined in accordance with ANSI Specification A21.4 (AWWA C104) or the latest revision thereof.

C. Joints for Pipe

Joints for use with ductile iron pipe shall be of the types enumerated below and shall be furnished with pipe for use at the locations shown on the plans or otherwise listed in the Contract Documents. All necessary joint materials, gaskets, bolts, lubricants and other such items as are necessary to make a completed joint shall be furnished with the pipe or fitting.

1. Slip on (push on) Joints. Slip on joints shall conform to ANSI Specification A21.11. Rubber gaskets and lubricant shall be furnished with the pipe in sufficient quantity to complete all joints in the pipeline.

2. Mechanical Joints. These joints shall conform to ANSI A21.11. Rubber gaskets shall be according to the manufacturer's standard. Mechanical joint pipe shall be required for use when watermain is to be enclosed in a casing pipe.

3. Flanged Joints. Flanged joints will be made using ANSI 125-pounds pattern flanges and shall include all necessary bolts, nuts, washers and gaskets in accordance with ANSI B16.1.

4. Ball Joints. These joints shall be cast iron, mechanical, flexible jointed tube, designed to withstand a working pressure of 200 psi and a hydrostatic test pressure of 300 psi. Joints shall be similar to those produced by the following companies:

a. "FLEX-LOK" by American Cast Iron Pipe Company

b. "USIFLEX" by U.S. Pipe and Foundry Company

c. "River Crossing Pipe" by James B. Clow & Sons, Inc.

D. Valves

Valves of the required type shall be furnished and installed at the locations shown on the plans. Valves supplied shall be compatible with the type of pipe material and joints called for on the plans and shall conform to the requirements listed below:

1. Valves for Use with Ductile Iron and Cast Iron Pipe

a. Resilient Wedge Gate Valves, 3 inch – 12 inch - Resilient wedge gate valves shall conform to AWWA Standard C509-94, or the latest revision thereof and shall be furnished with the following detailing:

i. Open left or counter-clockwise
ii. 2" square wrench nuts, where applicable
iii. Bronze stem
iv. Wedge rubber bonded to ductile iron wedge
v. Symmetrical seating about stem centerline
vi. Depression or cavities in seat area
vii. Body and bonnet of valve to be fusion bonded epoxy coated inside and out
viii. Double "O" ring stem seal
ix. Arrow cast in metal indicating direction opening

Valves shall be designated as follows:

Type	Application	Operator	Type Joints
RA	Direct burial	2 inch square wrench nut	Mechanical

Valves shall be similar to the Waterous Series 500, American 80 "CRS", Clow R/W or an approved equal.

b. Tapping Valves. Tapping valves shall conform to the requirements outlined in Section a., above, for gate valves, except that joints shall consist of a flanged joint inlet end for mating with the tapping sleeve and a restrained mechanical joint outlet. Oversize seat rings may be provided to permit entry of tapping machine cutters. Tapping valves shall be similar to the F-5093 Mechanical Joint Tapping Valves as manufactured by the Clow Company or an approved equal.

E. Valve boxes for use with buried gate valves or butterfly valves shall be two piece, screw type adjustable cast iron boxes with a 5¼ inch diameter shaft (similar to Clow 2452) or approved equal. Covers shall be furnished with finger holes and shall be marked "WATER".

F. Standard Fittings

Fittings to be used for watermain construction shall be of a type and material compatible for use with the type of pipe being used and shall meet the following requirements:

1. Fittings for use with Ductile Iron Pipe
Fittings for Ductile Iron Pipe shall meet the requirements of ANSI Specification A21.10 (AWWA C110) and shall be constructed of cast iron or ductile iron as specified. The exterior of the fittings shall have a one mil thick coating of bituminous material applied at the point of manufacture in accordance with AWWA C110. The interior of all fittings shall be cement lined in accordance with ANSI Specification A 21.4 (AWWA C104). Certification and marking shall be as specified therein. This standard shall also apply to fittings with push-on joints.

G. Special Fittings

Fittings called for on the plans which do not fall under the purview of AWWA Standard C110 shall nonetheless be constructed and certified by the manufacturer thereof to be compatible with fittings for ductile iron watermain. Such Special Fittings comply insofar as practicable with the provisions of AWWA C110 with regard to workmanship, durability and material of construction, they shall be designed to withstand the same working and test pressures as prescribed for the watermain and its appurtenances and shall be built to such other standards as are commonly accepted as normal practice within the waterworks industry.

H. Fire Hydrants

Fire hydrants shall be of the dry-barrel type and shall meet the requirements of AWWA Standard C502-80, including any revisions thereto. In addition, the standard fire hydrant for use in the City of Escanaba will be supplied with the following details:

1. Bury Length:	6 foot – 6 inch
2. Outlet Details:	
Hose Bibs:	2 ea, 2½ inch Diameter Thread 3-3/32 inch
Major:	Diameter x 8 threads per inch
Steamer:	1 ea, 4 inch diameter Thread 4.5-4NH, National Standard
3. Main Valve:	5 inch min diameter
4. Inlet Connection	6 inch Mechanical Joint (Restrained)

5. Direction to Open:	Left (Counter-clockwise)
6. Finish:	Paint chrome yellow above grade line; asphalt varnish per AWWA below grade
7. Shut Off:	Compression - closes with pressure
8. Drain Outlet:	Plugged or eliminated
9. Nozzle Cap Nuts:	7/8 inch Pentagon Lug
10. Operating Nut:	7/8 inch Pentagon Lug
11. Stem Seal:	"O" Ring

Hydrants shall be East Jordan Iron Works 5BR-250 Watermaster or similar. Approval by the Engineer is required.

I. Continuity Conductors

Electrical continuity on watermain pipe shall be provided through the use of continuity conductors where fittings such as push-on joints do not allow current to pass. Continuity shall be provided through the use of brass wedges as provided by the manufacturer of the pipe, "Electro-Bond" strips, "Cadweld" connectors or similar devices as approved by the Engineer. No lead tipped gaskets may be used.

J. Bedding Material

Bedding material for watermain, in general, shall consist of sand or a similar granular material. While some small amounts of clay or silt will be acceptable in the material, it shall be substantially free of lumps. The bedding material shall likewise be substantially free of sticks, rocks, boulders, rubbish, muck and other debris which would cause damage to the watermain. Bedding material which contains frozen chunks shall not be used.

K. Backfill Material

Unless otherwise called for on the plans or when directed by the Engineer, earth excavated from the trench may be used for backfill, provided that it consists of sand, loam or other suitable material. Unstable materials containing peat or other organic or materials which contain large amounts of refuse, broken pavement, boulders, roots, stumps or other debris shall not be incorporated into the backfill.

L. Stone Backfill

Stone used for backfilling trench undercuts or for trench stabilization shall meet the requirements for 6A Stone, per 2003 Interim Michigan Department of Transportation (MDOT) Standard Specifications for Construction.

4.01.03 CONSTRUCTION METHODS

A. GENERAL. The Contractor will be responsible for assuring that the methods of construction are in reasonable accord with generally accepted industry practices, standards as set forth by the American Water Works Association, the requirements set forth herein, and determinations made by the Engineer. Unless specifically stated otherwise on the plans or at the discretion of the Engineer, the following general rules shall apply:

1. Handling and Storage of Materials. Materials delivered to the job site for incorporation into the work shall be handled and stored in such a manner as to prevent damage to the materials. Such materials shall be neatly placed along or near the site so as to minimize inconvenience to the public and property owners and with due regard to the safety of the general public. Construction materials shall not be placed or stored closer than twenty feet from any fire hydrant, cross-walk or intersection.

2. Sequence of Operations: As a rule, the following sequence will be followed by the Contractor:

a. Pipe laying
b. Sterilization
c. Cleaning & Flushing
d. Bacteriological Testing
e. Pressure & Leakage Testing
f. Electrical Continuity Test
g. Put Main in Service
h. Tap & Install Services

Deviation from this sequence may be permitted by the City Engineer provided that prior approval is obtained and that such deviation is warranted.

3. Minimum Depth of Bury. All watermain constructed within the City of Escanaba shall be buried with a minimum of 6.0 feet of cover between the top of the pipe or fittings and the surface of the ground. When a proposed surface grade is shown on the plans, it shall serve as the datum for determining depth of burial; otherwise depth of burial shall be measured from the existing surface.

4. Isolation from Sewers. Any watermain constructed parallel to a sanitary sewer shall be separated by a distance of 10 feet, measured horizontally, from the centerline of the sewer. Watermain which crosses a sanitary sewer shall be separated by a distance of 18 inches, measured from the outside of each pipe, at their closest points.

5. Notification of Utility Customers. When the Contractor's schedule of work includes shutting down all or parts of a watermain, or other operation, which will disrupt service to customers of the water utility, the Contractor shall be responsible for notifying affected customers in advance. Businesses shall have at least 72 hours advance notice and contact shall be made personally or by telephone with the manager or other person in charge of the business. Private residences shall be notified as soon as practical in advance of any shutdown and mass media communication may be used. Fire departments shall be given 72-hour notice. Any outage shall not exceed four hours without approval of the Owner.

B. EXCAVATION. The Contractor shall proceed with trench excavation with due regard for life, health and property. MIOSHA Construction Safety Standards by Sections 19 and 21 of Act #154 of the Public Acts of 1974 and all amendments to present date. Appropriate equipment shall be used to perform the work and, where necessary, extra measures such as the use of sheathing, shoring, trench boxes and dewatering systems shall be employed. Excavation shall proceed in the direction of pipe laying and shall be in reasonable conformity to the line and grade established on the plans or by the Engineer. The following shall also be observed:

1. Protecting Other Utilities: **CALL MISS-DIG**. No excavation work shall commence until owners of other utilities have been notified and they have had an opportunity to mark the location of any equipment, pipelines, conduits or other works located within the project area. Excavation within close proximity to underground utilities shall proceed cautiously and final uncovering shall be done with hand shovels in order to protect such utilities from damage. Where excavation work uncovers conduit, pipelines, bases for utility poles, or similar structures, the Contractor shall make arrangements to shore up, guy, support, or otherwise protect such utilities from damage caused by cave-ins or settlement in the trench.

2. Removal of Surfacing. When excavation will take place within or through an improved street, roadway, driveway or sidewalk, the pavement or surfacing shall be cut straight and square at the edges of the trench, using suitable equipment. The surfacing material shall then be removed and disposed of before excavation of the trench begins. Cuts for removal of surfacing shall be made equidistant on either side of the pipe centerline and no further apart than the allowable trench width, as

provided in Section 4, below. Payment will be incidental to the cost of installing watermain, unless provided for elsewhere in the Contract.

3. Length of Open Trench. Not more than 200 linear feet of trench may be open at one time. Under unusual circumstances, the Engineer may authorize more than 200 linear feet of trench to be open, provided that pedestrian and driveway crossings are maintained at intervals of not more than 200 feet and that not more than one street intersection is closed to traffic.

4. Trench Width. The maximum trench width at the top of the pipe shall not exceed the outside diameter of the pipe being laid, plus 24 inches. This width may be increased to allow for stringers and sheathing when they are required. At least 6 inches of clearance shall be maintained between the outside face of the pipe barrel and the trench wall or sheathing. If the trench width at the ground surface exceeds the allowable width at the top of the pipe by more than four (4) feet, the Contractor shall use sheeting and shoring, dewatering systems, or other such measures as are consistent with maintaining a safe trench and safeguarding adjacent curbing, sidewalk, utilities and lawns.

5. Trench Undercut and Backfill. Where unstable soil conditions, or obstructions, require that the trench be excavated below the elevation shown on the plans and backfilled with material meeting the gradation requirements for Coarse Aggregate 6A, such excavation and backfill will be measured by volume in cubic yards as Trench Undercut and Backfill. The volume of Trench Undercut and Backfill will be computed from the length, depth, and width of undercut authorized. The width of the trench authorized will be in accordance with the width shown on the plans for the size of pipe required. No allowance will be made for sloping the sides of the trench. Trench Undercut and Backfill will be paid for at the contract unit price per cubic yard, which price shall be payment in full for excavation and disposal of materials below the bottom of the trench indicated by the plans and for furnishing, backfilling, and compacting the undercut with material meeting the gradation of Coarse Aggregate 6A, up to the bottom of the trench elevation indicated by the plans.

C. PIPELAYING. The Contractor shall have adequate and sufficient equipment at the work site for lowering pipe and fittings into the trench and effecting their installation without damage. Under no circumstances will pipe or fittings be dropped into the trench. Any scratches or damage to coatings will be repaired and all mud or accumulations of dirt will be removed from pipe or fittings prior to their installation. The following items shall be followed in laying pipe:

1. Line and Grade. The pipe shall be laid in the trench in reasonably close conformity to the line and grade shown on the plan. The Contractor will be responsible for string line, batter boards or other

methods of measurement as will assure that the pipe is to correct line and grade based on the plans, directions of the Engineer and layout controls as the Engineer may establish. In general, pipe in the trench will be laid with a tolerance of plus or minus 6 inches for grade and plus or minus one (1) foot for line. At structures or fittings, alignment shall be sufficiently precise to assure that no undue misalignment or stress is placed upon fittings or structures.

2. Direction of Laying. Unless otherwise directed, the pipe shall be laid with bell ends facing the direction of laying. When the grade exceeds 2 percent (2%), the bell ends shall face upgrade.

3. Bedding Pipe. All pipe shall be bedded around the bottom one-quarter of its circumference in material meeting the requirements of Section 4.01.02 J., Bedding Material. Care shall be exercised to ensure that a minimum of four (4) inches of bedding material, free of rocks, sticks or boulders is placed below the pipe. Where the natural material in the trench bottom meets the requirements for bedding material, the pipe may be laid directly on the trench bottom and bedding material placed and compacted around its circumference. The pipe shall be uniformly supported along its entire length and no loose spots or voids are to be tolerated. If Trench Undercut and Backfill (4.01.03 B.5) has been used, sufficient bedding material shall be placed to assure that the pipe is uniformly supported. Where trench excavation is in rock, a minimum of 6 inches of bedding material will be placed between the neat line and the bottom of the pipe.

4. Covering Pipe. Once the pipe has been properly laid and jointed, it shall be covered with material meeting the requirements of bedding material. The cover material shall be carefully placed by hand or other means to prevent inclusion of rock, frozen lumps or other deleterious material and to ensure that the pipe will not be dislocated in the trench. The cover material will be placed and compacted, free of loose spots or voids around the side of the pipe and up to a depth of 6 inches above the top of the pipe. No backfilling of the trench will be done until the pipe is properly covered.

5. Joining Pipe. The interior of all pipe and fittings will be kept clean during the laying and joining operations. If necessary, the Contractor shall plug or cover the ends of pipe and fittings until they have been lowered into the trench and just before the joint is made. The spigot ends of pipe shall be carefully centered in the bell of the previous piece and forced home. The pipe shall then be brought to line and grade. Every precaution shall be taken to prevent dirt from entering the joint space or damage to gaskets. All joints shall be made in strict accordance with manufacturers recommended practice with particular attention given to maximum allowable deflections. After the joint is made and the pipe has been brought to line and grade, it shall be sufficiently anchored with

bedding and cover material to prevent its being dislodged by placement of the next piece.

6 Restraining Joints. All joints with deflections greater than 10 degrees, all tees, hydrant leads, end caps, plugs and similar fittings subject to axial thrust from water pressure shall be suitably restrained against movement or blowing off. The method of joint restraint shall be designed to withstand, at a minimum, the test pressure to be applied to the watermain. The Contractor shall submit details of proposed joint restraints, showing type and location, to the Engineer for approval. The following methods of joint restraint and their applications shall be acceptable:

a. Retainer Glands: When mechanical joint pipe and fittings are used, mechanical joint retainer glands shall be installed on a sufficient number of joints each side of a bend or fitting to adequately restrain the pipe. Extreme care shall be used in tightened uniformly and in proper sequence, to the torque specified by the manufacturer.

PIPE RESTRAINT SCHEDULE

	Length of restraint reg'd (feet - each side)			Design Strength of Restraint Required (Kips)	
Deflection Angle:	22½	45	90 or tee	45	90 or tee
6"	3	11	37	2.0	5.0
8"	4	15	50	3.0	9.0
12"	6	22	73	6.0	20.0
16"	8	28	95	11.0	36.0

b. Strapping & Lugging: Where it is not practical to use thrust blocks to restrain push-on joints, as at points of vertical deflection in a pipe, strapping and lugging of the joints may be used. A sufficient number of joints shall be restrained each side of the joint so as to prevent movement or blow-off of the joints or fittings. Strapping and lugging systems shall be of a suitably corrosion resistant material and shall be approved by the Engineer before use.

7. Field Cutting Pipe. When cutting pipe in the field, suitable equipment shall be used which will not damage the pipe, its lining or coatings. Cuts shall be perpendicular to the long axis of the pipe and the end of the cut shall be beveled back about 1/8 inch at an angle of 30 degrees to the pipe centerline.

8. Protecting Open Pipe Ends. Open ends of all pipe shall be protected against the intrusion of dirt, water and other contaminants during the pipe laying operation. Pipes which have been filled with dirt of mud shall be cleaned to the satisfaction of the inspector prior to continuation of the pipelaying operation. When pipelaying work is suspended for any period of time, a watertight plug shall be inserted in the end of the last pipe laid.

D. VALVES AND HYDRANTS. Valves and hydrants shall be installed at the locations indicted on the plans and in accordance with requirements elsewhere in these documents concerning depth of bury and types of joints.

1. Installing Valves. All valves will be installed with valve boxes unless they are to be located in a vault or structure as indicated on the plans. The valve shall be set with the stem plumb and shall be set on concrete blocking adequate to prevent settling. Care shall be exercised in aligning the valve with its mating pipe so that no load or stress is placed on the valve body due to misalignment or improper bedding of the pipe. Bedding material shall be carefully placed and compacted up to the level of the bottom of the valve box after the valve has been properly installed and all joints secured.

2. Installing Valve Boxes. Valve boxes shall be centered over the valve operating nuts and set on brick blocking adequate to support the valve box at the proper elevation above the valve. The valve box shall then be plumbed and the top adjusted to grade. During backfilling, the valve box shall be adequately braced to prevent its shifting. Any valve box which is knocked substantially out of plumb or which is dislodged from its center over the operating nut, shall be re-excavated, plumbed up and re-centered over the valve.

3. Installing Hydrants. Hydrants shall be set on a concrete pad 18 inch x 18 inch x 2 inch or stone backfill material which has been cut properly to grade. The grade ring of the hydrant shall be at the finished surface grade at the hydrant location and the barrel of the hydrant shall be plumb from top to bottom. The shut-off gate for the hydrant and a connecting piece of 6 inch watermain between the hydrant and the gate valve shall have been installed, connected to the hydrant lead and suitably restrained against thrust as prescribed in Section 4.01.03 C. Care will be exercised that there is no misalignment between the pipe, valve and hydrant.

4. Cutting In Valves. When the plans call for cutting a valve into an existing watermain, the Contractor shall make arrangements at least 72 hours in advance with the City Water Department to shut down the section of main involved. (All work of this type will be coordinated specifically with the City Water Department prior to any work being performed). The work may have to be scheduled at night in order to minimize service disruptions. Excavation will comply with applicable parts of Section

4.01.03 B. The required length of main shall be cut out using an appropriate cutter in accordance with Section 4.01.03 C.7. After the outside of the pipe has been cleaned of scale and loose rust, a valve of the type called for on the plans shall be installed along with a cutting-in sleeve. A special cutting-in valve and sleeve unit may be used, provided that the valve is of the required type and conforms to the specifications in Section 4.01.02D. Joints on the valve and sleeve shall be mechanical joints and shall be furnished with retainer glands. When a valve is to be cut into sand cast pipe, a mechanical joint transition coupling and short piece of ductile iron pipe shall be installed on the side of the valve opposite the cutting-in sleeve. Joints shall be restrained with mechanical joint retainer glands. No machining of the O.D. of sand cast pipe in order to make valves fit directly will be allowed.

E. GRADE AND DIRECTION CHANGES

1. By Deflection of Joints. Changes in grade or direction to produce a gradual curve in the pipeline or for minor corrections of alignment shall not, in general, exceed 4 degrees at any one joint unless the manufacturer warrants that a larger deflection is permissible (80% of the maximum).

2. By Use of Bends & Fittings. When a change in direction or an obstruction is encountered in the path of the watermain such as a culvert, manhole or other utility, the watermain shall be deflected around or under the obstruction using appropriate fittings. A minimum of 18 inches of clearance between the watermain and its crossing of another utility will be provided and where the watermain must cross under a stream or culvert, 3 feet of clearance will be provided. All bends or fittings shall be restrained. The laying of such fittings will be paid for at the unit price bid for each size of watermain. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstructions.

SCHEDULE - MAXIMUM DEFLECTION OF DUCTILE IRON PIPE

Type of Pipe Joint	Pipe Size in Inches 4	6	8	10	12	14	16
Super Bell-Tite	5E	5E	5E	5E	5E	5E	5E
Mechanical Joint	E 8-18'	E 7-7'	E 5-21'	E 5-21'	E 5-21'	E 3-35'	E 3-35'
Locked M.J.	E 2-45'	E 2	E 1-30'	E 1-15'	E 1	E 0-45'	E 0-46'
Super-Lock	E -	E 4	E 4	E 4	E 4	E 3	3
River Crossing	-	E 15	E 15	E 15	E 15	E 15	E 15

SCHEDULE - TOTAL DEFLECTION OF PIPE IN FEET FOR DIFFERENT ANGLES OF DEFLECTION AND NUMBER OF LENGTHS OF PIPE

No. of Degrees of Deflection per Joint:

Total Length of Pipe in Feet	Lengths of Pipe	1E	2E	3E	4E	5E
18	1	.31	.63	.94	1.26	1.57
36	2	.94	1.88	2.82	3.76	4.69
54	3	1.88	3.77	5.64	7.50	9.35
72	4	3.14	6.27	9.38	12.47	15.51
90	5	4.71	9.40	14.04	18.62	23.12
108	6	6.59	13.14	19.60	25.94	32.12
126	7	8.79	17.49	26.05	34.39	42.44
144	8	11.29	22.45	33.37	43.93	54.01
162	9	14.11	28.02	41.54	54.51	66.74
180	10	17.23	34.17	50.54	66.08	80.53
Approx. Radius in feet of curve produced by a success of joints.		1034	514	343	258	206
Approx number of 18 ft lengths of pipe required to make a 90° bend		90	45	30	23	18

F. CONNECTIONS TO EXISTING WATERMAIN. Connections to the existing water distribution system will be made only after the new section of the main has been tested and approved by the Engineer in accordance with Section 4.01.04. Where service to the existing distribution system must be disrupted in order to cut in tees or do similar work, arrangements will be made at least 72 hours in advance with the City Water Department to shut down the required portion of the distribution system. This work may have to be done at night in order to minimize disruption of service to utility customers. Connections shall be made at the required location using fittings as detailed on the plans. Any tees, couplings or cutting-in sleeves used shall be provided with restrained mechanical joints. Where sand cast pipe or pipe of another material is encountered which as a different outside diameter from ductile iron pipe of the same nominal size, a mechanical joint transition coupling shall be used to make the connection. Machining the outside diameter of sand cast pipe to mate with ductile iron fittings will not be authorized. Tapping into existing watermains shall be done by City of Escanaba personnel only on a work order basis or as directed by the Engineer.

G. BACKFILLING. Once the requirements of Section 4.01.03C. have been met and the watermain has been properly covered with bedding material, backfilling may commence. Except as indicated below, backfill material shall meet the requirements of Section 4.01.02 K.

1. Excavated material from the trench may be used as backfill if it meets the requirements of Section 4.01.02 K and provided that details on the plans do not call for other materials for subbase under a roadway.

2. Where excavated trench material is found to be unsuitable, borrow material meeting the requirements of section 4.01.02 K. or other details shown on the plans shall be furnished by the Contractor. Surplus excavated material shall become the property of the Contractor and shall be disposed of by him.

3. The backfill material shall be placed carefully in the trench by hand or by machine. Care shall be exercised so as not to shift or dislodge pipe, valve boxes, hydrants and other such items.

4. The backfill shall be placed in 12 inch lifts and compacted to 95% density as measured by the Standard Proctor Test. The engineer may require other compaction densities under roadways or for special circumstances. Unless agreed to, density tests shall be performed by the Engineer or other agents of the City of Escanaba.

5. The upper limits of backfill shall be top of subgrade under roadways and final grade in other areas.

H. SURFACE RESTORATION. All streets and other areas, including all lawns, driveways, pavements, sidewalks, shoulders, curbs and roadway slopes, shall be

restored to original condition or better after completion of the work. The Contractor shall be responsible for restoration, at his own expense, of any private or public properties outside the project limits which have been damaged by his operations or by negligence of his employees. Unless otherwise detailed ln the plans, materials used for restoration work, and their application, shall conform to requirements of the Michigan Department of Transportation Standard Specifications for Construction, edition of 2012, and any revisions thereto. Such materials include, but are not limited to, the following:

ITEM	APPLICABLE MDOT SPECIFICATION
Embankment	205
Subbase	301
Hot Mix Asphalt Pavement	501
Aggregate Base Course	302
Granular Material	205
Concrete	801
Sidewalk	803
Aggregate Surface Course, 22A, 23A	306
Concrete Curb & Gutter	802
Topsoil surface	917
Sodding	816
Seeding	917
Mulching	917

4.01.04 CLEANING, TESTING, STERILIZATION

A. GENERAL. Cleaning, testing, and sterilization of watermains shall comply with there requirements of AWWA Standards C651-92 and the requirements contained herein. The sequence of operations shall follow that outlined in Section 4.01.03 A., unless otherwise approved by the Engineer for a good reason. The watermain or portions thereof shall be tested by the Contractor in the presence of the Engineer, and all leaks or other deficiencies corrected prior to acceptance by the Engineer. The Contractor shall furnish all piping, bulkheads, pumps, gauges, water, and other materials required to clean, sterilize and test the watermain.

B. CROSS CONNECTIONS. The Contractor shall take every precaution necessary to assure that cross connection does not exist between the public water supply and the watermain being cleaned, tested or sterilized. For the purposes of this specification, a cross connection shall be any connection between the new watermain and the public water supply or any operation by the Contractor which could potentially introduce non-potable water, contaminated water, sterilizing chemicals, mud, dirt or other objectionable or hazardous materials into the public water supply. Particular attention shall be paid to the following areas:

1. During pressure testing or other operations where the new main is at higher pressures than the water in the distribution system, any hose, pipe or other connections used to obtain water from the public water supply shall be physically disconnected.

2. When portions of the existing distribution system must be shut down in order to complete a connection of the new main or do similar work, any open pipe ends, tees, tapping valves or similar items shall be bulkheaded after the pipe is drained and safeguarded against intrusion of dirt, trench water or other contaminants until after the connections are completed.

3. Any corporations and attached water tubing installed for the purpose of chlorinating or flushing shall be shut off and capped after final use in order to prevent groundwater or other contaminants getting into newly cleaned mains.

C. PRESSURE AND LEAKAGE TESTING. The Contractor shall have adequate pumps, monitoring gauges and other such equipment to properly perform the test to the conditions and requirements of Section 4 of AWWA Standard C600-93. The main shall be pressure tested in convenient lengths with a test pressure of 140 to 150 psi, measured at the highest point in the pipe, maintained throughout the test. The following procedures shall be followed:

1. PRESSURE TEST – TWO HOUR DURATION

a) All gate valves at the boundaries of the test section shall be closed.
b) The test section shall be slowly filled with water and all air bled out of the test section through hydrants, blow-offs or other connections.
c) Any hoses or connections to the public water supply, used for filling the test section, shall be disconnected for the duration of the test.
d) The high pressure pump shall be connected to the main at the test point and the main brought up to test pressure and held there.
e) During the pressure test, all exposed pipe, fittings, valves, hydrants and joints will be examined for leakage, distortion or other failures. If any damage or defective parts are discovered, they shall be replaced and the pressure test repeated.

2. LEAKAGE TEST - TWO HOUR DURATION

a) The leakage test shall commence immediately after successfully completion of the pressure test and while the main is at the test pressure of 140 to 150 psi.
b) All main line valves and hydrant lead valves within the test section shall remain open during the leakage test.
c) The test section shall be maintained at the test pressure, for a two-hour test period.
d) Make-up water for the leakage test shall be taken by the pump from a calibrated drum or other suitable container, from which the volume of water pumped into the main can be determined.
e) At the end of the two-hour test period, the volume of water taken from the container shall be considered to represent the volume of leakage from the section of watermain under test.

f) The allowable leakage shall be computed by the formula:

$$L=\frac{SD\sqrt{P}}{148,000}$$

Where:
L = is the allowable leakage in gallons per hour,
S = length of pipe in feet,
D = is the nominal pipe diameter in inches,
P = is the average test pressure during the leakage test in pounds per square inch gauge.

An additional leakage of 0.0078 gallons per hour/inch of nominal valve size will also be allowed for each closed valve at the test section, including hydrant valves.
NOTE: Formula equals 0.5 gallons per hour per mile per inch diameter at 140 psi for 18 foot lengths or 1.0 gallons in two hours testing.

g) The following tabulated values may be used where applicable:

Allowable leakage per 1000 feet of pipeline (two-hour test, 18 feet nominal laying length, 150 psi test pressure)

NOMINAL ALLOWABLE OR VALVE SIZE	ALLOWABLE LEAKAGE (Gallons /2 hours)	ADDITIONAL LEAKAGE EACH VALVE
4”	0.33	0.05
6"	0.50	0.1
8"	0.66	0.1
10"	0.83	0.2
12"	1.00	0.2
14"	1.16	0.2
16"	1.32	0.3

Note that a test section may contain different pipe sizes, hydrant leads, etc. the leakage of each of which must be combined for the test section.

h) In the event that leakage exceeds the specified amount, the main and all fittings, valves and other appurtenances shall be exposed and inspected until the leak is found and repaired. After repair of any leaks, the section shall be retested. Final acceptance of the watermain will not be made until all sections thereof have been successfully tested.

i) After successful completion of the two hour pressure test, each valve within the test section, including gates on hydrant leads, shall be checked against test pressure as follows:

a] Close valve furthest from test point;
b] Vent main on non-pressure side of valve being tested;
c] Observe pressure gauge at test point; allowable pressure drop shall not
d] Close next closest valve toward test point;
e] Open valve previously tested;
f] Repeat procedures a] through e] progressively back toward test point until all valves within the test section has been tested;
g] Any valve which shows excessive leakage by this test shall be repaired or replaced by the Contractor and retested.

D. CLEANING. After successful completion of the pressure and leakage testing and prior to sterilization, the Contractor shall clean the main and all hydrant leads by flushing with potable water. A minimum velocity of flow of 2.5 feet per second shall be maintained to ensure that all heavy debris is removed from the main. Flushing shall continue until the water runs clear or until a volume of water equal to twice the volume of the pipe has been flushed through. This requirement for cleaning shall not absolve the Contractor of responsibility for assuring that the pipe is not contaminated during construction, as outlined in Section 4.01.03. As a guide to determining required flushing rates the following table may be used:

Required Openings to Flush Pipelines:

PIPE SIZE

At 40 psi residual pressure, a 2½ inch hydrant nozzle will discharge approximately 1000 g.p.m..

All hydrant leads and connecting pipe within the section shall be flushed clean.

E. STERILIZATION. Upon completion of the flushing operation, the main shall be sterilized by chlorinating in accordance with AWWA Standard C651-92. The following rules shall apply:

1. Potable water shall be used.

2. As the main is filled with water for disinfecting, a chlorine solution shall be added or injected so as to completely mix with the water and distribute throughout the main.

3. Initial chlorine solution strength in the main shall be chlorinated according to the (standards for disinfecting watermains), prepared by the American Water Works Association, C651-92.

4. The chlorine solution shall be allowed to stand in the main for a period of 24 hours, at the end of which time the chlorine concentration shall not be less than 10 or more parts per million throughout the length of the main.

5. During the contact period, all main line valves and hydrant gates shall be operated in order to disinfect them.

6. Chlorine in tablet form may not be used.

7. Chlorine required to produce 50 mg/l concentration in 100 feet of pipe by diameter.

Pipe Size In.	100% Chlorine Pound	1% Chlorine Solutions Gallon
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.40
12	0.240	2.88

8. At the end of the contact period, the highly chlorinated water shall be flushed from the main until the chlorine concentration leaving the main is no higher than that prevailing in the distribution system or less than one part per million. The chlorinated water shall not be discharged into the City storm system.

9. After the final flushing and before the main is put into service, not less than 2 consecutive water samples for bacteriologic analysis shall be collected. The first sample shall be drawn 24 hours after final flushing; the second sample shall be drawn 24 hours after the first sample. (Refer to Part II, Michigan Safe Drinking Water Act, being Act 399 of Public Acts of 1976 and Recommended Standards for Waterworks).

10. The Contractor may utilize fire hydrants to obtain samples for the bacteriological tests if they are at an appropriate location from the spacing standpoint. However, he should be aware that these can sometimes be a source of contamination and may cause samples to show an unsafe condition. In order to meet the total testing requirements, the Contractor may have to install temporary corporations in the main line at various locations. Any costs associated with such temporary installations shall be the sole responsibility of the Contractor and shall be incidental to the price of watermain construction. If corporations are used, the Contractor shall use threaded plugs after testing is completed.

11. If the samples do not show results which meet State of Michigan safe drinking water standards, the main shall be re-sterilized and new samples taken as prescribed above. Final acceptance of the main will not be made by the Engineer until bacteriologic sampling shows safe results.

12. Upon acceptance of the test results, the Contractor may proceed with installing services and making connections to the distribution system. All short pieces of pipe, tapping valves and other items used in final connection shall be field chlorinated by swabbing with a 4% chlorine solution.

F. CONTINUITY TESTING. The pipeline and hydrants shall be tested for electrical continuity and current capacity. The test shall be made after hydrostatic testing is completed and while the line is at normal operating pressure. A direct current of 200 amperes, ±10%, shall be passed through the section under test for a period of 5 minutes. Current flow shall be continuously monitored with a suitable ammeter. Insufficient current, excessive fluctuation or arcing shall be indicative of defective electrical contact and the cause shall be isolated and corrected. The section shall be retested until it passes the conductivity test.

4.02 WATER SERVICES (DEFINISION)

Add language referring to private water services and public water main.

Any water service line 2 inches in diameter or smaller shall be considered (private). Any repairs or replacements shall be at the expense of the property owner. Any water service line 2 ¼ inches or larger shall be considered a City of Escanaba water main. Any repairs or replacements shall be at the expense of the City of Escanaba.

4.02.01 GENERAL

A. Description

This work shall consist of installing a water service line, of the size specified, from the City watermain to the property line. Items included in the work will be: pressure tapping of the watermain and installation of a corporation stop, laying of the service line piping, installation of a curb stop and box at a location designated by the Engineer, connecting to an existing water service with the required fittings or capping the curb stop for a future connection. Also included in the work are the necessary excavation, jacking, tunneling, backfilling, compaction, dewatering of trenches, removal and replacement of curb, sidewalk, trees, shrubs, lawns, street surface, provision of labor, materials, equipment and other incidentals necessary to complete the work and test the installation for its suitability for use.

4.02.02 MATERIALS

A. GENERAL

Materials to be incorporated into the work shall meet the requirements as outlined below for service lines 1 inch through 2 inch diameter and shall

comply with the provisions of AWWA C800 as regards composition and style of thread.

1. Corporation Stops shall be constructed of red brass, per AWWA C800, shall have the standard tapered inlet thread and a compression copper outlet for use with copper water tube. Acceptable brands shall include the Mueller H 15008 or Mueller H 5023 or an approved equal.
2. Curb Stops shall have compression connectors for both inlet and outlet ends and shall be of red brass as per AWWA C800. Acceptable brands shall include the Mueller H 15209 or an approved equal.
3. Service Piping for 2 inch shall be type "K" soft annealed seamless copper tubing conforming to the requirements of ASTM B-88.
4. Service Boxes (Curb Boxes) shall be of cast iron, extended arch pattern with Lake Erie pattern 2-hole lid (#89982 Mueller) and 54 inch stationary rod and painted inside and out with a suitable asphalt varnish. The adjustable 6 foot -6 inch depth shall be Mueller H 10314 or an approved equal.
5. Miscellaneous Fittings shall be of red brass conforming to AWWA C800 and shall have compression fittings for all connections to copper tubing. Where connection must be made to existing service lines of differing materials, threaded or compression joints, as applicable, may be provided. In all cases, provision for electrical conductivity will be made at all joints and fittings.
6. Plastic piping may not be used.

B. MATERIALS

All materials for 3 inch & 4 inch service shall be in accordance with Section 4.01.02.

4.02.03 CONSTRUCTION METHODS

A. Trench Excavation. CALL MISS-DIG. The Contractor shall proceed with trench excavation with due regard for the protection of life, health and property. Appropriate equipment shall be used to perform the work and, where necessary, extra measures such as the use of sheeting or shoring shall be used. The following shall be observed in excavating trenches:

1. Excavation shall not proceed until the location of nearby utilities have been ascertained and clearly marked by their owners.
2. Excavation in close proximity to other utilities shall be done by hand in order to protect them from damage.
3. Trenches shall be excavated in reasonably close proximity to the lines and grades on the plans or as established by the Engineer. Special attention shall be given to requirements for depth of burial, a minimum of six feet of earth cover.
4. The trench shall be of sufficient width to provide free access for completing the work (See 4.01.03, B).

5. Rock or hardpan shall be excavated to a depth of 4 inches below the bottom of the pipe and replaced with granular bedding material acceptable to the Engineer.
6. Where unstable soil conditions are encountered, the Engineer may authorize the use of Trench Undercut and Backfill (Sec. 4.01.03, B 5). Four inches of granular bedding material will be placed over the trench backfill.
7. Where work is within a paved roadway, the pavement will be cut and removed prior to excavation. Payment will be incidental to the replaced item.
8. If high ground water levels are encountered, an appropriate dewatering system shall be employed in order to prevent unnecessarily wide excavations and damage to adjacent properties.
9. Excess excavated material shall become the property of the Contractor.

B. Tapping Watermain shall be accomplished using a tapping machine which is capable of tapping the main and inserting the corporation stop while the main is under the pressure and in service. Under no circumstances will a watermain be taken out of service to perform a tap without the Engineer's prior approval. Taps shall be made at the location shown on the plan or as directed by the Engineer and the following specifications will be observed:

1. Corporations will be installed on the main in as nearly a horizontal position as possible (i.e. at the three o'clock or nine o'clock positions on the main). In no case will they be installed at a location above 22½ degrees measured from the horizontal or on top of the main.
2. Corporations may not be installed diametrically across from one another, but must be spaced at least two feet apart, measured along the longitudinal axis of the watermain.
3. Corporations made on the same side of the main as each other shall be separated longitudinally on the main by at least two feet.
4. Corporations may not be installed closer than two feet from any joint in the main, measured from the lip of the bell of the joint.

C. Installing Service Piping

1. Pipe Handling. During handling and installation of service piping, care shall be exercised to prevent denting or kinking pipe or contaminating pipe through the inclusion of mud, dirt or debris inside the pipe. Defective or damaged pipe will not be incorporated into the work. Any large pieces of dirt or debris will be removed prior to making joints.
2. Laying Conditions. After the trench bottom has been excavated to a uniform line and grade, the service piping will be laid on a bed of clean sandy material, at least 4 inches thick. The service pipe bedding shall be free of rocks, sticks and other debris which could dent or otherwise damage the pipe.

3. Depth of Burial. All service piping shall be buried with a minimum of six feet of earth cover over the top of the pipe. Where shown on the plans, or when directed by the Engineer, depth of burial will be determined by future or proposed street grades. Existing conditions at construction site may change from future construction which may change depth of burial.

4. Alignment & Position. In general, service piping will be installed in a straight line and, at the point of connection to the corporation stop, will be at right angles to the long axis of the watermain. Where changes in directions are required, they will be accomplished by bending smooth, uniform radius in the tubing or by the use of appropriate bends or fittings. In no case shall a bend in a pipe have a radius smaller than ten times the diameter of the pipe. Any pipe which becomes kinked or dented from bending shall be replaced with a new piece of pipe. If water service piping is to be installed in or near the same trench as a sanitary sewer lateral, the centerline spacing between the service pipe and the sewer lateral shall be a minimum of 18 inches and an effort will be made to keep the service pipe at least one foot higher than the sewer lateral, where consistent with depth of burial requirements.

5. Piping Lengths. Copper service piping 1¼ inches in diameter or less shall be installed without any couplings or joints between the corporation stop and the curb stop, except as permitted by the Engineer. Service piping 1½ and 2 inches in diameter shall be installed in lengths of 20 feet or more, except for one short closure piece which may be permitted ahead of the curb stop.

6. Joining Pipe. Copper service piping shall be joined by the use of compression type fittings providing direct metal to metal contact. use of pipe jointing compounds or Teflon tape will not be allowed. Under no circumstances will solder type of joints be used in water service piping. All ends shall be cut squarely and rough edges or burrs removed. In all cases, provisions for electrical conductivity will be made at all joints and fittings.

7. Clearance. Where other pipes, structures or like obstructions are encountered in the work, the service pipe shall be bent to go under or around such obstructions in the most practical manner. Bends shall be made as described in Section C.4, above. A minimum clearance of at least six inches shall be maintained between the service pipe and the obstruction and the space in between filled with clean sand, compacted and free of rocks, sticks or other debris which could cause pipe damage. Minimum 6 feet cover over the service pipe shall be maintained unless otherwise directed by the Engineer.

8. Termination. Unless otherwise shown on the plans or directed by the Engineer, the service piping shall terminate at the property line or where designated by the Engineer. In those cases where the service is intended for future use and there is no existing building piping, the customer side of the curb stop shall be capped by inserting a suitable non-metallic disc or plug inside the compression fitting and installing the compression nut tight on the curb stop. In the case where there is a building or premise with an

existing service line, the existing line shall be cut and the new service line connected there to, as described under Section 4.02.03 E.

D. Installing Curb Stop and Box.

The curb stop and box will be located near the property line or right-of-way line at the point determined by the Engineer. The curb stop shall be connected to the service pipe in a horizontal position with the valve stem vertical, as measured along the pipe and across the pipe. After all testing and connection at the service piping have been completed and prior to final backfilling, the curb box shall be carefully centered over the curb stop. The legs of the curb box shall rest firmly upon concrete bricks and clearance shall be provided so that the box does not rest on the service piping. The curb box shall be sufficiently plumbed and braced so that it stays vertical and centered over the curb stop during backfilling.

E. Connections to Existing Service.

When a new water service is being made to replace an existing water service, the existing service pipe shall be cut off at least three feet beyond the new curb stop and a closure piece consisting of the appropriate size copper service pipe installed between the curb stop and the cut end of the existing service line. Connection to the existing line shall be made by compression type fitting to the closure piece and assembling such reducers, adapters or couplers as are needed to make a firm, pressure-tight connection to the existing service line. If a "Dresser" or other type coupling is used which does not provide for electrical continuity, a bonding strap shall be installed across the coupling to provide such continuity.

F. Testing & Cleaning.

Prior to completing the termination of the service line and backfilling, it shall be cleaned and tested by the following method: The curb stop shall be opened and then the corporation stop at the watermain until a full flow of water is obtained. After sufficient time has elapsed to assure that the new line has been flushed and that the flowing water is clean, the curb stop only shall be shut off. All joints under pressure shall then be observed for at least 15 minutes for leaks.

During this time, the termination or connection to existing service piping may be made. When the connection to an existing service has been completed, the curb stop shall again be opened, restoring service to the customer. At this point, it will be necessary to flush air and any loosened pipe scale from the customer's building piping. The connection to the existing service piping shall be observed for a period of 15 minutes to assure that there are no leaks prior to backfilling.

G. Backfilling Trench.

Backfill material, free of rocks, sticks and other debris, shall be placed by hand to a depth of six inches over the service piping and compacted. Machine backfilling may then proceed by placing and compacting twelve-inch lifts of suitable material up to subgrade elevations (95% density Standard Proctor test). No muck, peat, stumps, roots, boulders or other large debris will be included in the backfill in any part of the trench. Where the trench is within a roadway, backfill and subgrade material as required by the plans or other parts of this document shall be used unless otherwise directed by the Engineer.

H. Surface Restoration.

Upon completion of backfilling operations up to the required subgrade elevation, the surface will be restored in kind to the same or better condition as existed prior to excavation, unless otherwise directed by the Engineer.

4.03 DEWATERING SYSTEM

When called for in the contract or with the approval of the Engineer, the Contractor will lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions for the pipe and also to prevent cave-ins and unnecessarily large excavations. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work. Dewatering installation, operation of any sedimentation and soil erosion control required is incidental to project costs. The following regulations will be adhered to in using and operating a dewatering system.

4.03.01 USE OF STORM SEWER SYSTEM.

Whenever it is possible to do so, the Contractor is to discharge drainage from his dewatering operation into the nearest storm sewer inlet or manhole. He will obtain the approval of the City Engineer as to the location and adequacy of the storm sewer prior to commencing operations.

4.03.02 RESTORATION OF SEWERS.

It will be the responsibility of the Contractor to assure that silt, sand, mud or similar materials are not discharged into the storm sewers such as would cause damage to, or salutation of, the storm sewer system or its outlet. Any cleaning or repairs occasioned by the dewatering operation shall be undertaken by the Contractor, at his own expense, within ten (10) working days of the occurrence of such damage.

4.03.03 OTHER DISCHARGE POINTS.

Overland discharge of water across private property or into areas where localized flooding or soil erosion might occur will not be permitted. If, in the opinion of the Engineer, discharge of water into a ditch which is well stabilized, and having an outlet to storm sewer or receiving body of water, may be safely accomplished, he may authorize the Contractor to so proceed. The Engineer may also require that a sediment trap be constructed to remove silts and other materials from the water before it is discharged to the receiving point. The Contractor shall repair or restore any areas damaged by these operations and shall dispose of any silts accumulated in sediment traps after the dewatering operation is completed.

4.03.04 USE OF SANITARY SEWERS.

Because of the cost of collection, pumping and treatment of sanitary sewage, as well as potential damage to sewers, use of the sanitary sewers as a discharge point is strictly prohibited. The Engineer may, however, authorize their use in an emergency.

4.03.05 PROPRIETY OF EQUIPMENT AND OPERATIONS.

Equipment used by the Contractor for dewatering shall be of a size and type adequate to perform the job of dewatering and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular, on operations which required continuous pumping over prolonged periods of time, noise and/or odors become a significant factor and the Contractor should do everything possible to reduce noise and/or odors from pumps, generators and other equipment.

4.03.06 CONTROL OF OPERATIONS.

The Contractor shall monitor his dewatering operation at all times to ensure that the method used does not undermine pipe bedding, place nearby utilities in jeopardy, or cause subsidence or damage to adjacent properties.

4.04 PROJECT RECORD DOCUMENTS

Contractor shall keep one record copy of all Specifications, Drawings, Addenda,Modifications and Shop Drawings at the site in good order and annotated to show all changes made during the construction process. These shall be available to the ENGINEER and shall be delivered to him for the OWNER upon completion of the Project. Drawings of record will be the "Project Record Drawings". At the completion of the work and prior to final payment, the CONTRACTOR responsible for each division of the work shall provide the ENGINEER with a marked-up set of drawings showing all changes or variations from the original drawings. These changes shall be made on a set of field drawings as the work is done. This set of drawings should be kept clean in a location at the site where the ENGINEER or the OWNER'S representative may examine it when desired.

The marked-up drawings shall be accurate. Careful measurements shall be made to locate underground sewers, gas lines, water lines, electrical conduit, underground telephone cable and miscellaneous piping.

4.05 MEASUREMENT AND PAYMENT

4.05.01 SCOPE

This section covers methods of measurement and payment for items of work under this contract.

4.05.02 GENERAL.

The total bid price for each section of the contract shall cover all work shown on the contract drawings and required by the specifications and other contract documents. All costs in connection with the work, including furnishing all materials, equipment, supplies and appurtenances; providing all construction, equipment and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and lump sum prices bid. No item that is required by the contract documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

4.05.03 ESTIMATED QUANTITIES.

All estimated quantities stipulated in the Bid Form or other contract documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the work and (b) for the purpose of comparing the bids submitted for the work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. The Contractor agrees that he will make no claim for damages, anticipated profits or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

4.05.04 EXCAVATION AND TRENCHING.

Except where otherwise specified, the unit or lump sum price bid for each item of work which involves excavation or trenching shall include all costs for such work. No direct payment will be made for excavation or trenching. All excavation and trenching will be unclassified as to materials which may be encountered; in addition, trenches will be unclassified as to depth.

4.05.05 STRUCTURE EXCAVATION

All excavation work required for structures, not otherwise paid for as trenching, shall be considered to be a subsidiary obligation of the Contractor and the cost of such excavation shall be included in the prices bid for the structures.

4.05.06 LAWN RESTORATION.

Class "A" sod shall be placed over 4 inch minimum of clean screened topsoil and used to restore all lawn areas disturbed by pipe installation, water services, hydrants, and appurtenances. Seed, fertilizer and mulch or Hydroseed Class A may be used only after the authorization of the Engineer. No mulch blanket netting shall be used in any situation. Any costs shall be incidental to project costs and not paid for separately.

4.05.07 WATERMAIN PIPE/DUCTILE PIPE

Ductile Iron Pipe is to be paid for on a unit price basis shall be measured for payment on a horizontal plane after installation of the pipe. Where lines are laid to conform to stationed profiles, payment will be made on linear quantities based on the pipeline stationing as determined by surveys made after installation.

The measurement of the length of each line or run of pipe of each size will begin and end at:

a. The end of the pipe where connected to an existing pipe, fitting or valve; at the end of a dead-end run; or at the limits of Contract as shown on the drawings.

b. The centerline intersection of run and branch on tees, crosses or laterals where a branch line connecting therewith is constructed under this contract. Where a branch fitting is installed under this contract and the branch or connecting line is to be constructed by others under a separate section, the pay measurement will include the entire laying length of the branch or branches of such fitting.

c. The measurement of each line of pipe of each size which is to be paid for on a unit price basis will be continuous through and shall include the full laying lengths of, all fittings and valves installed between the ends of each line; except that the laying lengths of reducers and increasers will be divided equally between the connected pipe sizes. Connected piping for fire hydrants will be measured for payment from the center of the main to the end of the pipe at the hydrant.

4.05.08 TAPPED CONNECTIONS TO EXISTING WATERMAINS.

DIVISION VII DETAILED SPECIFICATIONS

STORM SEWER CONSTRUCTION

ESCANABA MI

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DIVISION VII

7.01 STORM SEWER CONSTRUCTION

7.01.01 Scope of Work

A. The work covered by this section of the Specifications consists in the furnishing of all tools, labor, materials, equipment and supervision, and performing all operations involved in the construction of storm sewers, drains and facilities as required by this contract in strict accordance with the provisions of the Plans and Specifications and subject to the term and conditions of the contract.

7.01.02 General

The following miscellaneous provisions apply to this section of the Specifications:

A. Pipe, unless otherwise indicated on the plans or authorized in writing by the owner, shall be new and unused material of the size and type shown on the plans and shall conform to the requirement of the Specifications.

B. Pipe, materials and accessories offered by the contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of the particular item in question.

C. Pipes located inside structures or above ground shall be rigidly supported as shown on the plans or as specified herein. The full length of each section of underground pipe shall rest solidly upon the prepared bed or undisturbed earth or compacted refill, with recesses only to accommodate pipe bells and joints. Any pipe which has its grade, alignment or joints disturbed after laying shall be taken up and relaid. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operation. The pipe shall not be laid in water, or when trench or weather conditions are unsuitable for work. Water shall be kept out of the trench until the joints have been completed. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth or other foreign substance can enter the line. Any section of pipe found to be defective either before or after laying, shall be replaced with new pipe at the Contractor's expense.

Where sewer lines are shown crossing private property, the alignment of the sewers shall be as shown on the plans and as directed by the Engineer and the work shall be done within the construction easements provided by the Owner.

E. **Certification**

The manufacturer of pipe and fittings shall furnish a certified statement that all pipe and fittings furnished by him have been inspected and tested in accordance with the applicable specification. Pipe will be subject to inspection and approval upon delivery and no cracked, broken, damaged or defective pipe or fitting shall be laid in the work. Any piece that is found to be defective after it has been laid shall be removed and the Contractor and replaced by a sound and perfect piece.

7.02 MATERIALS

7.02.01 PIPE MATERIALS

All sewer pipe used in this work shall meet the requirements of the standard specifications of the American Society for Testing and Materials (ASTM), or American Standards Association (ASA). Sewer pipe shall be of the following types as noted on the Drawings.

A. PVC Sewer Pipe: ASTM Designation D3034-73 "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings." The minimum wall thickness shall conform to SDR-35..

B. Concrete Sewer Pipe (CSP) - ASTM C14, Class Specified.

C. Reinforced Concrete Sewer Pipe (RCSP) - ASTM C-76, Class as designated on the Drawings or special design conforming to ASTM C655.

D. Reinforced Concrete Elliptical Pipe (RCEP) - ASTM C-507 VE or HE Class as designated on the Drawings.

E. Ductile Iron Pipe (DIP) (cement lined, standard thickness) - ASA Standards A21.4, A21.51, Class thickness as designated on the Drawings.

F. Corrugated Metal Pipe (CMP) - AASHTO galvanized with or without bituminous coating M190, with or without paved invert. Gauge as specified on the Drawings.

G. Acrylonitrile - Butadiene-Styrene (ABS) and Polyvinyl Chloride (PVC) Composite Pipe - ABS and PVC composite pipe shall conform to the requirements of ASTM D 2680. The pipe furnished may be ABS or PVC at the Contractor's option.

Couplings, fittings, solvent and cement shall be as specified by the pipe or fitting manufacturer.

H. Corrugated Plastic Pipe - Corrugated plastic pipe shall meet the requirements of AASHTO M 294, Type C; any fittings required shall also meet the requirements of AASHTO M 294.

I. Galvanized Corrugated Steel Structural Plates for Field Bolted Pipe, Pipe Arches, and Arches - The bolted plates, bolts, and nuts shall meet the applicable requirements of AASHTO, M 167, except as otherwise specified herein.

If the zinc coating as determined from the required sample is less than 3.0 ounces per square foot, 2 additional samples shall be taken from the same lot of plates. If the average weight of zinc coating as determined from the 3 samples is less than 3.0 ounces per square foot, or if any one specimen fails the single specimen minimum check limit (2.7 ounces per square foot), the lot sampled shall be rejected. Zinc coating shall be of first-class commercial quality, free from injurious defects, such as blister, flux and uncoated spots.

The plates shall be of such size that on assembly there will be no four lap seams. No part of any plate shall be without curvature. The plates shall be formed so that the dimensions of the completed structure shall not vary from the dimensions shown on the plans by more than four percent (4%). All measurements shall be taken to the inside crests of the corrugations.

J. Aluminum Alloy Structural Plate for Field Bolted Conduits and Box Culverts - The structural plate, accessories and fasteners for aluminum alloy structural plate pipe, pipe-arches, arches and box culverts shall meet the requirements specified in AASHTO N 219.

K. Metal End Sections - Metal end sections shall be fabricated in accordance with the details shown on the plans and shall be furnished complete with coupling bands or hardware as indicated on the plans. The metallic coating on the end sections shall be the same as the metallic coating on the pipe, except zinc coated steel end sections may be used with aluminum coated steel pipe. Metal end sections shall conform to AASHTO M 36, where applicable.

L. Concrete End Sections - Precast concrete and sections shall be constructed of concrete and reinforcement conforming to the requirements of AASHTO M 170 (ASTM C 76), Class II, as modified by details shown on the plans. Concrete for end sections made by the wet-cast method shall contain an entrained air content of 6.0 ∀ 2.0 percent. Concrete for end sections made by the dry-pack process shall contain a minimum of 658 pounds of cement per cubic yard and a liquid air entraining agent used at four times the dosage as needed for conventional slump concrete.

Connections to pipe culverts shall be by means of tongue and groove joints.

7.02.02 CULVERT AND SEWER PIPE JOINTS

A. Compression Type Pipe Joint Sealer - For joints in circular concrete culvert and sewer pipe, the gaskets shall be flexible water-tight rubber gaskets conforming to the requirements of ASTM C 443 and ASTM C 361.

B. PVC Sewer Pipe: PVC sewer pipe shall have an O-ring bell gasket joint or the same interspersed with solvent welded joints. Only chemical solvents approved by the pipe manufacturer shall be used-443.

C. External Type Rubber Gaskets - External rubber gaskets, mastic, and protective film for sealing culvert and sewer joints shall meet the requirements of ASTM C 877. (Cadilloc external pipe joint or similar)

7.02.03 **CLASSES OF CONCRETE** - Concrete shall be of Class A except that mud mats and fill concrete shall be Class C unless otherwise shown on the Drawings.

7.02.04 **CEMENT** - Cement shall be a well-known brand conforming to the requirements of ASTM Specifications C-150, Type LA, or Type I with air-entraining admixture; or ASTM C 595, Type IP-A, or Type IP with air entraining admixture.

7.02.05 **SAND** - Sand shall be natural silica sand graded in size up to such grains as will, when dry, readily pass a screen having 4 meshes per lineal inch. It shall conform to Michigan Department of Transportation Specifications 2NS.

7.02.06 **COARSE AGGREGATE** - Coarse aggregate shall consist of crushed stone, gravel, or other approved materials having hard, strong, durable pieces free from adhering coatings. The aggregate shall range in size from 1 ½ inch to No. 4. All gravel shall be washed and screened.

Coarse aggregate shall be of premium grade, and the total amount of objectionable materials, such as soft particles, chert and hard absorbent particles, shall not exceed four percent (4%). It shall conform to Michigan Department of Transportation Specifications Class 6AA.

7.02.07 **ADMIXTURE** - In general, concrete plasticity is secured by the selection of aggregate and in the proportioning of ingredients including admixtures. Admixtures, when used, shall conform to ASTM Standards.

7.02.08 **WATER** - Water shall be clean, free from oil, acid, alkali, organic matter or other deleterious substances.

7.02.09 **STORING MATERIALS** - Cement at the site of work shall be housed in a building with floor raised above the ground and shall be adequately protected from dampness. Cement that has become lumpy or that has been otherwise injured shall not be used in the work.

7.02.10 **REINFORCING STEEL** - Steel reinforcement shall be round deformed bars free from loose scale and dirt and shall be either billet steel (ASTM A615) or rail steel (ASTM A616) with a yield point strength of not less than 60,000 psi. Welded wire fabric shall conform to ASTM A185 or A497.

7.03 **CONSTRUCTION METHODS**

7.03.01 **BORINGS AND SOUNDINGS** - When borings or soundings have been made, the location and log of each will be shown on the plans. Such information is valid only at the location shown and at the time when such investigation was made. The contractor or prospective bidder may make any supplementary borings or soundings at his own expense, but shall not dig test pits for this purpose.

7.03.02 **EXCAVATION** - The trench shall be excavated beginning at the outlet end and proceeding toward the upper end, unless otherwise directed by the Engineer. The trench shall be excavated in reasonably close conformity with the lines and grades of the flow line shown on the plans or established by the Engineer. The trench shall be of sufficient width to provide free working space and to permit ramming and compacting the backfill around the pipe. The bottom of the trench shall be shaped so that the pipe will be uniformly supported. Where rock or hardpan is encountered, the trench shall be excavated at least 4 inches below the elevation established for the bottom of the pipe. Any excavation below the grade for the bottom of the pipe shall be replaced with the appropriate granular material, approved by the Engineer, and thoroughly compacted.

Where unstable soil conditions, or obstructions other than rock, require excavation of the sewer trench below the elevation shown on the plans, such excavation shall be made to the dimensions authorized by the Engineer. Undercutting below the excavation shown on the plans because of unstable soil conditions shall be backfilled with material meeting the gradation of Michigan Department of Transportation (MDOT) Coarse Aggregate 6A. Coarse Aggregate 6A backfill will be considered incidental to laying of Storm Sewer Pipe.

7.03.03 **TUNNELING** - As an alternate to open-cut methods of utility construction crossing near structures or streets on which traffic is to be maintained, tunneling methods may be used when authorized by the Engineer. The term "tunnel method" will include the "jacked-in-place method" of construction.

7.03.04 **LASER ALIGNMENT** - As an alternate to using line and grade pole, the Contractor may use laser aligning equipment for the laying of sewers to the specified lines and grades. The Contractor shall furnish all necessary equipment and personnel required to operate the laser equipment.

The laser beam projection is to be rigidly mounted to its support platforms in a manner to be approved by the Engineer. This will assure that all grounded equipment vibrations will be kept to a minimum and will permit the laser beam to be projected coaxially through the center of the pipe. All units shall be furnished with equipment to control atmospheric conditions in the pipe which could affect the acceptable standard of construction.

The laser aligning method selected must be shown to have performed satisfactorily on at least three previous projects of a similar nature. The equipment shall be operated by competent, trained operators.

The Contractor will establish centerline stakes and offset stakes at each manhole and other centerline and offset stakes as required for check points from baseline established by Engineer.

The Contractor shall furnish openings in the pipe, as required for the installation of the laser equipment, at no additional cost to the Owner. Details of these openings shall be approved by the Engineer.

7.03.05 **ALLOWABLE TOLERANCES IN SEWER GRADE** - Sewers shall be constructed and laid to the alignment and grade indicated on the construction drawings or as designated by the Engineer. The grade as shown on the profile or as furnished by the Engineer is that to which the work must conform. A variation of one quarter (1/4) inch from this will be deemed sufficient reason to cause the work to be rejected and relaid.

7.03.06 **LAYING SEWER** - The sections shall be carefully laid in the prepared trench, bell or groove ends upgrade, with the spigot or tongue end fully entered into the adjacent bell or groove. Each section shall have a firm bearing throughout its length and shall be substantially true to the line and grade required. The use of blocks to bring sections to grade will not be permitted.

Circular concrete pipe with elliptical reinforcement shall be installed with the lift holes on top of the pipe. The manufacturer's marks designating the top and bottom of the pipe shall not be more than five degrees from the vertical plan through the longitudinal axis of the pipe. After the pipe is installed, the lift holes shall be sealed with suitable concrete plugs and waterproofed.

1. **Bedding Material (PVC)**

Bedding material for storm sewer, in general, shall consist of MDOT Coarse Aggregate 6A. The bedding material shall likewise by substantially free of sticks, boulders, rubbish, muck and other debris which would cause damage to the sanitary sewer. Bedding material which contains frozen chunks shall not be used.

7.03.07 **EXTENT OF OPEN TRENCH** - The excavation shall at all times be finished to grade for a safe distance in advance of the completed structures, but unless specifically directed or permitted by the Engineer, not more than two hundred (200) feet of trench shall be open at one time in advance of the built structure. The excavated earth along the line of the trench shall be controlled by the use made of the street or right-of-way by

the public, and shall always be confined to approved limits. Not more than six hundred (600) consecutive feet of street shall be closed at one time, and vehicular traffic through any street shall not be stopped for a period longer than two weeks without the written permission of the Engineer. Not more than two consecutive cross streets shall be closed to vehicular traffic at the same time, except by permission of the Engineer. Pedestrian crossings shall be erected and maintained by the Contractor where designated by the Engineer.

7.03.08 **EXISTING UNDERGROUND STRUCTURES** - The Contractor shall provide and install adequate supports and protection for all sewer and water pipes extending into or crossing the trench. Where gas mains or electric cable or conduits extend into or across the trench, the Contractor shall notify the Public Utility at once and provide such supports and protection as may be required by the Public Utility.

Should any such main or electric cable or conduit require raising or lowering or moving to another location, such changes will be made by the Contractor without additional expense to the Owner.

Where mains, cables or conduits are parallel to the Contractor's trench opening, the Contractor shall so carry on his work at all times as not to cause damage to the paralleling structure or structures.

Where gas, water, sewage or any utility service connections to occupied buildings must be temporarily shut off or disconnected, the Contractor shall give at least eight (8) hours notice to the affected occupants of the time and duration of the anticipated cut off.

When pipes, conduits or sewers are removed from the trench leaving "dead" ends in the ground, such ends shall be fully plugged or bulkheaded with brick and mortar by the Contractor without additional compensation.

Where house connections, laterals or sewers require re-connection to the proposed sewer, same shall be made by the Contractor and paid for separately under the appropriate items of the contract. Where existing laterals or house connections are reconnected to the new structures, the work shall be so arranged that water will not flow through newly built portions of the work until 24 hours after mortar joints are made or after concrete masonry is placed.

7.03.09 **TEMPORARY CHANNELS** - The Contractor shall provide without additional compensation, channels for water and sewer that may flow along or across the site of the work.

7.03.10 **DISPOSAL OF WATER AND SEWAGE** - The Contractor shall remove by pumping, bailing or otherwise, any water which may accumulate or be intercepted, or be found in the trenches and in any other excavations made under this contract. He shall form all dams, flumes or other work necessary to keep the trenches entirely clear of water and sewage while the structures and their appurtenances are being constructed. The Contractor shall at all times have sufficient pumping equipment on the job ready for immediate use.

Water from the trenches and excavation shall be disposed of in such a manner as it will not cause injury to the public health, not to public or private property, nor to the surface of the streets, nor cause any interference with the use of the streets by the public. No additional payment will be made to the Contractor for this work.

7.03.11 **BRACING AND SHEATING** - The Contractor shall furnish, install and maintain such sheating, bracing and shoring as may be required to support the sides of the excavation and to prevent any movement of earth which would injure or delay the work or cause damage to adjacent pavement, buildings or other structures. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports placed at the expense of the Contractor, and neither the placing of such additional support or by the order of the Engineer, nor the failure of the Engineer to order such additional supports placed, shall relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside the sheating, but if voids are formed, they shall immediately be filled and rammed to the satisfaction of the Engineer.

All sheating and bracing which is not to be left in place in the trench, shall be removed in such manner as not to endanger the constructed sewer or other structures, utility conduits, or property, whether public or private. All voids left or caused by the withdrawal of the sheating, shall be immediately refilled with sand or gravel, by ramming with tools adapted for that purpose, by watering, or otherwise as may be directed by the Engineer.

7.03.12 **BACKFILLING - General Requirements** - Backfill material shall be placed on sections of the sewer only after such have been approved by the Engineer for backfilling. Sound earth, of a granular nature, free from top soil, large stones and lumps shall be placed under and around the barrel of the sewer until the sewer is completely covered to a depth of at least one foot. This portion of the backfill shall be placed in layers not more than 6 inches in thickness, and each layer thoroughly compacted, without damaging or displacing the sewer. The balance of the backfill, including that around manholes, catch basins, and other structures, shall be of sound earth, free from top soil, large stones and lumps, and shall be placed in

layers not more than 6 inches thick, each layer being fully compacted. When the material to be used for this upper part of the backfill is of a granular nature, it may be compacted by flooding, or flooding may be prohibited, at the discretion of the Engineer.

7.03.13 **DISPOSAL OF EXCESS EXCAVATION** - All excavated material in excess of that needed for backfill shall be disposed of as directed by the Engineer. The Engineer reserves the right to direct the Contractor to haul any excess material for filling any low street, alley or sidewalk space to an established grade, provided that such haul shall not be more than two thousand five hundred (2500) feet outside this project.

7.03.14 **ROCK EXCAVATION**

A. **Definition** - Rock excavation shall include all ledge rock in place that cannot be excavated by hand except by blasting, or in the opinion of the Engineer, by the continuous use of air tools, and all boulders whose individual volume is one half (½) cubic yard or more.

B. **Pipe Clearance in Rock** - When rock is encountered in the excavation, it shall be removed to the depth shown on the plans for concrete masonry sewers or 6 inches below the bottom of pipe sewers, when no underdrain is required. If an underdrain is required, additional excavation shall be made to the depth and width required for the underdrain. The width of rock excavation for concrete masonry sewers shall be as shown on the plans. The width for pipe sewers shall be two (2) feet greater than the inside diameter of the pipe, unless otherwise specified.

C. **Blasting** - Where blasting is necessary, the Contractor shall obtain the required permits and licenses at his own expense. This work shall be done with due regard to the safety of workmen, other people and public and private property. The method of covering blasts, amounts of charges used and the general procedure for doing this work shall conform to the requirements of local ordinances and be subject to the approval of the Engineer.

D. **Measurement** - Rock shall be stripped a sufficient distance ahead of excavation operations, but not less than fifty (50) feet, and the Engineer shall be notified so that he may measure it. Rock blasted before such measurement is made will not be paid for as rock excavation.

7.03.15 **DRAINAGE STRUCTURES** - This work shall consist of constructing or reconstructing drainage structures of portland cement concrete (with or without steel reinforcement as provided), portland cement concrete block masonry, or brick masonry; furnishing and placing metal covers; and shall include excavation and backfilling.

The term drainage structures, as used herein, refers to manholes, catch basins, leaching basins, inlets, and drop inlets. The type of drainage structure required is designated in one of three ways:

A. **Drainage Structure** - This pay item consists of a concrete footing, or precast sump, and the drainage structure. This type is specified for accessing sewers having diameters of forty two (42) inches and smaller.

B. **Precast Manhole Tee and Manhole Riser** - These pay items are generally used to access new sewers having diameters of forty two (42) inches and larger.

7.03.16 **DRAINAGE STRUCTURE CASTINGS** - Castings used herein refers to the metal frame and lid or grate of the details shown on the plans. Castings are paid for separately at the contract unit price. Castings shall be East Jordan Iron Works #1040 or equivalent with a vented lids.

7.03.17 **DRAINAGE STRUCTURE CONSTRUCTION**

A. **Excavation** - Excavation shall be as specified under Subsection MDOT 2.09.03.

B. **Concrete Construction** - Concrete construction shall be as specified under Section MDOT Section 5.03. Casting of concrete during hot weather shall be limited by the temperature of the concrete at the time of placing. Concrete shall not be cast when the temperature of the concrete is above 90 degrees.

C. **Placing Brick and Block Masonry** - Masonry with mortar shall not be placed in freezing weather and any work which is damaged by frost shall be removed and replaced.

A plaster coat of mortar one half (½) inch in thickness shall be applied to the outer surface of the structure, and to the inner surface below the outlet flow line of all catch basins with traps.

1. Brick - Before being laid all brick shall be thoroughly wetted and the surface allowed to dry only sufficiently to prevent slipping on the mortar.

Broken or chipped brick shall not be used on the faces of the structure.

The brick shall be laid in courses with full and close mortar joints. The courses shall be level throughout except where otherwise required. Adjoining courses shall break joints by half the length of a brick, as nearly as practicable, and at least one course in every seven shall be composed of headers. The length of pieces of brick used for making closures shall not

be less than the width of a whole brick and, wherever practicable, closures shall be made with whole bricks as headers.

Joints shall not be more than one half (½) inch in thickness unless otherwise provided, and shall be of a uniform thickness throughout the structure. All joints shall be struck and properly pointed and the exposed surfaces shall be true and smooth.

Where plaster coat is required the joints shall be raked.

Before applying a plaster coat of mortar to a brick surface, the brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to provide for proper bonding of plaster coat.

2. Concrete Block - The first course of blocks, as placed on the concrete footing, shall be on a full bed of mortar.

All blocks shall be laid in courses with full and close mortar joints. The courses shall be level throughout except where otherwise necessary. Adjoining courses shall break joints by half the length of the block as nearly as practicable.

The joints shall be of a uniform thickness throughout the structure. All joints shall be struck and properly pointed and the exposed surfaces shall be true and smooth.

D. **Precast Reinforced Concrete Units** - Precast reinforced concrete units shall be constructed in accordance with the details shown on the plans. The joints shall be sealed with mortar in accordance with the requirements specified for Culverts, under Subsection MDOT 5.11.05. Precast units shall be constructed on poured-in-place or precast concrete footings. Precast footings shall be supported by a compacted six (6) inch granular subbase.

E. **Steel Reinforcement** - Steel reinforcement shall be installed as specified under Subsection MDOT Section 5.03.07.

F. **Placing Castings** - Castings shall be set to the required elevation in full mortar beds or otherwise secured as shown on the plans.

G. **Inlet and Outlet Pipes** - Pipe or tile placed in the masonry for inlet or outlet connections shall extend through the walls and beyond and the outside surface of the walls a sufficient distance to allow for connections, and the masonry shall be carefully constructed around them and sealed with mortar to prevent leakage. When required, traps shall be installed according to details shown on the plans.

H. **Backfilling** - The method of backfilling shall be as specified under MDOT Subsection 5.13.08. The backfilling may begin immediately and progress with the construction of the drainage or manhole riser.

7.03.18 **RECONSTRUCTING DRAINAGE STRUCTURES** - Where called for on the plans or directed by the Engineer, existing manholes, catch basins, leaching basins, or inlets shall be reconstructed to the required line and elevation and to conform essentially to the details shown on the plans, using the castings on the existing structures.

Where reconstruction to top of footing is necessary, the work will be classified as a new structure of the detail and depth required.

7.03.19 **ADJUSTING DRAINAGE STRUCTURE CASTINGS, MONUMENT BOXES AND WATER SHUTOFFS** - Final adjustment of drainage structures, monument boxes, and water shutoffs on bituminous projects shall be made after the surface is ready for the top course and prior to placing the top course.

Adjusting castings shall apply where the elevation of the casting is not changed more than 6 inches and no other alterations are necessary. Where called for on the plans, or authorized by the Engineer, existing castings shall be adjusted to the proper elevation by removing the castings and setting them to the required elevation by supporting them on a concrete collar or on masonry in a full mortar bed, and constructed such that they will be held firmly in place. The adjacent pavement, curb, or curb and gutter shall be replaced to the original elevation, condition and kind of construction, unless otherwise provided.

7.03.20 **CLEAN UP** - The Contractor shall remove surplus excavated materials and materials for construction as the work progresses, and shall render the street suitable, safe, and convenient for traffic. Before final acceptance of the work, the Contractor shall clean the street surface, walks, gutters, fences, lawns, private property, right-of-way, and structures, leaving them in as good condition as originally found, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site of the work. Furthermore, the sewers, manholes, etc., shall be cleared of all scaffolding, centering, rubbish, dirt, dams or other obstructions.

All areas outside of the project area distributed by Contractor's work shall be top soiled, seeded, or stabilized sufficiently to prevent any soil erosion by wind or rain.

7.03.21 **INFILTRATION** - In storm sewers, weirs will be placed temporarily for testing purposes in such manholes as necessary to measure the amount of

infiltration, in which work the Contractor shall give the Engineer all reasonable assistance together with the necessary materials. In the event the allowable limit of infiltration is exceeded in any item of the contract, the Engineer may order the re-construction of the defective portion of the sewer, or he may agree to accept it at a reduced unit price.

The allowable amount of infiltration is shown in the following tabulation:

Diameter of Sewer In Inches	Inside Surface Area Per Lineal Feet or Sewer in Square Yards	Per Lin Ft Per In. Diam. of Sewer Per Miles	Infiltration in Gallons per 24 Hours Based on 2 Gallons per Square Yard of Inner Surface Area
10"	0.2909	.582	307
12"	0.3490	.698	307
15"	0.4363	.873	307
18"	0.5326	1.065	307
21"	0.6108	1.222	307
24"	0.6981	1.396	307
27"	0.7854	1.571	307
30"	0.8727	1.745	307
36"	1.0472	2.094	307
42"	1.2217	2.443	307
48"	1.3963	2.793	307
54"	1.5706	3.141	307
60"	1.7453	3.491	307
66"	1.9199	3.840	307
72"	2.9044	5.809	307

7.04 DEWATERING SYSTEM

When called for in the contract or with the approval of the Engineer, the Contractor will lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions for the pipe, and also to prevent cave-ins and unnecessarily large excavations. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work. The following regulations will be adhered to in using and operating a dewatering system:

7.04.01 **USE OF STORM SEWER SYSTEM** - Whenever it is possible to do so, the Contractor is to discharge drainage from his dewatering operation into the nearest storm sewer inlet or manhole. He will obtain the approval of the City Engineer

as to the location and adequacy of the storm sewer prior to commencing operations.

7.04.02 **RESTORATION OF SEWERS** - It will be the responsibility of the Contractor to assure that silt, sand, mud, or similar materials are not discharged into the storm sewers such as would cause damage to, or siltation of, the storm sewer system or its outlet. Any cleaning or repairs occasioned by the dewatering operation shall be undertaken by the Contractor, at his own expense, within ten (10) working days of the occurrence of such damage.

7.04.03 **OTHER DISCHARGE POINTS** - Overland discharge of water across private property or into areas where localized flooding or soil erosion might occur will not be permitted. If, in the opinion of the Engineer, discharge of water into a ditch which is well stabilized, and having an outlet to a storm sewer or receiving body of water, may be safely accomplished, he may authorize the Contractor to so proceed. The Engineer may also require that a sediment trap be constructed to remove silts and other materials from the water before it is discharged to the receiving point. The Contractor shall repair or restore any areas damaged by these operations, and shall dispose of any silts accumulated in sediment traps after the dewatering operation is completed.

7.04.04 **USE OF SANITARY SEWERS** - Because of the cost of collection, pumping and treatment of sanitary sewage, as well as potential damage to sewers, use of the sanitary sewers as a discharge point is strictly prohibited. The Engineer may, however, authorize their use in an emergency.

7.04.05 **PROPERTY OF EQUIPMENT AND OPERATIONS** - Equipment used by the Contractor for dewatering shall be of a size and type adequate to perform the job of dewatering and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular, on operations which require continuous pumping over prolonged periods of time, noise becomes a significant factor and the Contractor should do everything possible to reduce noise from pumps, generators, and other equipment.

7.04.06 **CONTROL OF OPERATIONS** - The Contractor shall monitor his dewatering operation at all times to ensure that the method used does not undermine pipe bedding, place nearby utilities in jeopardy, or cause subsidence or damage to adjacent properties.

7.04.07 **MEASUREMENT AND PAYMENT** - Dewatering installation, operation or any sedimentation and soil erosion control needed is incidental to project costs.

7.05 PROJECT RECORD DOCUMENTS

Contractor shall keep one (1) record copy of all Specifications, Drawings, Addenda, Modifications and Shop Drawings at the site in good order and annotated to show all changes made during the construction process. These shall

be available to the ENGINEER and shall be delivered to him for the OWNER upon completion of the Project.
Drawings of record will be the "Project Record Drawings". At the completion of the work and prior to final payment, the CONTRACTOR responsible for each division of the work shall provide the ENGINEER with a marked-up set of drawings showing all changes or variations from the original drawings. These changes shall be made on a set of field drawings as the work is done. This set of drawings should be kept clean in a location at the site where the ENGINEER or the OWNER'S representative may examine it when desired.

The marked-up drawings shall be accurate. Careful measurements shall be made to locate underground sewers, gas lines, water lines, electrical conduit, underground telephone cable and miscellaneous piping.

DIVISION III DETAILED SPECIFICATIONS

STREET/ROAD CONSTRUCTION, RECONSTRUCTION OR REPAIR

ESCANABA, MICHIGAN

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DIVISION III - STREET/ROAD CONSTRUCTION

3.01 STREET/ROAD CONSTRUCTION - UTILITY IMPROVEMENTS

3.01.01 GENERAL

This work shall consist of street or road construction as shown on the plans.

3.01.02 CONSTRUCTION METHODS

All items of work listed in the bid proposal for street construction shall be completed in accordance with the 2012 MDOT Standard Specifications for Construction for each specific item of work.

3.01.03 MATERIAL REQUIREMENTS

The following items shall be certified by the Contractor to the following material requirements before payment of the work is allowed. The Engineer reserves the right to reject any material he feels does not meet the specifications until tests are completed at the owner's expense to determine the material characteristics delivered or proposed to be delivered to the job site.

All streets and other areas, including all lawns, driveways, pavements, sidewalks, shoulders, curbs and roadway slopes, shall be restored to original condition or better after completion of the work, if applicable. The Contractor shall be responsible for restoration, at his own expense of any private or public properties outside the project limits which have been damaged by his operations or by negligence of his employees. Unless otherwise detailed on the plans, materials used for restoration work, and their application, shall conform to requirements of the 2012 Michigan Department of Transportation Standard Specifications for Construction, and any revisions thereto. Such materials include, but are not limited to the following:

ITEM	APPLICABLE MDOT SPECIFICATIONS
Subbase	301
Subgrade Undercutting	205
Embankment	205
Hot Mix Asphalt	501
Granular Material, Class I, II, and III	205
Aggregate Surface Course, 22A	306
Topsoil Surface	816
Sodding	816
Seeding	816
Mulching	816
Fertilizing	816
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DIVISION V - DETAILED SPECIFICATION

SANITARY SEWER CONSTRUCTION CONTRACT

ESCANABA, MICHIGAN

2015

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DIVISION V

5.01 SANITARY SEWER CONSTRUCTION

5.01.01 Scope of Work

A. The work covered by this section of the Specifications consists in the furnishing of all tools, labor, materials, equipment and supervision, and performing all operations involved in the construction of sanitary sewers, drains and facilities as required by this contract in strict accordance with the provisions of the Plans and Specifications and subject to the term and conditions of the contract.

5.01.02 GENERAL

The following miscellaneous provisions apply to this section of the Specifications:

A. Pipe, unless otherwise indicated on the plans or authorized in writing by the owner, shall be new and unused material of the size and type shown on the plans and shall conform to the requirement of the Specifications.

B. Pipe, materials and accessories offered by the contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of the particular item in question.

C. Pipes located inside structures or above ground shall be rigidly supported as shown on the plans or as specified herein. The full length of each section of underground pipe shall rest solidly upon the prepared bed or undisturbed earth or compacted refill, with recesses only to accommodate pipe bells and joints. Any pipe which has its grade, alignment or joints disturbed after laying shall be taken up and re-laid. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operation. The pipe shall not be laid in water, or when trench or weather conditions are unsuitable for work. Water shall be kept out of the trench until the joints have been completed. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth or other foreign substance can enter the line. Any section of pipe found to be defective either before or after laying, shall be replaced with new pipe at the Contractor's expense.

D. Where sewer lines are shown crossing private property, the alignment of the sewers shall be as shown on the plans and as directed by the Engineer and the work shall be done within the construction easements provided by the Owner.

E. **Certification**

The manufacturer of pipe and fittings shall furnish a certified statement that all pipe and fittings furnished by him have been inspected and tested in accordance with the applicable specification. Pipe will be subject to inspection and approval upon delivery and no cracked, broken, damaged or defective pipe or fitting shall be laid in the work. Any piece that is found to be defective after it has been laid shall be removed and the Contractor and replaced by a sound and perfect piece.

5.01.03 MATERIALS FOR SANITARY SEWER CONSTRUCTION

Unless otherwise specified, shall be or the type and quality specified below:

A. **Pipe and Fittings**

1. **PVC Sewer Pipe:** PVC sanitary sewer pipe and fittings shall meet the requirements of ASTM Designation D3034-73 "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings." The minimum wall thickness shall conform to SDR-35.

2. **Concrete Sewer Pipe:** Shall conform to the requirements of ASTM C-14 for non-reinforced pipe and ASTM C-76 for reinforced pipe.

B. **Joint Materials**

1. **PVC Sewer Pipe:** PVC sewer pipe shall have an O-ring bell gasket joint or the same interspersed with solvent welded joints. Only chemical solvents approved by the pipe manufacturer shall be used.

2. **Joints for Concrete Pipe:** Shall be O-ring designed and conform to ASTM C-443.

5.01.04 CONSTRUCTION METHODS

A. **Excavation**

The Contractor shall proceed with trench excavation with due regard for life, health and property. MIOSHA Construction Safety Standards by Section 19 and 21 of Act #154 of the Public Acts of 1974 and all amendments to present date. Appropriate equipment shall be used to perform the work and, where necessary, extra measures such as the use of sheathing, shoring, trench boxes and dewatering systems shall be employed. Excavation shall proceed in the direction of pipe laying and shall be in reasonable conformity to the line and grade established on the plans or by the Engineer. The following shall also be observed:

1. **Protecting Other Utilities:** No excavation work shall commence until owners of other utilities have been notified and they have had an opportunity to mark the location of any equipment, pipelines, conduits or other works located within the project area. Excavation within close proximity to underground utilities shall proceed cautiously and final uncovering shall be done with hand shovels in order to protect such utilities from damage. Where excavation work uncovers conduit, pipelines, bases for utility poles, or similar structures, the contractor shall make arrangement to shore up, guy, support, or otherwise protect such utilities from damage caused by cave-ins or settlement in the trench, at the Contractor's expense.

2. **Removal of Surfacing:** When excavation will take place within or through an improved street, roadway, driveway or sidewalk, the pavement or surfacing shall be cut straight and square at the edges of the trench, using suitable equipment. The surfacing material shall then be removed and disposed of before excavation of the trench begins. Cuts for removal of surfacing shall be made equidistant on either side of the pipe centerline and no further apart than the allowable trench width, as provided in Section 4, below. Payment will be incidental to the cost of installing sanitary sewer unless otherwise provided for.

3. **Length of Open Trench:** Not more than 200 linear feet of trench may be open at one time. Under unusual circumstances, the Engineer may authorize more than 200 linear feet of trench to open, provided that pedestrian and driveway crossings are maintained at intervals of not more than 200 feet and that not more than one street intersection is closed to traffic.

4. **Trench Width:** The maximum trench width at the top of the pipe shall not exceed the outside diameter of the pipe being laid, plus 24 inches. This width may be increased to allow for stringers and sheathing when they are required. At least 6 inches of clearance shall be maintained between the outside face of the pipe barrel and the trench wall or sheathing. If the trench width at the ground surface exceeds the allowable width at the top of the pipe by more than 4 feet, the Contractor shall use sheathing and shoring, dewatering systems, or other such measures as are consistent with maintaining a safe trench and safeguarding adjacent curing, sidewalk, utilities and lawns.

B. **Handling**

The sewer pipe shall be handled in such a manner as to insure delivery on the site and final installation in a sound undamaged condition. Any damaged pipe or other materials shall be replaced by the contractor at his expense.

C. **Pumping and Bypassing**

When pumping/bypassing is required, the Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow of sewage around the manhole section in which work is to be performed in a sanitary manner. Leaking pumps, fitting, hoses or pipes which allow sewage to reach the street or ground surface will not be allowed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during peak periods. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, all engines shall be equipped in a manner to keep the pump noise at a minimum.

D. **Laser Alignment**

For all pipes twenty four (24) inches or less in diameter the contractor shall use laser alignment equipment to lay sewers to the specified lines and grades. The Contractor shall furnish all necessary equipment and personnel required to operate the laser

equipment.

The laser beam projection is to be rigidly mounted to its support platforms in a manner to be approved by the Engineer. This will assure that all ground equipment vibrations will be kept to a minimum and will permit the laser beam to be projected to control atmospheric conditions in the pipe which could affect the acceptable standard of construction.

The laser alignment method selected must be shown to have performed satisfactorily on at least three previous projects of a similar nature. The equipment shall be operated by competent, trained operators.

The Contractor will establish centerline stakes and offset stakes at each manhole and other centerline and offset stakes as required for check points from baseline established by Engineer.

The Contractor shall furnish openings in the pipe, as required for the installation of the laser equipment, at no additional cost to the Owner. Details of these openings shall be approved by the Engineer.

E. **Bedding Material**

The installation of plastic pipe must meet the requirements of ASTM D2321, which states that bedding material must not half a particle size which exceeds 1.5 inches in diameter within 6 inches of the pipe. The bedding material shall likewise be substantially free of sticks, boulders, rubbish, muck and other debris which would cause damage to the sanitary sewer. Bedding material which contains frozen chunks shall not be used.

Note: MDOT Class II material does not meet this requirement. MDOT Class II material that contains particle diameters less than 1.5 inches is acceptable with Engineer approval.

F. **Bedding Pipe**

All pipe shall be bedded around the bottom one-quarter of its circumference in material meeting the requirements of section 5.01.04 E., Bedding Material. Care shall be exercised to ensure that a minimum of 4 inches of bedding material, free of sticks or boulders, is placed below the pipe. Where the natural material in the trench bottom meets the requirements for bedding material, the pipe may be laid directly on the trench bottom and bedding material placed and compacted around its circumference. The pipe shall be uniformly supported along its entire length, and no loose spots or voids are to be tolerated. If Trench Undercut and Backfill (5.01.04 J.) has been used, sufficient bedding material shall be placed to assure that the pipe is uniformly supported. Where trench excavation is in rock, a minimum of 6 inches of bedding material will be placed between the neat line and the bottom of the pipe.

G. **Installation**

The installation of PVC pipe shall meet the requirements of ASTM D2321.

The pipe shall be laid as rapidly as normal working hours and weather conditions permit after the trench excavation has been made. The pipe shall be carefully laid to the required grade in a prepared trench, up grade from structure to structure, with the bell or groove end of the pipe upgrade. Each section shall have a firm bearing throughout its length, with recesses only to accommodate pipe bells and joints. Any pipe which has its alignment, grade or joints disturbed after laying shall be taken up and re-laid. The joints and interior of all pipe shall be thoroughly cleaned and all foreign matter before being lowered into the trench, and shall be kept clean during the laying operations.

Water shall be kept out of the trench until the material of the joints has hardened and the trench partially backfilled to prevent floating of the pipe. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other foreign substance can enter the line.

H. **Joints**

Joints shall be of the material specified and shall be made in accordance with the manufacturer's specification.

I. **Backfill Material**

Unless otherwise called for on the plans or when directed by the Engineer, earth excavated from the trench may be used for backfill, provided that it consists of sand, loam or other suitable material. Unstable materials containing peat or other organic or materials which contain large amounts of refuse, broken pavements, boulders, roots, trumps or other debris shall not be incorporated into the backfill.

J. **Stone Backfill**

Stone used for backfilling trench undercuts or for trench stabilization shall meet the requirements for 6A Stone, per MDOT Standard Specification for Construction. The cost of Stone Backfill will be incidental to the installation of the pipe.

K. **Backfilling**

Once the requirements of Section 5.01.04 F have been met and the sanitary sewer has been properly covered with bedding material, backfilling may commence. Except as indicated below, backfill material shall meet the requirements of Section 5.01.04 I.

1. Unless otherwise called for on the plans or when directed by the Engineer, earth excavated from the trench may be used for backfill, provided that it consists of sand, loam or other suitable material. Unstable materials containing peat or other organic or materials which contain large amounts of refuse, broken pavement, boulders, roots, stumps or other debris shall not be incorporated into the backfill.

2. Where excavated trench material is found to be unsuitable, borrow material meeting the requirements of Section 5.01.04 I or other details shown on the plans shall be furnished by the contractor. Surplus excavated material shall become the property of the Contractor and shall be disposed of by him.

3. The backfill material shall be placed carefully in the trench by hand or by machine. Care shall be exercised so as not to shift or dislodge pipe, valve boxes, hydrants and other such items.

4. The backfill shall be placed in 12 inch lifts and compacted to 95% density as measured by the Standard Proctor Test. The Engineer may require other compaction densities under roadways or for special circumstances. Unless agreed to, density tests shall be performed by the Engineer or other agents of the City of Escanaba.

5. The upper limits of backfill shall be top of subgrade under roadways and final grade in other areas.

L. **Visual Acceptance**

At the time of final acceptance, if on inspection it is found that there is an accumulation of earth or silt in the pipe, the Contractor shall clean out and remove such deposits at his own expense.

M. **Connect to Existing Sanitary Sewer Main**

Connections to the existing sanitary sewer system shall be made only after the new section of main has been tested or approved by the Engineer. Connections shall be made at the locations as shown on the plans with approved fittings. The Contractor shall be responsible to excavate the connection area to determine if the proposed grade will be adequate for the existing field conditions.

N. **Cleanout - Sanitary Sewer Main**

A cleanout shall be constructed upstream of the connection and in the direction of the flow of the sanitary sewer. The cleanout shall consist of a wye-branch installed in the main, a 45 degree bend, cleanout-minimum 4", and an approved monument box. The general Contractor shall be responsible for the final grade of the monument box which shall be within +/- 1/4 inch of the finish grade.

O. **Pipe Casings (Bore & Jack)**

Where casings are required in connection with railroad, highway, or primary road crossings, each casing will be measured for payment horizontally along the longitudinal centerline from end to end of the tunnel. The unit price bid for each casing shall include all costs in connection with excavation and backfilling, pipe casing, the excess cost of installing pipe in casing above the amount bid for the pipe laid in open trench, all skids, jointing materials, jacking pipe, jacking pits, sand backfill, flowable fill, end closures, and all other work for and in connection with the crossing not paid for separately.

5.01.05 INSPECTION AND TESTING

A. **Acceptance Tests**

All sewers shall be subjected to air, infiltration or exfiltration tests, or a combination of same, prior to acceptance by the Owner. At the discretion of the Engineer, televising of the pipe may be required. Televising will be required for all cases when leakage tests cannot be performed due to hooking up of live sewer laterals. All sewers where the ground water level above the top of the sewer is over 7 feet, shall be subjected to infiltration tests. All sewers, where the ground water level above the top of the sewer is 7 feet or less, shall be subjected to air tests or exfiltration tests. If an exfiltration test is performed, the maximum exfiltration rate shall be the same as that permitted for infiltration. For the purposes of exfiltration testing, the internal water level shall be equal to the external water level plus 7 feet as measured from the top of the pipe.

Within five (5) working days following pipe-laying and backfilling of each manhole section, the Contractor shall complete all testing. Should the workmanship employed or pipe material selected fail to meet the test requirements, the Contractor shall select a different material or utilize different techniques to achieve the desired result.

Where groundwater conditions require dewatering operations in order to construct sewers, the Contractor may, at his option, perform preliminary air tests after backfilling and while the dewatering equipment is still operating. After dewatering operation have ceased and the groundwater has stabilized at its normal level, seven 7 feet or less above the sewer and if the preliminary air test was satisfactory, the preliminary air test may be accepted as final.

Maximum allowable infiltration shall not exceed 100 gallons per inch of diameter per mile of pipe per 24 hours for any individual run between manholes.

SCHEDULE-SANITARY SEWER INFILTRATION (EXFILTRATION)
ALLOWABLE LIMITS BASED ON 100 GALLONS PER INCH
PER MILE OF PIPE PER 24 HOURS

4 inch = .00315 gal./ft./hr.
6 inch = .00475 gal./ft./hr
8 inch = .00630 gal./ft./hr
10 inch = .00790 gal./ft./hr
12 inch = .00950 gal./ft./hr
15 inch = .01185 gal./ft./hr
18 inch = .01420 gal./ft./hr
21 inch = .01660 gal./ft./hr
24 inch = .01890 gal./ft./hr

The procedure for air testing of sewers shall meet the requirements of ASTM F1417 for PVC pipe and ASTM C924 for concrete pipe and as follows:

The sewer line shall be tested in increments between manholes. The lines shall be cleaned and plugged at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide and air-tight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be fitted with suitable control valves and a pressure in the sewer. The pressure gauge shall have a minimum diameter of 3-1/2 inches and a range of 0-10 PSIG. The gauge shall have minimum divisions of 0.10 PSIG and an accuracy of plus or minus 0.04 PSIG.

The sewer shall be pressurized to 2 PSIG greater than the greatest back pressure caused by groundwater over the top of the sewer pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize between 3.5 and 4 PSIG. If necessary, air shall be added to the sewer to maintain a pressure of 3.5 PSIG or greater.

After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 PSIG, or such other pressure as is necessary to compensate for ground water level.

The time required for the air pressure to decrease 1.0 PSIG during the test shall not be less than the time shown in the following table:

Pipe Diameter In Inches	Minutes per 100 ft. of Sewer Pipe Length
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

If a sewer fails to pass any of the previously descried tests, the Contractor shall determine to location of the leaks, repair them and retest the sewer. The tests shall be repeated until satisfactory results are obtained.

Method of testing and measurement shall be approved by the Engineer. The Contractor shall provide the necessary equipment and labor for making tests, and the cost of same shall be included in the unit price bid for completed sewer.

Chemical grouting will be considered an acceptable method of repairing leaking pipe joints. Before this type of repair is undertaken, the Contractor shall obtain approval for making such repairs. Additionally, if chemical grouting of pipe joints is necessary, this operation must be performed under the observation of the Engineer, and a complete report of all grouting operation shall furnished to the Engineer after completion.

Where structural failures of the pipe have occurred, the broken pipe sections shall be removed and reconstructed.

B. **Deflection Testing of PVC Sewer Pipe**

In addition to other acceptance tests, PVC sewer pipe shall be tested for vertical deflection. Deflection tests shall be performed on 100% of PVC sewer pipe of 8 inch in diameter and larger.

This testing shall be carried out under the observation of the Engineer using a GO-NO-GO device approved by the Engineer and furnished by the Contractor. The cost for such testing will be included in the Contractor's bid price for sewer pipe. The deflection testing shall be no sooner than thirty (30) days after installation.

The maximum allowable vertical deflection of the circular cross section of the pipe will be limited to five percent (5%) of the actual internal pipe diameter. If the results of the testing shows the deflection of any sewer to be in excess of the maximum allowable, then the Contractor shall make repairs by re-excavation and compaction or replacement at no additional expense to the Owner. The section needing repair shall be retested.

5.01.06 DEWATERING SYSTEM

When called for in the contract or with the approval of the Engineer, the Contractor will lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions fro the pipe, and also to prevent cave-ins and unnecessarily large excavations. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work. The following regulations will be adhered to in using and operating a dewatering system:

A. **Use of Storm Sewer System**

Whenever it is possible to do so, the Contractor is to discharge drainage form his dewatering operation into the nearest storm sewer inlet or manhole. He will obtain the approval of the City Engineer as to the location and adequacy of the storm sewer prior to commencing operations.

B. **Restoration of Sewers**

It will be the responsibility of the Contractor to assure that silt, mud, or similar materials are not discharged into the storm sewers such as would cause damage to, or siltation of , the storm sewer system or its outlet. Any cleaning or repairs occasioned by the dewatering operation shall be undertaken by the Contractor, at his own expense, within ten (10) working days of the occurrence of such damage.

C. **Other Discharge Points**

Overland discharge of water across private property or into areas where localized flooding or soil erosion might occur will not be permitted. If, in the opinion of the Engineer, discharge of water into a ditch which is well stabilized, and having an outlet to a storm sewer or receiving body of water, may be safely accomplished, he may authorize the Contractor to so proceed. The Engineer may also require that a sediment trap be constructed to remove silts and other materials from the water before it is discharged to the receiving point.

The Contractor shall repair or restore any areas damaged by these operations, and shall dispose of any silts accumulated in sediment traps after the dewatering operation is completed.

D. **Use of Sanitary Sewers**

Because of the cost of collection, pumping and treatment of sanitary sewage, as well as potential damage to sewers, use of the sanitary sewers as a discharge point is strictly prohibited. The Engineer may, however, authorize their use in an emergency.

E. **Propriety of Equipment and Operations**

Equipment used by the Contractor for dewatering shall be of a size and type adequate to perform the job of dewatering and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular, on operation which require continuous pumping over prolonged periods of time, noise becomes a significant factor and the Contractor should do everything possible to reduce noise from pumps, generators, and other equipment.

F. **Control of Operations**

The Contractor shall monitor his dewatering operation at all times to ensure that the method used does not undermine pipe bedding place nearby utilities in jeopardy, or cause subsidence or damage to adjacent properties.

G. **Measurement and Payment**

Dewatering installation, operation or any sedimentation and soil erosion control needed is incidental to project costs.

5.01.07 PROJECT RECORD DOCUMENTATION

A. Contractor shall keep one record copy of all Specifications, Drawings, Addenda, Modifications and Shop Drawings at the site in good order and annotated to show all changes made during the construction process. These shall be available to the Engineer and shall be delivered to him for the Owner upon completion of the Project.

B. Drawings for record will be the "Project Record Drawings". At the completion of the work and prior to final payment, the Contractor responsible for each division of the work shall provide the Engineer with a marked-up set of drawings showing all changes of variation form the original drawings.

These changes shall be made on a set of filed drawings as the work is done. This set of drawings should be kept clean in a location at the site where the Engineer or the Owner's representative may examine it when desired.

C. The marked-up drawings shall be accurate. Careful measurements shall be made to locate underground sewers, gas lines, water lines, electrical conduit, underground telephone cable and miscellaneous piping.

5.01.08 BORINGS AND SOUNDINGS

When borings or soundings have been made, the location and log of each will be shown on the plans. Such information is valid only at the location shown and at the time when such investigation was made. The Contractor or prospective bidder may make any supplementary borings or soundings at his own expense, but shall not dig test pits for this purpose.

5.02 SANITARY LATERALS – 4 inch, 6 inch, 8 inch

5.02.01 SCOPE OF WORK

This work will consist of constructing a sanitary sewer lateral between the City's sanitary sewer main and a building sewer at the property line, or other point of termination point, as directed by the Engineer. Included in the word will be tapping of the sewer main, excavation, pipe laying, cleanouts, capping, connection to building sewer or other termination point, backfilling, and the provision of all necessary labor, tools, materials, and equipment to complete the work and test the acceptability of the installation.

5.02.02 MATERIALS

Materials to be used for construction of sanitary sewer laterals shall be as listed below, unless another equally suitable material is authorized for use by the Engineer. Fittings, saddles, and other connections shall, in general, be of the same material and have the same type of joints as the pipe itself.

A. **Pipe and Fittings**

1. **ABS Solid Wall Pipe** shall conform to ASTM D-2751, SDR 35 minimum or equal.

2. **PVC pipe** shall conform to ASTM D-3034 Schedule D.

5.02.03 CONSTRUCTION METHODS

A. **Excavation** - as specified in Section 5.01.04

B. **Connection to Main Sewer.** Where practical to do so, the sewer lateral will be connected to the main sewer at an existing wye-branch or tee, using suitable jointing material or couplers (such as "Fernco" fittings). Where no wye-branch or tee exists, the Contractor will make a sewer tap by one of the following methods:

1. **Concrete, Vitrified Clay, and Asbestos Cement Main Sewers**. A circular hole of the required diameter shall be cored from the side of the main sewer using a mechanically powered hollow cylindrical bit. No "break-in" connections will be allowed. A fitting approved for use by the Engineer, and which has a hub or appropriate joint to match the sewer lateral, shall be firmly secured and sealed to the main sewer.

2. **PVC Main Sewer.**
Saddles shall be secured to the main sewer and a circular hole of the required diameter cut or cored into the main sewer. Saddles shall be secured by solvent welding, and two stainless steel bands or clamps.

3. **Alternate Method.**

At the discretion of the Engineer, the Contractor may be allowed to remove a section of the main sewer and replace it with a new section containing a wye-branch. The new section shall be of the same size and material as the original section and shall be installed using appropriate joints or couplers to effect a leak-tight seal at the ends of the section.

C. **Pipelaying.** Pipelaying shall commence at the main sewer and proceed upstream toward the property line. The pipe shall be laid true to line and grade and shall be bedded in at least four inches of an acceptable granular material, free from rocks, sticks and other debris. Also installation shall meet ASTM D2321.

The following shall also apply:

1. Changes in direction and grade shall be accomplished by using one or more fittings (bends) with an angle of deflection no greater than 45 degrees.

2. Minimum grade for lateral shall be 1/4" rise per foot of run, unless otherwise directed or approved by the Engineer.

D. **Termination.** The sanitary sewer lateral will terminate at the property line with the cleanout in the case where there is no existing building sewer, or at the point of connection to an existing building sewer. When there is no existing building sewer, the open end of the wye-branch at the cleanout shall be plugged with a suitable plug or cap which will prevent the entry of dirt and water into the sewer lateral. If connection is to be made to an existing building sewer, a closure piece consisting of a minimum 12-inch piece of sewer pipe and the necessary fittings and couplers shall be installed between the clean-out and the end of the building sewer.

E. **Backfilling** - as specified in Section 5.01.04K.

F. **Dewatering** - incidental to sanitary sewer construction.

5.02.04 INSPECTION AND TESTING

A. Before backfilling the trench may proceed, the completed sewer lateral, its joints, connections and tap at the main sewer shall be inspected by the Engineer or its representative. If the inspector has doubts about the adequacy of the installation, he may order testing done to check that all joints are secure and water tight, or may order all or part of the installation re-laid to correct any deficiencies.

B. The air test specified must meet the requirements of ASTM F1417 for plastic pipe and ASTM C924 for concrete pipe.

C. Televising of all new sewer lines is required and will be paid for at the Contractor's expense. This item may be waived in certain specific cases at the discretion of the Engineer.

5.05 SANITARY SEWER APPURTENANCES

5.05.01 SCOPE OF WORK

The work covered in this section of the Specifications consists in the furnishings of all tools, labor, materials equipment and supervision and performing all operations involved in the construction of sewer appurtenances as required by this contract in strict accordance with the provisions, of the Plans and Specifications and subject to the terms and conditions of the Contract.

5.05.02 GENERAL

The following provisions apply to this section of the Specifications:

A. All materials unless otherwise indicated on the plans or authorized in writing by the Engineer, shall be new and unused materials of the size and type shown on the plans and standards details, and shall conform to the requirements of the Specifications.

B. All materials offered by the contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of such materials.

C. The foundations of all structures shall be rigidly supported by undisturbed earth, or compacted backfill. The interiors of all appurtenances shall be thoroughly cleaned of all foreign materials.

D. Where appurtenances are shown to be constructed on private property, the location of the structure shall be as shown on the plans. Al work shall be done within the construction easement provided by the Owner.

5.05.03 MATERIALS FOR SANITARY SEWER APPURTENANCES

A. **Precast Reinforced Concrete Manhole Units:** These units shall be circular with circular reinforcement and shall conform to the requirements of ASTM-C478-70. All manhole joints shall be of the rubber O-ring design.

B. **Cast Iron Frames and Covers for Manholes:** Each casting shall be East Jordan 1040 frame and solid cover or equivalent. A 24 inch clear opening is required on all manhole castings.

C. **Manhole Steps:** Cast iron manhole steps shall be furnished and set by the Contractor. They shall conform to the requirements of ASTM Standard Specifications for "Gray Iron Castings", A-48 Class No. 30, minimum width 14 inches. (East Jordan No. 8509 or equal). Polypropylene plastic, steel reinforced, manhole steps may also be furnished. They shall be #P52 manhole steps as manufactured by M.S. Industries, Inc. of Peachtree City, Georgia or equal. In the event FRP manholes are used, Armco manhole steps shall be furnished.

D. **Manhole Waterstops:** All manhole connection will be fitted with a waterstop assembly. The waterstop shall be of a design acceptable to the Engineer and the pipe manufacturer. Waterstops shall be KOR-N-SEAL as manufactured by national Pollution Control Systems: PRESS WEDGE II as manufactured by the Press-Seal Gasket Corporation; RES-SEAL as manufactured by Scales Manufacturing Corp., or equal.

E. **Flow Channels:** Flow channels must be poured concrete, 3500 psi concrete or equal, smooth edges and bottom and round cross section. PVC flow channels are acceptable if authorized for use by the Engineer.

5.05.04 CONSTRUCTION METHODS

A. As specified in Section 5.14.03, 2003 MDOT Standard Specification for Construction, and typical details on plans.

B. **Inlet and Outlet Pipes:** Pipes placed in the masonry for inlet or outlet connections shall extend through the walls and beyond the outside surface of the walls a sufficient distance to allow for connections. When required, drops shall be installed according to details shown on the plans.

C. **Drop Manholes:** All sanitary manholes with an invert drop in excess of 24 inches shall have a drop structure. The drop structure shall be built as shown on the plans.

D. **Tap Existing Manhole:** As specified in Section 5.13.06 2003 MDOT Standard Specifications.

E. **Backfilling:** As specified in Section 4.01.03 G.

F. **Placing Cast Iron Frame and Cover:** As specified in Section 5314.06, 2003 MDOT, Standard Specifications.

5.05.05 ACCEPTANCE TESTS

A. Manholes on sanitary sewer are to be subjected to an exfiltration test. All incoming and outgoing sewer lines shall be plugged and the manhole filled with water of to ∀ 6 inches of the manhole cover. If the water loss exceeds the maximum allowable as shown below, the manhole shall have failed the test.

Depth of Manhole	Maximum Allowable Water Loss
0-8 feet	1 inch / 5 minutes
Over 8 feet	1/8 gal / vertical ft. / 5 min

All manholes which fail the above test shall be inspected as to the source of the problem, corrected and retested.

3.01.04 CLEARING

Before removing topsoil from proposed roadbed and utility trench areas, the Contractor shall remove all vegetation, brush, rocks, stumps, and any other objectionable litter or foreign material which shall be removed and disposed of off site. The topsoil shall be completely removed to the top of acceptable subbase material to the limits of proposed utility trenches and/or roadbed area and stored in an acceptable location.

3.01.05 EARTH EXCAVATION

Topsoil and other unclassified material shall be removed from the roadbed and utility trench areas. Topsoil recovered may be stored on private land by permit and unsuitable material shall become the property of the Contractor. The Contractor shall allow the Engineer to take any measurements needed before installing the utilities or constructing the roadbed. Large boulders if encountered during construction shall become the property of the Contractor.

3.01.06 SUBBASE (CIP)

Subbase shall be constructed with granular material Class II, secured from locations outside the right-of-way, which can be shaped and compacted to a minimum of 95 percent of the maximum unit weight to the required cross-section using the controlled density method. The contract price paid is payment in full for furnishing, hauling, placing, watering, and compacting the material to the required cross-section. The subbase shall be approved material supplied by the Contractor from locations outside the right-of-way.

3.01.07 SAWCUTTING

Any sawcutting required for pavement removal whether HMA or concrete shall be sawed perpendicular to the edge of existing pavement to a depth necessary to cleaning remove said pavement. Any sawcutting work will be paid for in other items of work and not paid for separately.

Connections to existing watermains will be paid for at the unit price bid. Each price named for a connection shall include all costs incurred for making the connection over and above the price of the connecting piping in place and concrete blocking which will be paid for separately. Each unit price shall include furnishing and installing the pipe fitting or the tapping sleeve and valve; all excavation and backfill work; tapping of existing main; and all other costs not included under other bid items.

4.05.09 HYDRANT COMPLETE.

Hydrant Complete will be paid for at the unit price bid. The unit price named for each hydrant installation shall include all costs incurred in furnishing and installing the hydrant; 6 inch gate valve with box and connecting pipe, accessories and appurtenance; concrete blocking behind and under said hydrant; concrete curb removal and replacement with Escanaba standard curb; (if applicable) and all other costs not included under other bid items from the new hydrant assembly to the watermain, all as one pay item. This shall also including fittings and any material to provide electrical conductivity for testing for future main thawing.

4.05.10 PIPE CASINGS.

Where casings are required in connection with railroad, highway or primary road crossings, each casing will be measured for payment horizontally along the longitudinal centerline from end to end of the tunnel.

The unit price bid for each casing shall include all costs in connection with excavation and backfilling, pipe casing, the excess cost of installing pipe in casing above the amount bid for the pipe laid in open trench, all skids, jointing materials, jacking pipe, jacking pits, sand backfill, end closures and all other work for and in connection with the crossing, not paid for separately.

4.05.11 WATER SERVICES.

Water services to be paid for on a unit price basis for each size shall include all costs incurred in pressure tapping the watermain, service piping of size and type specified, the installation of the service piping to the designated location by an approved method, installation of a curb stop and box, capping or connection to the existing building water system, replacement of curb, sidewalk, sod and plantings through the boulevard. Also included in the work are the necessary excavation, backfilling, compaction, dewatering of trenches, provision of labor, materials, equipment and other incidentals necessary to complete the work and test the installation for its suitability for use.

4.06 MISCELLANEOUS

CITY OF ESCANABA

DIVISION IV DETAILED SPECIFICATIONS

WATERMAIN CONSTRUCTION CONTRACT

ESCANABA MICHIGAN

2015

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DIVISION IV

4.01 WATERMAIN CONSTRUCTION

4.01.01 GENERAL

A. Scope of Work

This work will be subject to the General Requirements and Covenants of the Contract, requirements contained herein, and details shown on the Plans. The Contractor shall provide all the labor, material, tools, equipment, accessories and services necessary to install the items called for on the contract documents, and will be responsible for producing a complete and workable installation in keeping with the intent of the Contract.

B. Applicable Standards

Unless otherwise specified herein, materials and methods for the construction of the watermain will conform to the standards set forth by the American Water Works Association (AWWA) and the American National Standards Institute (ANSI), including the latest revisions of any of those standards.

C. Work Included Under This Section

The work shall consist of furnishing and installing watermains, valves, hydrants, and fittings and other connections, of the type and size specified and at the locations shown on the plans. The work shall also include the necessary excavations, pipe bedding, backfill, testing and sterilization.

D. Shop Drawings

The Contractor shall furnish to the Engineer, as prescribed under the General Requirements, shop drawings of the various pieces of equipment to be incorporated into the work. Shop drawings will indicate design details of the items to be furnished, their location and function in the project, furnish operating details and other such information as will indicate to the Engineer their suitability for use under this Contract. The Engineer will approve shop drawings or request revisions or re-submittal as necessary to assure that a particular item is acceptable and conforms to the specifications.

E. Certification and Inspection

The manufacturer of pipe, fittings and other such items shall furnish a certified statement that all materials provided by him have been inspected and tested in accordance with the applicable standards. Each piece of pipe

and each fitting shall have its weight and class designation conspicuously cast or painted on it. All other pipe materials shall have the class designation painted thereon. Where required, other designation marks shall be painted on pipe and fittings to indicate correct location in the pipeline to conform to a detailed layout.

Upon delivery of pipe and other materials to the job site, it will be inspected and approved by the Engineer or his representative, at which time the Engineer will receive a copy of the manufacturer's certified statement. No cracked, broken, damaged or otherwise defective pipe or fittings will be incorporated into the work. Any item that is found to be defective after it has been placed shall be removed by the Contractor and replaced with a new piece.

F. Use of Public Water Supply

Unless specifically authorized by the Engineer or by special provisions elsewhere in this document, the Contractor shall not take water from an un-metered connection for use in the course of his work. Where water is to be drawn from City fire hydrants, the Contractor shall make an application with the City for a permit and issuance of a hydrant meter. The Contractor will be billed for water used at a rate determined by the City of Escanaba.

G. Equipment and Material Supplied by City

The Contractor shall not seek to purchase equipment or materials for use under this contract from the City Water Department, unless special provisions have been made elsewhere in this document for the purchase of specific items from City supplies.

4.01.02 MATERIALS FOR WATERMAIN CONSTRUCTION

A. General

The allowable types of pipe, fittings, joints and other items for watermain construction are specified herein. No leaded pipe, leaded pipe joints or other items containing lead will be allowed of any kind. All pipe shall have clear inside diameter not less than the dimensions called for in the plans and specifications. Wall thickness, class designation, and material of construction shall conform to these requirements and other such standards as are called for in these specifications.

B. Pipe Material

1. Ductile Iron Pipe (Class 52)

Ductile iron pipe (special thickness class 52) or (standard pressure class 52) for watermain construction shall meet all the requirements of the American National Standards Institute (ANSI) Specification A 21.51 and the American Water Works Association Specification C151, or the latest revisions thereof. Pipe shall be designated for a minimum working pressure of 250 pounds per square inch (psi), and shall be coated on the outside with a coating of coal tar varnish or asphalt base paint one mil thick applied at the point of manufacture in accordance with AWWA specifications. The inside of all ductile iron pipe shall be cement lined in accordance with ANSI Specification A21.4 (AWWA C104) or the latest revision thereof.

C. Joints for Pipe

Joints for use with ductile iron pipe shall be of the types enumerated below and shall be furnished with pipe for use at the locations shown on the plans or otherwise listed in the Contract Documents. All necessary joint materials, gaskets, bolts, lubricants and other such items as are necessary to make a completed joint shall be furnished with the pipe or fitting.

1. Slip on (push on) Joints. Slip on joints shall conform to ANSI Specification A21.11. Rubber gaskets and lubricant shall be furnished with the pipe in sufficient quantity to complete all joints in the pipeline.

2. Mechanical Joints. These joints shall conform to ANSI A21.11. Rubber gaskets shall be according to the manufacturer's standard. Mechanical joint pipe shall be required for use when watermain is to be enclosed in a casing pipe.

3. Flanged Joints. Flanged joints will be made using ANSI 125-pounds pattern flanges and shall include all necessary bolts, nuts, washers and gaskets in accordance with ANSI B16.1.

4. Ball Joints. These joints shall be cast iron, mechanical, flexible jointed tube, designed to withstand a working pressure of 200 psi and a hydrostatic test pressure of 300 psi. Joints shall be similar to those produced by the following companies:

a. "FLEX-LOK" by American Cast Iron Pipe Company

b. "USIFLEX" by U.S. Pipe and Foundry Company

c. "River Crossing Pipe" by James B. Clow & Sons, Inc.

D. Valves

Valves of the required type shall be furnished and installed at the locations shown on the plans. Valves supplied shall be compatible with the type of pipe material and joints called for on the plans and shall conform to the requirements listed below:

1. Valves for Use with Ductile Iron and Cast Iron Pipe

a. Resilient Wedge Gate Valves, 3 inch – 12 inch - Resilient wedge gate valves shall conform to AWWA Standard C509-94, or the latest revision thereof and shall be furnished with the following detailing:

i. Open left or counter-clockwise
ii. 2" square wrench nuts, where applicable
iii. Bronze stem
iv. Wedge rubber bonded to ductile iron wedge
v. Symmetrical seating about stem centerline
vi. Depression or cavities in seat area
vii. Body and bonnet of valve to be fusion bonded epoxy coated inside and out
viii. Double "O" ring stem seal
ix. Arrow cast in metal indicating direction opening

Valves shall be designated as follows:

Type	Application	Operator	Type Joints
RA	Direct burial	2 inch square wrench nut	Mechanical

Valves shall be similar to the Waterous Series 500, American 80 "CRS", Clow R/W or an approved equal.

b. Tapping Valves. Tapping valves shall conform to the requirements outlined in Section a., above, for gate valves, except that joints shall consist of a flanged joint inlet end for mating with the tapping sleeve and a restrained mechanical joint outlet. Oversize seat rings may be provided to permit entry of tapping machine cutters. Tapping valves shall be similar to the F-5093 Mechanical Joint Tapping Valves as manufactured by the Clow Company or an approved equal.

E. Valve boxes for use with buried gate valves or butterfly valves shall be two piece, screw type adjustable cast iron boxes with a 5¼ inch diameter shaft (similar to Clow 2452) or approved equal. Covers shall be furnished with finger holes and shall be marked "WATER".

F. Standard Fittings

Fittings to be used for watermain construction shall be of a type and material compatible for use with the type of pipe being used and shall meet the following requirements:

1. Fittings for use with Ductile Iron Pipe
Fittings for Ductile Iron Pipe shall meet the requirements of ANSI Specification A21.10 (AWWA C110) and shall be constructed of cast iron or ductile iron as specified. The exterior of the fittings shall have a one mil thick coating of bituminous material applied at the point of manufacture in accordance with AWWA C110. The interior of all fittings shall be cement lined in accordance with ANSI Specification A 21.4 (AWWA C104). Certification and marking shall be as specified therein. This standard shall also apply to fittings with push-on joints.

G. Special Fittings

Fittings called for on the plans which do not fall under the purview of AWWA Standard C110 shall nonetheless be constructed and certified by the manufacturer thereof to be compatible with fittings for ductile iron watermain. Such Special Fittings comply insofar as practicable with the provisions of AWWA C110 with regard to workmanship, durability and material of construction, they shall be designed to withstand the same working and test pressures as prescribed for the watermain and its appurtenances and shall be built to such other standards as are commonly accepted as normal practice within the waterworks industry.

H. Fire Hydrants

Fire hydrants shall be of the dry-barrel type and shall meet the requirements of AWWA Standard C502-80, including any revisions thereto. In addition, the standard fire hydrant for use in the City of Escanaba will be supplied with the following details:

1. Bury Length:	6 foot – 6 inch
2. Outlet Details:	
Hose Bibs:	2 ea, 2½ inch Diameter Thread 3-3/32 inch
Major:	Diameter x 8 threads per inch
Steamer:	1 ea, 4 inch diameter Thread 4.5-4NH, National Standard
3. Main Valve:	5 inch min diameter
4. Inlet Connection	6 inch Mechanical Joint (Restrained)

5. Direction to Open:	Left (Counter-clockwise)
6. Finish:	Paint chrome yellow above grade line; asphalt varnish per AWWA below grade
7. Shut Off:	Compression - closes with pressure
8. Drain Outlet:	Plugged or eliminated
9. Nozzle Cap Nuts:	7/8 inch Pentagon Lug
10. Operating Nut:	7/8 inch Pentagon Lug
11. Stem Seal:	"O" Ring

Hydrants shall be East Jordan Iron Works 5BR-250 Watermaster or similar. Approval by the Engineer is required.

I. Continuity Conductors

Electrical continuity on watermain pipe shall be provided through the use of continuity conductors where fittings such as push-on joints do not allow current to pass. Continuity shall be provided through the use of brass wedges as provided by the manufacturer of the pipe, "Electro-Bond" strips, "Cadweld" connectors or similar devices as approved by the Engineer. No lead tipped gaskets may be used.

J. Bedding Material

Bedding material for watermain, in general, shall consist of sand or a similar granular material. While some small amounts of clay or silt will be acceptable in the material, it shall be substantially free of lumps. The bedding material shall likewise be substantially free of sticks, rocks, boulders, rubbish, muck and other debris which would cause damage to the watermain. Bedding material which contains frozen chunks shall not be used.

K. Backfill Material

Unless otherwise called for on the plans or when directed by the Engineer, earth excavated from the trench may be used for backfill, provided that it consists of sand, loam or other suitable material. Unstable materials containing peat or other organic or materials which contain large amounts of refuse, broken pavement, boulders, roots, stumps or other debris shall not be incorporated into the backfill.

L. Stone Backfill

Stone used for backfilling trench undercuts or for trench stabilization shall meet the requirements for 6A Stone, per 2003 Interim Michigan Department of Transportation (MDOT) Standard Specifications for Construction.

4.01.03 CONSTRUCTION METHODS

A. GENERAL. The Contractor will be responsible for assuring that the methods of construction are in reasonable accord with generally accepted industry practices, standards as set forth by the American Water Works Association, the requirements set forth herein, and determinations made by the Engineer. Unless specifically stated otherwise on the plans or at the discretion of the Engineer, the following general rules shall apply:

1. Handling and Storage of Materials. Materials delivered to the job site for incorporation into the work shall be handled and stored in such a manner as to prevent damage to the materials. Such materials shall be neatly placed along or near the site so as to minimize inconvenience to the public and property owners and with due regard to the safety of the general public. Construction materials shall not be placed or stored closer than twenty feet from any fire hydrant, cross-walk or intersection.

2. Sequence of Operations: As a rule, the following sequence will be followed by the Contractor:

a. Pipe laying
b. Sterilization
c. Cleaning & Flushing
d. Bacteriological Testing
e. Pressure & Leakage Testing
f. Electrical Continuity Test
g. Put Main in Service
h. Tap & Install Services

Deviation from this sequence may be permitted by the City Engineer provided that prior approval is obtained and that such deviation is warranted.

3. Minimum Depth of Bury. All watermain constructed within the City of Escanaba shall be buried with a minimum of 6.0 feet of cover between the top of the pipe or fittings and the surface of the ground. When a proposed surface grade is shown on the plans, it shall serve as the datum for determining depth of burial; otherwise depth of burial shall be measured from the existing surface.

4. Isolation from Sewers. Any watermain constructed parallel to a sanitary sewer shall be separated by a distance of 10 feet, measured horizontally, from the centerline of the sewer. Watermain which crosses a sanitary sewer shall be separated by a distance of 18 inches, measured from the outside of each pipe, at their closest points.

5. Notification of Utility Customers. When the Contractor's schedule of work includes shutting down all or parts of a watermain, or other operation, which will disrupt service to customers of the water utility, the Contractor shall be responsible for notifying affected customers in advance. Businesses shall have at least 72 hours advance notice and contact shall be made personally or by telephone with the manager or other person in charge of the business. Private residences shall be notified as soon as practical in advance of any shutdown and mass media communication may be used. Fire departments shall be given 72-hour notice. Any outage shall not exceed four hours without approval of the Owner.

B. EXCAVATION. The Contractor shall proceed with trench excavation with due regard for life, health and property. MIOSHA Construction Safety Standards by Sections 19 and 21 of Act #154 of the Public Acts of 1974 and all amendments to present date. Appropriate equipment shall be used to perform the work and, where necessary, extra measures such as the use of sheathing, shoring, trench boxes and dewatering systems shall be employed. Excavation shall proceed in the direction of pipe laying and shall be in reasonable conformity to the line and grade established on the plans or by the Engineer. The following shall also be observed:

1. Protecting Other Utilities: **CALL MISS-DIG**. No excavation work shall commence until owners of other utilities have been notified and they have had an opportunity to mark the location of any equipment, pipelines, conduits or other works located within the project area. Excavation within close proximity to underground utilities shall proceed cautiously and final uncovering shall be done with hand shovels in order to protect such utilities from damage. Where excavation work uncovers conduit, pipelines, bases for utility poles, or similar structures, the Contractor shall make arrangements to shore up, guy, support, or otherwise protect such utilities from damage caused by cave-ins or settlement in the trench.

2. Removal of Surfacing. When excavation will take place within or through an improved street, roadway, driveway or sidewalk, the pavement or surfacing shall be cut straight and square at the edges of the trench, using suitable equipment. The surfacing material shall then be removed and disposed of before excavation of the trench begins. Cuts for removal of surfacing shall be made equidistant on either side of the pipe centerline and no further apart than the allowable trench width, as

provided in Section 4, below. Payment will be incidental to the cost of installing watermain, unless provided for elsewhere in the Contract.

3. Length of Open Trench. Not more than 200 linear feet of trench may be open at one time. Under unusual circumstances, the Engineer may authorize more than 200 linear feet of trench to be open, provided that pedestrian and driveway crossings are maintained at intervals of not more than 200 feet and that not more than one street intersection is closed to traffic.

4. Trench Width. The maximum trench width at the top of the pipe shall not exceed the outside diameter of the pipe being laid, plus 24 inches. This width may be increased to allow for stringers and sheathing when they are required. At least 6 inches of clearance shall be maintained between the outside face of the pipe barrel and the trench wall or sheathing. If the trench width at the ground surface exceeds the allowable width at the top of the pipe by more than four (4) feet, the Contractor shall use sheeting and shoring, dewatering systems, or other such measures as are consistent with maintaining a safe trench and safeguarding adjacent curbing, sidewalk, utilities and lawns.

5. Trench Undercut and Backfill. Where unstable soil conditions, or obstructions, require that the trench be excavated below the elevation shown on the plans and backfilled with material meeting the gradation requirements for Coarse Aggregate 6A, such excavation and backfill will be measured by volume in cubic yards as Trench Undercut and Backfill. The volume of Trench Undercut and Backfill will be computed from the length, depth, and width of undercut authorized. The width of the trench authorized will be in accordance with the width shown on the plans for the size of pipe required. No allowance will be made for sloping the sides of the trench. Trench Undercut and Backfill will be paid for at the contract unit price per cubic yard, which price shall be payment in full for excavation and disposal of materials below the bottom of the trench indicated by the plans and for furnishing, backfilling, and compacting the undercut with material meeting the gradation of Coarse Aggregate 6A, up to the bottom of the trench elevation indicated by the plans.

C. PIPELAYING. The Contractor shall have adequate and sufficient equipment at the work site for lowering pipe and fittings into the trench and effecting their installation without damage. Under no circumstances will pipe or fittings be dropped into the trench. Any scratches or damage to coatings will be repaired and all mud or accumulations of dirt will be removed from pipe or fittings prior to their installation. The following items shall be followed in laying pipe:

1. Line and Grade. The pipe shall be laid in the trench in reasonably close conformity to the line and grade shown on the plan. The Contractor will be responsible for string line, batter boards or other

methods of measurement as will assure that the pipe is to correct line and grade based on the plans, directions of the Engineer and layout controls as the Engineer may establish. In general, pipe in the trench will be laid with a tolerance of plus or minus 6 inches for grade and plus or minus one (1) foot for line. At structures or fittings, alignment shall be sufficiently precise to assure that no undue misalignment or stress is placed upon fittings or structures.

2. Direction of Laying. Unless otherwise directed, the pipe shall be laid with bell ends facing the direction of laying. When the grade exceeds 2 percent (2%), the bell ends shall face upgrade.

3. Bedding Pipe. All pipe shall be bedded around the bottom one-quarter of its circumference in material meeting the requirements of Section 4.01.02 J., Bedding Material. Care shall be exercised to ensure that a minimum of four (4) inches of bedding material, free of rocks, sticks or boulders is placed below the pipe. Where the natural material in the trench bottom meets the requirements for bedding material, the pipe may be laid directly on the trench bottom and bedding material placed and compacted around its circumference. The pipe shall be uniformly supported along its entire length and no loose spots or voids are to be tolerated. If Trench Undercut and Backfill (4.01.03 B.5) has been used, sufficient bedding material shall be placed to assure that the pipe is uniformly supported. Where trench excavation is in rock, a minimum of 6 inches of bedding material will be placed between the neat line and the bottom of the pipe.

4. Covering Pipe. Once the pipe has been properly laid and jointed, it shall be covered with material meeting the requirements of bedding material. The cover material shall be carefully placed by hand or other means to prevent inclusion of rock, frozen lumps or other deleterious material and to ensure that the pipe will not be dislocated in the trench. The cover material will be placed and compacted, free of loose spots or voids around the side of the pipe and up to a depth of 6 inches above the top of the pipe. No backfilling of the trench will be done until the pipe is properly covered.

5. Joining Pipe. The interior of all pipe and fittings will be kept clean during the laying and joining operations. If necessary, the Contractor shall plug or cover the ends of pipe and fittings until they have been lowered into the trench and just before the joint is made. The spigot ends of pipe shall be carefully centered in the bell of the previous piece and forced home. The pipe shall then be brought to line and grade. Every precaution shall be taken to prevent dirt from entering the joint space or damage to gaskets. All joints shall be made in strict accordance with manufacturers recommended practice with particular attention given to maximum allowable deflections. After the joint is made and the pipe has been brought to line and grade, it shall be sufficiently anchored with

bedding and cover material to prevent its being dislodged by placement of the next piece.

6 Restraining Joints. All joints with deflections greater than 10 degrees, all tees, hydrant leads, end caps, plugs and similar fittings subject to axial thrust from water pressure shall be suitably restrained against movement or blowing off. The method of joint restraint shall be designed to withstand, at a minimum, the test pressure to be applied to the watermain. The Contractor shall submit details of proposed joint restraints, showing type and location, to the Engineer for approval. The following methods of joint restraint and their applications shall be acceptable:

a. Retainer Glands: When mechanical joint pipe and fittings are used, mechanical joint retainer glands shall be installed on a sufficient number of joints each side of a bend or fitting to adequately restrain the pipe. Extreme care shall be used in tightened uniformly and in proper sequence, to the torque specified by the manufacturer.

PIPE RESTRAINT SCHEDULE

	Length of restraint reg'd (feet - each side)			Design Strength of Restraint Required (Kips)	
Deflection Angle:	22½	45	90 or tee	45	90 or tee
6"	3	11	37	2.0	5.0
8"	4	15	50	3.0	9.0
12"	6	22	73	6.0	20.0
16"	8	28	95	11.0	36.0

b. Strapping & Lugging: Where it is not practical to use thrust blocks to restrain push-on joints, as at points of vertical deflection in a pipe, strapping and lugging of the joints may be used. A sufficient number of joints shall be restrained each side of the joint so as to prevent movement or blow-off of the joints or fittings. Strapping and lugging systems shall be of a suitably corrosion resistant material and shall be approved by the Engineer before use.

7. Field Cutting Pipe. When cutting pipe in the field, suitable equipment shall be used which will not damage the pipe, its lining or coatings. Cuts shall be perpendicular to the long axis of the pipe and the end of the cut shall be beveled back about 1/8 inch at an angle of 30 degrees to the pipe centerline.

8. Protecting Open Pipe Ends. Open ends of all pipe shall be protected against the intrusion of dirt, water and other contaminants during the pipe laying operation. Pipes which have been filled with dirt of mud shall be cleaned to the satisfaction of the inspector prior to continuation of the pipelaying operation. When pipelaying work is suspended for any period of time, a watertight plug shall be inserted in the end of the last pipe laid.

D. VALVES AND HYDRANTS. Valves and hydrants shall be installed at the locations indicted on the plans and in accordance with requirements elsewhere in these documents concerning depth of bury and types of joints.

1. Installing Valves. All valves will be installed with valve boxes unless they are to be located in a vault or structure as indicated on the plans. The valve shall be set with the stem plumb and shall be set on concrete blocking adequate to prevent settling. Care shall be exercised in aligning the valve with its mating pipe so that no load or stress is placed on the valve body due to misalignment or improper bedding of the pipe. Bedding material shall be carefully placed and compacted up to the level of the bottom of the valve box after the valve has been properly installed and all joints secured.

2. Installing Valve Boxes. Valve boxes shall be centered over the valve operating nuts and set on brick blocking adequate to support the valve box at the proper elevation above the valve. The valve box shall then be plumbed and the top adjusted to grade. During backfilling, the valve box shall be adequately braced to prevent its shifting. Any valve box which is knocked substantially out of plumb or which is dislodged from its center over the operating nut, shall be re-excavated, plumbed up and re-centered over the valve.

3. Installing Hydrants. Hydrants shall be set on a concrete pad 18 inch x 18 inch x 2 inch or stone backfill material which has been cut properly to grade. The grade ring of the hydrant shall be at the finished surface grade at the hydrant location and the barrel of the hydrant shall be plumb from top to bottom. The shut-off gate for the hydrant and a connecting piece of 6 inch watermain between the hydrant and the gate valve shall have been installed, connected to the hydrant lead and suitably restrained against thrust as prescribed in Section 4.01.03 C. Care will be exercised that there is no misalignment between the pipe, valve and hydrant.

4. Cutting In Valves. When the plans call for cutting a valve into an existing watermain, the Contractor shall make arrangements at least 72 hours in advance with the City Water Department to shut down the section of main involved. (All work of this type will be coordinated specifically with the City Water Department prior to any work being performed). The work may have to be scheduled at night in order to minimize service disruptions. Excavation will comply with applicable parts of Section

4.01.03 B. The required length of main shall be cut out using an appropriate cutter in accordance with Section 4.01.03 C.7. After the outside of the pipe has been cleaned of scale and loose rust, a valve of the type called for on the plans shall be installed along with a cutting-in sleeve. A special cutting-in valve and sleeve unit may be used, provided that the valve is of the required type and conforms to the specifications in Section 4.01.02D. Joints on the valve and sleeve shall be mechanical joints and shall be furnished with retainer glands. When a valve is to be cut into sand cast pipe, a mechanical joint transition coupling and short piece of ductile iron pipe shall be installed on the side of the valve opposite the cutting-in sleeve. Joints shall be restrained with mechanical joint retainer glands. No machining of the O.D. of sand cast pipe in order to make valves fit directly will be allowed.

E. GRADE AND DIRECTION CHANGES

1. By Deflection of Joints. Changes in grade or direction to produce a gradual curve in the pipeline or for minor corrections of alignment shall not, in general, exceed 4 degrees at any one joint unless the manufacturer warrants that a larger deflection is permissible (80% of the maximum).

2. By Use of Bends & Fittings. When a change in direction or an obstruction is encountered in the path of the watermain such as a culvert, manhole or other utility, the watermain shall be deflected around or under the obstruction using appropriate fittings. A minimum of 18 inches of clearance between the watermain and its crossing of another utility will be provided and where the watermain must cross under a stream or culvert, 3 feet of clearance will be provided. All bends or fittings shall be restrained. The laying of such fittings will be paid for at the unit price bid for each size of watermain. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstructions.

SCHEDULE - MAXIMUM DEFLECTION OF DUCTILE IRON PIPE

Type of Pipe Joint	Pipe Size in Inches 4	6	8	10	12	14	16
Super Bell-Tite	5E	5E	5E	5E	5E	5E	5E
Mechanical Joint	E 8-18'	E 7-7'	E 5-21'	E 5-21'	E 5-21'	E 3-35'	E 3-35'
Locked M.J.	E 2-45'	E 2	E 1-30'	E 1-15'	E 1	E 0-45'	E 0-46'
Super-Lock	E -	E 4	E 4	E 4	E 4	E 3	3
River Crossing	-	E 15	E 15	E 15	E 15	E 15	E 15

SCHEDULE - TOTAL DEFLECTION OF PIPE IN FEET FOR DIFFERENT ANGLES OF DEFLECTION AND NUMBER OF LENGTHS OF PIPE

No. of Degrees of Deflection per Joint:

Total Length of Pipe in Feet	Lengths of Pipe	1E	2E	3E	4E	5E
18	1	.31	.63	.94	1.26	1.57
36	2	.94	1.88	2.82	3.76	4.69
54	3	1.88	3.77	5.64	7.50	9.35
72	4	3.14	6.27	9.38	12.47	15.51
90	5	4.71	9.40	14.04	18.62	23.12
108	6	6.59	13.14	19.60	25.94	32.12
126	7	8.79	17.49	26.05	34.39	42.44
144	8	11.29	22.45	33.37	43.93	54.01
162	9	14.11	28.02	41.54	54.51	66.74
180	10	17.23	34.17	50.54	66.08	80.53
Approx. Radius in feet of curve produced by a success of joints.		1034	514	343	258	206
Approx number of 18 ft lengths of pipe required to make a 90° bend		90	45	30	23	18

F. CONNECTIONS TO EXISTING WATERMAIN. Connections to the existing water distribution system will be made only after the new section of the main has been tested and approved by the Engineer in accordance with Section 4.01.04. Where service to the existing distribution system must be disrupted in order to cut in tees or do similar work, arrangements will be made at least 72 hours in advance with the City Water Department to shut down the required portion of the distribution system. This work may have to be done at night in order to minimize disruption of service to utility customers. Connections shall be made at the required location using fittings as detailed on the plans. Any tees, couplings or cutting-in sleeves used shall be provided with restrained mechanical joints. Where sand cast pipe or pipe of another material is encountered which as a different outside diameter from ductile iron pipe of the same nominal size, a mechanical joint transition coupling shall be used to make the connection. Machining the outside diameter of sand cast pipe to mate with ductile iron fittings will not be authorized. Tapping into existing watermains shall be done by City of Escanaba personnel only on a work order basis or as directed by the Engineer.

G. BACKFILLING. Once the requirements of Section 4.01.03C. have been met and the watermain has been properly covered with bedding material, backfilling may commence. Except as indicated below, backfill material shall meet the requirements of Section 4.01.02 K.

1. Excavated material from the trench may be used as backfill if it meets the requirements of Section 4.01.02 K and provided that details on the plans do not call for other materials for subbase under a roadway.

2. Where excavated trench material is found to be unsuitable, borrow material meeting the requirements of section 4.01.02 K. or other details shown on the plans shall be furnished by the Contractor. Surplus excavated material shall become the property of the Contractor and shall be disposed of by him.

3. The backfill material shall be placed carefully in the trench by hand or by machine. Care shall be exercised so as not to shift or dislodge pipe, valve boxes, hydrants and other such items.

4. The backfill shall be placed in 12 inch lifts and compacted to 95% density as measured by the Standard Proctor Test. The engineer may require other compaction densities under roadways or for special circumstances. Unless agreed to, density tests shall be performed by the Engineer or other agents of the City of Escanaba.

5. The upper limits of backfill shall be top of subgrade under roadways and final grade in other areas.

H. SURFACE RESTORATION. All streets and other areas, including all lawns, driveways, pavements, sidewalks, shoulders, curbs and roadway slopes, shall be

restored to original condition or better after completion of the work. The Contractor shall be responsible for restoration, at his own expense, of any private or public properties outside the project limits which have been damaged by his operations or by negligence of his employees. Unless otherwise detailed ln the plans, materials used for restoration work, and their application, shall conform to requirements of the Michigan Department of Transportation Standard Specifications for Construction, edition of 2012, and any revisions thereto. Such materials include, but are not limited to, the following:

ITEM	APPLICABLE MDOT SPECIFICATION
Embankment	205
Subbase	301
Hot Mix Asphalt Pavement	501
Aggregate Base Course	302
Granular Material	205
Concrete	801
Sidewalk	803
Aggregate Surface Course, 22A, 23A	306
Concrete Curb & Gutter	802
Topsoil surface	917
Sodding	816
Seeding	917
Mulching	917

4.01.04 CLEANING, TESTING, STERILIZATION

A. GENERAL. Cleaning, testing, and sterilization of watermains shall comply with there requirements of AWWA Standards C651-92 and the requirements contained herein. The sequence of operations shall follow that outlined in Section 4.01.03 A., unless otherwise approved by the Engineer for a good reason. The watermain or portions thereof shall be tested by the Contractor in the presence of the Engineer, and all leaks or other deficiencies corrected prior to acceptance by the Engineer. The Contractor shall furnish all piping, bulkheads, pumps, gauges, water, and other materials required to clean, sterilize and test the watermain.

B. CROSS CONNECTIONS. The Contractor shall take every precaution necessary to assure that cross connection does not exist between the public water supply and the watermain being cleaned, tested or sterilized. For the purposes of this specification, a cross connection shall be any connection between the new watermain and the public water supply or any operation by the Contractor which could potentially introduce non-potable water, contaminated water, sterilizing chemicals, mud, dirt or other objectionable or hazardous materials into the public water supply. Particular attention shall be paid to the following areas:

1. During pressure testing or other operations where the new main is at higher pressures than the water in the distribution system, any hose, pipe or other connections used to obtain water from the public water supply shall be physically disconnected.

2. When portions of the existing distribution system must be shut down in order to complete a connection of the new main or do similar work, any open pipe ends, tees, tapping valves or similar items shall be bulkheaded after the pipe is drained and safeguarded against intrusion of dirt, trench water or other contaminants until after the connections are completed.

3. Any corporations and attached water tubing installed for the purpose of chlorinating or flushing shall be shut off and capped after final use in order to prevent groundwater or other contaminants getting into newly cleaned mains.

C. PRESSURE AND LEAKAGE TESTING. The Contractor shall have adequate pumps, monitoring gauges and other such equipment to properly perform the test to the conditions and requirements of Section 4 of AWWA Standard C600-93. The main shall be pressure tested in convenient lengths with a test pressure of 140 to 150 psi, measured at the highest point in the pipe, maintained throughout the test. The following procedures shall be followed:

1. PRESSURE TEST – TWO HOUR DURATION

a) All gate valves at the boundaries of the test section shall be closed.
b) The test section shall be slowly filled with water and all air bled out of the test section through hydrants, blow-offs or other connections.
c) Any hoses or connections to the public water supply, used for filling the test section, shall be disconnected for the duration of the test.
d) The high pressure pump shall be connected to the main at the test point and the main brought up to test pressure and held there.
e) During the pressure test, all exposed pipe, fittings, valves, hydrants and joints will be examined for leakage, distortion or other failures. If any damage or defective parts are discovered, they shall be replaced and the pressure test repeated.

2. LEAKAGE TEST - TWO HOUR DURATION

a) The leakage test shall commence immediately after successfully completion of the pressure test and while the main is at the test pressure of 140 to 150 psi.
b) All main line valves and hydrant lead valves within the test section shall remain open during the leakage test.
c) The test section shall be maintained at the test pressure, for a two-hour test period.
d) Make-up water for the leakage test shall be taken by the pump from a calibrated drum or other suitable container, from which the volume of water pumped into the main can be determined.
e) At the end of the two-hour test period, the volume of water taken from the container shall be considered to represent the volume of leakage from the section of watermain under test.

f) The allowable leakage shall be computed by the formula:

$$L=\frac{SD\sqrt{P}}{148,000}$$

Where:
L = is the allowable leakage in gallons per hour,
S = length of pipe in feet,
D = is the nominal pipe diameter in inches,
P = is the average test pressure during the leakage test in pounds per square inch gauge.

An additional leakage of 0.0078 gallons per hour/inch of nominal valve size will also be allowed for each closed valve at the test section, including hydrant valves.
NOTE: Formula equals 0.5 gallons per hour per mile per inch diameter at 140 psi for 18 foot lengths or 1.0 gallons in two hours testing.

g) The following tabulated values may be used where applicable:

Allowable leakage per 1000 feet of pipeline (two-hour test, 18 feet nominal laying length, 150 psi test pressure)

NOMINAL ALLOWABLE OR VALVE SIZE	ALLOWABLE LEAKAGE (Gallons /2 hours)	ADDITIONAL LEAKAGE EACH VALVE
4”	0.33	0.05
6"	0.50	0.1
8"	0.66	0.1
10"	0.83	0.2
12"	1.00	0.2
14"	1.16	0.2
16"	1.32	0.3

Note that a test section may contain different pipe sizes, hydrant leads, etc. the leakage of each of which must be combined for the test section.

h) In the event that leakage exceeds the specified amount, the main and all fittings, valves and other appurtenances shall be exposed and inspected until the leak is found and repaired. After repair of any leaks, the section shall be retested. Final acceptance of the watermain will not be made until all sections thereof have been successfully tested.

i) After successful completion of the two hour pressure test, each valve within the test section, including gates on hydrant leads, shall be checked against test pressure as follows:

a] Close valve furthest from test point;
b] Vent main on non-pressure side of valve being tested;
c] Observe pressure gauge at test point; allowable pressure drop shall not
d] Close next closest valve toward test point;
e] Open valve previously tested;
f] Repeat procedures a] through e] progressively back toward test point until all valves within the test section has been tested;
g] Any valve which shows excessive leakage by this test shall be repaired or replaced by the Contractor and retested.

D. CLEANING. After successful completion of the pressure and leakage testing and prior to sterilization, the Contractor shall clean the main and all hydrant leads by flushing with potable water. A minimum velocity of flow of 2.5 feet per second shall be maintained to ensure that all heavy debris is removed from the main. Flushing shall continue until the water runs clear or until a volume of water equal to twice the volume of the pipe has been flushed through. This requirement for cleaning shall not absolve the Contractor of responsibility for assuring that the pipe is not contaminated during construction, as outlined in Section 4.01.03. As a guide to determining required flushing rates the following table may be used:

Required Openings to Flush Pipelines:

PIPE SIZE

At 40 psi residual pressure, a 2½ inch hydrant nozzle will discharge approximately 1000 g.p.m..

All hydrant leads and connecting pipe within the section shall be flushed clean.

E. STERILIZATION. Upon completion of the flushing operation, the main shall be sterilized by chlorinating in accordance with AWWA Standard C651-92. The following rules shall apply:

1. Potable water shall be used.

2. As the main is filled with water for disinfecting, a chlorine solution shall be added or injected so as to completely mix with the water and distribute throughout the main.

3. Initial chlorine solution strength in the main shall be chlorinated according to the (standards for disinfecting watermains), prepared by the American Water Works Association, C651-92.

4. The chlorine solution shall be allowed to stand in the main for a period of 24 hours, at the end of which time the chlorine concentration shall not be less than 10 or more parts per million throughout the length of the main.

5. During the contact period, all main line valves and hydrant gates shall be operated in order to disinfect them.

6. Chlorine in tablet form may not be used.

7. Chlorine required to produce 50 mg/l concentration in 100 feet of pipe by diameter.

Pipe Size In.	100% Chlorine Pound	1% Chlorine Solutions Gallon
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.40
12	0.240	2.88

8. At the end of the contact period, the highly chlorinated water shall be flushed from the main until the chlorine concentration leaving the main is no higher than that prevailing in the distribution system or less than one part per million. The chlorinated water shall not be discharged into the City storm system.

9. After the final flushing and before the main is put into service, not less than 2 consecutive water samples for bacteriologic analysis shall be collected. The first sample shall be drawn 24 hours after final flushing; the second sample shall be drawn 24 hours after the first sample. (Refer to Part II, Michigan Safe Drinking Water Act, being Act 399 of Public Acts of 1976 and Recommended Standards for Waterworks).

10. The Contractor may utilize fire hydrants to obtain samples for the bacteriological tests if they are at an appropriate location from the spacing standpoint. However, he should be aware that these can sometimes be a source of contamination and may cause samples to show an unsafe condition. In order to meet the total testing requirements, the Contractor may have to install temporary corporations in the main line at various locations. Any costs associated with such temporary installations shall be the sole responsibility of the Contractor and shall be incidental to the price of watermain construction. If corporations are used, the Contractor shall use threaded plugs after testing is completed.

11. If the samples do not show results which meet State of Michigan safe drinking water standards, the main shall be re-sterilized and new samples taken as prescribed above. Final acceptance of the main will not be made by the Engineer until bacteriologic sampling shows safe results.

12. Upon acceptance of the test results, the Contractor may proceed with installing services and making connections to the distribution system. All short pieces of pipe, tapping valves and other items used in final connection shall be field chlorinated by swabbing with a 4% chlorine solution.

F. CONTINUITY TESTING. The pipeline and hydrants shall be tested for electrical continuity and current capacity. The test shall be made after hydrostatic testing is completed and while the line is at normal operating pressure. A direct current of 200 amperes, ±10%, shall be passed through the section under test for a period of 5 minutes. Current flow shall be continuously monitored with a suitable ammeter. Insufficient current, excessive fluctuation or arcing shall be indicative of defective electrical contact and the cause shall be isolated and corrected. The section shall be retested until it passes the conductivity test.

4.02 WATER SERVICES (DEFINISION)

Add language referring to private water services and public water main.

Any water service line 2 inches in diameter or smaller shall be considered (private). Any repairs or replacements shall be at the expense of the property owner. Any water service line 2 ¼ inches or larger shall be considered a City of Escanaba water main. Any repairs or replacements shall be at the expense of the City of Escanaba.

4.02.01 GENERAL

A. Description

This work shall consist of installing a water service line, of the size specified, from the City watermain to the property line. Items included in the work will be: pressure tapping of the watermain and installation of a corporation stop, laying of the service line piping, installation of a curb stop and box at a location designated by the Engineer, connecting to an existing water service with the required fittings or capping the curb stop for a future connection. Also included in the work are the necessary excavation, jacking, tunneling, backfilling, compaction, dewatering of trenches, removal and replacement of curb, sidewalk, trees, shrubs, lawns, street surface, provision of labor, materials, equipment and other incidentals necessary to complete the work and test the installation for its suitability for use.

4.02.02 MATERIALS

A. GENERAL

Materials to be incorporated into the work shall meet the requirements as outlined below for service lines 1 inch through 2 inch diameter and shall

comply with the provisions of AWWA C800 as regards composition and style of thread.

1. Corporation Stops shall be constructed of red brass, per AWWA C800, shall have the standard tapered inlet thread and a compression copper outlet for use with copper water tube. Acceptable brands shall include the Mueller H 15008 or Mueller H 5023 or an approved equal.
2. Curb Stops shall have compression connectors for both inlet and outlet ends and shall be of red brass as per AWWA C800. Acceptable brands shall include the Mueller H 15209 or an approved equal.
3. Service Piping for 2 inch shall be type "K" soft annealed seamless copper tubing conforming to the requirements of ASTM B-88.
4. Service Boxes (Curb Boxes) shall be of cast iron, extended arch pattern with Lake Erie pattern 2-hole lid (#89982 Mueller) and 54 inch stationary rod and painted inside and out with a suitable asphalt varnish. The adjustable 6 foot -6 inch depth shall be Mueller H 10314 or an approved equal.
5. Miscellaneous Fittings shall be of red brass conforming to AWWA C800 and shall have compression fittings for all connections to copper tubing. Where connection must be made to existing service lines of differing materials, threaded or compression joints, as applicable, may be provided. In all cases, provision for electrical conductivity will be made at all joints and fittings.
6. Plastic piping may not be used.

B. MATERIALS

All materials for 3 inch & 4 inch service shall be in accordance with Section 4.01.02.

4.02.03 CONSTRUCTION METHODS

A. Trench Excavation. CALL MISS-DIG. The Contractor shall proceed with trench excavation with due regard for the protection of life, health and property. Appropriate equipment shall be used to perform the work and, where necessary, extra measures such as the use of sheeting or shoring shall be used. The following shall be observed in excavating trenches:

1. Excavation shall not proceed until the location of nearby utilities have been ascertained and clearly marked by their owners.
2. Excavation in close proximity to other utilities shall be done by hand in order to protect them from damage.
3. Trenches shall be excavated in reasonably close proximity to the lines and grades on the plans or as established by the Engineer. Special attention shall be given to requirements for depth of burial, a minimum of six feet of earth cover.
4. The trench shall be of sufficient width to provide free access for completing the work (See 4.01.03, B).

5. Rock or hardpan shall be excavated to a depth of 4 inches below the bottom of the pipe and replaced with granular bedding material acceptable to the Engineer.
6. Where unstable soil conditions are encountered, the Engineer may authorize the use of Trench Undercut and Backfill (Sec. 4.01.03, B 5). Four inches of granular bedding material will be placed over the trench backfill.
7. Where work is within a paved roadway, the pavement will be cut and removed prior to excavation. Payment will be incidental to the replaced item.
8. If high ground water levels are encountered, an appropriate dewatering system shall be employed in order to prevent unnecessarily wide excavations and damage to adjacent properties.
9. Excess excavated material shall become the property of the Contractor.

B. Tapping Watermain shall be accomplished using a tapping machine which is capable of tapping the main and inserting the corporation stop while the main is under the pressure and in service. Under no circumstances will a watermain be taken out of service to perform a tap without the Engineer's prior approval. Taps shall be made at the location shown on the plan or as directed by the Engineer and the following specifications will be observed:

1. Corporations will be installed on the main in as nearly a horizontal position as possible (i.e. at the three o'clock or nine o'clock positions on the main). In no case will they be installed at a location above 22½ degrees measured from the horizontal or on top of the main.
2. Corporations may not be installed diametrically across from one another, but must be spaced at least two feet apart, measured along the longitudinal axis of the watermain.
3. Corporations made on the same side of the main as each other shall be separated longitudinally on the main by at least two feet.
4. Corporations may not be installed closer than two feet from any joint in the main, measured from the lip of the bell of the joint.

C. Installing Service Piping

1. Pipe Handling. During handling and installation of service piping, care shall be exercised to prevent denting or kinking pipe or contaminating pipe through the inclusion of mud, dirt or debris inside the pipe. Defective or damaged pipe will not be incorporated into the work. Any large pieces of dirt or debris will be removed prior to making joints.
2. Laying Conditions. After the trench bottom has been excavated to a uniform line and grade, the service piping will be laid on a bed of clean sandy material, at least 4 inches thick. The service pipe bedding shall be free of rocks, sticks and other debris which could dent or otherwise damage the pipe.

3. Depth of Burial. All service piping shall be buried with a minimum of six feet of earth cover over the top of the pipe. Where shown on the plans, or when directed by the Engineer, depth of burial will be determined by future or proposed street grades. Existing conditions at construction site may change from future construction which may change depth of burial.

4. Alignment & Position. In general, service piping will be installed in a straight line and, at the point of connection to the corporation stop, will be at right angles to the long axis of the watermain. Where changes in directions are required, they will be accomplished by bending smooth, uniform radius in the tubing or by the use of appropriate bends or fittings. In no case shall a bend in a pipe have a radius smaller than ten times the diameter of the pipe. Any pipe which becomes kinked or dented from bending shall be replaced with a new piece of pipe. If water service piping is to be installed in or near the same trench as a sanitary sewer lateral, the centerline spacing between the service pipe and the sewer lateral shall be a minimum of 18 inches and an effort will be made to keep the service pipe at least one foot higher than the sewer lateral, where consistent with depth of burial requirements.

5. Piping Lengths. Copper service piping 1¼ inches in diameter or less shall be installed without any couplings or joints between the corporation stop and the curb stop, except as permitted by the Engineer. Service piping 1½ and 2 inches in diameter shall be installed in lengths of 20 feet or more, except for one short closure piece which may be permitted ahead of the curb stop.

6. Joining Pipe. Copper service piping shall be joined by the use of compression type fittings providing direct metal to metal contact. use of pipe jointing compounds or Teflon tape will not be allowed. Under no circumstances will solder type of joints be used in water service piping. All ends shall be cut squarely and rough edges or burrs removed. In all cases, provisions for electrical conductivity will be made at all joints and fittings.

7. Clearance. Where other pipes, structures or like obstructions are encountered in the work, the service pipe shall be bent to go under or around such obstructions in the most practical manner. Bends shall be made as described in Section C.4, above. A minimum clearance of at least six inches shall be maintained between the service pipe and the obstruction and the space in between filled with clean sand, compacted and free of rocks, sticks or other debris which could cause pipe damage. Minimum 6 feet cover over the service pipe shall be maintained unless otherwise directed by the Engineer.

8. Termination. Unless otherwise shown on the plans or directed by the Engineer, the service piping shall terminate at the property line or where designated by the Engineer. In those cases where the service is intended for future use and there is no existing building piping, the customer side of the curb stop shall be capped by inserting a suitable non-metallic disc or plug inside the compression fitting and installing the compression nut tight on the curb stop. In the case where there is a building or premise with an

existing service line, the existing line shall be cut and the new service line connected there to, as described under Section 4.02.03 E.

D. Installing Curb Stop and Box.

The curb stop and box will be located near the property line or right-of-way line at the point determined by the Engineer. The curb stop shall be connected to the service pipe in a horizontal position with the valve stem vertical, as measured along the pipe and across the pipe. After all testing and connection at the service piping have been completed and prior to final backfilling, the curb box shall be carefully centered over the curb stop. The legs of the curb box shall rest firmly upon concrete bricks and clearance shall be provided so that the box does not rest on the service piping. The curb box shall be sufficiently plumbed and braced so that it stays vertical and centered over the curb stop during backfilling.

E. Connections to Existing Service.

When a new water service is being made to replace an existing water service, the existing service pipe shall be cut off at least three feet beyond the new curb stop and a closure piece consisting of the appropriate size copper service pipe installed between the curb stop and the cut end of the existing service line. Connection to the existing line shall be made by compression type fitting to the closure piece and assembling such reducers, adapters or couplers as are needed to make a firm, pressure-tight connection to the existing service line. If a "Dresser" or other type coupling is used which does not provide for electrical continuity, a bonding strap shall be installed across the coupling to provide such continuity.

F. Testing & Cleaning.

Prior to completing the termination of the service line and backfilling, it shall be cleaned and tested by the following method: The curb stop shall be opened and then the corporation stop at the watermain until a full flow of water is obtained. After sufficient time has elapsed to assure that the new line has been flushed and that the flowing water is clean, the curb stop only shall be shut off. All joints under pressure shall then be observed for at least 15 minutes for leaks.

During this time, the termination or connection to existing service piping may be made. When the connection to an existing service has been completed, the curb stop shall again be opened, restoring service to the customer. At this point, it will be necessary to flush air and any loosened pipe scale from the customer's building piping. The connection to the existing service piping shall be observed for a period of 15 minutes to assure that there are no leaks prior to backfilling.

G. Backfilling Trench.

Backfill material, free of rocks, sticks and other debris, shall be placed by hand to a depth of six inches over the service piping and compacted. Machine backfilling may then proceed by placing and compacting twelve-inch lifts of suitable material up to subgrade elevations (95% density Standard Proctor test). No muck, peat, stumps, roots, boulders or other large debris will be included in the backfill in any part of the trench. Where the trench is within a roadway, backfill and subgrade material as required by the plans or other parts of this document shall be used unless otherwise directed by the Engineer.

H. Surface Restoration.

Upon completion of backfilling operations up to the required subgrade elevation, the surface will be restored in kind to the same or better condition as existed prior to excavation, unless otherwise directed by the Engineer.

4.03 DEWATERING SYSTEM

When called for in the contract or with the approval of the Engineer, the Contractor will lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions for the pipe and also to prevent cave-ins and unnecessarily large excavations. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work. Dewatering installation, operation of any sedimentation and soil erosion control required is incidental to project costs. The following regulations will be adhered to in using and operating a dewatering system.

4.03.01 USE OF STORM SEWER SYSTEM.

Whenever it is possible to do so, the Contractor is to discharge drainage from his dewatering operation into the nearest storm sewer inlet or manhole. He will obtain the approval of the City Engineer as to the location and adequacy of the storm sewer prior to commencing operations.

4.03.02 RESTORATION OF SEWERS.

It will be the responsibility of the Contractor to assure that silt, sand, mud or similar materials are not discharged into the storm sewers such as would cause damage to, or salutation of, the storm sewer system or its outlet. Any cleaning or repairs occasioned by the dewatering operation shall be undertaken by the Contractor, at his own expense, within ten (10) working days of the occurrence of such damage.

4.03.03 OTHER DISCHARGE POINTS.

Overland discharge of water across private property or into areas where localized flooding or soil erosion might occur will not be permitted. If, in the opinion of the Engineer, discharge of water into a ditch which is well stabilized, and having an outlet to storm sewer or receiving body of water, may be safely accomplished, he may authorize the Contractor to so proceed. The Engineer may also require that a sediment trap be constructed to remove silts and other materials from the water before it is discharged to the receiving point. The Contractor shall repair or restore any areas damaged by these operations and shall dispose of any silts accumulated in sediment traps after the dewatering operation is completed.

4.03.04 USE OF SANITARY SEWERS.

Because of the cost of collection, pumping and treatment of sanitary sewage, as well as potential damage to sewers, use of the sanitary sewers as a discharge point is strictly prohibited. The Engineer may, however, authorize their use in an emergency.

4.03.05 PROPRIETY OF EQUIPMENT AND OPERATIONS.

Equipment used by the Contractor for dewatering shall be of a size and type adequate to perform the job of dewatering and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular, on operations which required continuous pumping over prolonged periods of time, noise and/or odors become a significant factor and the Contractor should do everything possible to reduce noise and/or odors from pumps, generators and other equipment.

4.03.06 CONTROL OF OPERATIONS.

The Contractor shall monitor his dewatering operation at all times to ensure that the method used does not undermine pipe bedding, place nearby utilities in jeopardy, or cause subsidence or damage to adjacent properties.

4.04 PROJECT RECORD DOCUMENTS

Contractor shall keep one record copy of all Specifications, Drawings, Addenda,Modifications and Shop Drawings at the site in good order and annotated to show all changes made during the construction process. These shall be available to the ENGINEER and shall be delivered to him for the OWNER upon completion of the Project. Drawings of record will be the "Project Record Drawings". At the completion of the work and prior to final payment, the CONTRACTOR responsible for each division of the work shall provide the ENGINEER with a marked-up set of drawings showing all changes or variations from the original drawings. These changes shall be made on a set of field drawings as the work is done. This set of drawings should be kept clean in a location at the site where the ENGINEER or the OWNER'S representative may examine it when desired.

The marked-up drawings shall be accurate. Careful measurements shall be made to locate underground sewers, gas lines, water lines, electrical conduit, underground telephone cable and miscellaneous piping.

4.05 MEASUREMENT AND PAYMENT

4.05.01 SCOPE

This section covers methods of measurement and payment for items of work under this contract.

4.05.02 GENERAL.

The total bid price for each section of the contract shall cover all work shown on the contract drawings and required by the specifications and other contract documents. All costs in connection with the work, including furnishing all materials, equipment, supplies and appurtenances; providing all construction, equipment and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and lump sum prices bid. No item that is required by the contract documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

4.05.03 ESTIMATED QUANTITIES.

All estimated quantities stipulated in the Bid Form or other contract documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the work and (b) for the purpose of comparing the bids submitted for the work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. The Contractor agrees that he will make no claim for damages, anticipated profits or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

4.05.04 EXCAVATION AND TRENCHING.

Except where otherwise specified, the unit or lump sum price bid for each item of work which involves excavation or trenching shall include all costs for such work. No direct payment will be made for excavation or trenching. All excavation and trenching will be unclassified as to materials which may be encountered; in addition, trenches will be unclassified as to depth.

4.05.05 STRUCTURE EXCAVATION

All excavation work required for structures, not otherwise paid for as trenching, shall be considered to be a subsidiary obligation of the Contractor and the cost of such excavation shall be included in the prices bid for the structures.

4.05.06 LAWN RESTORATION.

Class "A" sod shall be placed over 4 inch minimum of clean screened topsoil and used to restore all lawn areas disturbed by pipe installation, water services, hydrants, and appurtenances. Seed, fertilizer and mulch or Hydroseed Class A may be used only after the authorization of the Engineer. No mulch blanket netting shall be used in any situation. Any costs shall be incidental to project costs and not paid for separately.

4.05.07 WATERMAIN PIPE/DUCTILE PIPE

Ductile Iron Pipe is to be paid for on a unit price basis shall be measured for payment on a horizontal plane after installation of the pipe. Where lines are laid to conform to stationed profiles, payment will be made on linear quantities based on the pipeline stationing as determined by surveys made after installation.

The measurement of the length of each line or run of pipe of each size will begin and end at:

a. The end of the pipe where connected to an existing pipe, fitting or valve; at the end of a dead-end run; or at the limits of Contract as shown on the drawings.

b. The centerline intersection of run and branch on tees, crosses or laterals where a branch line connecting therewith is constructed under this contract. Where a branch fitting is installed under this contract and the branch or connecting line is to be constructed by others under a separate section, the pay measurement will include the entire laying length of the branch or branches of such fitting.

c. The measurement of each line of pipe of each size which is to be paid for on a unit price basis will be continuous through and shall include the full laying lengths of, all fittings and valves installed between the ends of each line; except that the laying lengths of reducers and increasers will be divided equally between the connected pipe sizes. Connected piping for fire hydrants will be measured for payment from the center of the main to the end of the pipe at the hydrant.

4.05.08 TAPPED CONNECTIONS TO EXISTING WATERMAINS.

Connections to existing watermains will be paid for at the unit price bid. Each price named for a connection shall include all costs incurred for making the connection over and above the price of the connecting piping in place and concrete blocking which will be paid for separately. Each unit price shall include furnishing and installing the pipe fitting or the tapping sleeve and valve; all excavation and backfill work; tapping of existing main; and all other costs not included under other bid items.

4.05.09 HYDRANT COMPLETE.

Hydrant Complete will be paid for at the unit price bid. The unit price named for each hydrant installation shall include all costs incurred in furnishing and installing the hydrant; 6 inch gate valve with box and connecting pipe, accessories and appurtenance; concrete blocking behind and under said hydrant; concrete curb removal and replacement with Escanaba standard curb; (if applicable) and all other costs not included under other bid items from the new hydrant assembly to the watermain, all as one pay item. This shall also including fittings and any material to provide electrical conductivity for testing for future main thawing.

4.05.10 PIPE CASINGS.

Where casings are required in connection with railroad, highway or primary road crossings, each casing will be measured for payment horizontally along the longitudinal centerline from end to end of the tunnel.

The unit price bid for each casing shall include all costs in connection with excavation and backfilling, pipe casing, the excess cost of installing pipe in casing above the amount bid for the pipe laid in open trench, all skids, jointing materials, jacking pipe, jacking pits, sand backfill, end closures and all other work for and in connection with the crossing, not paid for separately.

4.05.11 WATER SERVICES.

Water services to be paid for on a unit price basis for each size shall include all costs incurred in pressure tapping the watermain, service piping of size and type specified, the installation of the service piping to the designated location by an approved method, installation of a curb stop and box, capping or connection to the existing building water system, replacement of curb, sidewalk, sod and plantings through the boulevard. Also included in the work are the necessary excavation, backfilling, compaction, dewatering of trenches, provision of labor, materials, equipment and other incidentals necessary to complete the work and test the installation for its suitability for use.

4.06 MISCELLANEOUS

DIVISION VII DETAILED SPECIFICATIONS

STORM SEWER CONSTRUCTION

ESCANABA MI

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DIVISION VII

7.01 STORM SEWER CONSTRUCTION

7.01.01 Scope of Work

A. The work covered by this section of the Specifications consists in the furnishing of all tools, labor, materials, equipment and supervision, and performing all operations involved in the construction of storm sewers, drains and facilities as required by this contract in strict accordance with the provisions of the Plans and Specifications and subject to the term and conditions of the contract.

7.01.02 General

The following miscellaneous provisions apply to this section of the Specifications:

A. Pipe, unless otherwise indicated on the plans or authorized in writing by the owner, shall be new and unused material of the size and type shown on the plans and shall conform to the requirement of the Specifications.

B. Pipe, materials and accessories offered by the contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of the particular item in question.

C. Pipes located inside structures or above ground shall be rigidly supported as shown on the plans or as specified herein. The full length of each section of underground pipe shall rest solidly upon the prepared bed or undisturbed earth or compacted refill, with recesses only to accommodate pipe bells and joints. Any pipe which has its grade, alignment or joints disturbed after laying shall be taken up and relaid. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operation. The pipe shall not be laid in water, or when trench or weather conditions are unsuitable for work. Water shall be kept out of the trench until the joints have been completed. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth or other foreign substance can enter the line. Any section of pipe found to be defective either before or after laying, shall be replaced with new pipe at the Contractor's expense.

Where sewer lines are shown crossing private property, the alignment of the sewers shall be as shown on the plans and as directed by the Engineer and the work shall be done within the construction easements provided by the Owner.

E. **Certification**

The manufacturer of pipe and fittings shall furnish a certified statement that all pipe and fittings furnished by him have been inspected and tested in accordance with the applicable specification. Pipe will be subject to inspection and approval upon delivery and no cracked, broken, damaged or defective pipe or fitting shall be laid in the work. Any piece that is found to be defective after it has been laid shall be removed and the Contractor and replaced by a sound and perfect piece.

7.02 MATERIALS

7.02.01 PIPE MATERIALS

All sewer pipe used in this work shall meet the requirements of the standard specifications of the American Society for Testing and Materials (ASTM), or American Standards Association (ASA). Sewer pipe shall be of the following types as noted on the Drawings.

A. PVC Sewer Pipe: ASTM Designation D3034-73 "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings." The minimum wall thickness shall conform to SDR-35..

B. Concrete Sewer Pipe (CSP) - ASTM C14, Class Specified.

C. Reinforced Concrete Sewer Pipe (RCSP) - ASTM C-76, Class as designated on the Drawings or special design conforming to ASTM C655.

D. Reinforced Concrete Elliptical Pipe (RCEP) - ASTM C-507 VE or HE Class as designated on the Drawings.

E. Ductile Iron Pipe (DIP) (cement lined, standard thickness) - ASA Standards A21.4, A21.51, Class thickness as designated on the Drawings.

F. Corrugated Metal Pipe (CMP) - AASHTO galvanized with or without bituminous coating M190, with or without paved invert. Gauge as specified on the Drawings.

G. Acrylonitrile - Butadiene-Styrene (ABS) and Polyvinyl Chloride (PVC) Composite Pipe - ABS and PVC composite pipe shall conform to the requirements of ASTM D 2680. The pipe furnished may be ABS or PVC at the Contractor's option.

Couplings, fittings, solvent and cement shall be as specified by the pipe or fitting manufacturer.

H. Corrugated Plastic Pipe - Corrugated plastic pipe shall meet the requirements of AASHTO M 294, Type C; any fittings required shall also meet the requirements of AASHTO M 294.

I. Galvanized Corrugated Steel Structural Plates for Field Bolted Pipe, Pipe Arches, and Arches - The bolted plates, bolts, and nuts shall meet the applicable requirements of AASHTO, M 167, except as otherwise specified herein.

If the zinc coating as determined from the required sample is less than 3.0 ounces per square foot, 2 additional samples shall be taken from the same lot of plates. If the average weight of zinc coating as determined from the 3 samples is less than 3.0 ounces per square foot, or if any one specimen fails the single specimen minimum check limit (2.7 ounces per square foot), the lot sampled shall be rejected. Zinc coating shall be of first-class commercial quality, free from injurious defects, such as blister, flux and uncoated spots.

The plates shall be of such size that on assembly there will be no four lap seams. No part of any plate shall be without curvature. The plates shall be formed so that the dimensions of the completed structure shall not vary from the dimensions shown on the plans by more than four percent (4%). All measurements shall be taken to the inside crests of the corrugations.

J. Aluminum Alloy Structural Plate for Field Bolted Conduits and Box Culverts - The structural plate, accessories and fasteners for aluminum alloy structural plate pipe, pipe-arches, arches and box culverts shall meet the requirements specified in AASHTO N 219.

K. Metal End Sections - Metal end sections shall be fabricated in accordance with the details shown on the plans and shall be furnished complete with coupling bands or hardware as indicated on the plans. The metallic coating on the end sections shall be the same as the metallic coating on the pipe, except zinc coated steel end sections may be used with aluminum coated steel pipe. Metal end sections shall conform to AASHTO M 36, where applicable.

L. Concrete End Sections - Precast concrete and sections shall be constructed of concrete and reinforcement conforming to the requirements of AASHTO M 170 (ASTM C 76), Class II, as modified by details shown on the plans. Concrete for end sections made by the wet-cast method shall contain an entrained air content of 6.0 ∀ 2.0 percent. Concrete for end sections made by the dry-pack process shall contain a minimum of 658 pounds of cement per cubic yard and a liquid air entraining agent used at four times the dosage as needed for conventional slump concrete.

Connections to pipe culverts shall be by means of tongue and groove joints.

7.02.02 CULVERT AND SEWER PIPE JOINTS

A. Compression Type Pipe Joint Sealer - For joints in circular concrete culvert and sewer pipe, the gaskets shall be flexible water-tight rubber gaskets conforming to the requirements of ASTM C 443 and ASTM C 361.

B. PVC Sewer Pipe: PVC sewer pipe shall have an O-ring bell gasket joint or the same interspersed with solvent welded joints. Only chemical solvents approved by the pipe manufacturer shall be used-443.

C. External Type Rubber Gaskets - External rubber gaskets, mastic, and protective film for sealing culvert and sewer joints shall meet the requirements of ASTM C 877. (Cadilloc external pipe joint or similar)

7.02.03 **CLASSES OF CONCRETE** - Concrete shall be of Class A except that mud mats and fill concrete shall be Class C unless otherwise shown on the Drawings.

7.02.04 **CEMENT** - Cement shall be a well-known brand conforming to the requirements of ASTM Specifications C-150, Type LA, or Type I with air-entraining admixture; or ASTM C 595, Type IP-A, or Type IP with air entraining admixture.

7.02.05 **SAND** - Sand shall be natural silica sand graded in size up to such grains as will, when dry, readily pass a screen having 4 meshes per lineal inch. It shall conform to Michigan Department of Transportation Specifications 2NS.

7.02.06 **COARSE AGGREGATE** - Coarse aggregate shall consist of crushed stone, gravel, or other approved materials having hard, strong, durable pieces free from adhering coatings. The aggregate shall range in size from 1 ½ inch to No. 4. All gravel shall be washed and screened.

Coarse aggregate shall be of premium grade, and the total amount of objectionable materials, such as soft particles, chert and hard absorbent particles, shall not exceed four percent (4%). It shall conform to Michigan Department of Transportation Specifications Class 6AA.

7.02.07 **ADMIXTURE** - In general, concrete plasticity is secured by the selection of aggregate and in the proportioning of ingredients including admixtures. Admixtures, when used, shall conform to ASTM Standards.

7.02.08 **WATER** - Water shall be clean, free from oil, acid, alkali, organic matter or other deleterious substances.

7.02.09 **STORING MATERIALS** - Cement at the site of work shall be housed in a building with floor raised above the ground and shall be adequately protected from dampness. Cement that has become lumpy or that has been otherwise injured shall not be used in the work.

7.02.10 **REINFORCING STEEL** - Steel reinforcement shall be round deformed bars free from loose scale and dirt and shall be either billet steel (ASTM A615) or rail steel (ASTM A616) with a yield point strength of not less than 60,000 psi. Welded wire fabric shall conform to ASTM A185 or A497.

7.03 **CONSTRUCTION METHODS**

7.03.01 **BORINGS AND SOUNDINGS** - When borings or soundings have been made, the location and log of each will be shown on the plans. Such information is valid only at the location shown and at the time when such investigation was made. The contractor or prospective bidder may make any supplementary borings or soundings at his own expense, but shall not dig test pits for this purpose.

7.03.02 **EXCAVATION** - The trench shall be excavated beginning at the outlet end and proceeding toward the upper end, unless otherwise directed by the Engineer. The trench shall be excavated in reasonably close conformity with the lines and grades of the flow line shown on the plans or established by the Engineer. The trench shall be of sufficient width to provide free working space and to permit ramming and compacting the backfill around the pipe. The bottom of the trench shall be shaped so that the pipe will be uniformly supported. Where rock or hardpan is encountered, the trench shall be excavated at least 4 inches below the elevation established for the bottom of the pipe. Any excavation below the grade for the bottom of the pipe shall be replaced with the appropriate granular material, approved by the Engineer, and thoroughly compacted.

Where unstable soil conditions, or obstructions other than rock, require excavation of the sewer trench below the elevation shown on the plans, such excavation shall be made to the dimensions authorized by the Engineer. Undercutting below the excavation shown on the plans because of unstable soil conditions shall be backfilled with material meeting the gradation of Michigan Department of Transportation (MDOT) Coarse Aggregate 6A. Coarse Aggregate 6A backfill will be considered incidental to laying of Storm Sewer Pipe.

7.03.03 **TUNNELING** - As an alternate to open-cut methods of utility construction crossing near structures or streets on which traffic is to be maintained, tunneling methods may be used when authorized by the Engineer. The term "tunnel method" will include the "jacked-in-place method" of construction.

7.03.04 **LASER ALIGNMENT** - As an alternate to using line and grade pole, the Contractor may use laser aligning equipment for the laying of sewers to the specified lines and grades. The Contractor shall furnish all necessary equipment and personnel required to operate the laser equipment.

The laser beam projection is to be rigidly mounted to its support platforms in a manner to be approved by the Engineer. This will assure that all grounded equipment vibrations will be kept to a minimum and will permit the laser beam to be projected coaxially through the center of the pipe. All units shall be furnished with equipment to control atmospheric conditions in the pipe which could affect the acceptable standard of construction.

The laser aligning method selected must be shown to have performed satisfactorily on at least three previous projects of a similar nature. The equipment shall be operated by competent, trained operators.

The Contractor will establish centerline stakes and offset stakes at each manhole and other centerline and offset stakes as required for check points from baseline established by Engineer.

The Contractor shall furnish openings in the pipe, as required for the installation of the laser equipment, at no additional cost to the Owner. Details of these openings shall be approved by the Engineer.

7.03.05 **ALLOWABLE TOLERANCES IN SEWER GRADE** - Sewers shall be constructed and laid to the alignment and grade indicated on the construction drawings or as designated by the Engineer. The grade as shown on the profile or as furnished by the Engineer is that to which the work must conform. A variation of one quarter (1/4) inch from this will be deemed sufficient reason to cause the work to be rejected and relaid.

7.03.06 **LAYING SEWER** - The sections shall be carefully laid in the prepared trench, bell or groove ends upgrade, with the spigot or tongue end fully entered into the adjacent bell or groove. Each section shall have a firm bearing throughout its length and shall be substantially true to the line and grade required. The use of blocks to bring sections to grade will not be permitted.

Circular concrete pipe with elliptical reinforcement shall be installed with the lift holes on top of the pipe. The manufacturer's marks designating the top and bottom of the pipe shall not be more than five degrees from the vertical plan through the longitudinal axis of the pipe. After the pipe is installed, the lift holes shall be sealed with suitable concrete plugs and waterproofed.

1. **Bedding Material (PVC)**

Bedding material for storm sewer, in general, shall consist of MDOT Coarse Aggregate 6A. The bedding material shall likewise by substantially free of sticks, boulders, rubbish, muck and other debris which would cause damage to the sanitary sewer. Bedding material which contains frozen chunks shall not be used.

7.03.07 **EXTENT OF OPEN TRENCH** - The excavation shall at all times be finished to grade for a safe distance in advance of the completed structures, but unless specifically directed or permitted by the Engineer, not more than two hundred (200) feet of trench shall be open at one time in advance of the built structure. The excavated earth along the line of the trench shall be controlled by the use made of the street or right-of-way by

the public, and shall always be confined to approved limits. Not more than six hundred (600) consecutive feet of street shall be closed at one time, and vehicular traffic through any street shall not be stopped for a period longer than two weeks without the written permission of the Engineer. Not more than two consecutive cross streets shall be closed to vehicular traffic at the same time, except by permission of the Engineer. Pedestrian crossings shall be erected and maintained by the Contractor where designated by the Engineer.

7.03.08 **EXISTING UNDERGROUND STRUCTURES** - The Contractor shall provide and install adequate supports and protection for all sewer and water pipes extending into or crossing the trench. Where gas mains or electric cable or conduits extend into or across the trench, the Contractor shall notify the Public Utility at once and provide such supports and protection as may be required by the Public Utility.

Should any such main or electric cable or conduit require raising or lowering or moving to another location, such changes will be made by the Contractor without additional expense to the Owner.

Where mains, cables or conduits are parallel to the Contractor's trench opening, the Contractor shall so carry on his work at all times as not to cause damage to the paralleling structure or structures.

Where gas, water, sewage or any utility service connections to occupied buildings must be temporarily shut off or disconnected, the Contractor shall give at least eight (8) hours notice to the affected occupants of the time and duration of the anticipated cut off.

When pipes, conduits or sewers are removed from the trench leaving "dead" ends in the ground, such ends shall be fully plugged or bulkheaded with brick and mortar by the Contractor without additional compensation.

Where house connections, laterals or sewers require re-connection to the proposed sewer, same shall be made by the Contractor and paid for separately under the appropriate items of the contract. Where existing laterals or house connections are reconnected to the new structures, the work shall be so arranged that water will not flow through newly built portions of the work until 24 hours after mortar joints are made or after concrete masonry is placed.

7.03.09 **TEMPORARY CHANNELS** - The Contractor shall provide without additional compensation, channels for water and sewer that may flow along or across the site of the work.

7.03.10 **DISPOSAL OF WATER AND SEWAGE** - The Contractor shall remove by pumping, bailing or otherwise, any water which may accumulate or be intercepted, or be found in the trenches and in any other excavations made under this contract. He shall form all dams, flumes or other work necessary to keep the trenches entirely clear of water and sewage while the structures and their appurtenances are being constructed. The Contractor shall at all times have sufficient pumping equipment on the job ready for immediate use.

Water from the trenches and excavation shall be disposed of in such a manner as it will not cause injury to the public health, not to public or private property, nor to the surface of the streets, nor cause any interference with the use of the streets by the public. No additional payment will be made to the Contractor for this work.

7.03.11 **BRACING AND SHEATING** - The Contractor shall furnish, install and maintain such sheating, bracing and shoring as may be required to support the sides of the excavation and to prevent any movement of earth which would injure or delay the work or cause damage to adjacent pavement, buildings or other structures. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports placed at the expense of the Contractor, and neither the placing of such additional support or by the order of the Engineer, nor the failure of the Engineer to order such additional supports placed, shall relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside the sheating, but if voids are formed, they shall immediately be filled and rammed to the satisfaction of the Engineer.

All sheating and bracing which is not to be left in place in the trench, shall be removed in such manner as not to endanger the constructed sewer or other structures, utility conduits, or property, whether public or private. All voids left or caused by the withdrawal of the sheating, shall be immediately refilled with sand or gravel, by ramming with tools adapted for that purpose, by watering, or otherwise as may be directed by the Engineer.

7.03.12 **BACKFILLING - General Requirements** - Backfill material shall be placed on sections of the sewer only after such have been approved by the Engineer for backfilling. Sound earth, of a granular nature, free from top soil, large stones and lumps shall be placed under and around the barrel of the sewer until the sewer is completely covered to a depth of at least one foot. This portion of the backfill shall be placed in layers not more than 6 inches in thickness, and each layer thoroughly compacted, without damaging or displacing the sewer. The balance of the backfill, including that around manholes, catch basins, and other structures, shall be of sound earth, free from top soil, large stones and lumps, and shall be placed in

layers not more than 6 inches thick, each layer being fully compacted. When the material to be used for this upper part of the backfill is of a granular nature, it may be compacted by flooding, or flooding may be prohibited, at the discretion of the Engineer.

7.03.13 **DISPOSAL OF EXCESS EXCAVATION** - All excavated material in excess of that needed for backfill shall be disposed of as directed by the Engineer. The Engineer reserves the right to direct the Contractor to haul any excess material for filling any low street, alley or sidewalk space to an established grade, provided that such haul shall not be more than two thousand five hundred (2500) feet outside this project.

7.03.14 **ROCK EXCAVATION**

A. **Definition** - Rock excavation shall include all ledge rock in place that cannot be excavated by hand except by blasting, or in the opinion of the Engineer, by the continuous use of air tools, and all boulders whose individual volume is one half (½) cubic yard or more.

B. **Pipe Clearance in Rock** - When rock is encountered in the excavation, it shall be removed to the depth shown on the plans for concrete masonry sewers or 6 inches below the bottom of pipe sewers, when no underdrain is required. If an underdrain is required, additional excavation shall be made to the depth and width required for the underdrain. The width of rock excavation for concrete masonry sewers shall be as shown on the plans. The width for pipe sewers shall be two (2) feet greater than the inside diameter of the pipe, unless otherwise specified.

C. **Blasting** - Where blasting is necessary, the Contractor shall obtain the required permits and licenses at his own expense. This work shall be done with due regard to the safety of workmen, other people and public and private property. The method of covering blasts, amounts of charges used and the general procedure for doing this work shall conform to the requirements of local ordinances and be subject to the approval of the Engineer.

D. **Measurement** - Rock shall be stripped a sufficient distance ahead of excavation operations, but not less than fifty (50) feet, and the Engineer shall be notified so that he may measure it. Rock blasted before such measurement is made will not be paid for as rock excavation.

7.03.15 **DRAINAGE STRUCTURES** - This work shall consist of constructing or reconstructing drainage structures of portland cement concrete (with or without steel reinforcement as provided), portland cement concrete block masonry, or brick masonry; furnishing and placing metal covers; and shall include excavation and backfilling.

The term drainage structures, as used herein, refers to manholes, catch basins, leaching basins, inlets, and drop inlets. The type of drainage structure required is designated in one of three ways:

A. **Drainage Structure** - This pay item consists of a concrete footing, or precast sump, and the drainage structure. This type is specified for accessing sewers having diameters of forty two (42) inches and smaller.

B. **Precast Manhole Tee and Manhole Riser** - These pay items are generally used to access new sewers having diameters of forty two (42) inches and larger.

7.03.16 **DRAINAGE STRUCTURE CASTINGS** - Castings used herein refers to the metal frame and lid or grate of the details shown on the plans. Castings are paid for separately at the contract unit price. Castings shall be East Jordan Iron Works #1040 or equivalent with a vented lids.

7.03.17 **DRAINAGE STRUCTURE CONSTRUCTION**

A. **Excavation** - Excavation shall be as specified under Subsection MDOT 2.09.03.

B. **Concrete Construction** - Concrete construction shall be as specified under Section MDOT Section 5.03. Casting of concrete during hot weather shall be limited by the temperature of the concrete at the time of placing. Concrete shall not be cast when the temperature of the concrete is above 90 degrees.

C. **Placing Brick and Block Masonry** - Masonry with mortar shall not be placed in freezing weather and any work which is damaged by frost shall be removed and replaced.

A plaster coat of mortar one half (½) inch in thickness shall be applied to the outer surface of the structure, and to the inner surface below the outlet flow line of all catch basins with traps.

1. Brick - Before being laid all brick shall be thoroughly wetted and the surface allowed to dry only sufficiently to prevent slipping on the mortar.

Broken or chipped brick shall not be used on the faces of the structure.

The brick shall be laid in courses with full and close mortar joints. The courses shall be level throughout except where otherwise required. Adjoining courses shall break joints by half the length of a brick, as nearly as practicable, and at least one course in every seven shall be composed of headers. The length of pieces of brick used for making closures shall not

be less than the width of a whole brick and, wherever practicable, closures shall be made with whole bricks as headers.

Joints shall not be more than one half (½) inch in thickness unless otherwise provided, and shall be of a uniform thickness throughout the structure. All joints shall be struck and properly pointed and the exposed surfaces shall be true and smooth.

Where plaster coat is required the joints shall be raked.

Before applying a plaster coat of mortar to a brick surface, the brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to provide for proper bonding of plaster coat.

2. Concrete Block - The first course of blocks, as placed on the concrete footing, shall be on a full bed of mortar.

All blocks shall be laid in courses with full and close mortar joints. The courses shall be level throughout except where otherwise necessary. Adjoining courses shall break joints by half the length of the block as nearly as practicable.

The joints shall be of a uniform thickness throughout the structure. All joints shall be struck and properly pointed and the exposed surfaces shall be true and smooth.

D. **Precast Reinforced Concrete Units** - Precast reinforced concrete units shall be constructed in accordance with the details shown on the plans. The joints shall be sealed with mortar in accordance with the requirements specified for Culverts, under Subsection MDOT 5.11.05. Precast units shall be constructed on poured-in-place or precast concrete footings. Precast footings shall be supported by a compacted six (6) inch granular subbase.

E. **Steel Reinforcement** - Steel reinforcement shall be installed as specified under Subsection MDOT Section 5.03.07.

F. **Placing Castings** - Castings shall be set to the required elevation in full mortar beds or otherwise secured as shown on the plans.

G. **Inlet and Outlet Pipes** - Pipe or tile placed in the masonry for inlet or outlet connections shall extend through the walls and beyond and the outside surface of the walls a sufficient distance to allow for connections, and the masonry shall be carefully constructed around them and sealed with mortar to prevent leakage. When required, traps shall be installed according to details shown on the plans.

H. **Backfilling** - The method of backfilling shall be as specified under MDOT Subsection 5.13.08. The backfilling may begin immediately and progress with the construction of the drainage or manhole riser.

7.03.18 **RECONSTRUCTING DRAINAGE STRUCTURES** - Where called for on the plans or directed by the Engineer, existing manholes, catch basins, leaching basins, or inlets shall be reconstructed to the required line and elevation and to conform essentially to the details shown on the plans, using the castings on the existing structures.

Where reconstruction to top of footing is necessary, the work will be classified as a new structure of the detail and depth required.

7.03.19 **ADJUSTING DRAINAGE STRUCTURE CASTINGS, MONUMENT BOXES AND WATER SHUTOFFS** - Final adjustment of drainage structures, monument boxes, and water shutoffs on bituminous projects shall be made after the surface is ready for the top course and prior to placing the top course.

Adjusting castings shall apply where the elevation of the casting is not changed more than 6 inches and no other alterations are necessary. Where called for on the plans, or authorized by the Engineer, existing castings shall be adjusted to the proper elevation by removing the castings and setting them to the required elevation by supporting them on a concrete collar or on masonry in a full mortar bed, and constructed such that they will be held firmly in place. The adjacent pavement, curb, or curb and gutter shall be replaced to the original elevation, condition and kind of construction, unless otherwise provided.

7.03.20 **CLEAN UP** - The Contractor shall remove surplus excavated materials and materials for construction as the work progresses, and shall render the street suitable, safe, and convenient for traffic. Before final acceptance of the work, the Contractor shall clean the street surface, walks, gutters, fences, lawns, private property, right-of-way, and structures, leaving them in as good condition as originally found, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site of the work. Furthermore, the sewers, manholes, etc., shall be cleared of all scaffolding, centering, rubbish, dirt, dams or other obstructions.

All areas outside of the project area distributed by Contractor's work shall be top soiled, seeded, or stabilized sufficiently to prevent any soil erosion by wind or rain.

7.03.21 **INFILTRATION** - In storm sewers, weirs will be placed temporarily for testing purposes in such manholes as necessary to measure the amount of

infiltration, in which work the Contractor shall give the Engineer all reasonable assistance together with the necessary materials. In the event the allowable limit of infiltration is exceeded in any item of the contract, the Engineer may order the re-construction of the defective portion of the sewer, or he may agree to accept it at a reduced unit price.

The allowable amount of infiltration is shown in the following tabulation:

Diameter of Sewer In Inches	Inside Surface Area Per Lineal Feet or Sewer in Square Yards	Per Lin Ft Per In. Diam. of Sewer Per Miles	Infiltration in Gallons per 24 Hours Based on 2 Gallons per Square Yard of Inner Surface Area
10"	0.2909	.582	307
12"	0.3490	.698	307
15"	0.4363	.873	307
18"	0.5326	1.065	307
21"	0.6108	1.222	307
24"	0.6981	1.396	307
27"	0.7854	1.571	307
30"	0.8727	1.745	307
36"	1.0472	2.094	307
42"	1.2217	2.443	307
48"	1.3963	2.793	307
54"	1.5706	3.141	307
60"	1.7453	3.491	307
66"	1.9199	3.840	307
72"	2.9044	5.809	307

7.04 DEWATERING SYSTEM

When called for in the contract or with the approval of the Engineer, the Contractor will lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions for the pipe, and also to prevent cave-ins and unnecessarily large excavations. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work. The following regulations will be adhered to in using and operating a dewatering system:

7.04.01 **USE OF STORM SEWER SYSTEM** - Whenever it is possible to do so, the Contractor is to discharge drainage from his dewatering operation into the nearest storm sewer inlet or manhole. He will obtain the approval of the City Engineer

as to the location and adequacy of the storm sewer prior to commencing operations.

7.04.02 **RESTORATION OF SEWERS** - It will be the responsibility of the Contractor to assure that silt, sand, mud, or similar materials are not discharged into the storm sewers such as would cause damage to, or siltation of, the storm sewer system or its outlet. Any cleaning or repairs occasioned by the dewatering operation shall be undertaken by the Contractor, at his own expense, within ten (10) working days of the occurrence of such damage.

7.04.03 **OTHER DISCHARGE POINTS** - Overland discharge of water across private property or into areas where localized flooding or soil erosion might occur will not be permitted. If, in the opinion of the Engineer, discharge of water into a ditch which is well stabilized, and having an outlet to a storm sewer or receiving body of water, may be safely accomplished, he may authorize the Contractor to so proceed. The Engineer may also require that a sediment trap be constructed to remove silts and other materials from the water before it is discharged to the receiving point. The Contractor shall repair or restore any areas damaged by these operations, and shall dispose of any silts accumulated in sediment traps after the dewatering operation is completed.

7.04.04 **USE OF SANITARY SEWERS** - Because of the cost of collection, pumping and treatment of sanitary sewage, as well as potential damage to sewers, use of the sanitary sewers as a discharge point is strictly prohibited. The Engineer may, however, authorize their use in an emergency.

7.04.05 **PROPERTY OF EQUIPMENT AND OPERATIONS** - Equipment used by the Contractor for dewatering shall be of a size and type adequate to perform the job of dewatering and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular, on operations which require continuous pumping over prolonged periods of time, noise becomes a significant factor and the Contractor should do everything possible to reduce noise from pumps, generators, and other equipment.

7.04.06 **CONTROL OF OPERATIONS** - The Contractor shall monitor his dewatering operation at all times to ensure that the method used does not undermine pipe bedding, place nearby utilities in jeopardy, or cause subsidence or damage to adjacent properties.

7.04.07 **MEASUREMENT AND PAYMENT** - Dewatering installation, operation or any sedimentation and soil erosion control needed is incidental to project costs.

7.05 PROJECT RECORD DOCUMENTS

Contractor shall keep one (1) record copy of all Specifications, Drawings, Addenda, Modifications and Shop Drawings at the site in good order and annotated to show all changes made during the construction process. These shall

be available to the ENGINEER and shall be delivered to him for the OWNER upon completion of the Project.
Drawings of record will be the "Project Record Drawings". At the completion of the work and prior to final payment, the CONTRACTOR responsible for each division of the work shall provide the ENGINEER with a marked-up set of drawings showing all changes or variations from the original drawings. These changes shall be made on a set of field drawings as the work is done. This set of drawings should be kept clean in a location at the site where the ENGINEER or the OWNER'S representative may examine it when desired.

The marked-up drawings shall be accurate. Careful measurements shall be made to locate underground sewers, gas lines, water lines, electrical conduit, underground telephone cable and miscellaneous piping.

DIVISION III DETAILED SPECIFICATIONS

STREET/ROAD CONSTRUCTION, RECONSTRUCTION OR REPAIR

ESCANABA, MICHIGAN

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DIVISION III - STREET/ROAD CONSTRUCTION

3.01 STREET/ROAD CONSTRUCTION - UTILITY IMPROVEMENTS

3.01.01 GENERAL

This work shall consist of street or road construction as shown on the plans.

3.01.02 CONSTRUCTION METHODS

All items of work listed in the bid proposal for street construction shall be completed in accordance with the 2012 MDOT Standard Specifications for Construction for each specific item of work.

3.01.03 MATERIAL REQUIREMENTS

The following items shall be certified by the Contractor to the following material requirements before payment of the work is allowed. The Engineer reserves the right to reject any material he feels does not meet the specifications until tests are completed at the owner's expense to determine the material characteristics delivered or proposed to be delivered to the job site.

All streets and other areas, including all lawns, driveways, pavements, sidewalks, shoulders, curbs and roadway slopes, shall be restored to original condition or better after completion of the work, if applicable. The Contractor shall be responsible for restoration, at his own expense of any private or public properties outside the project limits which have been damaged by his operations or by negligence of his employees. Unless otherwise detailed on the plans, materials used for restoration work, and their application, shall conform to requirements of the 2012 Michigan Department of Transportation Standard Specifications for Construction, and any revisions thereto. Such materials include, but are not limited to the following:

ITEM	APPLICABLE MDOT SPECIFICATIONS
Subbase	301
Subgrade Undercutting	205
Embankment	205
Hot Mix Asphalt	501
Granular Material, Class I, II, and III	205
Aggregate Surface Course, 22A	306
Topsoil Surface	816
Sodding	816
Seeding	816
Mulching	816
Fertilizing	816
Saw Cutting	603

3.01.04 CLEARING

Before removing topsoil from proposed roadbed and utility trench areas, the Contractor shall remove all vegetation, brush, rocks, stumps, and any other objectionable litter or foreign material which shall be removed and disposed of off site. The topsoil shall be completely removed to the top of acceptable subbase material to the limits of proposed utility trenches and/or roadbed area and stored in an acceptable location.

3.01.05 EARTH EXCAVATION

Topsoil and other unclassified material shall be removed from the roadbed and utility trench areas. Topsoil recovered may be stored on private land by permit and unsuitable material shall become the property of the Contractor. The Contractor shall allow the Engineer to take any measurements needed before installing the utilities or constructing the roadbed. Large boulders if encountered during construction shall become the property of the Contractor.

3.01.06 SUBBASE (CIP)

Subbase shall be constructed with granular material Class II, secured from locations outside the right-of-way, which can be shaped and compacted to a minimum of 95 percent of the maximum unit weight to the required cross-section using the controlled density method. The contract price paid is payment in full for furnishing, hauling, placing, watering, and compacting the material to the required cross-section. The subbase shall be approved material supplied by the Contractor from locations outside the right-of-way.

3.01.07 SAWCUTTING

Any sawcutting required for pavement removal whether HMA or concrete shall be sawed perpendicular to the edge of existing pavement to a depth necessary to cleaning remove said pavement. Any sawcutting work will be paid for in other items of work and not paid for separately.

DIVISION V - DETAILED SPECIFICATION

SANITARY SEWER CONSTRUCTION CONTRACT

ESCANABA, MICHIGAN

2015

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DIVISION V

5.01 SANITARY SEWER CONSTRUCTION

5.01.01 Scope of Work

A. The work covered by this section of the Specifications consists in the furnishing of all tools, labor, materials, equipment and supervision, and performing all operations involved in the construction of sanitary sewers, drains and facilities as required by this contract in strict accordance with the provisions of the Plans and Specifications and subject to the term and conditions of the contract.

5.01.02 GENERAL

The following miscellaneous provisions apply to this section of the Specifications:

A. Pipe, unless otherwise indicated on the plans or authorized in writing by the owner, shall be new and unused material of the size and type shown on the plans and shall conform to the requirement of the Specifications.

B. Pipe, materials and accessories offered by the contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of the particular item in question.

C. Pipes located inside structures or above ground shall be rigidly supported as shown on the plans or as specified herein. The full length of each section of underground pipe shall rest solidly upon the prepared bed or undisturbed earth or compacted refill, with recesses only to accommodate pipe bells and joints. Any pipe which has its grade, alignment or joints disturbed after laying shall be taken up and re-laid. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operation. The pipe shall not be laid in water, or when trench or weather conditions are unsuitable for work. Water shall be kept out of the trench until the joints have been completed. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth or other foreign substance can enter the line. Any section of pipe found to be defective either before or after laying, shall be replaced with new pipe at the Contractor's expense.

D. Where sewer lines are shown crossing private property, the alignment of the sewers shall be as shown on the plans and as directed by the Engineer and the work shall be done within the construction easements provided by the Owner.

E. **Certification**

The manufacturer of pipe and fittings shall furnish a certified statement that all pipe and fittings furnished by him have been inspected and tested in accordance with the applicable specification. Pipe will be subject to inspection and approval upon delivery and no cracked, broken, damaged or defective pipe or fitting shall be laid in the work. Any piece that is found to be defective after it has been laid shall be removed and the Contractor and replaced by a sound and perfect piece.

5.01.03 MATERIALS FOR SANITARY SEWER CONSTRUCTION

Unless otherwise specified, shall be or the type and quality specified below:

A. **Pipe and Fittings**

1. **PVC Sewer Pipe:** PVC sanitary sewer pipe and fittings shall meet the requirements of ASTM Designation D3034-73 "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings." The minimum wall thickness shall conform to SDR-35.

2. **Concrete Sewer Pipe:** Shall conform to the requirements of ASTM C-14 for non-reinforced pipe and ASTM C-76 for reinforced pipe.

B. **Joint Materials**

1. **PVC Sewer Pipe:** PVC sewer pipe shall have an O-ring bell gasket joint or the same interspersed with solvent welded joints. Only chemical solvents approved by the pipe manufacturer shall be used.

2. **Joints for Concrete Pipe:** Shall be O-ring designed and conform to ASTM C-443.

5.01.04 CONSTRUCTION METHODS

A. **Excavation**

The Contractor shall proceed with trench excavation with due regard for life, health and property. MIOSHA Construction Safety Standards by Section 19 and 21 of Act #154 of the Public Acts of 1974 and all amendments to present date. Appropriate equipment shall be used to perform the work and, where necessary, extra measures such as the use of sheathing, shoring, trench boxes and dewatering systems shall be employed. Excavation shall proceed in the direction of pipe laying and shall be in reasonable conformity to the line and grade established on the plans or by the Engineer. The following shall also be observed:

1. **Protecting Other Utilities:** No excavation work shall commence until owners of other utilities have been notified and they have had an opportunity to mark the location of any equipment, pipelines, conduits or other works located within the project area. Excavation within close proximity to underground utilities shall proceed cautiously and final uncovering shall be done with hand shovels in order to protect such utilities from damage. Where excavation work uncovers conduit, pipelines, bases for utility poles, or similar structures, the contractor shall make arrangement to shore up, guy, support, or otherwise protect such utilities from damage caused by cave-ins or settlement in the trench, at the Contractor's expense.

2. **Removal of Surfacing:** When excavation will take place within or through an improved street, roadway, driveway or sidewalk, the pavement or surfacing shall be cut straight and square at the edges of the trench, using suitable equipment. The surfacing material shall then be removed and disposed of before excavation of the trench begins. Cuts for removal of surfacing shall be made equidistant on either side of the pipe centerline and no further apart than the allowable trench width, as provided in Section 4, below. Payment will be incidental to the cost of installing sanitary sewer unless otherwise provided for.

3. **Length of Open Trench:** Not more than 200 linear feet of trench may be open at one time. Under unusual circumstances, the Engineer may authorize more than 200 linear feet of trench to open, provided that pedestrian and driveway crossings are maintained at intervals of not more than 200 feet and that not more than one street intersection is closed to traffic.

4. **Trench Width:** The maximum trench width at the top of the pipe shall not exceed the outside diameter of the pipe being laid, plus 24 inches. This width may be increased to allow for stringers and sheathing when they are required. At least 6 inches of clearance shall be maintained between the outside face of the pipe barrel and the trench wall or sheathing. If the trench width at the ground surface exceeds the allowable width at the top of the pipe by more than 4 feet, the Contractor shall use sheathing and shoring, dewatering systems, or other such measures as are consistent with maintaining a safe trench and safeguarding adjacent curing, sidewalk, utilities and lawns.

B. **Handling**

The sewer pipe shall be handled in such a manner as to insure delivery on the site and final installation in a sound undamaged condition. Any damaged pipe or other materials shall be replaced by the contractor at his expense.

C. **Pumping and Bypassing**

When pumping/bypassing is required, the Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow of sewage around the manhole section in which work is to be performed in a sanitary manner. Leaking pumps, fitting, hoses or pipes which allow sewage to reach the street or ground surface will not be allowed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during peak periods. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, all engines shall be equipped in a manner to keep the pump noise at a minimum.

D. **Laser Alignment**

For all pipes twenty four (24) inches or less in diameter the contractor shall use laser alignment equipment to lay sewers to the specified lines and grades. The Contractor shall furnish all necessary equipment and personnel required to operate the laser

equipment.

The laser beam projection is to be rigidly mounted to its support platforms in a manner to be approved by the Engineer. This will assure that all ground equipment vibrations will be kept to a minimum and will permit the laser beam to be projected to control atmospheric conditions in the pipe which could affect the acceptable standard of construction.

The laser alignment method selected must be shown to have performed satisfactorily on at least three previous projects of a similar nature. The equipment shall be operated by competent, trained operators.

The Contractor will establish centerline stakes and offset stakes at each manhole and other centerline and offset stakes as required for check points from baseline established by Engineer.

The Contractor shall furnish openings in the pipe, as required for the installation of the laser equipment, at no additional cost to the Owner. Details of these openings shall be approved by the Engineer.

E. **Bedding Material**

The installation of plastic pipe must meet the requirements of ASTM D2321, which states that bedding material must not half a particle size which exceeds 1.5 inches in diameter within 6 inches of the pipe. The bedding material shall likewise be substantially free of sticks, boulders, rubbish, muck and other debris which would cause damage to the sanitary sewer. Bedding material which contains frozen chunks shall not be used.

Note: MDOT Class II material does not meet this requirement. MDOT Class II material that contains particle diameters less than 1.5 inches is acceptable with Engineer approval.

F. **Bedding Pipe**

All pipe shall be bedded around the bottom one-quarter of its circumference in material meeting the requirements of section 5.01.04 E., Bedding Material. Care shall be exercised to ensure that a minimum of 4 inches of bedding material, free of sticks or boulders, is placed below the pipe. Where the natural material in the trench bottom meets the requirements for bedding material, the pipe may be laid directly on the trench bottom and bedding material placed and compacted around its circumference. The pipe shall be uniformly supported along its entire length, and no loose spots or voids are to be tolerated. If Trench Undercut and Backfill (5.01.04 J.) has been used, sufficient bedding material shall be placed to assure that the pipe is uniformly supported. Where trench excavation is in rock, a minimum of 6 inches of bedding material will be placed between the neat line and the bottom of the pipe.

G. **Installation**

The installation of PVC pipe shall meet the requirements of ASTM D2321.

The pipe shall be laid as rapidly as normal working hours and weather conditions permit after the trench excavation has been made. The pipe shall be carefully laid to the required grade in a prepared trench, up grade from structure to structure, with the bell or groove end of the pipe upgrade. Each section shall have a firm bearing throughout its length, with recesses only to accommodate pipe bells and joints. Any pipe which has its alignment, grade or joints disturbed after laying shall be taken up and re-laid. The joints and interior of all pipe shall be thoroughly cleaned and all foreign matter before being lowered into the trench, and shall be kept clean during the laying operations.

Water shall be kept out of the trench until the material of the joints has hardened and the trench partially backfilled to prevent floating of the pipe. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other foreign substance can enter the line.

H. **Joints**

Joints shall be of the material specified and shall be made in accordance with the manufacturer's specification.

I. **Backfill Material**

Unless otherwise called for on the plans or when directed by the Engineer, earth excavated from the trench may be used for backfill, provided that it consists of sand, loam or other suitable material. Unstable materials containing peat or other organic or materials which contain large amounts of refuse, broken pavements, boulders, roots, trumps or other debris shall not be incorporated into the backfill.

J. **Stone Backfill**

Stone used for backfilling trench undercuts or for trench stabilization shall meet the requirements for 6A Stone, per MDOT Standard Specification for Construction. The cost of Stone Backfill will be incidental to the installation of the pipe.

K. **Backfilling**

Once the requirements of Section 5.01.04 F have been met and the sanitary sewer has been properly covered with bedding material, backfilling may commence. Except as indicated below, backfill material shall meet the requirements of Section 5.01.04 I.

1. Unless otherwise called for on the plans or when directed by the Engineer, earth excavated from the trench may be used for backfill, provided that it consists of sand, loam or other suitable material. Unstable materials containing peat or other organic or materials which contain large amounts of refuse, broken pavement, boulders, roots, stumps or other debris shall not be incorporated into the backfill.

2. Where excavated trench material is found to be unsuitable, borrow material meeting the requirements of Section 5.01.04 I or other details shown on the plans shall be furnished by the contractor. Surplus excavated material shall become the property of the Contractor and shall be disposed of by him.

3. The backfill material shall be placed carefully in the trench by hand or by machine. Care shall be exercised so as not to shift or dislodge pipe, valve boxes, hydrants and other such items.

4. The backfill shall be placed in 12 inch lifts and compacted to 95% density as measured by the Standard Proctor Test. The Engineer may require other compaction densities under roadways or for special circumstances. Unless agreed to, density tests shall be performed by the Engineer or other agents of the City of Escanaba.

5. The upper limits of backfill shall be top of subgrade under roadways and final grade in other areas.

L. **Visual Acceptance**

At the time of final acceptance, if on inspection it is found that there is an accumulation of earth or silt in the pipe, the Contractor shall clean out and remove such deposits at his own expense.

M. **Connect to Existing Sanitary Sewer Main**

Connections to the existing sanitary sewer system shall be made only after the new section of main has been tested or approved by the Engineer. Connections shall be made at the locations as shown on the plans with approved fittings. The Contractor shall be responsible to excavate the connection area to determine if the proposed grade will be adequate for the existing field conditions.

N. **Cleanout - Sanitary Sewer Main**

A cleanout shall be constructed upstream of the connection and in the direction of the flow of the sanitary sewer. The cleanout shall consist of a wye-branch installed in the main, a 45 degree bend, cleanout-minimum 4", and an approved monument box. The general Contractor shall be responsible for the final grade of the monument box which shall be within +/- 1/4 inch of the finish grade.

O. **Pipe Casings (Bore & Jack)**

Where casings are required in connection with railroad, highway, or primary road crossings, each casing will be measured for payment horizontally along the longitudinal centerline from end to end of the tunnel. The unit price bid for each casing shall include all costs in connection with excavation and backfilling, pipe casing, the excess cost of installing pipe in casing above the amount bid for the pipe laid in open trench, all skids, jointing materials, jacking pipe, jacking pits, sand backfill, flowable fill, end closures, and all other work for and in connection with the crossing not paid for separately.

5.01.05 INSPECTION AND TESTING

A. **Acceptance Tests**

All sewers shall be subjected to air, infiltration or exfiltration tests, or a combination of same, prior to acceptance by the Owner. At the discretion of the Engineer, televising of the pipe may be required. Televising will be required for all cases when leakage tests cannot be performed due to hooking up of live sewer laterals. All sewers where the ground water level above the top of the sewer is over 7 feet, shall be subjected to infiltration tests. All sewers, where the ground water level above the top of the sewer is 7 feet or less, shall be subjected to air tests or exfiltration tests. If an exfiltration test is performed, the maximum exfiltration rate shall be the same as that permitted for infiltration. For the purposes of exfiltration testing, the internal water level shall be equal to the external water level plus 7 feet as measured from the top of the pipe.

Within five (5) working days following pipe-laying and backfilling of each manhole section, the Contractor shall complete all testing. Should the workmanship employed or pipe material selected fail to meet the test requirements, the Contractor shall select a different material or utilize different techniques to achieve the desired result.

Where groundwater conditions require dewatering operations in order to construct sewers, the Contractor may, at his option, perform preliminary air tests after backfilling and while the dewatering equipment is still operating. After dewatering operation have ceased and the groundwater has stabilized at its normal level, seven 7 feet or less above the sewer and if the preliminary air test was satisfactory, the preliminary air test may be accepted as final.

Maximum allowable infiltration shall not exceed 100 gallons per inch of diameter per mile of pipe per 24 hours for any individual run between manholes.

SCHEDULE-SANITARY SEWER INFILTRATION (EXFILTRATION)
ALLOWABLE LIMITS BASED ON 100 GALLONS PER INCH
PER MILE OF PIPE PER 24 HOURS

4 inch = .00315 gal./ft./hr.
6 inch = .00475 gal./ft./hr
8 inch = .00630 gal./ft./hr
10 inch = .00790 gal./ft./hr
12 inch = .00950 gal./ft./hr
15 inch = .01185 gal./ft./hr
18 inch = .01420 gal./ft./hr
21 inch = .01660 gal./ft./hr
24 inch = .01890 gal./ft./hr

The procedure for air testing of sewers shall meet the requirements of ASTM F1417 for PVC pipe and ASTM C924 for concrete pipe and as follows:

The sewer line shall be tested in increments between manholes. The lines shall be cleaned and plugged at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide and air-tight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be fitted with suitable control valves and a pressure in the sewer. The pressure gauge shall have a minimum diameter of 3-1/2 inches and a range of 0-10 PSIG. The gauge shall have minimum divisions of 0.10 PSIG and an accuracy of plus or minus 0.04 PSIG.

The sewer shall be pressurized to 2 PSIG greater than the greatest back pressure caused by groundwater over the top of the sewer pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize between 3.5 and 4 PSIG. If necessary, air shall be added to the sewer to maintain a pressure of 3.5 PSIG or greater.

After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 PSIG, or such other pressure as is necessary to compensate for ground water level.

The time required for the air pressure to decrease 1.0 PSIG during the test shall not be less than the time shown in the following table:

Pipe Diameter In Inches	Minutes per 100 ft. of Sewer Pipe Length
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

If a sewer fails to pass any of the previously descried tests, the Contractor shall determine to location of the leaks, repair them and retest the sewer. The tests shall be repeated until satisfactory results are obtained.

Method of testing and measurement shall be approved by the Engineer. The Contractor shall provide the necessary equipment and labor for making tests, and the cost of same shall be included in the unit price bid for completed sewer.

Chemical grouting will be considered an acceptable method of repairing leaking pipe joints. Before this type of repair is undertaken, the Contractor shall obtain approval for making such repairs. Additionally, if chemical grouting of pipe joints is necessary, this operation must be performed under the observation of the Engineer, and a complete report of all grouting operation shall furnished to the Engineer after completion.

Where structural failures of the pipe have occurred, the broken pipe sections shall be removed and reconstructed.

B. **Deflection Testing of PVC Sewer Pipe**

In addition to other acceptance tests, PVC sewer pipe shall be tested for vertical deflection. Deflection tests shall be performed on 100% of PVC sewer pipe of 8 inch in diameter and larger.

This testing shall be carried out under the observation of the Engineer using a GO-NO-GO device approved by the Engineer and furnished by the Contractor. The cost for such testing will be included in the Contractor's bid price for sewer pipe. The deflection testing shall be no sooner than thirty (30) days after installation.

The maximum allowable vertical deflection of the circular cross section of the pipe will be limited to five percent (5%) of the actual internal pipe diameter. If the results of the testing shows the deflection of any sewer to be in excess of the maximum allowable, then the Contractor shall make repairs by re-excavation and compaction or replacement at no additional expense to the Owner. The section needing repair shall be retested.

5.01.06 DEWATERING SYSTEM

When called for in the contract or with the approval of the Engineer, the Contractor will lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions fro the pipe, and also to prevent cave-ins and unnecessarily large excavations. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work. The following regulations will be adhered to in using and operating a dewatering system:

A. **Use of Storm Sewer System**

Whenever it is possible to do so, the Contractor is to discharge drainage form his dewatering operation into the nearest storm sewer inlet or manhole. He will obtain the approval of the City Engineer as to the location and adequacy of the storm sewer prior to commencing operations.

B. **Restoration of Sewers**

It will be the responsibility of the Contractor to assure that silt, mud, or similar materials are not discharged into the storm sewers such as would cause damage to, or siltation of , the storm sewer system or its outlet. Any cleaning or repairs occasioned by the dewatering operation shall be undertaken by the Contractor, at his own expense, within ten (10) working days of the occurrence of such damage.

C. **Other Discharge Points**

Overland discharge of water across private property or into areas where localized flooding or soil erosion might occur will not be permitted. If, in the opinion of the Engineer, discharge of water into a ditch which is well stabilized, and having an outlet to a storm sewer or receiving body of water, may be safely accomplished, he may authorize the Contractor to so proceed. The Engineer may also require that a sediment trap be constructed to remove silts and other materials from the water before it is discharged to the receiving point.

The Contractor shall repair or restore any areas damaged by these operations, and shall dispose of any silts accumulated in sediment traps after the dewatering operation is completed.

D. **Use of Sanitary Sewers**

Because of the cost of collection, pumping and treatment of sanitary sewage, as well as potential damage to sewers, use of the sanitary sewers as a discharge point is strictly prohibited. The Engineer may, however, authorize their use in an emergency.

E. **Propriety of Equipment and Operations**

Equipment used by the Contractor for dewatering shall be of a size and type adequate to perform the job of dewatering and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular, on operation which require continuous pumping over prolonged periods of time, noise becomes a significant factor and the Contractor should do everything possible to reduce noise from pumps, generators, and other equipment.

F. **Control of Operations**

The Contractor shall monitor his dewatering operation at all times to ensure that the method used does not undermine pipe bedding place nearby utilities in jeopardy, or cause subsidence or damage to adjacent properties.

G. **Measurement and Payment**

Dewatering installation, operation or any sedimentation and soil erosion control needed is incidental to project costs.

5.01.07 PROJECT RECORD DOCUMENTATION

A. Contractor shall keep one record copy of all Specifications, Drawings, Addenda, Modifications and Shop Drawings at the site in good order and annotated to show all changes made during the construction process. These shall be available to the Engineer and shall be delivered to him for the Owner upon completion of the Project.

B. Drawings for record will be the "Project Record Drawings". At the completion of the work and prior to final payment, the Contractor responsible for each division of the work shall provide the Engineer with a marked-up set of drawings showing all changes of variation form the original drawings.

These changes shall be made on a set of filed drawings as the work is done. This set of drawings should be kept clean in a location at the site where the Engineer or the Owner's representative may examine it when desired.

C. The marked-up drawings shall be accurate. Careful measurements shall be made to locate underground sewers, gas lines, water lines, electrical conduit, underground telephone cable and miscellaneous piping.

5.01.08 BORINGS AND SOUNDINGS

When borings or soundings have been made, the location and log of each will be shown on the plans. Such information is valid only at the location shown and at the time when such investigation was made. The Contractor or prospective bidder may make any supplementary borings or soundings at his own expense, but shall not dig test pits for this purpose.

5.02 SANITARY LATERALS – 4 inch, 6 inch, 8 inch

5.02.01 SCOPE OF WORK

This work will consist of constructing a sanitary sewer lateral between the City's sanitary sewer main and a building sewer at the property line, or other point of termination point, as directed by the Engineer. Included in the word will be tapping of the sewer main, excavation, pipe laying, cleanouts, capping, connection to building sewer or other termination point, backfilling, and the provision of all necessary labor, tools, materials, and equipment to complete the work and test the acceptability of the installation.

5.02.02 MATERIALS

Materials to be used for construction of sanitary sewer laterals shall be as listed below, unless another equally suitable material is authorized for use by the Engineer. Fittings, saddles, and other connections shall, in general, be of the same material and have the same type of joints as the pipe itself.

A. **Pipe and Fittings**

1. **ABS Solid Wall Pipe** shall conform to ASTM D-2751, SDR 35 minimum or equal.

2. **PVC pipe** shall conform to ASTM D-3034 Schedule D.

5.02.03 CONSTRUCTION METHODS

A. **Excavation** - as specified in Section 5.01.04

B. **Connection to Main Sewer.** Where practical to do so, the sewer lateral will be connected to the main sewer at an existing wye-branch or tee, using suitable jointing material or couplers (such as "Fernco" fittings). Where no wye-branch or tee exists, the Contractor will make a sewer tap by one of the following methods:

1. **Concrete, Vitrified Clay, and Asbestos Cement Main Sewers**. A circular hole of the required diameter shall be cored from the side of the main sewer using a mechanically powered hollow cylindrical bit. No "break-in" connections will be allowed. A fitting approved for use by the Engineer, and which has a hub or appropriate joint to match the sewer lateral, shall be firmly secured and sealed to the main sewer.

2. **PVC Main Sewer.**
Saddles shall be secured to the main sewer and a circular hole of the required diameter cut or cored into the main sewer. Saddles shall be secured by solvent welding, and two stainless steel bands or clamps.

3. **Alternate Method.**

At the discretion of the Engineer, the Contractor may be allowed to remove a section of the main sewer and replace it with a new section containing a wye-branch. The new section shall be of the same size and material as the original section and shall be installed using appropriate joints or couplers to effect a leak-tight seal at the ends of the section.

C. **Pipelaying.** Pipelaying shall commence at the main sewer and proceed upstream toward the property line. The pipe shall be laid true to line and grade and shall be bedded in at least four inches of an acceptable granular material, free from rocks, sticks and other debris. Also installation shall meet ASTM D2321.

The following shall also apply:

1. Changes in direction and grade shall be accomplished by using one or more fittings (bends) with an angle of deflection no greater than 45 degrees.

2. Minimum grade for lateral shall be 1/4" rise per foot of run, unless otherwise directed or approved by the Engineer.

D. **Termination.** The sanitary sewer lateral will terminate at the property line with the cleanout in the case where there is no existing building sewer, or at the point of connection to an existing building sewer. When there is no existing building sewer, the open end of the wye-branch at the cleanout shall be plugged with a suitable plug or cap which will prevent the entry of dirt and water into the sewer lateral. If connection is to be made to an existing building sewer, a closure piece consisting of a minimum 12-inch piece of sewer pipe and the necessary fittings and couplers shall be installed between the clean-out and the end of the building sewer.

E. **Backfilling** - as specified in Section 5.01.04K.

F. **Dewatering** - incidental to sanitary sewer construction.

5.02.04 INSPECTION AND TESTING

A. Before backfilling the trench may proceed, the completed sewer lateral, its joints, connections and tap at the main sewer shall be inspected by the Engineer or its representative. If the inspector has doubts about the adequacy of the installation, he may order testing done to check that all joints are secure and water tight, or may order all or part of the installation re-laid to correct any deficiencies.

B. The air test specified must meet the requirements of ASTM F1417 for plastic pipe and ASTM C924 for concrete pipe.

C. Televising of all new sewer lines is required and will be paid for at the Contractor's expense. This item may be waived in certain specific cases at the discretion of the Engineer.

5.05 SANITARY SEWER APPURTENANCES

5.05.01 SCOPE OF WORK

The work covered in this section of the Specifications consists in the furnishings of all tools, labor, materials equipment and supervision and performing all operations involved in the construction of sewer appurtenances as required by this contract in strict accordance with the provisions, of the Plans and Specifications and subject to the terms and conditions of the Contract.

5.05.02 GENERAL

The following provisions apply to this section of the Specifications:

A. All materials unless otherwise indicated on the plans or authorized in writing by the Engineer, shall be new and unused materials of the size and type shown on the plans and standards details, and shall conform to the requirements of the Specifications.

B. All materials offered by the contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of such materials.

C. The foundations of all structures shall be rigidly supported by undisturbed earth, or compacted backfill. The interiors of all appurtenances shall be thoroughly cleaned of all foreign materials.

D. Where appurtenances are shown to be constructed on private property, the location of the structure shall be as shown on the plans. Al work shall be done within the construction easement provided by the Owner.

5.05.03 MATERIALS FOR SANITARY SEWER APPURTENANCES

A. **Precast Reinforced Concrete Manhole Units:** These units shall be circular with circular reinforcement and shall conform to the requirements of ASTM-C478-70. All manhole joints shall be of the rubber O-ring design.

B. **Cast Iron Frames and Covers for Manholes:** Each casting shall be East Jordan 1040 frame and solid cover or equivalent. A 24 inch clear opening is required on all manhole castings.

C. **Manhole Steps:** Cast iron manhole steps shall be furnished and set by the Contractor. They shall conform to the requirements of ASTM Standard Specifications for "Gray Iron Castings", A-48 Class No. 30, minimum width 14 inches. (East Jordan No. 8509 or equal). Polypropylene plastic, steel reinforced, manhole steps may also be furnished. They shall be #P52 manhole steps as manufactured by M.S. Industries, Inc. of Peachtree City, Georgia or equal. In the event FRP manholes are used, Armco manhole steps shall be furnished.

D. **Manhole Waterstops:** All manhole connection will be fitted with a waterstop assembly. The waterstop shall be of a design acceptable to the Engineer and the pipe manufacturer. Waterstops shall be KOR-N-SEAL as manufactured by national Pollution Control Systems: PRESS WEDGE II as manufactured by the Press-Seal Gasket Corporation; RES-SEAL as manufactured by Scales Manufacturing Corp., or equal.

E. **Flow Channels:** Flow channels must be poured concrete, 3500 psi concrete or equal, smooth edges and bottom and round cross section. PVC flow channels are acceptable if authorized for use by the Engineer.

5.05.04 CONSTRUCTION METHODS

A. As specified in Section 5.14.03, 2003 MDOT Standard Specification for Construction, and typical details on plans.

B. **Inlet and Outlet Pipes:** Pipes placed in the masonry for inlet or outlet connections shall extend through the walls and beyond the outside surface of the walls a sufficient distance to allow for connections. When required, drops shall be installed according to details shown on the plans.

C. **Drop Manholes:** All sanitary manholes with an invert drop in excess of 24 inches shall have a drop structure. The drop structure shall be built as shown on the plans.

D. **Tap Existing Manhole:** As specified in Section 5.13.06 2003 MDOT Standard Specifications.

E. **Backfilling:** As specified in Section 4.01.03 G.

F. **Placing Cast Iron Frame and Cover:** As specified in Section 5314.06, 2003 MDOT, Standard Specifications.

5.05.05 ACCEPTANCE TESTS

A. Manholes on sanitary sewer are to be subjected to an exfiltration test. All incoming and outgoing sewer lines shall be plugged and the manhole filled with water of to ∀ 6 inches of the manhole cover. If the water loss exceeds the maximum allowable as shown below, the manhole shall have failed the test.

Depth of Manhole	Maximum Allowable Water Loss
0-8 feet	1 inch / 5 minutes
Over 8 feet	1/8 gal / vertical ft. / 5 min

All manholes which fail the above test shall be inspected as to the source of the problem, corrected and retested.