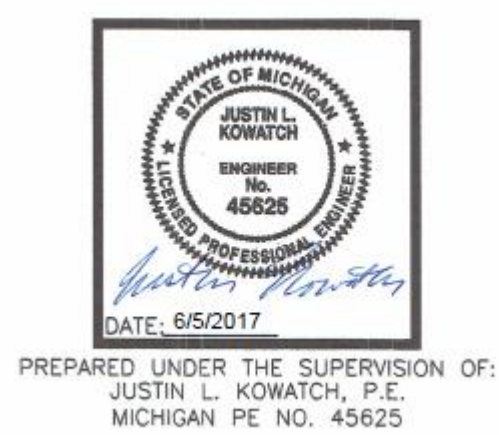
PROJECT MANUAL

for

WOLVERINE COMMUNITY SCHOOLS – Boiler Replacement Project

Middle-High School Building –
13131 Brook Street, Wolverine, MI 49799

JLK PROJECT NO. WCS1701



PREPARED UNDER THE SUPERVISION OF:
JUSTIN L. KOWATCH, P.E.
MICHIGAN PE NO. 45625

June 5, 2017

JLK ENGINEERING

5766 Catawaba Ct | Gaylord, MI 49735 | P 989.448.4631
www.jlkengineering.com

DOCUMENT 00 01 01

PROJECT TITLE PAGE

PROJECT NAME: WOLVERINE COMMUNITY SCHOOLS
Middle-High School Boiler Replacement Project

OWNER: Wolverine Community Schools
Elementary School / Central Office
5993 Sholes Street
Wolverine, MI 49799
Contact: Joe Hart, Superintendent

ENGINEER: JLK Engineering
5766 Catawaba Ct
Gaylord, MI 49735
Contact: Justin Kowatch, PE
PH: 989-448-4631
Email: jkowatch@jlkengineering.com

DOCUMENT 00 01 10

TABLE OF CONTENTS

Section Title

PROCUREMENT AND CONTRACTION REQUIREMENTS GROUP
DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION

00 01 01 Project Title Page 1
00 01 10 Table of Contents 2

PROCUREMENT REQUIREMENTS

00 11 16 Invitation to Bid 2
00 21 13 Instructions to Bidders 6
00 41 13 Bid Form - Stipulated Sum (Single-Prime Contract) 3
00 45 01 Familial Disclosure Statement 1
00 45 02 Iran Economic Sanctions Act Compliance Certificate 1

CONTRACTING REQUIREMENTS

00 52 14 Agreement Form - AIA Stipulated Sum (Single-Prime Contract) 1
AIA Document A107 – 2007 26

SPECIFICATIONS GROUP
FACILITY SERVICES SUBGROUP

DIVISION 22 – PLUMBING

22 00 01 General Plumbing Requirements 8
22 05 53 Identification for Plumbing Systems and Equipment 2
22 10 05 Plumbing Piping 7

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 01 General Mechanical Requirements 10
23 05 16 Expansion Fittings and Loops for HVAC Piping 3
23 05 19 Meters and Gages for HVAC Piping 3
23 05 53 Identification for HVAC Systems and Equipment 2
23 05 93 Testing, Adjusting, and Balancing For HVAC 5
23 07 19 HVAC Piping Insulation 5
23 21 13 Hydronic Piping 8
23 21 14 Hydronic Specialties 3
23 21 23 Hydronic Pumps 4
23 25 00 HVAC Water Treatment 4
23 52 16 Condensing Boilers-FTXL 8

DIVISION 26 – ELECTRICAL

26 00 01	General Electrical Requirements	7
26 05 19	Low-Voltage Electrical Power Cables (600 V And Less)	4
26 05 26	Grounding and Bonding for Electrical Systems	1
26 05 29	Hangers and Supports for Electrical Systems	2
26 05 34	Conduit	4
26 05 37	Boxes	2
26 05 53	Identification for Electrical Systems	2
26 27 17	Equipment Wiring	2
26 29 13	Enclosed Controllers	2

END OF SECTION

DOCUMENT 00 11 16

INVITATION TO BID

Project: Wolverine Community Schools Middle-High School Boiler Replacement Project

Owner:

Wolverine Community Schools
Elementary School / Central Office
5993 Sholes Street
Wolverine, MI 49799
Joe Hart, Superintendent
231-525-8201
jhart@wolverineschools.org

Engineer:

JLK Engineering
5766 Catawaba Ct
Gaylord, MI 49735
989-448-4631
jkowatch@jlkengineering.com

Date: June 5, 2017

Wolverine Community Schools will receive Bids from qualified Bidders for renovations to the existing boilers at Wolverine Middle-High School building located at 13131 Brook Street, Wolverine, Michigan 49799.

Sealed Bids should be delivered in person to Wolverine Community Schools Central Office, c/o Joe Hart, Superintendent, 5993 Sholes Street, Wolverine, MI 49799. Bids must be received prior to 3:00 PM local time on June 29, 2017. Bids will be opened publically and read aloud immediately following the closure of the bidding period, in the Wolverine Community Schools Central Office located at 5993 Sholes Street Wolverine, MI 49799. The Owner will not consider or accept a bid received after the date and time specified for bid submission. Post Bid Interviews with the apparent low Bidder(s) will be scheduled following receipt of Bids. All Bids will be evaluated at a later date.

There will be a Pre-Bid Meeting conducted by the Owner and Engineer at 3:15 PM local time on June 13, 2017. The meeting will convene at the Wolverine Middle-High School located at 13131 Brook Street, Wolverine, Michigan 49799. The Pre-Bid Meeting will consist of a brief informational meeting followed by an opportunity for Bidders to examine the Project site. **Attendance by Mechanical-General Contractor Bidders is mandatory.** Attendance by Sub-bidders (electrical subs) is not mandatory, but is strongly encouraged.

Bidding Documents will be available on or about June 5, 2017, and will be on file for inspection at the following locations:

Builders Exchange Traverse City, Grand Rapids, Lansing, and Saginaw
CDC News Michigan
Construction Association of Michigan
Reed Construction Data

Bidding Documents will be available to Bidders in electronic format (.pdf) free of charge. Interested Bidders may view and download bidding documents at www.jlkengineering.com. Select and download Wolverine Schools Boiler Project information under the Bid Docs tab. Paper copies of Bidding Documents may be purchased from Traverse Reproduction & Supply Company; 1373 Barlow Street, Traverse City, MI 49686; telephone 231/947-6284, fax: 231/947-6552. Requests for paper copies of Bidding Documents shall be made to Traverse Reproduction & Supply Company at the address above. Each request should be accompanied by the Bidders name, mailing address, shipping address if different, telephone and fax numbers, and e-mail address. Contact Traverse Reproduction & Supply Company for non-refundable Bidding Document purchase pricing and shipping costs.

Each Bidder shall include with its Bid, a sworn and notarized statement disclosing any familial relationships that exist between the owner or any employee of the Bidder and any member of the Board of Education of the Superintendent of the School District.

Compliance with the Iran Economic Sanctions Act (PA 517 of 2012) is required. Each Bidder shall include a sworn and notarized certification that they are not an "Iran Linked Business" as the term is defined in the Act.

A Bid security in the amount of no less than 5 percent of the Bid Sum in the form of a Bid Bond, or certified check payable to the Owner shall accompany each Bid. A personal or company check does not constitute a Bid security.

Refer to other bidding requirements described in Document 00 21 13.

Bids shall be submitted on the Bid Form provided in the Bidding Documents.

The successful Bidder will be required to furnish Performance and Labor/Material Payment Bonds in the amount of 100% of the contract amount.

Bids will be required to be submitted under a condition of irrevocability for a period of 60 days after submission.

The Owner reserves the right to accept or reject any or all Bids, either in whole or in part; to award the Contract to other than the lowest Bidder; to waive any irregularities and/or informalities; and in general to make awards in any manner deemed to be in the best interest of the Owner.

END OF DOCUMENT

DOCUMENT 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. Prebid conference.
12. Bidder qualifications.
13. Subcontractors.
14. Submission procedure.
15. Bid ineligibility.
16. Security deposit.
17. Performance Assurance.
18. Bid Form requirements.
19. Bid alternates.
20. Fees for changes in the Work.
21. Bid Form signature.
22. Additional Bid Information.
23. Bid opening.
24. Duration of offer.
25. 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).
3. AIA Document A107–2007 Standard Form of Agreement Between Owner and Contractor for a Project of Limited Scope:
   a. Definitions.
   b. Contract Time identification.
   c. Contractor’s fees for changes.
   d. Contractor’s liability insurance.
   e. Bond types and values.

1.2 BID SUBMISSION

A. Bids signed, executed, and dated will be received by Wolverine Community Schools, c/o Joe Hart, Superintendent, until 3:00 PM local time on June 29, 2017. Bids are to be delivered to Wolverine Community Schools, Elementary School / Central Office, 5993 Sholes Street, Wolverine, MI 49799.

B. Bids submitted after the above time will 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 at any time before bid closing.

1.3 INTENT

A. The intent of this Bid request is to obtain an offer to perform work to complete renovations of the Middle-High School Boilers for a Stipulated Sum contract, in accordance with Contract Documents.

1.4 WORK IDENTIFIED IN CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises replacement of Middle-High School boilers and includes related plumbing, HVAC and electrical work.

B. Location:
1. Wolverine Middle-High School: 13131 Brook Street, Wolverine, Michigan 49799.

1.5 CONTRACT TIME

A. The Owner requires the work of this contract be substantially complete and approved for occupancy by the authority having jurisdiction not later than the end of business September 21, 2017.

B. Liquidated Damages: Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed and approved for occupancy by applicable Governing Authorities within the time agreed upon, plus any extensions of time as allowed by the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by the Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as penalty) Contractor shall pay the Owner Five Hundred Dollars ($500) for each day that expires after the specified date of Substantial Completion until the Work is Substantially Complete and Two Hundred Fifty Dollars ($250) for each day that expires after the specified date of Final Completion until the Work is Finally Complete. Liquidated Damages charges shall be deducted from the Contractor's progress payment or final payment as applicable. The Owner reserves the right to demand legal proceedings should the actual loss exceed the damages provided herein.

1.6 DEFINITIONS

A. Bidding Documents: Contract Documents supplemented with Invitation to Bid, Instructions to Bidders, Bid Form, and bid securities, identified.

B. Contract Documents: Defined in AIA Document A107-2007, including issued Addenda.

C. Bid: Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.

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

1.7 CONTRACT DOCUMENTS IDENTIFICATION

A. The Contract Documents are identified as Project Number WCS1701; Wolverine Community Schools; Boiler Replacement Project as prepared by JLK Engineering.

1.8 AVAILABILITY OF DOCUMENTS

A. Bidding Documents may be obtained as stated in Invitation to Bid.

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. Bidding Documents may be viewed at the Engineers website www.jlkengineering.com. Select Wolverine Schools Boiler Project under the Bid Docs tab.

B. Bidding Documents are on display at the construction association plan room facilities listed in the Invitation to Bid.

C. Upon receipt of Bidding Documents verify documents are complete. Notify Archictect/Engineer if documents are incomplete.

D. Immediately notify Archictect/Engineer upon finding discrepancies or omissions in Bidding Documents.

1.10 INQUIRIES AND ADDENDA

A. Direct questions in writing to Justin Kowatch, at the office of the Engineer; Email jkowatch@jlkengineering.com.

B. Verbal answers are not binding on any party.

C. Submit questions not less than 4 business days before date set for receipt of Bids. Replies will be made by Addenda.

D. Addenda may be issued during bidding period. Addenda will be posted on the Architects website and will be sent to the construction association plan room facilities listed in the Invitation to Bid. Addenda become part of the Contract Documents. Include resultant costs in the Bid Sum.

1.11 PRODUCT SUBSTITUTIONS

A. Where Bidding Documents stipulate particular Products with provisions for substitutions, substitution requests will be considered by Archictect/Engineer up to 7 days before receipt of Bids.

B. With each substitution request, provide sufficient information for Archictect/Engineer to determine acceptability of proposed products.

C. When a request to substitute a Product is made, Archictect/Engineer 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 and changes to Contract Time and 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 PREBID CONFERENCE

A. A Bidders conference will be held at 3:15 PM local time on June 13, 2017. The meeting will convene at the Wolverine Community Schools Middle-High School located at 13131 Brook Street, Wolverine, Michigan 49799.

B. Mechanical-General contract Bidders are required to attend. Attendance by major trade sub-bidders is not required, but is strongly encouraged.

C. Representatives of the Owner and Architect/Engineer will be in attendance.

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

1.13 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, current commitments, and license to perform work.

1.14 SUBCONTRACTORS

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

B. Refer to AIA Document A107-2007.

1.15 SUBMISSION PROCEDURE

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

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

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

1.16 BID INELIGIBILITY

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

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

C. Failure to provide security deposit, bonds or insurance requirements may invalidate the Bid at the discretion of the Owner.

1.17 SECURITY DEPOSIT

A. Bids shall be accompanied by security deposit as follows:
   1. Bid Bond of a sum no less than 5 percent of the Bid Sum on standard surety company form.
   2. Certified check in the amount of 5% of the Bid Sum.

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

C. Endorse certified check in name of the Owner.

D. Security deposits will be returned after execution of the agreement.

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

1.18 PERFORMANCE ASSURANCE

A. Accepted Bidder: Provide a Performance and Payment bond as described in AIA Document A107-2007.

B. Include the cost of performance assurance bonds in the Bid Sum.

1.19 BID FORM REQUIREMENTS

A. Complete requested information in the Bid Form and Bid Form Supplements.

1.20 BID ALTERNATES

A. Indicate variation of Bid Price for alternates listed in Document 00 41 13. Provide the "difference" in Bid Price which will be adding to or deducting from base Bid Price if selected.

B. Bids will be evaluated on total of base Bid Price with full consideration of selected alternates.

C. Bid Alternates:
   1. Alternate Add #M1: State the cost of materials & labor required for adding replacement of the existing air separator (A/S) to the scope of the project.
   2. Alternate Add #M2: State the cost of materials & labor required for adding replacement of the existing heating system pumps (HP-1 & HP-2) to the scope of the project.

1.21 FEES FOR CHANGES IN THE WORK

A. When the Architect/Engineer establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, the percentage fee allowed for Overhead and Profit shall be Ten Percent (10%) on the net cost of work by the General Contractor, and Five Percent (5%) on the gross cost of work by a Subcontractor.

1.22 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. Insert the words "Sole Proprietor" under the signature.
   2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature.

3. Corporation: Signature of a duly authorized signing officers in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. If the Bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, submit a copy of the by-law resolution of their board of directors authorizing them to do so, with the Bid Form in the bid envelope.
4. Joint Venture: Signature of each party of the joint venture under their respective seals in a manner appropriate to such party as described above, similar to requirements for Partnerships.

1.23 ADDITIONAL BID INFORMATION

A. Familial Disclosure Statement
   1. Include Familial Disclosure Statement with the Bid.
   2. Complete all requested information in the affidavit.
   3. Signature of the affidavit shall be notarized.
   4. Failure of the Bidder to submit a fully executed affidavit will result in disqualification of the bidder.

B. Iran Economic Sanctions Act Compliance Affidavit
   1. Include Iran Economics Sanctions Act Compliance Affidavit with the Bid.
   2. Complete all requested information in the affidavit.
   3. Signature of the affidavit shall be notarized.
   4. Failure of the Bidder to submit a fully executed affidavit will result in disqualification of the bidder.

1.24 BID OPENING

A. Bids will be opened immediately following the closure of the bidding period in the Wolverine Community Schools Central Office, located at 5993 Sholes Street, Wolverine, MI 49799.

1.25 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of 60 days after bid closing date.

1.26 ACCEPTANCE OF OFFER

A. The Owner reserves the right to accept or reject any or all offers.

B. After acceptance by the Owner, the Architect/Engineer on behalf of the Owner, will issue to the accepted Bidder, a written letter of Contract 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 the Owner to proceed, or on date stipulated in such order.

D. The accepted bidder shall assist and cooperate with the Owner to prepare the Agreement, and within 7 days following its presentation shall execute Agreement and return it to the Owner.

END OF DOCUMENT

DOCUMENT 00 41 13

BID FORM – STIPULATED PRICE

To: Wolverine Community Schools
c/o Joe Hart, Superintendent
Wolverine Community Schools Central Office
5993 Sholes Street
Wolverine, MI 49799

Project: Wolverine Community Schools; Middle-High School Boiler Project
Project No. WCS1701

Date: _____

Submitted by: _____
(full name)

(full address) _____

_____

1. OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the

Stipulated Sum of: $_____(numerical)

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

- We have included the cost of Performance and Labor/Material Payment Bonds in the Bid.
- We have included the required security deposit as required by the Instruction to Bidders.
- All applicable federal and/or State of Michigan taxes are included in the Bid Sum.
- We have included the costs of all required construction permits and inspections in the bid sum.
- We have completed and attached Certificates of the Bidder as required in Section 00 21 13: Document 00 45 01 – Familial Disclosure Statement; and 00 45 02 – Iran Economics Sanctions Act Affidavit.

2. BID ALTERNATES

We offering the following Alternate Prices for specific portions of the Work as provided in the Contract Documents:

a. Alternate Add #M1: State the cost of materials & labor required for adding replacement of the existing air separator (A/S) to the scope of the project.

ADD$_____.

b. Alternate Add #M2: State the cost of materials & labor required for adding replacement of the existing heating system pumps (HP-1 & HP-2) to the scope of the project.

ADD$_____.

3. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty days from the bid closing date. If this bid is accepted by the Owner within the time period stated above, we will:

a. Execute the Agreement within seven (7) days of receipt of Notice of Award.

b. Commence work within seven (7) days after written Notice to Proceed.

If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit 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 security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

4. 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 _____

5. BID FORM SIGNATURE(S)

BIDDER:

_____

By: _____

Its: _____

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 BID FORM - STIPULATED PRICE

DOCUMENT 00 45 01

FAMILIAL DISCLOSURE STATEMENT

The undersigned, the owner or authorized officer of _____ (the "Bidder") pursuant to the familial disclosure requirement provided in the advertisement for construction bids, hereby represent and warrant, except as provided below, that no familial relationships exist between the owner(s) or any employee of the Bidder and any member of the Board of Education or the Superintendent of Wo Schools (the School), except as indicated below:

List any Familial Relationships:

BIDDER:

_____

By: _____

Its: _____

State of Michigan)
) SS
County of)

This instrument was acknowledged before me on the _____ day of _____, 20___, by

_____.

_____
, Notary Public

_____, County, Michigan

My Commission Expires: _____

Acting in the County of: _____

END OF FAMILIAL DISCLOSURE STATEMENT

DOCUMENT 00 45 02

IRAN ECONOMIC SANCTIONS ACT COMPLIANCE AFFIDAVIT

Effective April 1, 2013, all Bids and/or Proposals received by public entities in the State of Michigan must comply with the Iran Economic Sanctions Act, Act 517 of 2012. As a condition to compliance with the Act, the following certification must be submitted with the Bid.

The undersigned, the owner or authorized officer of _____ (the "Bidder"), pursuant to the requirements of the Iran Economic Sanctions Act, Act 517 of 2012, hereby certifies under civil penalty for false certification, that the Bidder is not an "Iran Linked Business", as defined in the Act, and is eligible to submit a Bid.

By: _____

Its: _____

State of Michigan)
) SS
County of)

This instrument was acknowledged before me on the _____ day of _____, 20__, by

_____.

_____
, Notary Public

_____, County, Michigan

My Commission Expires: _____

Acting in the County of: _____

END OF IRAN ECONOMIC SANCTIONS ACT COMPLIANCE AFFIDAVIT

DOCUMENT 00 52 14

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

1.1 SUMMARY

A. Document Includes:
   1. Agreement.

1.2 AGREEMENT

A. AIA Document A107-2007, Standard Form of Agreement Between Owner and Contractor for a Project of Limited Scope as modified, forms the basis of Agreement Between the Owner and Contractor.

END OF DOCUMENT

AIA® Document A107™ – 2007

Standard Form of Agreement Between Owner and Contractor for a Project of Limited Scope

AGREEMENT made as of the day of in the year Two Thousand Seventeen
(In words, indicate day, month and year.)

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

Wolverine Community Schools
5993 Sholes Street
Wolverine, MI 49799

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

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

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

Wolverine Community Schools
Middle-High School Boiler Project
13131 Brook Street
Wolverine, Michigan 49799

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

JLK Engineering
5766 Catawaba Ct
Gaylord, MI 49735

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

1 THE WORK OF THIS CONTRACT

2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3 CONTRACT SUM

4 PAYMENT

5 DISPUTE RESOLUTION

6 ENUMERATION OF CONTRACT DOCUMENTS

7 GENERAL PROVISIONS

8 OWNER

9 CONTRACTOR

10 ARCHITECT

11 SUBCONTRACTORS

12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

13 CHANGES IN THE WORK

14 TIME

15 PAYMENTS AND COMPLETION

16 PROTECTION OF PERSONS AND PROPERTY

17 INSURANCE & BONDS

18 CORRECTION OF WORK

19 MISCELLANEOUS PROVISIONS

20 TERMINATION OF THE CONTRACT

21 CLAIMS AND DISPUTES

~~EXHIBIT A DETERMINATION OF THE COST OF THE WORK~~

ARTICLE 1 THE WORK OF THIS CONTRACT

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

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

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

§ 2.3 The Contract shall achieve Substantial Completion of the entire Work not later than ~~( ) days from the date of commencement, or as follows:~~September 21, 2017.
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

Liquidated Damages: Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed and approved for occupancy by applicable Governing Authorities within the time agreed upon, plus any extensions of time as allowed by the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by the Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as penalty) Contractor shall pay the Owner Five Hundred Dollars ($500) for each day that expires after the specified date of Substantial Completion until the Work is Substantially Complete and Two Hundred Fifty Dollars ($250) for each day that expires after the specified date of Final Completion until the Work is Finally Complete. Liquidated Damages charges shall be deducted from the Contractor's progress payment or final payment as applicable. The Owner reserves the right to demand legal proceedings should the actual loss exceed the damages provided herein.

ARTICLE 3 CONTRACT SUM

§ 3.1 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 one of the following:
(Check the appropriate box.)

[X] Stipulated Sum, in accordance with Section 3.2 below
~~[ ] Cost of the Work plus the Contractor's Fee, in accordance with Section 3.3 below~~

~~[ ] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 3.4 below~~

(Based on the selection above, complete Section 3.2, 3.3 or 3.4 below.)

§ 3.2 The Stipulated Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 3.2.1 The Stipulated Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

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

Item	Units and Limitations	Price Per Unit ($0.00)
None		

§ 3.2.3 Allowances included in the stipulated sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Allowance
None	

~~**§ 3.3 COST OF THE WORK PLUS CONTRACTOR'S FEE**~~
~~**§ 3.3.1** The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.~~

~~**§ 3.3.2** The Contractor's Fee:~~
~~*(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)*~~

~~**§ 3.4 COST OF THE WORK PLUS CONTRACTOR'S FEE WITH A GUARANTEED MAXIMUM PRICE**~~
~~**§ 3.4.1** The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.~~

~~**§ 3.4.2** The Contractor's Fee:~~
~~*(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)*~~

~~**§ 3.4.3 GUARANTEED MAXIMUM PRICE**~~
~~**§ 3.4.3.1** The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed ($), subject to additions and deductions by changes in the Work as provided in the Contract Documents. Such maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner.~~
~~*(Insert specific provisions if the Contractor is to participate in any savings.)*~~

~~**§ 3.4.3.2** The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:~~

~~**§ 3.4.3.3** Unit Prices, if any:~~
~~*(Identify and state the unit price, and state the quantity limitations, if any, to which the unit price will be applicable.)*~~

~~Item~~	~~Units and Limitations~~	~~Price Per Unit ($0.00)~~

~~**§ 3.4.3.4** Allowances included in the Guaranteed Maximum Price, if any:~~
~~*(Identify and state the amounts of any allowances, and state whether they include labor, materials, or both.)*~~

~~Item~~	~~Allowance~~

~~**§ 3.4.3.5** Assumptions, if any, on which the Guaranteed Maximum Price is based:~~

ARTICLE 4 PAYMENTS

§ 4.1 PROGRESS PAYMENTS

§ 4.1.1 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.

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

§ 4.1.3 Provided that an Application for Payment is received by the Architect not later than the last day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the last day of the following month. If an Application for Payment is received by the Architect after the date fixed above, payment 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.)

§ 4.1.4 Retainage, if any, shall be withheld as follows:

Ten Percent (10%) of each progress payment.

§ 4.1.5 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.)

0 % Zero percent per annum.

§ 4.2 FINAL PAYMENT

§ 4.2.1 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 Section 18.2, and to satisfy other requirements, if any, which extend beyond final payment;

.2 the contractor has submitted a final accounting for the Cost of the Work, where payment is on the basis of the Cost of the Work with or without a guaranteed maximum price; and

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

§ 4.2.2 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:

ARTICLE 5 DISPUTE RESOLUTION

§ 5.1 BINDING DISPUTE RESOLUTION

For any claim subject to, but not resolved by, mediation pursuant to Section 21.3, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, claims will be resolved in a court of competent jurisdiction.)

~~[ ] Arbitration pursuant to Section 21.4 of this Agreement~~

[X] Litigation in a court of competent jurisdiction

~~[ ] Other *(Specify)*~~

ARTICLE 6 ENUMERATION OF CONTRACT DOCUMENTS

§ 6.1 The Contract Documents are defined in Article 7 and, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 6.1.1 The Agreement is this executed AIA Document A107–2007, Standard Form of Agreement Between Owner and Contractor for a Project of Limited Scope.

§ 6.1.2 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
None			

§ 6.1.3 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages
22 00 01	General Plumbing Requirements	June 5, 2017	8
22 05 53	Identification for Plumbing Systems and Equipment	June 5, 2017	2
22 10 05	Plumbing Piping	June 5, 2017	7
23 00 01	General Mechanical Requirements	June 5, 2017	10
23 05 16	Expansion Fittings and Loops for HVAC Piping	June 5, 2017	3
23 05 19	Meters and Gages for HVAC Piping	June 5, 2017	3
23 05 53	Identification for HVAC Systems and Equipment	June 5, 2017	2
23 05 93	Testing, Adjusting, and Balancing For HVAC	June 5, 2017	5
23 07 19	HVAC Piping Insulation	June 5, 2017	5
23 21 13	Hydronic Piping	June 5, 2017	8
23 21 14	Hydronic Specialties	June 5, 2017	3
23 21 23	Hydronic Pumps	June 5, 2017	4
23 25 00	HVAC Water Treatment	June 5, 2017	4
23 52 16	Condensing Boilers-FTXL	June 5, 2017	8
26 00 01	General Electrical Requirements	June 5, 2017	7
26 05 19	Low-Voltage Electrical Power Cables (600 V And Less)	June 5, 2017	4
26 05 26	Grounding and Bonding for Electrical Systems	June 5, 2017	1
26 05 29	Hangers and	June 5, 2017	2

Init.
/

	Supports for Electrical Systems		
26 05 34	Conduit	June 5, 2017	4
26 05 37	Boxes	June 5, 2017	2
26 05 53	Identification for Electrical Systems	June 5, 2017	2
26 27 17	Equipment Wiring	June 5, 2017	2
26 29 13	Enclosed Controllers	June 5, 2017	2

§ 6.1.4 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date
M1	Mechanical and Plumbing Title Sheet	June 5, 2017
M2	Mechanical Plans	June 5, 2017
M3	Plumbing Plans	June 5, 2017
M4	Mechanical and Plumbing Details	June 5, 2017
M5	Mechanical and Plumbing Details	June 5, 2017
E1	Electrical Title Sheet	June 5, 2017
E2	Electrical Plans	June 5, 2017

§ 6.1.5 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are enumerated in this Article 6.

§ 6.1.6 Additional documents, if any, forming part of the Contract Documents:

.1 ~~Exhibit A, Determination of the Cost of the Work, if applicable.~~

.2 ~~AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed, or the following:~~

.3 Other documents:
(List here any additional documents that are intended to form part of the Contract Documents.)

Number	Title	Date	Pages
00 41 13	Bid Form – Stipulated Price as submitted.		3

ARTICLE 7 GENERAL PROVISIONS

§ 7.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in Article 6 and consist of this Agreement (including, if applicable, Supplementary and other Conditions of the Contract), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement. 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. The Contract Documents also include terms stated in the advertisement or invitation to bid, instructions to

bidders, and other information furnished by the Owner in anticipation of receiving bids or proposals unless expressly excluded or in conflict with this Agreement. 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 to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 7.1.1 The Term Architect, as used in and throughout this Agreement, shall mean the professional of record (Engineer) as identified on page one of the this Agreement.

§ 7.2 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 between any persons or entities other than the Owner and the Contractor.

§ 7.3 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.

§ 7.4 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.

§ 7.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 7.5.1 ~~The~~ Subject to contrary provisions in the contract between the Owner and the Architect or in the Contract Documents, 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 will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 7.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service ~~provided to them~~ 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 7.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they ~~shall~~ may endeavor to establish necessary protocols governing such transmission, unless otherwise provided in the Agreement or in the Contract Documents.

ARTICLE 8 OWNER

§ 8.1 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 8.1.1 The Owner shall furnish all necessary surveys and a legal description of the site.

§ 8.1.2 ~~The~~ Taking into account the Contractor's experience and expertise, 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.

§ 8.1.3 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, ~~including~~ including, but not limited to, those required under Section 9.6.1, the Owner shall secure and pay for other necessary approvals, easements, assessments and charges required for the construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 8.2 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or ~~repeatedly~~ fails to carry out the 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 is 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. This right shall be in addition to and not in limitation of the Owner's rights under any other provisions of the Contract Documents.

§ 8.3 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~~ three-day period after receipt of written notice from the Owner or the Owner's designee to commence and continue correction of such default or neglect with diligence and promptness, the Owner, without prejudice to any other remedy the Owner may have, including any claim against the Contractor's performance bond, may correct such deficiencies and may deduct the reasonable cost thereof, including Owner's expenses, including all legal expenses incurred to effectuate and enforce this provision, and compensation for the Architect's services made necessary thereby, from the payment then or thereafter due the Contractor. Exercise of such rights shall in no way limit or jeopardize the Owner's right to any claim against either the Performance Bond or the Contractor. In the event the Owner directs another entity to perform Work pursuant to this Section that otherwise is the obligation of the Contractor, including correction of safety violations, either at the Contractor's request or as a result of the Contractor's failure to perform such Work, that other entity shall charge the Contractor all costs for labor, material and equipment plus that other entity's administrative, profit and overhead costs. The Contractor shall pay that other entity within ten (10) days of the date of invoice. If not paid within ten (10) days, the Contractor authorizes the Owner to withhold that amount from the Contractor and to pay the same to that other entity from the next payment due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 9 CONTRACTOR

§ 9.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 9.1.1 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.

§ 9.1.2 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 8.1.1, 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.

§ 9.1.3 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.

§ 9.1.4 Prior to submitting its bid, the Contractor shall have studied and compared the Contract Documents and shall have reported to the Architect any error, inconsistency or omission in the Contract Documents. It will be presumed that the Contractor's bid and the Contract Sum include the cost of correcting any such error, inconsistency or omission, which could have been discovered by the exercise of reasonable diligence. Unless the Contractor

establishes that such error, inconsistence or omission could not have been discovered by the exercise of reasonable diligence, the Contractor will make such corrections without additional compensation so that the Work is fully functional.

§ 9.2 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 9.2.1 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, unless the Contract Documents give other specific instructions concerning these matters.

§ 9.2.2 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.

§ 9.3 LABOR AND MATERIALS

§ 9.3.1 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. Such provision of labor and materials shall occur in sufficient time to satisfy the existing Project schedule. The Contractor bears the risk of any failure to timely provide such labor and materials for any reason. The Contractor agrees to execute the appropriate UCC forms to effectuate the Owner's ownership of the material and equipment furnished pursuant to this Contract.

§ 9.3.2 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 skilled in tasks assigned to them.

§ 9.3.3 The Contractor may make a substitution only with the consent of the Owner, after evaluation by the Architect and in accordance with a Modification.

§ 9.3.4 ASBESTOS-FREE PRODUCT INSTALLATION

§ 9.3.4.1 It is hereby understood and agreed that no product and/or material containing asbestos including chrysolite, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos and any combination of these materials that have been chemically treated and/or altered shall be installed or introduced into the Work by the contractor or his employees, agents, subcontractors, or other individuals or entities over whom the Contractor has control. If applicable, the Contractor shall be required to provide a signed certification statement ensuring that all products or materials installed or introduced into the work all be asbestos-free.

§ 9.3.4.2 The Contractor shall also be required to furnish certified statements from the manufacturers of supplied materials used during construction verifying their products to be asbestos-free in accordance with the requirements of Section 9.3.4.1.

§ 9.3.4.3 The Contractor shall complete and submit to the Owner a certification evidencing asbestos-free product installation prior to issuance of the final Certificate for Payment, in a form acceptable to the Owner.

§ 9.4 WARRANTY

~~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 under normal usage.~~In addition to any other warranties, guarantees or obligations set forth in the Contract Documents or applicable as a matter of a law and not in limitation of the terms of the Contract Documents, the Contractor warrants and guarantees that:

.1 The Owner shall have good title to the Work and all materials and equipment incorporated into the Work and, unless otherwise expressly provided in the Contract Documents, such materials and equipment shall be new;

2. The Work and all materials and equipment incorporated into the Work shall be free from all defects, including any defects in workmanship or materials;

3. The Work and all equipment incorporated into the Work shall be fit for the purpose for which they are intended;

4. The Work and all materials and equipment incorporated into the Work shall be merchantable; and

5. The Work and all materials and equipment incorporated into the Work shall conform in all respects to the Contract Documents.

Upon notice of the breach of any of the foregoing warranties or guarantees or any other warranties or guarantees under the Contract Documents, the Contractor, in addition to any other requirements in the Contract Documents, will commence to correct such breach within seventy-two (72) hours after written notice thereof and thereafter will use its best efforts to timely correct such breach to the satisfaction of the Owner; provided that if such notice is given after final payment hereunder, such seventy-two (72) hour period shall be extended to seven (7) days. The foregoing warranties and obligations of the Contractor shall survive the final payment and/or termination of the Contract.

§ 9.5 TAXES

The Contractor shall pay sales, consumer, use and other similar taxes that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. The Contractor shall pay all state and federal taxes levied on its business, income or property and shall make all contributions for social security and other wage or payroll taxes. The Contractor shall be solely responsible for such payments and shall indemnify the Owner and hold it harmless from same. The Contractor shall include and shall deem to have been included in its bid all Michigan Sales and Use Taxes currently imposed by legislative enactment and as administered by the Michigan Department of Treasury on the Bid Date.

§ 9.6 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

§ 9.6.1 ~~Unless otherwise provided in the Contract Documents, the~~ The Contractor shall secure and pay for the building permit as well as 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.

§ 9.6.2 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. 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. In the event the Contract exceeds $75,000, the requirements of Section 2 of 1998 PA 57, as amended, are hereby incorporated into this Agreement.

§ 9.7 ALLOWANCES

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Owner shall select materials and equipment under allowances with reasonable promptness. Allowance amounts shall include the costs to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Allowance amounts shall not include the Contractor's costs for unloading and handling at the site, labor, installation, overhead, and profit. In the event one or more allowances are not fully utilized, the unused value of those allowances shall be returned to the Owner.

§ 9.8 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 9.8.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. In no event shall the Contractor's Construction Schedule be extended due to action or inaction of the Contractor, except with prior written approval of the Owner within the Owner's sole discretion.

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

§ 9.9 SUBMITTALS

§ 9.9.1 The Contractor shall review for compliance with the Contract Documents and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in coordination with the Contractor's construction schedule and in such sequence as to allow the Architect reasonable time for review. 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. The Work shall be in accordance with approved submittals.

§ 9.9.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

§ 9.10 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.

§ 9.11 CUTTING AND PATCHING

The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 9.12 CLEANING UP

The Contractor and its Subcontractors under the Contractor's direction shall keep the premises and surrounding area free from accumulation of waste materials or 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 material from and about the Project.

§ 9.13 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 indemnify, defend and hold the Owner and Architect harmless from any and all cost, damage or loss on account thereof, including but not limited to actual attorney fees, but shall not be responsible for such 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 the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect. The review by the Owner or Architect of any method of construction, invention, appliance, process, article, device or materials of any kind shall be for its adequacy in the Work and shall not be an approval for the use thereof by the Contractor in violation of any patent or other rights of any third person.

§ 9.14 ACCESS TO WORK

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

§ 9.15 INDEMNIFICATION

§ 9.15.1 To the fullest extent permitted by law, the Contractor shall ~~indemnify~~ indemnify, defend 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 actual 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~~ Work or the duties or obligations of this Agreement or the failure of the Contractor or the Work to conform with the Contract Documents, caused in whole or in part by any acts or omissions of the Contractor, a Subcontractor, or anyone directly or indirectly employed by them or anyone for

whose acts ~~they~~ of any of them may be liable, regardless of whether such claim, damage, loss or expense is, or is claimed to be caused in part by a party indemnified hereunder, except where such loss, damage, injury, liability, expense or claim is the result of the sole negligence of the Owner, Architect or the consultants, agents or employees of any of them and is not contributed to by the Contractor or anyone for whose acts the Contractor may be liable, regardless of whether such claim, damage, loss or expense is caused in part by a party indemnified hereunder. The Contractor shall further indemnify the Owner, Architect, Architect's consultants and agents and employees of any of them from and against all amounts such parties may be required to pay in attorney fees in order to pursue enforcement of this provision against the Contractor or otherwise obtain indemnification from the Contractor provided under the terms of this Article. Such obligation shall not be construed to negate, ~~abridge,~~ abridge or reduce any other rights or obligations of indemnity which would otherwise exist as to ~~a party or person described in this Section 9.15.1.~~any party or person set forth in this section. To the fullest extent permitted by law, the Contractor shall indemnify the Owner and save the Owner harmless against all loss by fines, penalties or corrective measures resulting from acts of the Contractor or omissions by the Contractor, its Subcontractors, agents, employees or assigns, with respect to the violation of safety requirements of this Contract, including reasonable attorney fees.

§ 9.15.2 In ~~claims against any person or entity indemnified under this Section 9.15 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 9.15.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.~~addition to and not in limitation of the Contractor's other indemnity obligations, the Contractor hereby accepts and assumes exclusive liability for and shall indemnify, protect and save harmless the Owner and Architect from and against the payment of the following:

All contributions, taxes or premiums (including interest and penalties thereon) which may be payable under the unemployment insurance law of any state, the federal Social Security Act, federal, state, county and/or municipal tax withholding laws, or any other law, measured upon the payroll of or required to be withheld from employees by whomsoever employed, engaged in the Work to be performed and furnished under this Contract;

All sales, use, personal property and other taxes (including interest and penalties thereon) required by any federal, state, county, municipal or other law to be paid or collected by the Contractor or any of its Subcontractors or vendors or any other person or persons acting for, through or under it or any of them, by reason of the performance of the Work or the acquisition, ownership, furnishing, or use of any materials, equipment, supplies, labor, services or other items for or in connection with the Work; and

All pension, welfare, vacation, annuity and other benefit contributions payable under or in connection with respect to all persons by whomsoever employed, engaged in the Work to be performed and furnished under this Contract.

The Contractor shall indemnify, defend and hold the Owner harmless from any claim, damage, loss or expense, including but not limited to actual attorney fees, incurred by the Owner related to any hazardous material or waste, toxic substance, pollution or contamination brought into the Project site or caused by the Contractor or used, handled, transported, stored, removed, remediated, disturbed or dispersed of by Contractor.

ARTICLE 10 ARCHITECT

§ 10.1 The Architect will provide administration of the Contract and will be an Owner's representative during construction, until the date the Architect issues the final Certificate for ~~Payment.~~ Payment and with the Owner's written concurrence during the correction period.. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract ~~Documents,~~ Documents and in the Owner/Architect Agreement, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 10.2 The Architect will visit the site at intervals appropriate to the stage of the ~~construction~~ construction, or more frequently as agreed with the Owner or as required by law, 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~~ Except as otherwise set forth herein, the Architect will not have control over,

charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 10.3 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, will guard the Owner against defects and deficiencies in the work, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) 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. The Architect shall schedule and coordinate the Work of all Contractors on the Project, including the Contractors' use of the site. The Architect will keep the Contractors informed of the Project Construction Schedule to enable the Contractors to plan and perform the Work in a timely manner, develop a Project time line, inform the Contractors of same and take reasonable steps to notify the Contractors when the time line is not being materially adhered to.

§ 10.4 Based on the Architect's evaluations of the Work and 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.

§ 10.5 The Architect has authority to reject Work that does not conform to the Contract Documents and to require inspection or testing of the Work.

§ 10.6 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.

§ 10.7 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 will make initial decisions on all claims, disputes and other matters in question between the Owner and Contractor but will not be liable for results of any interpretations or decisions rendered in good ~~faith.~~faith and without negligence.

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

§ 10.9 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~~ Owner and Architect. Consent shall not be unreasonably withheld.

ARTICLE 11 SUBCONTRACTORS

§ 11.1 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. All contractual agreements with additional persons or entities serving as a Subcontractor shall expressly identify the Owner as a third-party beneficiary, and the Owner shall enjoy all third-party beneficiary rights not prohibited by law.

§ 11.2 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of the Subcontractors or suppliers for each of the principal portions of the Work. The Contractor shall not contract with any Subcontractor or supplier to whom the Owner or Architect has made reasonable written objection within ten days after receipt of the Contractor's list of Subcontractors and suppliers. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, despite the Architect's or Owner's reasonable objections, 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. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 11.3 Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the 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, which the Contractor, by the Contract Documents, assumes toward the Owner and Architect, and (2) allow the Subcontractor the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents, has against the Owner.

ARTICLE 12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 12.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under conditions of the contract identical or substantially similar to these, including those portions related to ~~insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such claim as provided in Article 21.~~ insurance. The Contractor shall be responsible for coordinating the Work with the work of other Contractors, including the Owner's own forces or separate contractors, so as to complete the Work in accordance with the Project time schedule.

§ 12.2 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 activities with theirs as required by the Contract Documents.

§ 12.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. ~~The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.~~Claims and other disputes and matters in question between the Contractor and other Contractors shall be subject to the provisions of Section 14.7, provided the other Contractors have reciprocal obligations. If such other Contractor initiates legal or any other proceedings against the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend such proceedings at its own expense, and if any judgment or award against the Owner arises therefrom, the Contractor shall pay or satisfy it and shall reimburse the Owner for all actual attorneys' fees and court or other costs which the Owner has incurred over and above those paid for directly by the Contractor.

ARTICLE 13 CHANGES IN THE WORK

§ 13.1 By appropriate Modification, changes in the Work may be accomplished after execution of the Contract. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, with the Contract Sum and Contract Time being adjusted accordingly. Such changes in the Work shall be authorized only by written Change Order signed by the Owner, Contractor and Architect, or by written Construction Change Directive signed by the Owner and Architect.

§ 13.2 Adjustments in the Contract Sum and Contract Time resulting from a change in the Work shall be determined by mutual agreement of the parties or, in the case of a Construction Change Directive signed only by the Owner and Architect, by the Contractor's cost of labor, material, equipment, and reasonable overhead and profit, unless the parties agree on another method for determining the cost or credit. Pending final determination of the total cost of a Construction Change Directive, the Contractor may request payment for Work completed pursuant to the Construction Change Directive. The Architect will make an interim determination of the amount of payment due for purposes of certifying the Contractor's monthly Application for Payment. When the Owner and Contractor agree on adjustments to the Contract Sum and Contract Time arising from a Construction Change Directive, the Architect will prepare a Change Order.

§ 13.3 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

§ 13.4 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and

Contract Time shall be equitably adjusted as mutually agreed between the Owner and Contractor; provided that the Contractor provides notice to the Owner and Architect promptly and before conditions are disturbed.

ARTICLE 14 TIME

§ 14.1 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 obtaining all supplies, materials, tools and equipment necessary to perform the Work and for properly performing the Work.

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

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

§ 14.4 The date of Substantial Completion is the date certified by the Architect in accordance with Section 15.4.3. All work shall be completed in sufficient time to allow for cleanup and preparation for Owner move-in prior to the date of Substantial Completion.

§ 14.5 If the Contractor is delayed at any time in the commencement or progress of the Work by changes ordered in the Work, by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties or any causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine, subject to the provisions of Article 21.

§ 14.6 Provided the Contractor submits a written request for an extension not more than fourteen (14) days after the occurrence that gives rise to the delay, if the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by fire, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner's pending litigation, mediation or arbitration, as applicable; or by other causes that the Architect determines may justify delay, then the contract time shall be extended by Change Order for such reasonable time as the Architect may determine and the Owner agrees. Failure of the Contractor to submit a timely request for an extension shall irrevocably waive the Contractor's right to such an extension of time. An extension of time as described in this section shall be the exclusive remedy of the Contractor for delays experienced by the Contractor on the Project, and the Contractor shall not be entitled to recover monetary damages for delay from the Owner. This section precludes recovery of damages for delay by the Contractor under other provisions of the Contract Documents.

§ 14.7 If the Contractor fails to complete its Work on time resulting in loss or damage to the Owner, whether or not liquidated damages are called for in the Contract Documents, the Owner shall be entitled to recover any damages caused by the Contractor's breach, including overhead, profit, extended general conditions, actual attorney fees, etc.

In the event the Contractor is hindered in the commencement or progress of the Work by the Work or the lack thereof or another contractor on the Project and in the event the Contractor claims damages as a direct and proximate consequence thereof (including but not limited to extended general conditions, acceleration, overhead, profit, overtime, interest, supervision or other costs or profits whatsoever), then the Contractor shall not assert such claims against the Owner, and, as to the Owner, the Contractor's claims of damages are hereby waived. The Contractor's sole and exclusive remedy regarding such claims for such damages shall be to pursue such claims directly against any contractor(s) on the job site that caused the circumstances, and with regard to such claims asserted against the Contractor by any other contractor(s), the Contractor hereby waives the defense of absence of contractual privity and hereby assumes liability to other contractor(s) arising out of the Contractor's actions resulting in similar types of damages and claims.

In the event of any interference in the completion of the Contractor's Work or scheduling of the Contractor's Work, including the sequence of that Work which is attributable to the Owner, and if it is determined by a court of competent jurisdiction that the Owner is liable for such delay despite the other terms of this Contract barring any Owner liability for damages for delay, then the Owner shall be liable to the Contractor for liquidated damages in the amount of not to exceed One Hundred Dollars ($100) per day, maximum, which shall include all of the Contractor's

claims, including by way of example, delays, compressions of schedule, lost productivity, lost profits, lost opportunities, out-of-sequence work, overhead, crowding, tools, equipment, rentals, etc.

ARTICLE 15 PAYMENTS AND COMPLETION

§ 15.1 APPLICATIONS FOR PAYMENT

The Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values, allocating the entire Contract Sum to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used in reviewing the Contractor's Applications for Payment. The schedule of values shall be prepared in such manner that the value associated for each major item of work and each subcontracted item of work is shown with materials and labor indicated separately on AIA Document G702A, Application and Certificate of Payment, Continuation Sheet.

~~**§ 15.1.1** Where the Contract is based on a Stipulated Sum or the Cost of the Work with a Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values, allocating the entire Contract Sum to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used in reviewing the Contractor's Applications for Payment.~~

§ 15.1.2 With each Application for ~~Payment where the Contract Sum is based upon the Cost of the Work, or the Cost of the Work with a Guaranteed Maximum Price,~~ Payment, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, releases/waivers of lien, and any other evidence required by the Owner to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed (1) progress payments already received by the Contractor, less (2) that portion of those payments attributable to the Contractor's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

§ 15.1.3 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 and in writing by the Owner, payment may similarly be made for materials and equipment stored, and protected from damage, off the site at a location agreed upon in writing.

§ 15.1.4 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 other encumbrances adverse to the Owner's interests.

§ 15.2 CERTIFICATES FOR PAYMENT

§ 15.2.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 15.2.3.

§ 15.2.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluations of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. 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.~~ Architect in writing together with the certification to which it pertains. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. 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 , unless otherwise required by the Agreement of Law, construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material 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.

§ 15.2.3 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 15.2.2 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 15.2.1. If the Contractor and the 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 9.2.2, because of

.1 defective Work not ~~remedied;~~remedied or the Contractor in default on the Agreement;
.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 for labor, materials or equipment;
.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.
.8 the Work not having progressed to the extent set forth in the Application for payment; or
.9 representations of the Contractor are untrue.

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

§ 15.2.5 If the Contractor disputes any determination by the Owner with regard to any Certificate for Payment, the Contractor shall nevertheless continue to expeditiously perform the Work and such dispute shall provide no basis for any manner of suspension of the Contractor's performance of the Work.

§ 15.3 PROGRESS PAYMENTS

§ 15.3.1 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment, 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 similar manner.

§ 15.3.2 Neither the Owner nor Architect shall have an obligation to pay or see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 15.3.3 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.

§ 15.4 SUBSTANTIAL COMPLETION

§ 15.4.1 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 and when all required occupancy permits, if any, have been issued so that the Owner can occupy or utilize the Work for its intended use.

§ 15.4.2 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.

§ 15.4.3 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. When the Architect determines that the Work or designated portion thereof is substantially complete, the Architect will issue a Certificate of Substantial Completion which 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.

§ 15.4.4 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such 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.

§ 15.4.5 Notwithstanding Section 15.4.2, as a condition precedent to establishing the date of Substantial Completion, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected (a "punch list"). The Contractor shall respond immediately to correct Work deficiencies and/or punch list items. Should the Contractor fail to make corrections in a timely manner including proper submission of all required close-out documents by September 29, 2017, Owner may assess liquidated damages as described under 2.3.

§ 15.4.6 The Contractor shall promptly notify the Architect, in writing, when the Work deficiencies and/or punch list items are completed. Upon the review of the Work by the Architect after such notification by the Contractor, if Work deficiencies and/or punch list items shall continue to exist, the Contractor shall reimburse the Owner its cost plus ten percent (10%) overhead and profit on any cost incurred by the Owner, including the Architect and Architect's fees for reinspections of the Work. Failure to pay such costs within ten (10) days of receipt of a demand regarding the same shall permit the Owner to pay such costs out of the retainage held by the Owner on the Contractor's contract.

§ 15.5 FINAL COMPLETION AND FINAL PAYMENT

§ 15.5.1 Upon receipt of the Contractor's written 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 and, 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 terms and conditions of 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 stated in Section 15.5.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 15.5.2 Final payment shall not become due until the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien 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 such lien, including costs and reasonable attorneys' fees.

§ 15.5.3 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; or
- **.3** terms of special warranties required by the Contract Documents.

§ 15.5.4 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of all 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.~~Payment and specifically referenced as being an exception to the waiver contained in this Section..

ARTICLE 16 PROTECTION OF PERSONS AND PROPERTY

§ 16.1 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. The Contractor shall take ~~reasonable precautions~~ every reasonable precaution for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

.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 or the Contractor's Subcontractors or Sub-subcontractors; 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.

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 and property and their protection from damage, injury or loss. The Contractor shall promptly remedy damage and loss to property 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 16.1.2 and 16.1.3, except for damage or loss attributable to acts or omissions of the Owner or Architect 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 9.15.

The Contractor shall take all reasonable safety precautions with respect to its Work and the work of others, shall comply with all standard industry safety measures and shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority and all other requirements of the Contract Documents, including those applicable to the safety of persons or property. The Contractor shall be responsible for the safety of all of the Contractor's employees and the safety of all of the Contractor's Subcontractors, suppliers, and their employees. The Contractor shall report in writing to the Architect any injury to any of Contractor's or its Subcontractors' employees at the site within one (1) day after the occurrence of such injury.

If the Contractor suffers injury or damage to person or property because of an act or omission of the Owner, or of others for whose acts the Owner is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the Owner within a reasonable time not exceeding twenty-one (21) days after discovery. The notice shall provide sufficient detail to enable the Owner to investigate the matter. This provision shall be for investigative purposes only and shall not eliminate or reduce a party's obligation to pursue claims. The Contractor's failure to do so shall be an irrevocable waiver of any claim arising out of such injury or damage. Injury or damage to persons or property suffered by the Owner because of an act or omission of the Contractor or others for whose acts the Contractor is legally responsible shall be subject to the limitations provisions established by Michigan law.

The Contractor causing damage to the Work of another Contractor shall be responsible for the repair and replacement of such damaged Work. Back charges shall be made against the Contract Sum of the damaging Contractor when corrections are not made promptly.

The Owner reserves the right to pay the Contractor originating the back charge from monies due the Contractor who is responsible for the Work required by same and shall deduct it from the Contract amount due the said responsible Contractor.

The Contractor originating back charges will determine the amount of the back charges in accordance with Article 13, Changes in the Work, in order to obtain the Architect's approval.

§ 16.2 HAZARDOUS MATERIALS

§ 16.2.1 The Contractor is responsible for compliance with the requirements of the Contract Documents regarding hazardous materials. 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 report the condition to the Owner and Architect in writing. 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 in the amount of the Contractor's reasonable additional costs of shutdown, delay and start-up.

~~**§ 16.2.2** 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 16.2.1 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.~~

~~**§ 16.2.3** 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 indemnify the Contractor for all cost and expense thereby incurred.~~

§ 16.3 NOTIFICATION OF UTILITY COMPANIES

§ 16.3.1 At least five (5) working days prior to the start of Work in areas which may involve existing utility lines, the Contractor shall notify by certified mail with return receipt requested the Registered Utility Protection Service of the utility company possibly affected by the planned work.

§ 16.3.2 The utility company should, upon receipt of notice, stake, mark or otherwise designate the location (and depth) of their lines, or temporarily move the line(s).

§ 16.3.3 The Contractor shall immediately report to the respective utility company any break or leak in its lines, or any dent, gouge, groove or other damage to the utility line or to its coating or cathodic protection made or discovered in the course of the Work.

§ 16.3.4 The Contractor shall immediately alert the Owner, Architect and occupants of nearby premises of any and all emergencies caused or discovered in the utility line(s) in the course of the Work.

ARTICLE 17 INSURANCE AND BONDS

§ 17.1 The Contractor shall purchase from, and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, insurance for protection from claims under workers' compensation acts and other employee benefit acts which are applicable, claims for damages because of bodily injury, including death, and claims for damages, other than to the Work itself, to property which may arise out of or result from the Contractor's operations and completed operations under the Contract, whether such operations be by the Contractor or by a Subcontractor or anyone directly or indirectly employed by any of them. This insurance shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater, and shall include contractual liability insurance applicable to the Contractor's obligations under Section 9.15. Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. The Contractor shall cause the commercial liability coverage required by the Contract Documents 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 during the Contractor's completed operations.

Type of Insurance	**Limit of liability ($0.00)**
Worker's Compensation	Statutory
Comprehensive General Liability	
a. Bodily Injury	$ 1,000,000 Each Person / $ 1,000,000 Each Occurrence
b. Personal Injury	$ 1,000,000 Aggregate / $ 1,000,000 General Aggregate
Automobile Liability	
a. Bodily Injury	$ 1,000,000 Each Person / $ 1,000,000 Each Occurrence

	b. Property Damage	$ 1,000,000 Each Occurrence
Independent Contractors		Same limits as preceding
Products and Complete Operations		Same limits as preceding for One (1) Year, commencing With issuance of final Certificate for Payment
Contractual Liability		Same limits as preceding

§ 17.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 17.3 PROPERTY INSURANCE

§ 17.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance on an "all-risk" or equivalent policy form, including builder's risk, in the amount of the initial Contract Sum, plus the value of subsequent modifications and cost of materials supplied and installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 15.5 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 17.3.1 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and sub-subcontractors in the Project. The term "temporary building", as used in this Section, shall not include job trailers of any party.

This policy will exclude any tools, equipment, scaffolding, glass breakage, etc., owned or rented by the Contractor or Subcontractors and material stored on the site but not incorporated into the Project. The Contractor shall be responsible for protecting all products until the date of Substantial Completion is established by the Architect/Engineer. The Contractor shall replace any Work if damaged before Substantial Completion. The Contractor may assume the risk itself or obtain insurance in amounts it deems sufficient.

§ 17.3.2 The Owner shall file a copy of each policy with the Contractor before an exposure to loss may occur. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

Superior to any other term in this Agreement, any reference in this document to "waiver of subrogation" or such similar term in this document is hereby deleted and shall be declared to no effect.

~~**§ 17.3.3** 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, and (2) the Architect, Architect's consultants, separate contractors described in Article 12, 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 covered by property insurance obtained pursuant to Section 17.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 12, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.~~

§ 17.3.4 A loss insured under the Owner's property insurance 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. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their sub-subcontractors in similar manner.

§ 17.4 PERFORMANCE BOND AND PAYMENT BOND

§ 17.4.1 The Owner ~~shall have the right to require~~ hereby requires the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder ~~as stipulated in bidding requirements or specifically required in the Contract Documents~~ each in the penal sum of 100% of the Contract Sum and in accordance with applicable law on the date of execution of the Contract.

§ 17.4.2 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.

§ 17.4.3 The Architect shall obtain copies of the Performance Bond and Payment Bond required by the Agreement from the Contractor prior to the Contractor beginning performance pursuant to the Agreement. The Contractor's obligation to provide such bonds shall not be waived in any fashion, including any failure to secure such bonds prior to the Contractor beginning performance pursuant to the Agreement.

ARTICLE 18 CORRECTION OF WORK

§ 18.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after 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, unless compensable under Section A.2.7.3 in Exhibit A, Determination of the Cost of the Work.

§ 18.2 In addition to the Contractor's obligations under Section 9.4, 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 15.4.3, or by terms of an 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 written 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.~~

§ 18.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 8.3.

§ 18.4 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.

§ 18.5 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Article 18.

ARTICLE 19 MISCELLANEOUS PROVISIONS

§ 19.1 ASSIGNMENT OF CONTRACT

Neither party to the Contract shall assign the Contract without written consent of the other, except that 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 such assignment.

§ 19.2 GOVERNING LAW

The Contract shall be governed by the law of the ~~place where the Project is located, except, that if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 21.4.~~State of Michigan.

§ 19.3 TESTS AND INSPECTIONS

Tests, inspections and approvals of portions of the Work required by the Contract Documents or by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and 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 (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating the costs to the Contractor.

§ 19.4 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement 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.~~ Project. For purposes of such statutory periods that are tied to use or acceptance of the Work, the parties intend that these periods are to begin upon Substantial Completion of the Project. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 19.4.

Regardless of any provisions to the contrary, the statute of limitations with respect to any defective or nonconforming Work which is not discovered by the Owner shall not commence until the discovery of such defective or nonconforming Work by the Owner.

§ 19.5 SURETY NOTICE AND PRIOR APPROVAL

Except where otherwise expressly required by the terms of the Agreement, the Contract Documents or the General Conditions, exercise by the Owner of any contractual or legal right or remedy without prior notice to or approval by the Contractor's surety shall in no way bar or prohibit the Owner's ability to pursue such right or remedy. Further, pursuit of such a right or remedy without prior notice to or approval of surety shall in no way compromise, limit or bar any claim by the Owner against a surety bond of the Contractor.

ARTICLE 20 TERMINATION OF THE CONTRACT

§ 20.1 TERMINATION BY THE CONTRACTOR

If the Architect fails to certify payment as provided in Section 15.2.1 for a period of 30 days through no fault of the Contractor, or if the Owner fails to make payment as provided in Section 4.1.3 for a period of 30 days, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 20.2 TERMINATION BY THE OWNER FOR CAUSE

§ 20.2.1 The Owner may terminate the Contract if the Contractor

- **.1** ~~repeatedly~~ refuses or fails to supply enough properly skilled workers or proper ~~materials;~~materials to the point of negatively impacting the Project and/or the related schedule;
- **.2** fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- **.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.~~Documents or;
- **.5** fails to prosecute the Work or any part thereof with promptness and diligence, fails to perform any provisions of this Agreement, goes into bankruptcy or liquidation, makes an assignment for the benefit of creditors, enters into a composition with its creditors or becomes insolvent.

§ 20.2.2 When any of the above reasons exists, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may, without prejudice to any other remedy the Owner may have and after giving the Contractor ~~seven~~ three days' written notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon 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.

§ 20.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 20.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 20.2.4 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 in pursuing termination and completion of the Work, including actual attorney and legal fees and costs, 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 Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 20.3 TERMINATION BY THE OWNER FOR CONVENIENCE

The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 21 CLAIMS AND DISPUTES

§ 21.1 Claims, disputes and other matters in question arising out of or relating to this Contract, including those alleging an error or omission by the Architect but excluding those arising under Section 16.2, shall be referred initially to the Architect for decision. Such matters, except those waived as provided for in Section 21.8 and Sections 15.5.3 and 15.5.4, shall, after initial decision by the Architect or 30 days after submission of the matter to the Architect, be subject to mediation as a condition precedent to binding dispute resolution. The Contractor shall not knowingly (as "knowingly" is defined in the Federal False Claims Act, 31 USC 3729, *et seq.*) present or cause to be presented a false or fraudulent claim. As a condition precedent to making a claim by the Contractor, the claim shall be accompanied by an affidavit sworn to before a notary public or other person authorized to administer oaths in the State of Michigan and executed by an authorized representative of the Contractor, which states that: "The claim which is submitted herewith complies with Section 21.1 of the Owner/Contractor Agreement, as amended, which provides that the Contractor shall not knowingly present or cause to be presented a false or fraudulent claim." Claims of the Contractor must be initiated by written notice to the Owner and to the Architect within twenty-one (21) days after occurrence of the event giving rise to such claim or within twenty-one (21) days after the claimant first recognizes the condition giving rise to the claim, whichever is later. A failure to timely raise such claims in accordance with the 21-day period stated in this section shall be an absolute bar against and waiver of pursuing such claims against the Owner. Claims of the Owner shall be governed by the relevant Michigan statutory limitations period.

§ 21.2 If a claim, dispute or other matter in question relates to or is the subject of a mechanic's lien, the party asserting such matter may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 21.3 The parties shall endeavor to resolve their disputes by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with their 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 this Agreement, and filed with the person or entity administering the mediation. The request may be made concurrently with the binding dispute resolution 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, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~

~~**§ 21.4** 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 the Construction Industry Arbitration Rules in effect on the date of this Agreement. 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 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.~~

§ 21.5 Either party, at its sole discretion, may consolidate ~~an arbitration conducted~~ a claim asserted under this Agreement with any other ~~arbitration~~ court action to which it is a party provided that ~~(1) the arbitration agreement governing the other arbitration permits consolidation; (2) the arbitrations~~ the actions 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).~~law.

~~**§ 21.6** Any party to an arbitration 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 a Claim not described in the written Consent.~~

~~**§ 21.7** 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.~~

§ 21.8 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor ~~and Owner waive claims against each other~~ waives claims against the Owner 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 20. Nothing contained in this Section 21.8 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

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

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
Phil Mikulski , Superintendent *(Printed name and title)*	*(Printed name and title)*

SECTION 22 0001

GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Division includes all labor, materials, equipment, tools, supervision, start-up services, Owner training, etc., including all incidental and related items, necessary to complete installation and successfully test and start up and operate the Plumbing systems indicated on the drawings, AND as described in each Section of Division 220000 Specifications.

B. All drawings and General Provisions of the Contract, including the General Conditions, Supplementary General Conditions, and Division 1 specification sections, apply to work of all Division 22 sections. The items in this section are not intended to supersede, but are supplementary to, the requirements set forth in other Divisions of the specifications.

C. The Contractor, and his Subcontractors and Suppliers, shall include in their bid all materials, labor, and equipment involved, in accordance with all local customs, codes, rules, regulations; and secure compliance of all parts of the Specifications and Drawings regardless of Sectional inclusion in these Specifications.

D. The Contractor shall be responsible for the complete and satisfactory accomplishment of all Work inclusive of whatever miscellaneous material and/or appurtenances are required to perfect the installation, and demonstrate that all plumbing systems will operate satisfactorily under normal operating conditions.

1.02 DRAWINGS

A. The drawings are diagrammatic and show the general location and arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit. The Contractor shall provide/install all plumbing systems, and associated equipment, complete and include all necessary offsets, fittings, and other components required due to interferences, space constraints, code requirements, etc. as required to provide a complete/functional system.

B. The general plumbing requirements are intended to augment the drawings and specifications. Should conflicts occur between the drawings and the specifications, the strictest provision shall govern. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the ARCHITECT and/or ENGINEER for resolution.

C. The Contractor shall examine the drawings of all other trades in order to verify the conditions governing the work on the job site. Arrange work accordingly, providing all piping, fittings, traps, valves and accessories as may be required to meet such conditions.

D. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the ARCHITECT and/or ENGINEER.

E. The architectural and structural drawings take precedence in all matters pertaining to the building structure, plumbing drawings in all matters pertaining to plumbing trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the ARCHITECT and/or ENGINEER for resolution.

1.03 COORDINATION OF WORK

A. The Contractor and his Subcontractors shall be responsible for all tasks applicable to their work in accordance with the Specifications, Drawings, and code requirements, and shall be responsible for coordinating locations and arrangements of their work to give best results with all

other relevant trades.

1. Coordinate all wall, roof, floor penetrations, equipment pads, etc. with architectural and structural trades.
2. Verify requirements of all equipment with shop drawing submittals prior to installation - notify Architect/Engineer of any conflicts between shop drawings and plans.
3. Verify clearance requirements of all electrical and mechanical equipment/systems prior to the installation of any new work. Plumbing equipment, piping, systems, etc. shall not interfere with electrical equipment spaces. Electrical conduit and equipment clearances shall not interfere with mechanical equipment spaces.

1.04 INSPECTION OF SITE AND PROJECT DOCUMENTATION

A. The CONTRACTOR shall visit the site and examine/verify the conditions under which the work must be conducted before submitting proposal. Examine the drawings and specifications of all other trades including Mechanical, Architectural, Structural and Electrical.

B. The submitting of a proposal implies that the CONTRACTOR has visited the site, examined all contract documents, and understands the conditions under which the work must be conducted.

C. The CONTRACTOR shall notify the ARCHITECT and/or ENGINEER, prior to submitting his bid via Request For Information (RFI), of any potential problems that he has identified during his inspection of the site or from the review of plans/specifications. RFIs must be submitted at least 5 working days prior to bid opening.

1.05 GENERAL SUPPORT REQUIREMENTS

A. Provide all necessary angle/brackets, hangers, or supplementary supporting steel as required for adequate support for all piping, ductwork, and equipment. Secure approval from Architect and/or Structural Engineer, in writing, before welding or bolting to steel framing or anchoring to concrete structure, or cutting/coring thru structural systems

B. Where piping or equipment is supported or suspended from concrete construction, provide approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

C. Install plumbing and mechanical piping systems with adequate anchors, guides, expansion loops, etc. as required to provide for piping expansion/contraction.

1.06 GUARANTEE

A. CONTRACTOR shall guarantee that all labor, materials, and equipment are free from defects and agrees to replace or repair any part of this installation which becomes defective within a period of one year from the date of substantial completion following final acceptance. Acceptance date of substantial completion shall be as determined by the ARCHITECT and/or ENGINEER.

B. The CONTRACTOR shall file with the OWNER any and all guarantees from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.07 CODES, PERMITS AND FEES

A. Refer to Division 1, General Conditions and Supplementary Conditions.

B. Unless otherwise indicated, all required permits, plan reviews, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the CONTRACTOR.

C. All work shall be executed in accordance with the latest enforceable rules and regulations set forth in local and state codes.

1. Mechanical and Plumbing systems shall be installed per current jurisdictional codes (Michigan Mechanical Code, Michigan Plumbing Code, International Fuel Gas Code, etc.), current NFPA codes (NFPA 101, NPFA 90, etc.), and applicable sections of the Michigan

Building Code.

D. In the event that the plans and specifications conflict with any rules, regulations, or codes applying, said rules, regulations and codes shall govern.

E. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

F. Contractor shall prepare any detailed drawings or diagrams which may be required by the governing authorities (i.e. fire protection plans, boiler room layouts, etc.).

1.08 UTILITIES

A. The CONTRACTOR shall be responsible for coordinating, obtaining service or changes to existing services, and advising the ENGINEER, and utility company(s) for the natural/propane gas service installations.

B. Rules of local utility companies shall be complied with. The CONTRACTOR shall check with each utility company supplying service to the installation (i.e. water, gas, sewer, storm, etc.) and coordinate service requirements including, but not limited to, all valves, meters, etc. which will be required.

C. In the event that the plans and specifications conflict with any utility rules, regulations, or codes applying, said utility rules, regulations and codes shall govern.

1.09 SUBSTITUTION ITEMS REQUIRING PRIOR APPROVAL

A. All items that the CONTRACTOR proposes to use in the work that are not specifically named in the contract documents must be submitted for review. Such items must be submitted to the ARCHITECT and/or ENGINEER for approval a minimum of ten (10) days prior to bid opening. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1.10 MATERIAL AND EQUIPMENT MANUFACTURERS

A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment of product provided shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Substitution Items Requiring Prior Approval specified in this Section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original bid.

C. All package unit skid mounted equipment that are factory assembled shall meet, in detail, the products named and specified within each section of the detailed mechanical and electrical specifications.

1.11 RECORD DRAWINGS

A. The CONTRACTOR shall keep accurate notes of all deviations from the construction documents and discrepancies of construction on field drawings as they occur. The marked up field documents shall be available for review by the ARCHITECT and/or ENGINEER, and OWNER at their request.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. Install equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the ARCHITECT and/or ENGINEER for resolution.

3.02 WORK INVOLVING OTHER TRADES

A. Certain items of equipment or materials specified in the Plumbing Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in his bid.

3.03 COORDINATION

A. Install work to avoid interference with work of other trades including, but not limited to, architectural and electrical trades. Remove and relocate any work that causes an interference at CONTRACTOR's expense. Disputes regarding the cause of an interference shall be resolved by the ARCHITECT and/or ENGINEER.

3.04 CHASE, SHAFTS AND RECESSES

A. Coordinate with structural, architectural and other trades to ensure accurate location and size of chases, shafts and recesses required for plumbing systems/piping.

3.05 SLEEVES

A. Provide and install Schedule 40 black steel pipe sleeves, cut to length, wherever pipes pass through above grade walls and floors. Provide and install galvanized steel pipe sleeves, cut to length, wherever pipes pass through below grade foundation walls and slab on grade floors. Sleeves shall terminate flush with walls in finished areas. All sleeves through the floor are to extend two (2) inches above finish floor.

B. Provide escutcheons at each penetration through walls, floors, and ceilings in exposed areas.

C. Patch sleeves to match building material.

3.06 SEALING OF PLUMBING OPENINGS

A. Seal the space around pipes and sleeves through walls, floors and ceilings.

B. Provide adequate clearance to allow for proper pipe movement and sealing.

C. Provide/install fireproof wall and floor sleeves as required by applicable building codes at all applicable wall, ceiling, and floor penetrations. Refer to Architectural plans for wall assembly ratings.

D. Sleeves placed in floors shall be flush with the underside of the floor construction and shall have planned, square ends, extending 2 inches above the finished floor, unless otherwise noted or detailed.

E. Where sleeves pass through reinforced concrete floors, they shall be properly set in position prior to concrete pouring in such a way that they will be maintained in position until the concrete is set.

F. Pipes passing through below grade perimeter walls or slabs on grade shall have the space between the pipe and sleeve sealed watertight with a mechanically expandable elastomer seal device.

G. Penetrations through fire rated floors and walls shall be firestopped in accordance with applicable building code requirements with UL and FMRC approved materials and shall have a fire rating equal to or greater than the fire partition rating. Refer to architectural plans for locations and assembly ratings.

1. Packing: Refractory fiber or ceramic fiber.
    a. Manufacturers:
        1) Carborundum Fiberfrax.
        2) Johns-Manville - Cerafelt.
        3) Eagle Picher Epitherm 1200.
        4) Babcock and Wilcox Kaowool.
2. Fire stop sealant.
    a. Manufacturers:
        1) Hilti
        2) Tremco
        3) Mameco
        4) Pecora
3. Where combustible pipes, tubes, vents, etc. penetrate a fire rated assembly, such penetrations shall be protected by an approved through-penetration fire stop collar/sealant system per the building code.
    a. Through -penetration firestop systems shall be tested in accordance with ASTM E814 with a minimum positive pressure differential of 0.01 inch WG. Through penetration firestop systems shall have a "F" rating and a "T" rating of not less than 1 hour but not less than the required rating of the assembly penetrated.
    b. Hilti CP 642 Firestop Collar.
    c. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
    d. 3M Fire Barrier PPD Plastic Pipe Device.
    e. 3M Fire Barrier Intumescent Firestop Sealant.

3.07 CUTTING, CORING AND PATCHING

A. Refer to General Conditions

B. The CONTRACTOR shall perform all cutting, coring, and patching that may be necessary for the installation of their Work. All cutting, coring, patching and repair work shall be performed by the CONTRACTOR through qualified Subcontractors. CONTRACTOR shall include full cost of same in his bid.

C. Secure approval form Architect and/or Structural Engineer, in writing, before cutting, welding/bolting to, or anchoring from any structural building components (i.e. structural steel, load bearing walls, footings/foundations, concrete floors/ceilings, etc.).

3.08 EQUIPMENT FOUNDATIONS AND SUPPORTS

A. For equipment suspended form ceiling or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of ARCHITECT and/or ENGINEER for same including loads, locations, and methods of attachment.

3.09 EQUIPMENT CONNECTIONS

A. Make connections to equipment, fixtures and other items included in the work in accordance with

the approved shop drawings and rough-in measurements furnished by the manufactures of the particular equipment furnished.

B. All piping connections to equipment shall be flanged or shall be made with unions to facilitate equipment removal.

C. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment.

D. Brass unions for connections of 2 inch and less and flanged union with dielectric gasket and bolt sleeves for 2-1/2 inch and greater shall be used for equipment connections of dissimilar metals.

3.10 ACCESSIBILITY

A. All equipment shall be installed so as to be readily accessible for operation, maintenance, and repair, as required by the equipment manufacturer and as subject to the approval of the ENGINEER.

3.11 CLEANING

A. Each trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.

B. After equipment and systems have been completed and tested, each entire system shall be cleaned and flushed.

C. Prior to connection of new piping to existing piping systems, all new piping shall be subject to initial flushing, cleaning and final flushing. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.

3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Electrical equipment furnished by Plumbing Trades and installed by Electrical Trades shall be turned over to Electrical Trades in good condition.

B. Equipment and materials shall be protected from theft, injury or damage.

C. Materials with enamel or glaze surface, shall be protected from damage by covering and/or coating as recommended in bulletin, "Handling and Care of Enameled Cast Iron Plumbing Fixtures," issued by the Plumbing Fixtures Manufacturers Association, and as approved.

D. Coat polished or plated metal parts with white petroleum jelly immediately after installation.

E. Protect equipment outlets, pipe openings with temporary plugs or caps.

F. Provide adequate storage for all equipment and materials delivered to the job site. Equipment set in place in unprotected areas must be provided with temporary protection.

3.13 GENERAL SUPPORT REQUIREMENTS

A. Each trade shall provide all required supporting components to properly support their work. Supporting components/systems shall be in accordance with Code and as specified.

B. Provide all necessary angle/brackets or supplementary steel as required for adequate support for all piping, ductwork, specialties, and equipment. Secure approval form ARCHITECT and/or Structural ENGINEER, in writing, before welding or bolting to steel framing or anchoring to concrete structure.

C. Where piping, specialties, or equipment is supported or suspended from concrete construction, provide approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

3.14 DRAWINGS AND MEASUREMENTS

A. These specifications and accompanying drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either the drawings or specifications shall be as binding as if call for by both. The work herein described shall be complete in every detail.

B. The Drawings are not intended to be scaled for rough-in measurements, nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor. The Contractor shall check latest architectural drawings to locate equipment/fixtures/etc., check latest structural drawings for interferences, etc..

3.15 PIPING SYSTEMS TESTING

A. Test backflow prevention at connections between potable water and non-potable water for proper functioning under normal operating conditions. Provide Owner with one (1) copy of the potable water backflow prevention test report.

B. Test drainage piping systems in accordance with their respective and applicable governing codes. Test drainage and waste piping hydraulically by filling the system to its highest point or at a static head of 10 feet, whichever is higher.

C. Pressure test plumbing piping (domestic cold water, domestic hot water, hot water recirculation, etc.) in accordance with governing and applicable codes. At minimum, test with water at 225 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

D. Pressure test natural gas and propane gas piping in accordance with governing and applicable codes. At minimum, test with air at 100 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

3.16 DEMOLITION WORK

A. All demolition of existing plumbing equipment and materials shall be done by the Contractor unless otherwise indicated. Included are all items such as, but not limited to, existing piping, pumps, supports and equipment where such items are not required for the proper operation of the modified system.

B. In general, demolition work is indicated on the drawings. However, the Contractor shall visit the job to determine the full extent and character of this work.

C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner shall move and store these materials. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of, away from the premises.

D. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

E. Clean and flush the interior and exterior of all existing relocated equipment and its related piping, valves, and accessories that are to be reused of all mud, debris, pipe dope, oils, welding slag, loose mill scale, rust and other extraneous material so that the existing equipment and all accessories can be repainted and repaired as required to place in first-class working condition.

F. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling or at mains.

3.17 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once work is

started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed work. Promptly repair any damage to same at Contractor's expense.

C. Consult with the ARCHITECT and/or ENGINEER as to the methods of carrying on the work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Architect and/or Owner's Representative.

3.18 EXTRA WORK

A. For any extra work which may be proposed, the Contractor shall furnish to the General Contractor/Construction Manager, an itemized breakdown of the estimated cost of all materials and labor required to complete this work. The estimate cost breakdown shall include unit prices (same prices for increase/decrease of work) for all materials (i.e. duct, piping, valves, equipment, equipment rental, etc.) and all labor (i.e. manhours, overtime, etc.) which may be required for any proposed extra work. The Contractor shall not proceed until receiving a written order from the General Contractor establishing the agreed price and describing the work to be done.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corp.

B. Champion-America, Inc.

C. Seton Identification Products.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: Conform to ANSI/ASME A13.1, unless specified otherwise.
2. Letter Height: 1/2 to 1 inch to suit the size of equipment being labeled.
3. Background Color: Conform to ANSI/ASME A13.1, unless specified otherwise.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify plumbing equipment (i.e. pumps, boilers, tanks, etc.) with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Tag automatic controls, instruments, and relays. Key to control schematic.

I. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and unique pressure or temperature if necessary to distinguish between other systems. 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. Arrows and markers shall be mounted to provide unobstructed visibility from floor level.

END OF SECTION

SECTION 22 1005

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

1. Sanitary sewer.
2. Domestic water.
3. Gas.

1.02 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers (ANSI B16.18).

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.

E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers.

F. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.1).

G. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.9).

H. ASME (BPV IV) - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; The American Society of Mechanical Engineers.

I. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

J. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

K. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

L. ASTM B 32 - Standard Specification for Solder Metal.

M. ASTM B 88 - Standard Specification for Seamless Copper Water Tube.

N. ASTM B 88M - Standard Specification for Seamless Copper Water Tube (Metric).

O. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

P. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

Q. AWWA C651 - Disinfecting Water Mains; American Water Works Association (ANSI/AWWA C651).

R. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute.

S. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe

and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute.

T. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements.

U. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.

V. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.

W. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

Y. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

Z. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

AA. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

1.03 SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of Michigan, standards.

B. Valves: Bear UL and FMRC label or marking. Manufacturer's name and pressure rating marked on valve body.

C. Solder containing lead may not be used for any systems.

D. Test drainage piping systems in accordance with their respective and applicable governing codes. Test drainage and waste piping hydraulically by filling the system to its highest point or at a static head of 10 feet, whichever is higher.

E. Pressure test plumbing piping (domestic cold water, domestic hot water, hot water recirculation, etc.) in accordance with governing and applicable codes. At minimum, test with water at 225 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

F. Pressure test natural gas/propane gas piping, compressed air piping, vacuum air piping, in accordance with governing and applicable codes. At minimum, test with air at 100 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State and local plumbing and mechanical codes.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY WASTE AND VENT PIPING (SAN, V), ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.02 DOMESTIC HOT WATER (HW), DOMESTIC COLD WATER (CW), AND DOMESTIC HOT WATER RETURN (HWR) PIPING, ABOVE GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B 32, solder, Grade 95TA. Solder containing lead will not be permitted.

B. Minimum System Pressure Rating: 125 psig.

C. Isolation Valves: Gate or ball valves for sizes 2 inch and smaller.

2.03 NATURAL GAS PIPING (G), ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.

2. Joints: NFPA 54, threaded or welded to ASME B31.1.

B. Isolation Valves: AGA approved and UL listed ball valves for sizes 3 inch and smaller and UL listed lubricated plug valves for sizes 4 inches and larger.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2-1/2 inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 2-1/2 inches:

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

a. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 (or approved equal).

2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union or waterway fitting with galvanized or plated steel threaded end, grooved end, copper solder end, water impervious isolation barrier. Victaulic Style 47 (or approved equal).

2.05 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to MSS SP-58.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

B. Plumbing Piping - Water:

1. Conform to MSS SP-58.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
8. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
9. Vertical Support: Steel riser clamp.
10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
12. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

2.06 GATE VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.
2. Nibco, Inc.: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 3 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.

C. 3-1/2 inches and Larger:

1. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.07 BALL VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.
2. Nibco, Inc.: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction, 2 Inches and Smaller: 300 psi CWP, forged brass two piece body, chrome plated brass ball and stem, regular port, TFE seats and seals, blow-out proof stem, lever handle.

C. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

D. Ball valves for natural gas service shall be UL labeled for such service.

2.08 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Amtrol Inc.: www.amtrol.com.
2. Cla-Val Co: www.cla-val.com.
3. Watts Regulator Company: www.wattsregulator.com.

B. Up to 2 Inches:

1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:

1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.09 PIPING TRANSITIONS

A. Manufacturers:

1. Can-Tex Industries Div. of Harsco Corp.; Model CT-Adapters:
2. Fernco Joint Sealer Co.; Model PVC Donut
3. Joint, Inc.; Model Caulder.

B. Provide transitions for jointing two different types of pipe materials such as cast iron, clay, steel, plastic, or copper. Fabricate transitions with bushings capable of resisting normal moisture corrosion.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide support for utility meters in accordance with requirements of utility companies.

I. Install bell and spigot pipe with bell end upstream.

J. Install valves with stems upright or horizontal, not inverted.

K. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

L. Install water piping to ASME B31.9.

M. Gas piping shall be painted per mechanical and building code requirements.

N. Sleeve pipes passing through partitions, walls and floors.

O. Pipe Hangers and Supports:

1. Install in accordance with MSS SP-89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

1. Unions are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope, for pipes 3 inches - 6 inches in diameter. Pipes smaller than 3 inches in diameter shall drain at minimum 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators, or on existing systems provide changes to existing gas service as needed to accommodate the gas service load/pressure changes.

3.08 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe size: 1/2 inches to 1-1/4 inches:

1) Maximum hanger spacing: 6.5 ft.

2) Hanger rod diameter: 3/8 inches.

b. Pipe size: 1-1/2 inches to 2 inches:

1) Maximum hanger spacing: 10 ft.

2) Hanger rod diameter: 3/8 inch.

c. Pipe size: 2-1/2 inches to 3 inches:

1) Maximum hanger spacing: 10 ft.

2) Hanger rod diameter: 1/2 inch.

d. Pipe size: 4 inches to 6 inches:

1) Maximum hanger spacing: 10 ft.

2) Hanger rod diameter: 5/8 inch.

END OF SECTION

SECTION 23 0001

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Division includes all labor, materials, equipment, tools, supervision, start-up services, Owner training, etc., including all incidental and related items, necessary to complete installation and successfully test and start up and operate the mechanical systems indicated on the drawings, AND as described in each Section of Division 230000 Specifications.

B. All drawings and General Provisions of the Contract, including the General Conditions, Supplementary General Conditions, and Division 1 specification sections, apply to work of all Division 230000 sections. The items in this section are not intended to supersede, but are supplementary to, the requirements set forth in other Divisions of the specifications.

C. The Contractor, and his Subcontractors and Suppliers, shall include in their bid all materials, labor, and equipment involved, in accordance with all local customs, codes, rules, regulations; and secure compliance of all parts of the Specifications and Drawings regardless of Sectional inclusion in these Specifications.

D. The Contractor shall be held responsible for the complete and satisfactory accomplishment of all Work inclusive of whatever miscellaneous material and/or appurtenances are required to perfect the installation, and demonstrate that all mechanical systems will operate satisfactorily under normal operating conditions.

1.02 DRAWINGS

A. The drawings are diagrammatic and show the general location and arrangement of equipment, piping, ductwork and related items. They shall be followed as closely as elements of the construction will permit. The Contractor shall provide/install all mechanical systems, and associated equipment, complete and include all necessary offsets, fittings, and other components required due to interferences, space constraints, code requirements, etc. as required to provide a complete/functional system.

B. The general mechanical requirements are intended to augment the drawings and specifications. Should conflicts occur between the drawings and the specifications, the strictest provision shall govern. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect and/or Engineer for resolution.

C. The Contractor shall examine the drawings of all other trades in order to verify the conditions governing the work on the job site. Arrange work accordingly, providing all ductwork, piping, fittings, traps, valves and accessories as may be required to meet such conditions.

D. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect and/or Engineer.

E. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect and/or Engineer for resolution.

1.03 COORDINATION OF WORK

A. The Contractor shall verify clearance requirements of all electrical and mechanical equipment/systems prior to the installation of any new work. Mechanical equipment, piping, ductwork, systems, etc. shall not interfere with mechanical equipment spaces or electrical

clearances.

B. The Contractor and his Subcontractors shall be responsible for all tasks applicable to their work in accordance with the Specifications, Drawings, and code requirements, and shall be responsible for coordinating locations and arrangements of their work to give best results with all other relevant trades.

1. Coordinate all wall, roof, floor penetrations, equipment pads, equipment locations, system routings, etc. with architectural and structural trades.
2. Verify requirements of all equipment with shop drawing submittals prior to installation - notify Architect and/or Engineer of any conflicts between shop drawings and plans.
3. Verify clearance requirements of all electrical and mechanical equipment/systems prior to the installation of any new work. Mechanical equipment, piping, ductwork, systems, etc. shall not interfere with electrical equipment spaces. Electrical conduit and equipment clearances shall not interfere with mechanical equipment spaces.

1.04 INSPECTION OF SITE AND PROJECT DOCUMENTATION

A. The Contractor shall visit the site and examine/verify the conditions under which the work must be conducted before submitting proposal. The Contractor shall examine the drawings and specifications of all other trades including Mechanical, Architectural, Structural and Electrical.

B. The submitting of a proposal implies that the Contractor has visited the site, examined all contract documents, and understands the conditions under which the work must be conducted.

C. The Contractor shall notify the Architect and/or Engineer, prior to submitting his bid via Request For Information (RFI), of any potential problems that he has identified during his inspection of the site or from the review of plans/specifications. RFIs must be submitted at least 5 working days prior to bid opening.

1.05 GENERAL SUPPORT REQUIREMENTS

A. Provide all necessary angle/brackets, hangers, or supplementary supporting steel as required for adequate support for all piping, ductwork, and equipment. Secure approval form Architect and/or Structural Engineer, in writing, before welding or bolting to steel framing or anchoring to concrete structure, or cutting/coring thru structural systems.

B. Where piping, ductwork, or equipment is supported or suspended from concrete construction, provide approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

C. Install mechanical piping systems with adequate anchors, guides, expansion loops, etc. as required to provide for piping expansion/contraction.

1.06 GUARANTEE

A. Contractor shall guarantee that all labor, materials, and equipment are free from defects and agrees to replace or repair any part of this installation which becomes defective within a period of one year from the date of substantial completion following final acceptance. Acceptance date of substantial completion shall be as determined by the Architect and/or Engineer.

B. The Contractor shall file with the Owner any and all guarantees from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.07 CODES, PERMITS AND FEES

A. Refer to Division 1, General Conditions and Supplementary Conditions.

B. Unless otherwise indicated, all required permits, plan reviews, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the Contractor.

C. All work shall be executed in accordance with the most current rules and regulations set forth in local and state codes.

1. Mechanical and Plumbing systems shall be installed per current jurisdictional codes (Michigan Mechanical Code, Michigan Plumbing Code, International Fuel Gas Code, Michigan Building Code, etc.), current NFPA codes (NFPA 101, NPFA 90, etc.), and applicable sections of the Michigan Building Code.

D. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern. In the event that the plans and specifications conflict with any rules, regulations, or codes applying, said rules, regulations and codes shall govern.

E. Contractor shall prepare any detailed drawings or diagrams which may be required by the governing authorities (i.e. boiler room layouts, etc.).

1.08 SUBSTITUTION ITEMS REQUIRING PRIOR APPROVAL

A. All items that the Contractor proposed to use in the work that are not specifically named in the contract documents must be submitted for review. Such items must be submitted in duplicate to the Architect and/or Engineer for approval a minimum of ten (10) days prior to bid opening. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1.09 MATERIAL AND EQUIPMENT MANUFACTURERS

A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment of product provided shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Substitution Items Requiring Prior Approval specified in this Section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original bid.

C. All package unit skid mounted equipment that are factory assembled shall meet, in detail, the products named and specified within each section of the detailed mechanical and electrical Specifications.

1.10 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

A. Provide compete maintenance and operating instructional manuals covering all mechanical equipment as specified herein, Division 1 requirements, and individual equipment specification sections.

B. The O&M data shall be bound in a suitable number of 3" or 4", 3-ring, hard cover binders. Permanently imprinted on the cover shall be the words, "Manufacturer's Operation and Maintenance Data", project title, location of project, and the date. A table of contents shall be provided in the front of each binder.

C. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Each piece of equipment in the O&M manual shall be identified as identified on the project drawings (i.e. Boiler B-1, Heating Pump P-1, etc.).

D. Internally subdivide the binder contents with permanent page dividers, organized by specification section and/or major equipment/systems (i.e. Boilers, Hydronic Specialties, Pumps, etc.)

E. Contents: Each volume of O&M manual shall have three parts:

1. Part 1: A directory listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: O&M data, arranged and subdivided by major equipment/systems. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers:

   a. List of equipment.

   b. Copies of Shop drawings and product data, approved by Architect/Engineer.

   c. Installation and operational procedures.

   d. Routine maintenance procedures.

   e. Trouble shooting procedures.

   f. Complete parts lists by nomenclature, manufacturer's part number and use.

   g. Recommended spare parts lists.

   h. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.

   i. Complete wiring and schematic diagrams.

   j. Elevations and/or sections cut through all of the major equipment and sub-assemblies.

   k. At the end of each section, a maintenance schedule shall be provided for each piece of equipment. The schedule shall display the daily, weekly, monthly, semi-annual, and annual lubrication and preventative maintenance required in order to meet warranty conditions and the manufacturer's recommendations for optimal performance and life of the equipment.

3. Part 3: Project documents and certificates, including the following:

   a. Testing, Adjusting, and Balance Reports (approved by Engineer).

   b. Warranty Certificates.

   c. Copies of approved construction permits.

F. Maintenance and Operating manuals shall be provided to the Architect and/or Engineer for review when construction is 75% complete.

G. A minimum of two (2) copies of all approved Operation and Maintenance literature shall be furnished to the Owner within 10 days after final inspection. O&M manuals must be completed prior to start of Owner training as the manuals shall be used as the basis of the training.

1.11 SHOP DRAWINGS/SUBMITTALS

A. Refer to General Conditions and Supplementary General Conditions.

B. All shop drawings shall be submitted in groupings of similar and/or related items. Incomplete submittal groupings will be returned unchecked.

C. Unless noted otherwise, submit digital (.pdf format) copies of complete manufacturer's shop drawings for all equipment, valves, plumbing and heating specialties, refrigeration specialties, pipe hangers, wiring diagrams and control diagrams including, but not limited to the items listed below. Where items are referred to by symbolic designation on the drawings and specifications, all submittals shall bear the same designation. Refer to other Sections of the mechanical specifications for additional requirements.

   1) 23 0516 Expansion Fittings and Loops for HVAC Piping

2) 23 0519 Meters and Gages for HVAC Piping

3) 23 0593 Testing, Adjusting, and Balancing For HVAC

4) 23 0719 HVAC Piping Insulation

5) 23 2114 Hydronic Specialties

6) 23 2123 Hydronic Pumps

7) 23 2500 HVAC Water Treatment

8) 23 5216 Modulating Condensing Boilers

1.12 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection the Contractor shall instruct Owner's designated personnel in operation, adjustment and maintenance of mechanical equipment and systems at agreed upon times.

B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

C. Use Operation and Maintenance Manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

E. Training shall be provided by factory authorized/trained representatives familiar with the startup and training on the equipment.

1.13 RECORD DRAWINGS

A. Contractor shall submit to the Architect and/or Engineer, record drawings which have been neatly marked to represent as-built conditions for all new mechanical work.

B. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect and/or Engineer, and Owner at their request.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. Install equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect and/or Engineer for resolution.

3.02 WORK INVOLVING OTHER TRADES

A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in his bid.

3.03 LUBRICATION

A. Provide all lubrication for the operation of the mechanical equipment until acceptance by the Owner. Contractor shall be responsible for all damage to bearings up to the date of acceptance

of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

3.04 COORDINATION

A. Install work to avoid interference with work of other trades including, but not limited to, architectural and electrical trades. Remove and relocate any work that causes an interference at Contractor's expense. Disputes regarding the cause of an interference shall be resolved by the Architect and/or Engineer.

3.05 SLEEVES

A. Provide and install Schedule 40 black steel pipe sleeves, cut to length, wherever pipes pass through above grade walls and floors. Provide and install galvanized steel pipe sleeves, cut to length, wherever pipes pass through below grade foundation walls and slab on grade floors. Sleeves shall terminate flush with walls in finished areas. All sleeves through the floor are to extend two (2) inches above finish floor.

B. Provide escutcheons at each penetration through walls, floors, and ceilings in exposed areas.

C. Patch sleeves to match building material.

3.06 SEALING OF MECHANICAL OPENINGS

A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings.

B. Provide adequate clearance to allow for proper duct/pipe movement and sealing.

C. Provide/install fireproof wall and floor sleeves as required by applicable building codes at all applicable wall, ceiling, and floor penetrations. Refer to Architectural plans for wall assembly ratings.

D. Sleeves placed in floors shall be flush with the underside of the floor construction and shall have planed, square ends, extending 2 inches above the finished floor, unless otherwise noted or detailed.

E. Where sleeves pass through reinforced concrete floors, they shall be properly set in position prior to concrete pouring in such a way that they will be maintained in position until the concrete is set.

F. Ducts and pipes passing through below grade perimeter walls or slabs on grade shall have the space between the duct/pipe and sleeve sealed watertight with a mechanically expandable elastomer seal device.

G. Penetrations through fire rated floors and walls shall be firestopped in accordance with applicable building code requirements with UL and FMRC approved materials and shall have a fire rating equal to or greater than the fire partition rating. Refer to architectural plans for locations and assembly ratings.

1. Packing: Refractory fiber or ceramic fiber.
    a. Manufacturers:
        1) Carborundum Fiberfrax.
        2) Johns-Manville - Cerafelt.
        3) Eagle Picher Epitherm 1200.
        4) Babcock and Wilcox Kaowool.
2. Fire stop sealant.
    a. Manufacturers:

1) Hilti
2) Tremco
3) Mameco
4) Pecora

3. Where combustible pipes, tubes, vents, etc. penetrate a fire rated assembly, such penetrations shall be protected by an approved through-penetration fire stop collar/sealant system per the building code.
   a. Through -penetration firestop systems shall be tested in accordance with ASTM E814 with a minimum positive pressure differential of 0.01 inch WG. Through penetration firestop systems shall have a "F" rating and a "T" rating of not less than 1 hour but not less than the required rating of the assembly penetrated.
   b. Hilti CP 642 Firestop Collar.
   c. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
   d. 3M Fire Barrier PPD Plastic Pipe Device.
   e. 3M Fire Barrier Intumescent Firestop Sealant.

3.07 CUTTING, CORING AND PATCHING

A. Refer to General Conditions.

B. Unless specifically noted otherwise, the Contractor shall perform all cutting, coring, and patching that may be necessary for the installation of their Work. All cutting, coring, patching and repair work shall be performed by the Contractor through qualified Subcontractors. Contractor shall include full cost of same in his bid.

C. Secure approval form Architect and/or Structural Engineer, in writing, before cutting, welding/bolting to, or anchoring from any structural building components (i.e. structural steel, load bearing walls, footings/foundations, concrete floors/ceilings, etc.).

3.08 EQUIPMENT FOUNDATIONS AND SUPPORTS

A. Shall be as required or as shown on plans or specified.

B. Provide concrete housekeeping pads for all floor mounted mechanical equipment (i.e. pumps, boilers, etc.). Concrete housekeeping pads shall be installed by qualified concrete trade subcontractors. Concrete housekeeping pads shall be poured before equipment is installed, minimum 4" tall, with anchor bolts and sleeves to fit machine base. Contractor shall include full cost of concrete housekeeping pads in his bid.

C. Coordinate concrete housekeeping pads to insure correct size, location, anchor bolts and sleeves.

D. For equipment suspended form ceiling or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect and/or Structural Engineer for same including loads, locations, and methods of attachment.

3.09 EQUIPMENT CONNECTIONS

A. Make connections to equipment, fixtures and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufactures of the particular equipment furnished.

B. All piping connections to equipment shall be flanged or shall be made with unions to facilitate equipment removal.

C. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment.

D. Brass unions for connections of 2 inch and less and flanged union with dielectric gasket and bolt sleeves for 2-1/2 inch and greater shall be used for equipment connections of dissimilar metals.

E. All ductwork connections to air handling equipment shall be made with flexible duct connectors.

3.10 ACCESSIBILITY

A. All equipment shall be installed so as to be readily accessible for operation, maintenance, and repair, as required by the equipment manufacturer and as subject to the approval of the Engineer.

3.11 CLEANING

A. Each trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.

B. After equipment, ductwork, piping systems have been completed and tested, each entire system shall be cleaned and flushed.

C. Prior to connection of new piping to existing piping systems, all new piping shall be subject to initial flushing, cleaning and final flushing. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.

3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Electrical equipment furnished by Mechanical Trades and installed by Electrical Trades shall be turned over to Electrical Trades in good condition.

B. Equipment and materials shall be protected from theft, injury or damage.

C. Materials with enamel or glaze surface, shall be protected from damage by covering and/or coating as recommended in bulletin, "Handling and Care of Enameled Cast Iron Plumbing Fixtures," issued by the Plumbing Fixtures Manufacturers Association, and as approved.

D. Coat polished or plated metal parts with white petroleum jelly immediately after installation.

E. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.

F. Provide adequate storage for all equipment and materials delivered to the job site. Equipment set in place in unprotected areas must be provided with temporary protection.

3.13 GENERAL SUPPORT REQUIREMENTS

A. Each mechanical trade shall provide all required supporting components to properly support their work. Supporting components/systems shall be in accordance with Code and as specified.

B. Provide all necessary angle/brackets or supplementary steel as required for adequate support for all piping, ductwork, specialties, and equipment. Secure approval form Architect and/or Engineer, in writing, before welding or bolting to steel framing or anchoring to concrete structure.

C. Where piping, ductwork, specialties, or equipment is supported or suspended from concrete construction, provide approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

3.14 PIPING SYSTEMS TESTING

A. Test backflow prevention at connections between potable water and nonpotable water for proper functioning under normal operating conditions. Provide Owner with one (1) copy of the potable water backflow prevention test report.

B. Pressure test hydronic piping (i.e. heating water, etc.) in accordance with governing and applicable codes. At minimum, test with water at 225 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

C. Pressure test natural gas and propane gas piping in accordance with governing and applicable codes. At minimum, test with air at 100 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

3.15 DRAWINGS AND MEASUREMENTS

A. These specifications and accompanying drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either the drawings or specifications shall be as binding as if call for by both. The work herein described shall be complete in every detail.

B. The Drawings are not intended to be scaled for rough-in measurements, nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor. The Contractor shall check latest architectural drawings to locate equipment/fixtures/etc., check latest structural drawings for interferences, etc..

3.16 EXTRA WORK

A. For any extra work which may be proposed, the Contractor shall furnish to the General Contractor/Construction Manager, an itemized breakdown of the estimated cost of all materials and labor required to complete this work. The estimate cost breakdown shall include unit prices (same prices for increase/decrease of work) for all materials (i.e. duct, piping, valves, equipment, equipment rental, etc.) and all labor (i.e. manhours, overtime, etc.) which may be required for any proposed extra work. The Contractor shall not proceed until receiving a written order from the General Contractor establishing the agreed price and describing the work to be done.

3.17 DEMOLITION WORK

A. All demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Included are all items such as, but not limited to, existing piping, pumps, ductwork, supports and equipment where such items are not required for the proper operation of the modified system.

B. In general, demolition work is indicated on the drawings. However, the Contractor shall visit the job to determine the full extent and character of this work.

C. The Contractor shall review all other contract documents (i.e. architectural plans, electrical plans, etc.) to review the extent of demolition and remodeling work.

D. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner shall move and store these materials. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of, away from the premises.

E. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

F. Clean and flush the interior and exterior of all existing relocated equipment and its related piping, valves, and accessories that are to be reused of all mud, debris, pipe dope, oils, welding slag, loose mill scale, rust and other extraneous material so that the existing equipment and all accessories can be repainted and repaired as required to place in first-class working condition.

G. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling or at mains.

H. Provide sheet metal caps on ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation. Caps shall be of same material as service requiring such.

3.18 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed work. Promptly repair any damage to same at Contractor's expense.

C. Consult with the Architect and/or Engineer as to the methods of carrying on the work so as not to interfere with the Owner’s operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Architect and/or Owner's Representative.

END OF SECTION

SECTION 23 0516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

1.02 SUBMITTALS

A. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

B. Design Data: Indicate selection calculations.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Maintenance Data: Include adjustment instructions.

1.03 REGULATORY REQUIREMENTS

A. Conform to UL requirements.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTIONS

A. FLEXIBLE PIPE CONNECTORS

1. Provide flexible pipe connectors at the inlet and outlet water connections to all vibration isolated equipment (i.e. base mounted pumps, etc.).

a. For water service:

1) Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable.

2) Sizes 2" and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16" to 24" may be single sphere.

3) Sizes 3/4" to 1 ½" may have threaded one piece bolted flange assemblies, one sphere and cable retention.

4) Connectors shall be rated at 250 psi up to 170 degrees F with a uniform drop in allowable pressure to 215 psi at 250 degrees F in sizes through 14". 16" through 24" single sphere minimum ratings are 180 psi at 170 degrees F and 150 psi at 250 degrees F. Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1.

5) Concentric reducers to the above ratings may be substituted for equal ended

expansion joints.

6) Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods.

7) If control rods are used, they must have ½" thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi maximum on the washer area.

8) Submittals shall include two test reports by independent consultants showing minimum reductions of 20 dB in vibration accelerations and 10 dB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.

b. Manufacturers:

1) SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

2) Metraflex

3) Flexhose

B. FLEXIBLE PIPE CONNECTORS - STEEL PIPING

1. Manufacturers:

a. Mercer Rubber Company: www.mercer-rubber.com.

b. Metraflex Company: www.metraflex.com.

c. Flexhose.

2. Inner Hose: Stainless Steel.

3. Exterior Sleeve: Double braided, stainless steel.

4. Pressure Rating: 200 psi and 250 degrees F.

5. Joint: Flanged.

6. Size: Use pipe sized units.

7. Maximum offset: 1 inch on each side of installed center line.

C. FLEXIBLE PIPE CONNECTORS - COPPER PIPING

1. Manufacturer:

a. Mercer Rubber Company: www.mercer-rubber.com.

b. Metraflex Company: www.metraflex.com.

2. Inner Hose: Bronze.

3. Exterior Sleeve: Braided bronze.

4. Pressure Rating: 200 psi and 250 degrees F.

5. Joint: Threaded with Union.

6. Size: Use pipe sized units.

7. Maximum offset: 1 inch on each side of installed center line.

8. Application: Copper piping.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to pumps and to vibration isolated equipment. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

END OF SECTION

SECTION 23 0519

METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

C. Static pressure gages.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers.

B. ASTM E 1 - Standard Specification for ASTM Thermometers.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories Inc..

1.03 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

B. Project Record Documents: Record actual locations of components and instrumentation.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Manufacturers:

1. Dwyer Instruments, Inc.: www.dwyer-inst.com.
2. Moeller Instrument Co., Inc.: www.moellerinstrument.com.
3. Omega Engineering, Inc.: www.omega.com.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.02 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc.: www.dwyer-inst.com.
2. Omega Engineering, Inc.: www.omega.com.

3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E 77.
5. Calibration: Degrees F.

2.03 DIAL THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc.: www.dwyer-inst.com.
2. Omega Engineering, Inc.: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B. Thermometer: ASTM E 1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.

1. Size: 5 inch diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.05 TEST PLUGS

A. Manufacturers:

1. Peterson Equipment Company - Pete's Plug.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

C. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage.

Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Pipe Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags. Key to control schematic.
B. Control Panels: Nameplates.
C. Heat Transfer Equipment: Nameplates.
D. Instrumentation: Tags.
E. Major Control Components: Nameplates.
F. Piping: Pipe markers.
G. Pumps: Nameplates.
H. Small-sized Equipment: Tags.
I. Tanks: Nameplates.
J. Valves: Tags.

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.
B. Champion America, Inc.: www.Champion-America.com.
C. Seton Identification Products: www.seton.com/aec.

2.03 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: Conform to ANSI/ASME A13.1, unless specified otherwise.
   2. Letter Height: 1/2 inch.
   3. Background Color: Conform to ANSI/ASME A13.1, unless specified otherwise.

2.04 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.05 PIPE MARKERS

A. Color: Conform to ASME A13.1.
B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Verify Owner's existing identification standard and provide new identification to match.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic pipe markers in accordance with manufacturer's instructions.
D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
E. Identify mechanical equipment (i.e. boilers, pumps, heat transfer equipment, etc.) with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
F. Identify control panels and major control components outside panels with plastic nameplates.
G. Identify valves in main and branch piping with tags.
H. Identify air terminal units and radiator valves with numbered tags.
I. Tag automatic controls, instruments, and relays. Key to control schematic.
J. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and unique pressure or temperature if necessary to distinguish between other systems. 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. Arrows and markers shall be mounted to provide unobstructed visibility from floor level.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of hydronic and refrigerating systems.

1.02 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

1.03 SUBMITTALS

A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Sample Report Forms: Submit two sets of sample TAB report forms.

C. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for ENGINEER and for inclusion in operating and maintenance manuals.
3. Provide reports in .pdf format, complete with cover identification and TOC/Index. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Units of Measure: Report data in I-P (inch-pound) units only.
6. Test Reports: Indicate data on AABC MN-1 forms, NEBB forms, or forms containing information indicated in Schedules.
7. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.

f. Project Engineer.

g. Project CONTRACTOR.

h. Project altitude.

i. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.
2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
3. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of five years documented experience.
3. Certified by one of the following:
   a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
4. And/Or one of the following Pre-Qualified TAB Agencies.

D. Pre-Qualified TAB Agencies:

1. Integrity Test & Balance, Inc.: 10381 E. Cherry Bend Rd. #A, Traverse City, MI 49684, (231-929-0940) - Contact Kevin Heikkila (cell: 231-499-5666)..
2. International Test & Balance Inc.: Southfield, MI (248-559-5864).
3. Hi-Tech Test & Balance: Freeland, MI (989-695-5498).
4. Northern Test and Balance: Traverse City, MI (231-492-5900).

3.02 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

B. The mechanical contractor shall provide to the TAB sub-contractor all shop drawings, submittal data, up-to-date revisions, change orders, bulletins, and other data required for the planning, preparation, and execution of the TAB work.

C. The mechanical contractor shall provide startup personnel to assist the TAB sub-contractor in testing, adjusting, and balancing work.

D. If testing, adjusting, and balancing of a mechanical system cannot take place due to seasonal weather, all parties involved (i.e. mechanical contractor and test/balance agency) shall return to the site during season required to properly test, adjust and balance the equipment. An example of this would be a heating system installed and tested in the cooling season (summer). Due to

the fact that there may not be enough heating load required to properly test and balance the heating systems, all parties shall return to the site the following heating season (winter) to test, adjust, and balance the heating system.

E. All test points, balance valves, mechanical identification, etc. shall be complete and accessible to the TAB sub-contractor.

3.03 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters/strainers are clean and in place. If required, install temporary media in addition to final filters/strainers.
5. Hydronic systems are flushed, filled, and vented.
6. Pumps are rotating correctly.
7. Proper strainer baskets are clean and in place.
8. Service and balance valves are open.

B. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

C. Examine system and equipment test reports.

D. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

E. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine equipment for installation and for properly operating safety interlocks and controls.

G. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

H. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

I. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.

3.04 PREPARATION

A. Hold a pre-balancing meeting 2 weeks prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

3.05 ADJUSTMENT TOLERANCES

A. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.06 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the OWNER.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

E. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE

A. Test, adjust, and balance the following:

1. HVAC Pumps
2. Boilers

3.09 MINIMUM DATA TO BE REPORTED

A. Items:

1. Electric Motors:
    a. Manufacturer
    b. Model/Frame
    c. HP/BHP
    d. Phase, voltage, amperage; nameplate, actual, no load
    e. RPM
    f. Service factor
    g. Starter size, rating, heater elements
    h. Sheave Make/Size/Bore
2. Pumps:
    a. Identification/number
    b. Manufacturer

c. Size/model
d. Impeller
e. Service
f. Design flow rate, pressure drop, BHP
g. Actual flow rate, pressure drop, BHP
h. Discharge pressure
i. Suction pressure
j. Total operating head pressure
k. Shut off, discharge and suction pressures
l. Shut off, total head pressure

3. Boilers:
   a. Identification/number
   b. Manufacturer
   c. Water flow, design and actual
   d. Water pressure drop, design and actual
   e. Entering water temperature, design and actual
   f. Leaving water temperature, design and actual

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Insulation jackets.

1.02 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

C. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

D. ASTM C 449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

E. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

F. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

G. ASTM C 534/C 534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

H. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation.

I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than 10 years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 10 years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Store insulation in original wrapping and protect from weather, dirt, chemicals, and damage.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.07 INSULATION OF EXISTING SYSTEMS

A. On renovation/addition projects where existing piping systems are being modified the existing piping systems shall be reinsulated as required to maintain sealed insulation/vapor barrier.

B. After completion of any required asbestos abatement, reinsulate all existing systems.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:

1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.

1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.
4. Density: 3.5 lb./cu. ft.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm-inches. Secure with self-sealing longitudinal laps and butt strips.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:

1. Compatible with insulation as recommended by insulation manufacturer.

F. Insulating Cement/Mastic:

1. ASTM C 195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz./sq. yd. weight.
2. Blanket: 1.0 lb./cu ft. density.

H. Indoor Vapor Barrier Finish:

1. Vinyl emulsion type acrylic, compatible with insulation, black color.

I. Insulating Cement:

1. ASTM C 449/C 449M.

2.03 HYDROUS CALCIUM SILICATE

A. Manufacturers:

1. Johns Manville Corporation; Model Thermo-12/Blue: www.jm.com.
2. Ownes-Corning; Model Kaylo Pink:
3. Pablo Div., Fiberboard Corp.; Model Super Caltemp Gold: www.jm.com.

B. Insulation: ASTM C 533 and ASTM C 795; rigid molded, asbestos free, gold color.

1. 'K' value: ASTM C 177 and C518; 0.40 at 300 degrees F, when tested in accordance with ASTM C 177 or ASTM C 518.
2. Maximum service temperature: 1200 degrees F.
3. Density: 15 lb./cu ft.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Insulating Cement:

1. ASTM C 449/C 449M.

2.04 JACKETS

A. PVC Plastic.

1. Manufacturers:
   a. Johns Manville Corporation: www.jm.com.
   b. Knauf.
   c. Ceel-Co..
   d. Certain Teed.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
   d. Thickness: 10 mil.
   e. Connections: Brush on welding adhesive.
   f. Maximum Flame Spread: ASTM E84; 25.
   g. Maximum Smoke Developed: ASTM E84; 50.
   h. Jacket shall be ultraviolet-resistant.
   i. Jackets shall meet USDA and FDA requirements where applicable.
3. Covering Adhesive Mastic:
   a. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

C. Equipment nameplates, identification tags, etc. shall not be covered by insulation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

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. Finish with tape and white paintable vapor barrier jacket.

4. Provide calcium silicate inserts or other heavy density insulating material suitable as approved by the Engineer for the planned temperature range, where pipes pass through walls, sleeves, pipe hangers/rollers, and other pipe penetrations.

5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints. Bevel and seal ends of insulation.

D. Provide removable insulation covers for providing access/removal of unions, flanges, strainers. Access sections shall be capable of removal and replacement with no damage to adjacent insulation.

E. Inserts and Shields:

1. Application: Piping 1 inches diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts. All piping, all sizes, shall have shields installed between the pipe hangers and insulation or inserts.

3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert material: Hydrous calcium silicate insulation (or other heavy density insulating material, as approved by the Engineer, for the planned temperature range).

F. Continue insulation through walls, sleeves, pipe hangers/rollers, and other pipe penetrations. Install steel sleeves at all wall and floor penetrations. Finish at supports, protrusions, and interruptions. At fire separations, fire caulk per building code requirements.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

H. Ends of insulation shall be sealed off. Spray paint is not acceptable. There shall be no exposed ends.

I. Insulation not properly installed shall be removed and replaced or repaired as necessary.

J. Insulation on hot surfaces shall be applied while the surfaces are hot to avoid breaking of insulation during expansion of piping.

3.03 SCHEDULE

A. Heating Systems:

1. Heating Water Supply and Return:

a. Glass Fiber Insulation:

1) Pipe Size Range: Up to 4 inches.

a) Thickness: 1.5 inch.

2) Pipe Size Range: Over 4 inches.

a) Thickness: 2 inches.

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings for:

1. Heating water piping system.
2. Equipment drains and overflows.

B. Valves:

1. Gate valves.
2. Ball valves.
3. Butterfly valves.
4. Check valves.

1.02 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers (ANSI B16.18).

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers.

F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.9).

G. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

H. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

I. ASTM B 32 - Standard Specification for Solder Metal.

J. ASTM B 88 - Standard Specification for Seamless Copper Water Tube.

K. ASTM B 88M - Standard Specification for Seamless Copper Water Tube (Metric).

L. ASTM F 708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

M. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel.

O. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

P. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

Q. ASTM A 536 - Standard Specification for Ductile Iron Castings.

1.03 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Use non-conducting dielectric connections whenever jointing dissimilar metals.

D. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-69 unless indicated otherwise.

E. Use gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Use lug end butterfly valves to isolate equipment.

G. Use 3/4 inch gate or ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

H. Purge all air from the system during start-up.

I. Provide vents, with manual vent valves, at all high points in the system. Purge all air from the system during start-up.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum 10 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with documented experience.

C. Welder Qualifications: Certify in accordance with ASME (BPV IX).

D. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

E. Pressure test all hydronic piping (i.e. heating water, etc.) in accordance with governing and applicable codes. At minimum, test with water at 225 PSIG - permissible pressure drop shall be 0 PSIG over 2 hour period.

F. Definitions shall be in accordance with local mechanical codes and ASTM F 2389.

G. Material shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

H. Special Engineered products shall be certified by NSF International as complying with NSF 14.

1.05 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

C. Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated and as follows:

1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
2. Isolate equipment using ball valves, or butterfly valves with lug end flanges.
3. For throttling, bypass, or manual flow control services, use characterized ball, or butterfly valves.
4. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

E. Welding/Brazing/Soldering Materials and Procedures: Conform to ASME (BPV IX).

2.02 HEATING WATER PIPING (HWHS, HWHR), ABOVE GROUND

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A 234/A 234M, wrought steel welding type fittings; AWS D1.1 welded.
2. Threaded Joints (2” and smaller): ASTM B 16.3, malleable iron fittings.
3. Fittings: ASTM B 16.3, malleable iron; ASTM A 536, cast ductile iron; or ASTM A 234/A 234M, wrought steel welding type fittings.
4. Joints:
   a. ANSI/AWS D1.1 welded.
   b. Threaded for sizes 2 inch and smaller; ANSI/AWS D1.1 welded for sizes 2-1/2 inches and larger.

B. Copper Tube: ASTM B 88 (ASTM B 88M), Type K (A) annealed. Allowed for sizes 5 inch diameter and smaller.

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
   a. Solder: ASTM B 32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.

2. Joints: Solder, lead free, ASTM B 32, 95-5 tin-antimony, or tin and silver.

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B 32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

2.04 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.9.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

G. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

H. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

J. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

L. 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.

2.05 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:

1. Ferrous Piping: 150 psig malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches:

1. Ferrous Piping: 150 psig forged steel, slip-on.

2. Copper Piping: Bronze.

3. Gaskets: 1/16 inch thick preformed neoprene.

C. Dielectric Connections: Union or waterway fitting with galvanized or plated steel threaded end, grooved end, copper solder end, water impervious isolation barrier. Victaulic Style 47 (or approved equal).

2.06 GATE VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.

2. Nibco, Inc.: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lockshield stem, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder or threaded ends.

C. Over 2 Inches:

1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.06 BALL VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.
2. Nibco, Inc.: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Keystone.

B. Up To and Including 2 Inches:

1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends with union.

C. Over 2 Inches:

1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.07 BUTTERFLY VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.
2. Crane Co.: www.cranevalve.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Keystone.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

1. Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.
2. In sizes through 12", the seat shall be pressure responsive.

C. Disc: Electroless-Nickel of polyphenylene sulfide coated ductile iron, aluminum-bronze, or stainless steel.

D. Operator: Infinite position lever handle or gear operated; with memory stop.

2.08 SWING CHECK VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.
2. Nibco, Inc.: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.

C. Over 2 Inches:

1. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2. 300 psi CWP ductile iron body, stainless steel swing disc and shaft, EPDM seat, grooved ends. Victaulic Series 712 (or approved equal).

2.18 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.

2. Crane Co.: www.cranevalve.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Victaulic Company (for all grooved end valves): www.victaulic.com

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

PART 3 EXECUTION

3.01 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 using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

I. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

3. 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.

J. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F 708, or MSS SP-89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.

L. Use eccentric reducers to maintain top of pipe level.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

N. Install valves with stems upright or horizontal, not inverted.

O. Branch piping run-outs to loads (i.e. tempering coils, radiators, unit heaters, etc.) shall be minimum 3/4" diameter unless noted otherwise.

P. Provide vents, with manual vent valves, at all high points in the system. Purge all air from the system during start-up.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.

1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.

7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 2114

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Air separators.

C. Strainers.

D. Pump suction fittings.

E. Combination flow measuring/balance valves.

1.02 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers.

1.03 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

B. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 10 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc.: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc.: www.taco-hvac.com.

B. General: Air vents shall be installed at all high points of hydronic systems, end of piping mains,

where shown on the drawings, and as required.

C. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 3/8 inch ball/globe valve at top of chamber.

2.02 AIR SEPARATORS

A. In-line Air Separators:

1. Manufacturers:

a. Armstrong International, Inc.: www.armstronginternational.com.

b. ITT Bell & Gossett; Model Rolairtrol.: www.bellgossett.com.

c. Taco, Inc.: www.taco-hvac.com.

2. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure, with tangential inlet and outlet connections, and internal stainless steel air collector tube. Provide blowdown connection, with valve, for routine cleaning and floor support where required.

2.03 STRAINERS

A. Manufacturers:

1. Keckley.

2. Yarway.

3. Spence.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen. Provide with integral blowdown valve and hose end fitting.

C. Size 2-1/2 inch to 4 inch:

1. Flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen. Provide with integral blowdown valve and hose end fitting.

2.04 SUCTION DIFFUSERS

A. Manufacturers:

1. ITT Bell & Gossett: www.bellgossett.com.

2. Armstrong.

3. Taco.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.05 COMBINATION BALANCE VALVE AND FLOW MEASURING DEVICES

A. Combination balance valve and flow measuring device shall be used in sizes up to and including 4 inch shall provide precise flow measurements, precision flow balancing and positive shut-off. The flow measuring element shall be a low loss, high signal venturi type with +/- 2% accuracy. Valve shall be ball type with large diameter chrome plated ball, Teflon set as, blow-out proof stem with Teflon packing and nut. Non-ferrous construction with threaded ends for sizes up to and including 2 inches, and ductile iron or cast iron body with flanged ends for sizes 2-1/2 inches and larger. Device shall be rated for an operating temperature of 250 deg F. Pressure rating shall

meet or exceed system minimum pressure rating. The flow measuring element shall have provision for connecting portable differential pressure meter with each meter connection being a pressure/temperature readout port. Valve shall have full size handle with grip and memory feature for use with positive shut-off.

B. Size each combination balance valve and flow measuring device based on the actual flow rate to be measured at each location where installed. Provide sizing criteria with submittal. Provide name tag attached to each combination balance valve and flow measuring device which indicates flow rate and associated mechanical equipment identification. Refer to Section 230553 - Mechanical Identification for additional information.

C. Manufacturers:

1. Flow Design.
2. Preso.
3. Nexus.
4. Pro Hydronic Specialties.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents, provide vent tubing to nearest drain.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

G. Support pump fittings with floor mounted pipe and flange supports.

H. Pipe relief valve outlet to nearest floor drain.

I. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

J. Purge all air from the entire system during start-up (including the existing system on renovation of existing systems).

END OF SECTION

SECTION 23 2123

HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. In-line circulators.

B. Base mounted pumps.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc..

1.03 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.04 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

C. Millwright's Certificate: Certify that base mounted pumps have been aligned.

D. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum 10 years of documented experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

1.07 EXTRA MATERIALS

A. Provide one set of mechanical seals for each pump.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Pumps Inc.: www.armstrongpumps.com.

B. ITT Bell & Gossett: www.bellgossett.com.

C. Taco.

D. Grundfos.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.03 SYSTEM LUBRICATED CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psi maximum working pressure, 230 degrees F maximum water temperature.

B. Casing: Bronze with flanged pump connections.

C. Impeller, Shaft, Rotor: Stainless Steel.

D. Bearings: Metal Impregnated carbon (graphite) and ceramic.

E. Motor: Impedance protected, single speed.

2.04 IN-LINE CIRCULATORS

A. Flexible coupled circulators:

1. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psi maximum working pressure and continuous service temperature of not less than 225 degree F..
2. All bronze or stainless steel for service water application; bronze or stainless steel fitted for others.
3. Impeller: Bronze keyed to shaft.
4. Bearings: Oil lubricated, sleeve type with oil reservoirs for extended periods of services without addition of oil.
5. Shaft: Stainless steel with bronze sleeve, integral thrust collar.
6. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.
7. Drive: Flexible coupling.
8. Manufacturers:
   a. Bell & Gossel Series 60.
   b. Armstrong.
   c. Taco.

2.05 BASE MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 250 psi maximum working pressure and a minimum operating temperature of 250 degree F.

B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft. Maximum impeller diameter shall not be greater than 90% of "cut water" diameter for a given casing and no smaller than the smallest published diameter for the casing.

D. Bearings: Heavy duty, deep groove type ball bearings with provisions for the mechanical and hydraulic radial thrust loads imposed by any normal service condition. Certified AFBMA L-10 rated life of not less than 200,000 hours. Grease lubricated, provided with surface ball type

grease supply fittings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

1. Balanced or unbalanced, requiring no shaft or sleeve shoulder. Seals shall have AISI 18-8 stainless steel and brass trim. Stationary surface shall be carbon or tungsten carbide steel. Rotating surface shall be ceramic or tungsten carbide steel. Elastomers shall be BUNA or EPT.

G. Drive: Flexible coupling with coupling guard.

1. Flexible coupling manufacturers:

a. Koppers "Elastomeric."

b. T.B. Woods "Sureflex."

H. Baseplate: Fabricated steel with integral drain rim, grout holes, and grout air vents. Formed or bent steel baseplates are not acceptable.

I. Coupling Guard: Shall enclose coupling and rotating parts and be ANSI and OSHA compliant

J. Balancing: Statically and dynamically balance impellers and rotating element. Submit one (1) copy of report to the Owner.

K. Nameplates: In addition to standard nameplate data, furnish the following data: Manufacturer's pump serial number, OEM model number of each bearing, recommended lubricant, OEM gasket type and thickness, OEM mechanical seal identification.

L. General: Pumps shall be in accordance with the following requirements:

1. Base non-overloading characteristics for pumps upon nameplate horsepower, at any point on the performance curve.

2. Shaft first critical speed shall not be less than 25% greater than 25% greater than operating speed.

3. Select the pump at a point of maximum efficiency for a given impeller-casing combination. Deviations shall be within 3% of the maximum efficiency on the increasing capacity side of the maximum efficiency point and 7% on the decreasing capacity side of the maximum efficiency point.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide factory coordinated start-up supervision by factory authorized service personnel.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Provide line sized shut-off valve and pump suction fitting on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base mounted pumps prior to start-up.

H. Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.

I. Lubricate pumps before start-up.

END OF SECTION

SECTION 23 2500

HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical treatment.

1.02 SUBMITTALS

A. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

B. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

D. Operation and Maintenance Data: Include data on chemical feed solutions, and other equipment including spare parts lists, procedures, and treatment programs.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 10 years of experience and approved by manufacturer.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.05 MAINTENANCE SERVICE

A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.

B. Provide 3 annual technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit .pdf copies of field service report after each visit.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Include training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.06 MAINTENANCE MATERIALS

A. Supply sufficient chemicals for treatment and testing during warranty period.

B. Provide portable testing kit as required for testing/monitoring system scale and corrosion inhibitor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AmSolv/Division of Amrep, Inc.: www.amsolv.com.

B. GE Water Technologies: www.gewater.com.

C. Enerco Corp..

D. MITCO.

2.02 GENERAL

A. Provide and install chemical cleaning and treatment for the entire hydronic system(s). Provide all necessary treatment chemicals, equipment, shot feeder(s), CW makeup meter, sidestream filter, service, etc. for start-up and operation of hydronic system(s).

B. All systems/equipment are based upon Enerco Corp. (Grand Ledge, MI 800-292-5908).

C. Existing system volume is unknown. For bidding purposes assume 6,000 gallon system volume and provide unit price ($/gallon) for additional treatment chemicals if needed.

2.03 MATERIALS

A. System Cleaner:

1. Manufacturers:
    a. AmSolv/Division of Amrep, Inc.: www.amsolv.com.
    b. GE Water Technologies: www.gewater.com.
    c. Nalco Company: www.nalco.com.
    d. Enerco Corp..
2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
3. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite, microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

B. Closed System Treatment (Water):

1. Manufacturers:
    a. AmSolv/Division of Amrep, Inc.: www.amsolv.com.
    b. GE Water Technologies: www.gewater.com.
    c. Nalco Company: www.nalco.com.
    d. Enerco Corp..
2. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
3. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
4. Conductivity enhancers; phosphates or phosphonates.

2.04 WATER METER

A. Electric contact head water meter of bronze construction with 110 degree F temperature rating and 150 psig pressure rating. Meter shall be oscillating piston head type using a magnetic drive to couple the measuring piston to the contact head. The electric contact switch shall be normally open and capable of handling control voltages up to 240V and rated at 10 amps minimum. The gallons per contact to be initially set for 5 gpc, but shall be field changeable. Water meter size and gallons per contact shall be determined by the water treatment sub-contractor and coordinated with the temperature controls contractor to sound an alarm upon water make-up.

1. Carlon type "JSJ" or equal.

2.07 CLOSED SYSTEM CARTRIDGE FILTER

A. Manufacturers:

1. United Filters, Inc..
2. Shelco.

B. For Smaller Hydronic Systems (< 20 GPM filter flow):

1. Filter Vessel: 304 stainless steel body, with brass head, 300 psig pressure rating @ 200 degree F temerature, 1" inlet/outlet flanged connections, o-ring cover gasket, vent screw, 1/4 gauge port, bottom SS drain plug.
2. Performance:
   a. 20" long cartridge: Design flow 14 GPM with maximum pressure drop of 1.5 psi (3.5 feet of H20 head).
3. Cartridge Filters: Provide wound filter cartridges for filtration down to 10 microns. Provide two (2) extra complete cartridge filter changes.

C. Filter Pump: Provide in-line pump (fractional HP @ 115V) with adequate flow/pressure to pump from system piping to/from cartridge filter.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use new water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

D. Chemical treatment contractor shall coordinate with equipment manufacturers (i.e. boilers, chillers, cooling towers, etc.) and verify treatment requirements (i.e. propleyne vrs ethylene glycol, approved cleaner chemicals, etc.) prior to treating systems.

3.02 CLEANING SEQUENCE

A. Hydronic Pre-cleaning:

1. Thoroughly flush entire system with fresh water. Remove and clean all strainers, open drip legs, or other non-flowing piping to remove debris.
2. Determine loop capacity in gallons, taken from the water meter readings, by carefully filling the loop from completely drained to completely full with all air bled out of the system. Submit written report of pre-cleaning and system capacity to the water treatment sub-contractor and Owner.

B. Concentration:

1. As recommended by manufacturer.

C. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.

2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.

3. Circulate for 6 hours at design temperatures, then drain.

4. Refill with clean water and repeat until system cleaner is removed.

D. Remove, clean, and replace strainer screens.

E. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Introduce closed system treatment through bypass pot-feeder, or side stream filter.

B. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

C. Provide a closed system cartridge filter on each system. Provide isolating valves, drain valves, and necessary piping. Provide with in-line pump (fractional HP @ 115V) to pump off main piping (downstream of circulating pumps) to/from cartridge filter. Install pressure gauges on inlet and outlet of filter for determining when filter is clogged and in need of replacement. Pressure gauge range shall match system pressure requirements.

END OF SECTION

SECTION 23 5216
FIRE-TUBE CONDENSING BOILERS

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. This Section includes packaged, factory-fabricated and assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for space heating hot water.

1.03 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, details, and attachments to other work.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

E. Warranty: Standard warranty specified in this Section.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. AHRI Compliance: Boilers shall be AHRI listed and must meet the minimum efficiency specified under AHRI BTS-2000 as defined by Department of Energy in 10 CFR Part 431.

E. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US and Canada.

F. CSA Compliant: Boilers shall be compliant with CSA certification.

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.07 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:

a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and failure due to thermal shock.

b. All other components shall carry a one year warranty from date of boiler start up.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Lochinvar Knight FTXL Boiler as specified on Drawings. All others must be submitted by Voluntary alternate.

2.02 CONSTRUCTION

A. Description: Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

B. Heat Exchanger: The heater exchanger shall bear the ASME “H” stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel and of fire tube design. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.

C. Efficiency: Boilers shall have an AHRI certified minimum thermal efficiency of 97 percent.

D. Condensate Collection Basin: Fully welded 316L stainless steel and shall include a stainless steel combustion analyzer test port.

E. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop. The pressure vessel shall contain a volume of water no less than:

Model	Water Content
FTX400	13 gallons
FTX500	12 gallons
FTX600	12 gallons
FTX725	17 gallons
FTX850	16 gallons

F. Burner: Natural gas, forced draft single burner premix design. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency.

G. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.

1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

H. Gas Train: The boiler shall be supplied with a negative pressure regulation gas train and shall be capable of the following minimum turndowns:

Model	Turndown	Minimum Input	Maximum Input
FTX400	10:1	40,000	400,000
FTX500	10:1	50,000	500,000
FTX600	7:1	85,700	600,000
FTX725	7:1	103,500	725,000
FTX850	7:1	121,500	850,000

I. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

J. High Altitude: Boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. High altitude operation shall be certified at a minimum of 4,500 feet above sea level by a third party organization. High altitude boilers shall be certified to 3,000 to 12,000 feet above sea level. The boilers shall carry a CSA certification for high altitude operation up to 12,000 feet.

K. Casing:

1. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.

2. Control Compartment Enclosures: NEMA 250, Type 1A.

3. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.

4. Combustion-Air Connections: Inlet and vent duct collars.

L. Characteristics and Capacities:

1. Heating Medium: Hot water.

2. Design Water Pressure Rating: 160 psi working pressure.

3. Safety Relief Valve Setting: 50 psig

4. Minimum Water Flow Rate:

Model	Minimum Flow
FTX400	10 gpm
FTX500	12 gpm
FTX600	15 gpm
FTX725	18 gpm
FTX850	21 gpm

2.03 TRIM

A. Safety Relief Valve:

1. Size and Capacity: 50 lb.

2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

D. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.04 CONTROLS

A. Refer to Division 23 Section "Instrumentation and Control for HVAC."

B. Boiler controls shall feature a standard, factory installed multi-color graphic LCD screen display with navigation dial and includes the following standard features:

1. Con-X-Us capable: Boiler shall have the ability to communicate remotely using the optional Con-X-Us software via a wireless or Ethernet connection.

2. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 20 degrees F and a maximum temperature rise of 60 degrees F. Project specific temperature rise shall be ____.

3. Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.

4. Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.

5. Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.

6. Four pump control: Boiler shall have the ability to control the boiler pump, a system pump, a domestic hot water pump, and a domestic hot water recirculation pump.

7. Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.

8. Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.

9. Domestic hot water priority: Boiler shall make the domestic hot water call for heat a priority over any space heating call and adjust the boiler setpoint to the domestic hot water boiler setpoint.

10. Domestic hot water modulation limiting: Boiler may be programmed to limit the maximum domestic hot water firing rate to match the input rating of the indirect tank coil.

11. Domestic hot water night setback: Boiler may be programmed to reduce the domestic hot water tank set point during a certain time of the day.

12. PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.

13. Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.

14. Maintenance reminder: Boiler shall have the ability to display a yellow colored, customizable maintenance notification screen. All notifications are adjustable by the installer based upon months of installation, hours of operation, and number of boiler cycles.

15. English Error codes: Boiler shall have a user interface that displays a red error screen with fault codes that are displayed in English and include a date and time stamp for ease of servicing.

16. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.

17. Space Heating Night setback: Boiler may be programmed to reduce the space heating temperature set point during a certain time of the day.

18. Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.

19. Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.

20. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.

21. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, space heat run hours, domestic hot water run hours and ignition attempts. All data should be visible on the boiler screen.

C. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include:

1. Lead lag: The Control module shall allow only one boiler to fire at the beginning of a call for heat. Once the lead boiler is in full fire and the control calculates that additional heat is required it will call on an additional boiler as needed.

2. Efficiency optimization: The Control module shall allow multiple boilers to simultaneously fire at minimum firing rate in lieu of Lead/Lag.

3. Front end loading: The Control module shall allow the cascading and functional control of several non condensing Lochinvar products alongside the Knight FTXL.

4. Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.

D. Boiler operating controls shall include the following devices and features:

1. Set-Point Adjust: Set points shall be fully adjustable by the installer.
2. Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
3. Sequence of Operation: Boiler shall come standard with outdoor reset control which will control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.

E. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation and include:

1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
5. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
6. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.
7. Optional Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

F. Building Automation System Interface:

1. Boiler shall have the ability to receive a 0-10V system from a building management system and control by the following:
   a. 0-10V DC input to control Modulation or Setpoint
   b. 0-10V DC input from Variable speed Boiler pump
   c. 0-10V DC output signal to a Variable speed system pump
   d. 0-10V DC input Enable/Disable signal
2. Factory installed Modbus gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.

2.05 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

C. Electrical Characteristics:

1. See Drawings

2. Voltage

   a. 120V / 1PH

3. Frequency: 60 Hz

2.06 VENTING

A. Exhaust flue must be Category IV approved PVC, CPVC, PP or stainless steel sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.

B. Intake piping must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.

C. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

D. Boilers using common venting must only include like models and the optional common vent damper. Contact the factory for common vent sizing.

E. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

F. Refer to manufacturer's Installation and Operations manual for detailed venting instructions and approved manufacturers.

2.07 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 BOILER INSTALLATION

A. Install equipment on 4" concrete housekeeping pad.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.03 CONNECTIONS

A. Install boilers level on concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting:

1. Install flue venting kit and combustion-air intake.

2. Connect full size to boiler connections. Comply with requirements in Division 23 Section “Breechings, Chimneys, and Stacks.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

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.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the instructions.

2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.

b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.05 DEMONSTRATION

A. Engage a factory representative or a factory-authorized service representative for boiler startup. Start-up sheet shall be completed and a copy shall be sent to the Engineer and the Manufacturer. A combustion analysis shall be completed and the gas valve adjusted per the Installation and Operations manual and note in start-up report.

B. Factory representative or a factory-authorized representative shall provide Owners training to instruct maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 5216
FIRE TUBE - CONDENSING BOILERS

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. This Section includes packaged, factory-fabricated and assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for space heating hot water.

1.03 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, details, and attachments to other work.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

E. Warranty: Standard warranty specified in this Section.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. AHRI Compliance: Boilers shall be AHRI listed and must meet the minimum efficiency specified under AHRI BTS-2000 as defined by Department of Energy in 10 CFR Part 431.

E. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US and Canada.

F. CSA Compliant: Boilers shall be compliant with CSA certification.

1.06 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:

a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and failure due to thermal shock.

b. All other components shall carry a one year warranty from date of boiler start up.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Lochinvar Knight FTXL Boiler as specified on Drawings. All others must be submitted by Voluntary alternate and clarified in the bid as such.

2.02 CONSTRUCTION

A. Description: Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

B. Heat Exchanger: The heater exchanger shall bear the ASME “H” stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel and of fire tube design. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.

C. Efficiency: Boilers shall have an AHRI certified minimum thermal efficiency of 97 percent.

D. Condensate Collection Basin: Fully welded 316L stainless steel and shall include a stainless steel combustion analyzer test port.

E. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop. The pressure vessel shall contain a volume of water no less than:

Model	Water Content
FTX400	13 gallons
FTX500	12 gallons
FTX600	12 gallons
FTX725	17 gallons
FTX850	16 gallons

F. Burner: Natural gas, forced draft single burner premix design. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency.

G. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.

H. Gas Train: The boiler shall be supplied with a negative pressure regulation gas train and shall be capable of the following minimum turndowns:

Model	Turndown	Minimum Input	Maximum Input
FTX400	10:1	40,000	400,000
FTX500	10:1	50,000	500,000
FTX600	7:1	85,700	600,000
FTX725	7:1	103,500	725,000
FTX850	7:1	121,500	850,000

I. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

J. High Altitude: Boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. High altitude operation shall be certified at a minimum of 4,500 feet above sea level by a third party organization. High altitude boilers shall be certified to 3,000 to 12,000 feet above sea level. The boilers shall carry a CSA certification for high altitude operation up to 12,000 feet.

K. Casing:

1. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
4. Combustion-Air Connections: Inlet and vent duct collars.

L. Characteristics and Capacities:

1. Heating Medium: Hot water.
2. Design Water Pressure Rating: 160 psi working pressure.
3. Safety Relief Valve Setting: 50 psig
4. Minimum Water Flow Rate:

Model	Minimum Flow
FTX400	10 gpm
FTX500	12 gpm
FTX600	15 gpm
FTX725	18 gpm
FTX850	21 gpm

2.03 TRIM

A. Safety Relief Valve:

1. Size and Capacity: 50 lb.
2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

D. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.04 CONTROLS

E. Boiler controls shall feature a standard, factory installed multi-color graphic LCD screen display with navigation dial and includes the following standard features:

1. Con-X-Us capable: Boiler shall have the ability to communicate remotely using the optional Con-X-Us software via a wireless or Ethernet connection.
2. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 20 degrees F and a maximum temperature rise of 60 degrees F. Project specific temperature rise shall be 40 degrees F.
3. Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.
4. Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
5. Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
6. Four pump control: Boiler shall have the ability to control the boiler pump, a system pump, a domestic hot water pump, and a domestic hot water recirculation pump.
7. Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
8. Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
9. Domestic hot water priority: Boiler shall make the domestic hot water call for heat a priority over any space heating call and adjust the boiler setpoint to the domestic hot water boiler setpoint.
10. Domestic hot water modulation limiting: Boiler may be programmed to limit the maximum domestic hot water firing rate to match the input rating of the indirect tank coil.
11. Domestic hot water night setback: Boiler may be programmed to reduce the domestic hot water tank set point during a certain time of the day.
12. PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.
13. Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
14. Maintenance reminder: Boiler shall have the ability to display a yellow colored, customizable maintenance notification screen. All notifications are adjustable by the installer based upon months of installation, hours of operation, and number of boiler cycles.
15. English Error codes: Boiler shall have a user interface that displays a red error screen with fault codes that are displayed in English and include a date and time stamp for ease of servicing.
16. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature

drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.

17. Space Heating Night setback: Boiler may be programmed to reduce the space heating temperature set point during a certain time of the day.

18. Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.

19. Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.

20. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.

21. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, space heat run hours, domestic hot water run hours and ignition attempts. All data should be visible on the boiler screen.

F. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include:

1. Lead lag: The Control module shall allow only one boiler to fire at the beginning of a call for heat. Once the lead boiler is in full fire and the control calculates that additional heat is required it will call on an additional boiler as needed.

2. Efficiency optimization: The Control module shall allow multiple boilers to simultaneously fire at minimum firing rate in lieu of Lead/Lag.

3. Front end loading: The Control module shall allow the cascading and functional control of several non condensing Lochinvar products alongside the Knight FTXL.

4. Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.

G. Boiler operating controls shall include the following devices and features:

1. Set-Point Adjust: Set points shall be fully adjustable by the installer.

2. Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.

3. Sequence of Operation: Boiler shall come standard with outdoor reset control which will control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.

H. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation and include:

1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.

2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.

3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.

4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.

5. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.

6. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.

7. Optional Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

I. Building Automation System Interface:

1. Boiler shall have the ability to receive a 0-10V system from a building management system and control by the following:

a. 0-10V DC input to control Modulation or Setpoint

b. 0-10V DC input from Variable speed Boiler pump

c. 0-10V DC output signal to a Variable speed system pump

d. 0-10V DC input Enable/Disable signal

2. Factory installed Modbus gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.

2.05 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

C. Electrical Characteristics:

1. See Drawings

2. Voltage

a. 120V / 1PH

3. Frequency: 60 Hz

2.06 VENTING

A. Exhaust flue must be Category IV approved PVC, CPVC, PP or stainless steel sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.

B. Intake piping must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.

C. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

D. Boilers using common venting must only include like models and the optional common vent damper. Contact the factory for common vent sizing.

E. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

F. Refer to manufacturer's Installation and Operations manual for detailed venting instructions and approved manufacturers.

2.07 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 BOILER INSTALLATION

A. Install equipment on 4" concrete housekeeping pad.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.03 CONNECTIONS

A. Install boilers level on concrete bases.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting:

1. Install flue venting kit and combustion-air intake.

2. Connect full size to boiler connections.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

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.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the instructions.

2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.

b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.05 DEMONSTRATION

A. Engage a factory representative or a factory-authorized service representative for boiler startup. Start-up sheet shall be completed and a copy shall be sent to the Engineer and the Manufacturer. A combustion analysis shall be completed and the gas valve adjusted per the Installation and Operations manual and note in start-up report.

B. Factory representative or a factory-authorized representative shall provide Owners training to instruct maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION

SECTION 26 0001

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Division includes all labor, materials, equipment, tools, supervision, start-up services, Owner's Instructions, including all incidental and related items necessary to complete installation and successfully test and start up and operate the Electrical Systems indicated on Drawings and described in each Section of Division 26 Specifications and conforming with ALL other Contract Documents.

B. The Drawings and General Provisions of the Contract, including the General Conditions, Supplementary General Conditions, and Division 1 specification sections, apply to work of Division 26 sections. The items in this section are not intended to supersede, but are supplementary to, the requirements set forth in other Divisions of the specifications.

C. The Contractor, and his Subcontractors and Suppliers, shall include in their bid all materials, labor, and equipment involved, in accordance with all local customs, codes, rules, regulations; and secure compliance of all parts of the Specifications and Drawings regardless of Sectional inclusion in these Specifications.

D. The Contractor shall be held responsible for the complete and satisfactory accomplishment of all Work inclusive of whatever miscellaneous material and/or appurtenances are required to perfect the installation, and demonstrate that all electrical systems will operate satisfactorily under normal operating conditions.

1.02 DRAWINGS & SPECIFICATIONS

A. The drawings are diagrammatic and show the general location and arrangement of equipment, outlets, lights and related electrical items. They shall be followed as closely as elements of the construction will permit. The Contractor shall provide/install all electrical systems, and associated equipment, complete and include all necessary wire/conduit, pull boxes, and other components required due to interferences, space constraints, code requirements, etc. as required to provide a complete/functional system.

B. These General Electrical Requirements are intended to augment the drawings and specifications. Should conflicts occur between the drawings and the specifications, the strictest provision shall govern. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect and/or Engineer for resolution.

C. The Contractor shall examine the drawings of all other trades in order to verify the conditions governing the work on the job site. Arrange work accordingly, providing all wiring, conduit, fittings, boxes, etc. as may be required to meet such conditions.

D. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect and/or Engineer.

E. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect and/or Engineer for resolution.

1.03 COORDINATION OF WORK

A. The Contractor shall verify clearance requirements of all electrical and mechanical equipment/systems prior to the installation of any new work. Electrical equipment, wiring,

systems, etc. shall not interfere with mechanical equipment spaces.

B. The Contractor, and his Subcontractors, shall be responsible for all tasks applicable to their work in accordance with the Specifications, Drawings, and code requirements, and shall be responsible for coordinating locations and arrangements of their work to give best results with all other relevant trades.

1. Coordinate all wall, roof, floor penetrations, equipment pads, equipment locations, system routings, etc. with architectural and structural trades.

2. Verify requirements of all equipment with shop drawing submittals prior to installation - notify Architect/Engineer of any conflicts between shop drawings and plans.

3. Coordinate rough-in locations of mechanical control devices (i.e. thermostats, sensors, etc.) with mechanical trades. E.C shall provide rough-in of box for T-stat/Sensor and conduit pathway from box to mechanical unit's control box, for wiring by M.C and/or T.C.. T-stats shall be located @ 48" AFF unless noted otherwise.

4. Verify clearance requirements of all electrical and mechanical equipment/systems prior to the installation of any new work. Electrical equipment, lighting, conduit, systems, etc. shall not interfere with mechanical equipment spaces. Mechanical equipment, piping, ductwork, systems, etc. shall not interfere with electrical equipment spaces.

1.04 INSPECTION OF SITE AND PROJECT DOCUMENTATION

A. The Contractor shall visit the site and examine/verify the conditions under which the work must be conducted before submitting proposal. The Contractor shall examine the drawings and specifications of all other trades including Mechanical, Architectural, Structural, Plumbing, and Electrical.

B. The submitting of a proposal implies that the Contractor has visited the site, examined all contract documents, and understands the conditions under which the work must be conducted.

C. The Contractor shall notify the Architect and/or Engineer, via written RFI prior to submitting his bid, of any potential conflicts/problems with the plans that he has identified during his inspection of the site and/or from the review of plans/specifications. RFIs must be submitted at least 5 working days prior to bid opening.

1.05 GENERAL SUPPORT REQUIREMENTS

A. Provide all necessary angle/brackets or supplementary steel as required for adequate support for all conduit, lighting, specialties, and equipment. Secure approval form Architect and/or Structural Engineer, in writing, before welding or bolting to steel framing or anchoring to concrete structure, or cutting/coring thru structural systems.

B. Where conduit or equipment is supported or suspended from concrete construction, provide approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

1.06 GUARANTEE

A. Contractor shall guarantee that all labor, materials, and equipment are free from defects and agrees to replace or repair any part of this installation which becomes defective within a period of one year from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material or installation. Acceptance date of substantial completion shall be Owner occupancy as determined by the Architect and/or Engineer.

B. The Contractor shall file with the Owner one set of guarantees from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.07 CODES, PERMITS AND FEES

A. Refer to Division 1, General Requirements and Supplementary Conditions.

B. Unless otherwise indicated, all required permits, plan reviews, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor.

C. All work shall be executed in accordance with the latest enforceable rules and regulations set forth in local and state codes.

1. Electrical systems shall be installed per current jurisdictional codes (Michigan Electrical Code, Michigan Energy Code, etc.), current NFPA codes (NFPA 101, NPFA 90, NFPA 72, etc.), and applicable sections of the Michigan Building Code.

D. In the event that the plans and specifications conflict with any rules, regulations, or codes applying, said rules, regulations and codes shall govern.

E. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.08 SUBSTITUTION ITEMS REQUIRING PRIOR APPROVAL

A. All items that the Contractor proposes to use in the work, that are not specifically named in the contract documents, must be submitted for review/approval. Such items must be submitted in duplicate to the Architect and/or Engineer for approval a minimum of ten (10) days prior to bid opening. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1.09 MATERIAL AND EQUIPMENT MANUFACTURERS

A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of electrical equipment and shall be the manufacturer's latest design.

B. If equipment by an approved manufacture is other than the equipment specified as the basis of design the substituted equipment shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Substitution Items Requiring Prior Approval specified in this Section of the Specifications. All costs to make these items of equipment comply with original requirements including, but not limited to, conduit, wiring, bus work, enclosures, and building alterations shall be included in the original bid.

1.10 RECORD DRAWINGS

A. Contractor shall submit to the Architect and/or Engineer, record drawings which have been neatly marked to represent as-built conditions for all new electrical work.

B. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the concealed conditions and other items of construction on field drawings as they occur. Proper circuiting, conduit runs, location and number of electrical devices shall be indicated on the "as-built" drawings. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

PART 2 PRODUCTS

2.01 MATERIALS

A. All material and equipment furnished and installed by the Contractor for the permanent Work shall be new, unused, of the best quality of make specified, shall be free from defects of any character, and shall be listed as approved by the UL and/or FM.

B. Outdoor electrical equipment shall be weatherproof, NEMA 3R or NEMA 4X (stainless steel), unless otherwise indicated.

C. Unless otherwise specified in other Division 26 sections, the sheet metal surfaces of equipment enclosures shall be coated with a rust resisting primer. Over the primer, a corrosion resistant baked enamel finish shall be applied. The color shall be ASA No. 49, medium light gray.

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. Install equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect and/or Engineer for resolution.

3.02 CHASE, SHAFTS AND RECESSES

A. Coordinate with architectural and other trades to ensure accurate location and size of chases, shafts and recesses.

3.03 CUTTING, CORING AND PATCHING

A. Refer to General Conditions.

B. The Contractor shall perform all cutting, coring, and patching that may be necessary for the installation of their Work. All cutting, coring, patching and repair work shall be performed by the Contractor through qualified Subcontractors. Contractor shall include full cost of same in his bid.

C. Secure approval form Architect and/or Structural Engineer, in writing, before cutting, welding/bolting to, or anchoring from any structural building components (i.e. structural steel, load bearing walls, footings/foundations, concrete floors/ceilings, etc.).

3.04 EQUIPMENT FOUNDATIONS AND SUPPORTS

A. For equipment suspended from ceiling or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect and/or Structural Engineer for same including loads, locations, and methods of attachment.

3.05 SLEEVES

A. Provide and install Schedule 40 black steel pipe sleeves, cut to length, wherever conduits pass through above grade walls and floors. Provide and install galvanized steel pipe sleeves, cut to length, wherever conduits pass through below grade foundation walls and slab on grade floors. Sleeves shall terminate flush with walls in finished areas. All sleeves through the floor are to extend two (2) inches above finish floor.

B. Provide escutcheons at each penetration through walls, floors, and ceilings in exposed areas.

C. Patch sleeves to match building material.

3.06 SEALING OF ELECTRICAL OPENINGS

A. Seal the space around conduits in sleeves through walls, floors and ceilings.

B. Provide adequate clearance to allow for proper sealing.

C. Provide/install fireproof wall and floor sleeves as required at all applicable wall, ceiling, and floor penetrations. Refer to Architectural plans for wall assembly ratings.

D. Sleeves placed in floors shall be flush with the underside of the floor construction and shall have planned, square ends, extending 2 inches above the finished floor, unless otherwise noted or detailed.

E. Where sleeves pass through reinforced concrete floors, they shall be properly set in position prior to concrete pouring in such a way that they will be maintained in position until the concrete is set.

F. Conduits passing through below grade perimeter walls or slabs on grade shall have the space between the pipe and sleeve sealed watertight with a mechanically expandable elastomer seal device.

3.07 FIRESTOP MATERIALS

A. Use only firestop products that have been tested according to ASTM E-814 and UL 1479 for the conditions set forth regarding construction assembly type, penetrating item type, annular space requirements and fire rating.

B. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in other related specification sections.

1. For non-combustible penetrations including conduit not passing through a sleeve, the following materials are acceptable:
   a. Hilti FS 601 Elastmeric Firestop Sealant.
   b. 3 M.
   c. CSD Sealing Systems.
   d. Firestop Systems.
2. For non-combustible penetrations including sleeved conduits, the following materials are acceptable:
   a. Hilti FS 601 Elastmeric Firestop Sealant.
   b. 3 M.
   c. CSD Sealing Systems.
   d. Firestop Systems.
3. For combustible penetrations including cables and cable bundles, the following materials are acceptable:
   a. Hilti FS 611A Intumescent Firestop Sealant.
   b. 3 M.
   c. CSD Sealing Systems.
   d. Firestop Systems.

3.08 EQUIPMENT CONNECTIONS

A. Make connections to equipment, fixtures and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufactures of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings, shall be provided at no additional cost.

3.09 CLEANING

A. Each Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.

B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Equipment and materials shall be protected from theft, injury or damage.

B. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.

C. Provide adequate storage for all equipment and materials delivered to the job site. Equipment set in place in unprotected areas must be provided with temporary protection.

3.11 ACCESSIBILITY

A. All equipment shall be installed so as to be readily accessible for operation, maintenance, and repair, as required by the equipment manufacturer and as subject to the approval of the Engineer.

3.12 NAMEPLATES AND DIRECTORIES

A. Identify switchgear, unit substations, motor controls, panelboards, safety switches, etc., with manufacturer's nameplate, shop order, where applicable on composite assemblies, and designations used on the Drawings. Nameplates shall be laminated phenolic plastic, beveled edged white with engraved black letters. Except where impractical, letter and numerals shall be a minimum of 1/2 inch high. Nameplates shall be mechanically secured. Pressure sensitive nameplates are not acceptable. Panel directories shall be neatly typed, showing equipment served and location for each breaker or switch with a clear plastic protective cover.

3.13 EXTRA WORK

A. Refer to Division 1, General Requirements.

B. For any extra electrical work which may be proposed, the Electrical Contractor shall furnish to the General Contractor/Construction Manager, an itemized breakdown of the estimated cost of all materials and labor required to complete this work. The estimate cost breakdown shall include unit prices (same prices for increase/decrease of work) for all materials (i.e. wire, conduit, devices, equipment, equipment rental, etc.) and all labor (i.e. manhours, overtime, etc.) which may be required for any proposed extra work. The Contractor shall not proceed until receiving a written order from the General Contractor establishing the agreed price and describing the work to be done.

3.14 DRAWINGS AND MEASUREMENTS

A. These specifications and accompanying drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either the drawings or specifications shall be as binding as if call for by both. The work herein described shall be complete in every detail.

B. The Drawings are not intended to be scaled for rough-in measurements, nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor. The Contractor shall check latest architectural drawings to locate light switches, check latest structural drawings for interferences, etc.

3.15 DEMOLITION AND REMOVAL WORK

A. All demolition of existing electrical equipment and materials shall be done by the Contractor unless otherwise indicated.

B. In general, demolition work is indicated on the drawings. However, the Contractor shall visit the job to determine the full extent and character of this work.

C. The Contractor shall review all other contract documents (i.e. architectural plans, mechanical plans, etc.) to review the extent of demolition and remodeling work.

D. Unless specifically noted, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner unless such ownership is waived. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises. Properly dispose of lighting fixture lamps and ballasts.

E. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

F. Where equipment or fixtures are removed, wire shall be removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a "finished" look, as approved by the Architect and/or Engineer. The original function of the existing electrical work to be modified shall not be changed unless required by the specific revisions shown on the drawings.

G. The Contractor is required to maintain service by rerouting wiring for power and lights as necessary. Where walls and ceilings are to be removed as shown on the drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or the panels.

H. Where new walls, ceilings, and/or floors are installed which interfere with existing outlets, devices, etc., which are to remain, the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.

I. Where devices on existing walls are no longer active, but wires feeding outlets are active, provide blank cover plates and box extensions are required to meet new finishes. Where devices and wires feeding them are no longer active, fill outlet boxes with plaster for finishing by others.

J. Where circuits, conduit, boxes, etc. are no longer used/in service they shall be entirely removed back to the panel (source of power).

K. Where shown as to use existing circuits and equipment in remodeled areas, the Contractor shall verify circuit identification, circuit loads, and as-build methods of installation to complete the demolition and new work in accordance with current codes.

3.16 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once work is started in the existing building, shall complete same work without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed work. The Contractor shall repair any damages that they are responsible for at their expense.

C. Consult with the Architect and/or Engineer as to the methods of carrying on the work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Architect, Engineer, and/or Owner's Representative.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CABLES (600 V AND LESS)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wire and cable for 600 volts and less.

B. Wiring connectors and connections.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

B. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 PROJECT CONDITIONS

A. Verify that field measurements are as shown on the Drawings.

B. Conductor sizes are based upon copper unless indicated as aluminum "AL" on the Drawings.

C. Wire and cable routing shown on the Drawings are approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only building wire in raceway or metal clad cable.

B. Exposed Dry Interior Locations: Use only building wire in raceway or building wire with Type THHN,THWN,XHHW insulation in raceway.

C. Above Accessible Ceilings: Use only building wire in raceway or metal clad cable.

D. Wet or Damp Interior Locations: Use only building wire with Type THWN, XHHW insulation in raceway.

E. Exterior Locations: Use only building wire with Type THWN or XHHW insulation in raceway.

F. Underground Installations: Use only building wire with Type THWN OR XHHW insulation in raceway.

G. Use stranded conductors for control circuits.

H. Use conductor not smaller than 10 AWG for power and lighting circuits.

I. Use conductor not smaller than 14 AWG for control circuits.

J. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).

K. All feeders not sized on the plans shall be sized by the CONTRACTOR for a maximum of 2% voltage drop. All branch circuits shall be sized for a maximum of 3% voltage drop.

2.02 WIRE MANUFACTURERS

A. Cerro Wire Inc.: www.cerrowire.com.

B. Industrial Wire & Cable, Inc.: www.iewc.com.

C. Southwire Company: www.southwire.com.

D. Royal.

E. Rome.

F. General Cable.

G. Triangle.

2.03 BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor: Copper. Class B strand per ICEA S-61-402.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: NFPA 70.

1. For Feeders and Branch Circuits Equal to and Smaller Than 4/0 AWG (Dry and Damp locations): Type THHN rated 90 degrees C.
2. For Feeders and Branch Circuits Equal to and Smaller Than 4/0 AWG (Wet locations): Type THWN rated 90 degrees C.
3. For Feeders and Branch Circuits Larger Than 4/0 AWG (Dry and Damp locations): Type XHHW rated 90 degrees C.

E. Color Coding:

1. Branch circuits shall have their insulation color coded the entire length as noted below.
2. Feeder conductors shall have their ends taped, when entering junction boxes or panels, as noted below.

2.04 CONTROL WIRING

A. Control circuit, single conductor field wire shall be No. 14 AWG, stranded copper with 30 mil thick wall of cross linked polyethylene or polyvinyl chloride insulation rated to withstand a copper temperature of 90 degrees C. at 600 volts without deterioration. It shall meet applicable ICEA Standards.

B. Multi conductor control cable shall consist of individual conductors, No. 14 AWG, stranded copper with 30 mil thick wall of insulation rated to withstand a copper temperature of 75 degrees C without deterioration. The insulation shall be a 20 mil wall of polyethylene with a 10 mil thick polyvinyl chloride jacket. The individual conductors shall be identified per Paragraph 5.6.3. of ICEA Publication No. S 61402 and shall be cabled together with suitable fillers and binder tape to give the completed cable a substantially circular cross section.

2.05 METAL CLAD CABLE (TYPE MC CABLE)

A. Description: NFPA 70, Type MC.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 75 degrees C.

E. Insulation Material: Thermoplastic.

F. Armor Material: Steel.

G. Armor Design: Interlocked metal tape.

H. Fittings: Shall be specifically designed for use with type MC cable.

2.06 WIRING CONNECTORS

A. Split Bolt Connectors:

1. Manufacturers:

a. Black Burn.

b. T & B.

c. Burndy.

B. Solderless Pressure Connectors:

1. Manufacturers:

a. AMP.

b. T & B.

c. 3 M.

C. Spring Wire Connectors:

1. Manufacturers:

a. Buchanah Model B-Cap.

b. 3 M Model Scotchlok or Hyflex.

c. Panduit Model P-Conn.

D. Compression Connectors:

1. Manufacturers:

a. Neer.

b. T & B.

c. Appleton.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported.

D. Verify that field measurements are as indicated.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Route wire and cable as required to meet project conditions.

1. Wire and cable routing indicated is approximate unless dimensioned.

2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

C. All wiring shall be installed in conduit or approved raceway. All raceways shall be provided with a ground conductor unless noted otherwise.

D. Use stranded conductors for control circuits.

E. Pull all conductors into raceway at same time.

F. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

G. Protect exposed cable from damage.

H. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.

I. Use suitable cable fittings and connectors.

J. Neatly train and lace wiring inside boxes, equipment, and panelboards.

K. Clean conductor surfaces before installing lugs and connectors.

L. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

M. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

N. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

O. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

P. Identify and color code wire and cable under provisions of Section 26 0553. Identify each conductor with its circuit number or other designation indicated.

Q. Branch circuits may be combined up to 8 conductors (A-phase, B-phase, C-phase, neutral and A-phase, B-phase, C-phase, neutral) and 2 ground conductors in conduit. Contractor shall be responsible for derating conductors as required by N.E.C Article 310, Note 8.

R. Branch circuit neutral conductors: The use of multi-wire branch circuits with a common neutral is not permitted. Each branch circuit shall be furnished and installed with an accompanying neutral conductor sized the same as the phase conductor.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding components.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association.

1.03 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. The Contractor shall be responsible for providing all grounding required in accordance with NEC and local code requirements. Grounding shown on the plans is minimum required.

PART 2 PRODUCTS

2.01 GENERAL

A. The contractor shall install a grounding system in accordance with the drawings, specifications, and with the National Electrical Code, NEMA, USASI, and IEEE Standards, latest editions. The ground bar at the main service disconnect shall be bonded to the water mains, structural steel, and driven ground rods, by grounding electricode conductors. Maximum grounding resistance shall be achieved per NEC requirements.

2.02 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.

1. Manufacturers: Chance, Burndy, American Electric - Blackburn.

B. Wire: Stranded copper.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

B. Where ground cables are installed in metallic conduit, the cables shall be bonded to the conduit at both ends of the run.

C. Install a minimum #12 AWG green grounding wire for each branch circuit. The grounding wire shall be connected to the grounding terminal bus bars in panelboards, and these bars shall be grounded to the building's grounding system.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

B. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized. All structural supports and channels shall be manufactured from a minimum of #16 gauge ASTM A570 grade 33 steel.

C. Anchors and Fasteners:

1. Do not use spring clips.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps or welded fasteners.
4. Concrete Surfaces: Use expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Wood Elements: Use wood screws.

D. Formed Steel Channel:

1. Product: B-Line Strut.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

2. Obtain permission from Engineer before drilling or cutting structural members.

B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

C. Install surface-mounted cabinets and panelboards with minimum of four anchors.

D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 0534

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit, fittings and conduit bodies.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT).

C. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

D. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association.

E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.

F. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.06 PROJECT CONDITIONS

A. Verify that field measurements are as shown on the drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.

1. Minimum Size: 3/4 inch (19 mm) where concealed within unaccessible construction (i.e. within walls, above drywall ceilings, etc.), 1/2" minimum elsewhere.

B. Underground Installations:

1. More than 5 Feet (1.5 Meters) from Foundation Wall: Use galvanized rigid steel conduit, thickwall nonmetallic conduit, or thinwall nonmetallic conduit.

2. Within 5 Feet (1.5 Meters) from Foundation Wall: Use galvanized rigid steel conduit, or thickwall nonmetallic conduit.

3. Minimum Size: 1 inch (25 mm).

C. Outdoor Locations Above Grade: Use galvanized rigid steel conduit.

D. Wet and Damp Locations: Use galvanized rigid steel conduit or rigid aluminum conduit

E. Dry Locations:

1. Concealed: Use galvanized rigid steel conduit or electrical metallic tubing.
2. Exposed: Use galvanized rigid steel conduit or electrical metallic tubing.

F. Transformer and Motor Connections:

1. Liquidtight flexible metal conduit (maximum length shall be 3'-0").

G. Lighting fixtures:

1. Interior: From junction box to lighting fixture shall be flexible metal conduit (maximum length shall be 6'-0").
2. Exterior: From junction box to lighting fixture shall be liquid-tight flexible metal conduit (maximum length shall be 3'-0").

H. AC/MC Cable:

1. Use for concealed branch circuit drops to devices or light fixtures. Do not use AC/MC cable for homeruns to panelboards.

I. Control Wiring (temperature controls systems):

1. Use electrical metallic tubing, except when making final connection to moving equipment where flexible conduit or sealtite should be used.

2.02 METAL CONDUIT

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedtube.com.
2. Beck Manufacturing, Inc.: www.beckmfg.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Century.

B. Rigid Steel Conduit: ANSI C80.1. Galvanized Rigid Steel (GRS).

C. Rigid Aluminum Conduit: ANSI C80.5.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

1. Connectors and couplings shall be threaded, set-screw, or compression type, and concrete tight and/or rain tight where required.
2. Locknuts shall be malleable iron or steel. Bushings shall be malleable iron, steel, or plastic. Malleable iron or steel bushings shall be zinc or cadmium plated and shall have insulating insert of thermostatic plastic molded and locked into bushing ring. Plastic bushings shall be thermostatic phenolic insulating type. Use of non-rigid plastic bushings is prohibited.

2.03 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC Cable Systems, Inc.: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.

B. Description: Interlocked steel construction.

C. Fittings: NEMA FB 1. cast fittings.

D. Flexible metal conduit shall have a separate grounding conductor.

2.04 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. AFC Cable Systems, Inc.: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.
4. Anaconda Type "UA" for less than 1-1/4" and Type "EF" for larger than 1-1/2".

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1. cast fittings.

D. Flexible metal conduit shall have a separate grounding conductor.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedtube.com.
2. Beck Manufacturing, Inc.: www.beckmfg.com.
3. Wheatland Tube Company: www.wheatland.com.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron set screw type.

1. Connectors and couplings shall be threaded, set-screw, or compression type, and concrete tight and/or rain tight where required.
2. Locknuts shall be malleable iron or steel. Bushings shall be malleable iron, steel, or plastic. Malleable iron or steel bushings shall be zinc or cadmium plated and shall have insulating insert of thermostatic plastic molded and locked into bushing ring. Plastic bushings shall be thermostatic phenolic insulating type. Use of non-rigid plastic bushings is prohibited.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify routing and termination locations of conduit prior to rough-in.

B. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install steel conduit as specified in NECA 101.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529.

F. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

G. Do not attach conduit to ceiling support wires.

H. Arrange conduit to maintain headroom and present neat appearance.

I. Route exposed conduit parallel and perpendicular to walls.

J. Maintain adequate clearance between conduit and piping.

K. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

L. Cut conduit square using saw or pipecutter; de-burr cut ends.

M. Bring conduit to shoulder of fittings; fasten securely.

N. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations, and to cast boxes.

O. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch (50 mm) size. Elbows larger than 3" dia. shall be long radius elbows.

P. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Q. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

R. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

S. Ground and bond conduit under provisions of Section 26 0526.

T. Identify conduit under provisions of Section 26 0553.

3.03 FIRESTOPPING

A. Use only firestop products that have been tested according to ASTM E-814 and UL 1479 for the conditions set forth regarding construction assembly type, penetrating item type, annular space requirements and fire rating.

B. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

1. For non-combustible penetrations including conduit not passing through a sleeve, the following materials are acceptable:
    a. Hilti FS 601 Elastmeric Firestop Sealant.
    b. 3 M.
    c. CSD Sealing Systems.
    d. Firestop Systems.
2. For non-combustible penetrations including sleeved conduits, the following materials are acceptable:
    a. Hilti FS 601 Elastmeric Firestop Sealant.
    b. 3 M.
    c. CSD Sealing Systems.
    d. Firestop Systems.

END OF SECTION

SECTION 26 0537

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall outlet boxes.

B. Pull and junction boxes.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.

C. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.

E. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Pull boxes, junction boxes, and cable support boxes of proper size and design shall be provided in accordance with the N.E.C. and as required to facilitate installation of wires. All boxes shall be sized in accordance with the N.E.C. Covers shall be gasketed and held in place with corrosion resistant machine screws. Cable supports for vertical runs shall be provided at code required locations, within pull or junction boxes. Boxes shall be NEMA 12 for inside and NEMA 4 for outside use where exposed to the weather or where otherwise called for on the drawings.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Outlet and switch boxes shall be minimum of 2-1/8" deep. When installed in a poured wall a 2-1/2" minimum deep box shall be used. When installed in masonry a 3-1/2" minimum deep box shall be used.

D. Use 2-gang 4" square boxes with single plaster rings for single device outlets.

2.02 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

3.02 INSTALLATION

A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.

D. Maintain headroom and present neat mechanical appearance.

E. Provide identification labels on all junction boxes indicating what systems/equipment circuits are feeding (i.e. Lights in Room #102) and where they are being fed from (i.e. Panel LP-1)

F. Install boxes to preserve fire resistance rating of partitions and other elements.

G. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

H. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.

I. Use 2-gang 4" square boxes with single plaster rings for single device outlets.

J. Use cast outlet box in exterior locations and wet locations.

K. Large Pull Boxes (boxes larger than 100 cubic inches in volume or 12 inches in any dimension): Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 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 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Panel schedules.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

C. Thomas & Betts.

D. Panduit.

2.02 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:

1. Each electrical distribution and control equipment enclosure (including starters, disconnects, panelboards, breakers at distribution panels, etc.).

2. Communication cabinets.

C. Letter Size:

1. Use 1/2 inch letters for identifying equipment and loads. Identification shall indicate where the load is fed from.

2.03 WIRE MARKERS

A. Description: Vinyl cloth type self-adhesive wire markers.

B. Description: tape or split sleeve type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, and junction boxes each load connection.

1. Identify circuit feeder numbers at all wiring devices (receptacle, light switches, dimmers, etc.) with a self-adhesive wire marker taped to the back of the device cover plate.

D. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2. Control Circuits: Control wire number indicated on shop drawings.

2.04 PANEL SCHEDULES

A. Each panel shall have a typewritten panel schedule indicating loads. A clear plastic cover over the schedule shall be provided to protect it.

B. Existing panel schedules shall be improved to indicate all existing loads and/or updated to indicate all changes that have occurred during renovation. Typing over writing over existing entries on existing schedules is not acceptable. A new schedule shall be provided. Entries must be in type written form.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using screws or rivets.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION

SECTION 26 2717

EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association.

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association.

C. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Conform to NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 2818, 26 2913 and in individual equipment sections.

C. Flexible Conduit: As specified in Section 26 0534.

D. Wire and Cable: As specified in Section 26 0519.

E. Boxes: As specified in Section 26 0537.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations. Maximum length shall be 6 feet. Minimum size shall be 3/4" diameter.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, 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.

END OF SECTION

SECTION 26 2913

ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manual motor controllers.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association.

C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association.

E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association.

F. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Electric Company: www.geindustrial.com.

B. Square D: www.squared.com. BASE BID Square D, other approved manufacturers may only be bid as a voluntary alternate to the base bid and must be clarified in the bid as such.

C. Allen Bradley.

D. Siemens.

2.02 MANUAL CONTROLLERS

A. Manual Motor Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, NO auxiliary contact, and toggle operator with handle guard/lock off feature.

B. Fractional Horsepower Manual Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator with handle guard/lock off feature.

C. Enclosures: NEMA ICS 6, Type 1 for interior, dry locations; Type 3R or 4X for exterior and damp locations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

C. Provide supports in accordance with Section 26 0529.

D. Height: 5 ft. (1500 mm) to operating handle.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Provide engraved plastic nameplates; refer to Section 26 0553 for product requirements and location.

G. Neatly type label 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.

END OF SECTION