



**BID 17-09**

**for**

**OTSEGO COUNTY ALPINE CENTER  
BOILER REPLACEMENT PROJECT**

**Date Issued: August 4, 2017**

**Date Due: August 16, 2017 by 1:00 p.m. local time**

**OTSEGO COUNTY  
ALPINE CENTER  
BOILER REPLACEMENT  
GAYLORD, MICHIGAN**

**TABLE OF CONTENTS**

Advertisement for Bids .....	AD1
Instructions to Bidders .....	IB1-6
Bid Form .....	BF1-4
Attachment A .....	NCA1
Attachment B .....	BI1
Engineer Table of Contents, Specifications, and Drawings.....	O-1-M-100
Otsego County Purchasing Policy .....	1-9

**ADVERTISEMENT FOR BIDS  
OTSEGO COUNTY ALPINE CENTER  
BOILER REPLACEMENT**

Gaylord, Michigan

**BID 2017-09**

1. Sealed Bids for the Otsego County Alpine Center Boiler Replacement will be received by Otsego County Administration, 225 West Main Suite 203, Gaylord, Michigan 49735 until 1:00 pm local time, on Wednesday, August 16, 2017. Bids will be opened at the Otsego County Building, 225 West Main, Gaylord, Michigan 49735 in Room 212 and publicly read aloud at that time.
2. The full bid package will be available on-line at <http://www.otsegocountymi.gov/general-information/bids-and-proposals/> beginning Friday, August 4, 2017. Hard copies of the Bid Documents are available upon request, starting August 4, 2017 at the Otsego County Administration Office, 225 West Main Suite 203, Gaylord, Michigan 49735. Phone: 989-731-7520.
3. Any questions must be received by the end of day on Friday, August 11, 2017. All questions related to the boiler system and the Alpine Center building are to be directed to Joe Switalski at [jswitalski@otsegocountymi.gov](mailto:jswitalski@otsegocountymi.gov) or (989) 370-3802. General questions are to be directed to Rachel Frisch at [rfrisch@otsegocountymi.gov](mailto:rfrisch@otsegocountymi.gov) or 989-731-7520.
4. The principal items of work consist of the following:  
  
Removal and replacement of the boilers at the Alpine Center 800 Livingston Blvd. Gaylord, Michigan 49735.
5. The intent of Otsego County is to award one (1) Contract for the entire project.
6. Bids shall remain firm and shall not be withdrawn for a period of ninety (90) calendar days after bid opening.
7. The County of Otsego reserves the right to accept, reject or negotiate any or all bids to waive or not waive informalities or irregularities in the bids or bidding procedures and to accept any bid determined by the County to be in the best interest of the County, regardless of price. Vendors located in Otsego County receive a 5% cost variance for low bid determination.

## INSTRUCTIONS TO BIDDERS

### ARTICLE 1 - DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:
- A. Bidder-The individual or entity who submits a Bid directly to OWNER.
  - B. OWNER-The owner of this project is Otsego County.
  - C. ENGINEER-The engineer is **C2AE, 123 West Main Suite 200 Gaylord, Michigan 49735**  
**Attention: Larry Fox, P.E.**
  - D. Issuing Office-The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered. The issuing office is **Otsego County Administration, 225 West Main Suite 203, Gaylord, Michigan 49735.**
  - E. Successful Bidder--The lowest responsible Bidder submitting a responsive Bid to whom OWNER (on the basis of OWNER'S evaluation as hereinafter provided) makes an award.

### ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

- 2.01 Complete hard copy sets of the Bidding Documents may be obtained from the Issuing Office upon request. The Complete set of Bidding Documents is available online at <http://www.otsegocountymi.gov/general-information/bids-and-proposals/>
- 2.02 Complete sets of Bidding Documents must be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 OWNER in making copies of Bidding Documents available on the above terms does so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

### ARTICLE 3 - QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of OWNER'S request Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for by the OWNER.
- 3.02 Bidders will be required to execute a Noncollusion Affidavit of Prime Bidder Statement (page NCA-1) and include the affidavit with this Bid.

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

- 4.01 On request, OWNER will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

- 4.02 It is the responsibility of each Bidder before submitting a Bid to:
- A. Examine and carefully study the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;
  - B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work; **Site visits shall be coordinated through Joe Switalski, [jswitalski@otsegocountymi.gov](mailto:jswitalski@otsegocountymi.gov) or 989-370-3802 and shall take place during the week of Monday, August 7 – Friday, August 11, 2017.**
  - C. Become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, or performance of the Work;
  - D. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;
  - E. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;
  - F. Promptly give ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by ENGINEER is acceptable to Bidder; and
  - G. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- 4.03 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by ENGINEER are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

#### ARTICLE 5 - PRE-BID CONFERENCE

- 5.01 No pre-bid conference will be held.

#### ARTICLE 6 - SITE AND OTHER AREAS

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

## ARTICLE 7 - INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to ENGINEER in writing. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by ENGINEER as having received the Bidding Documents, as well as posted online with the Complete Bidding Document. Questions must be received by Friday, August 11, 2017 in order to be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by OWNER or ENGINEER.

## ARTICLE 8 - BID SECURITY

- 8.01 A Bid security is required in the amount of 10% of the bid amount.

## ARTICLE 9 - CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be (a) Substantially Completed and (b) also completed and ready for final payment are set forth in the Agreement.

## ARTICLE 10 - LIQUIDATED DAMAGES

- 10.01 Provisions for liquidated damages, if any, are set forth in the Bid Form.

## ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

- 11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in the General Conditions.

## ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 The identity of certain Subcontractors, Suppliers, individuals, or entities are required to be submitted to OWNER within twenty-four (24) hours after the bid opening time and date. If OWNER or ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, OWNER may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and OWNER may consider such price adjustment in evaluating Bids and making the contract award.
- 12.02 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or

entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which OWNER or ENGINEER makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to OWNER and ENGINEER subject to revocation of such acceptable after the Effective Date of the Agreement as provided in paragraph 6.06 of the General Conditions.

- 12.03 CONTRACTOR shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom CONTRACTOR has reasonable objection.

#### ARTICLE 13 - PREPARATION OF BID

- 13.01 The Bid form is included with the Bidding Documents. Additional copies may be obtained from the OWNER.
- 13.02 All blanks on the Bid form shall be completed by printing in ink or by typewriter and the Bid signed. A Bid price shall be indicated for each Bid item and alternative listed therein.
- 13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.
- 13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.
- 13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.
- 13.06 A Bid by an individual shall show the Bidder's name and official address.
- 13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture must be shown below the signature.
- 13.08 All names shall be typed or printed in ink below the signatures.
- 13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid form.
- 13.10 The address and telephone number for communications regarding the Bid shall be shown.
- 13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number for the state of the Project, if any, shall also be shown on the Bid form.

#### ARTICLE 14 - BASIS OF BID; EVALUATION OF BIDS

- 14.01 Lump Sum
- A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each option described in the Bidding Documents as provided for in the Bid form. The price for each option will be the amount added or deleted from the base Bid if OWNER selects the

alternate. In the evaluation of Bids, options will be applied in any order or combination as determined by the Owner.

#### ARTICLE 15 - SUBMITTAL OF BID

- 15.01 Each prospective Bidder is furnished one copy of the Bidding Documents with one separate unbound copy each of the Bid form. The unbound copy of the Bid form is to be completed and submitted with the Bid security and the following data:
- A. Attachment A Noncollusion Affidavit of Prime Bidder
  - B. Attachment B Bidder Information
  - C. Manufacturers shop drawings for the boiler system upon which the bid is based.
- 15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to:

OTSEGO COUNTY ADMINISTRATION  
225 West Main, Suite 203  
Gaylord, Michigan 49735

#### ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

- 16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

#### ARTICLE 17 - OPENING OF BIDS

- 17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and options, if any, will be made available to Bidders after the opening of Bids.

#### ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

## ARTICLE 19 - AWARD OF CONTRACT

- 19.01 OWNER reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. OWNER further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. OWNER may also reject the Bid of any Bidder if OWNER believes that it would not be in the best interest of the Project to make an award to that Bidder. OWNER also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.
- 19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.
- 19.03 In evaluating Bids, OWNER will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- 19.04 In evaluating Bidders, OWNER will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in Article 12 - Subcontractors, Suppliers and others of these Instruction to Bidders.
- 19.05 OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.
- 19.06 If the Contract is to be awarded, OWNER will award the Contract to the Bidder whose Bid is in the best interests of the Project.

## ARTICLE 20 – FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

- 20.01 Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

## ARTICLE 21 – PERFORMANCE BOND AND PAYMENT BOND

- 21.01 Performance and payment bonds will not be required.

## ARTICLE 22 - SIGNING OF AGREEMENT

- 22.01 When OWNER gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER. Within fifteen (15) days thereafter, OWNER shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

BID FORM

**PROJECT IDENTIFICATION:** OTSEGO COUNTY  
ALPINE CENTER  
BOILER REPLACEMENT  
GAYLORD, MICHIGAN

**DELIVER BID TO:** Otsego County Administration  
225 West Main, Suite 203  
Gaylord, MI 49735

**1.01** The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

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

**3.01** In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

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

Addendum No. \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_,

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

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

D. Bidder has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities).

E. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

- G. Bidder is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents.
  - H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
  - I. Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by ENGINEER is acceptable to Bidder.
  - J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- 4.01** Bidder further represents that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.
- 5.01** Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

**Division A – Building Base Lump Sum Bid**

For the Otsego County Alpine Center Boiler Replacement. Complete with all appurtenance, as specified herein and as shown on the plans, the Bidder agrees to perform all of the work of this Contract for the following lump sum bid price.

Total Lump Sum Bid Price: \$ \_\_\_\_\_

Total bid amount in words

\_\_\_\_\_ Dollars and \_\_\_\_\_ cents.

**6.01** Bidder agrees to have the first set of 2 boilers installed and operational no later than Friday, December 1, 2017, and to have the second and final set of 2 boilers installed and operational no later than Monday, January 1, 2018. The project will be substantially completed on or before *Monday, January 1, 2018*, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions on or before *Monday, January 29, 2018*.

**7.01** The following documents are attached to and made a condition of this Bid:

- A. Required Bid security
- B. Noncollusion Affidavit of Prime Bidder (Attachment A)
- C. Bidder Information (Attachment B)
- D. Shop Drawings: The Bidder shall submit with his bid the manufacturers shop drawings for the boiler equipment upon which the bid is based. This is intended to speed up the equipment procurement process by allowing shop drawings to be approved in advance such that the selected bidder has the ability to order equipment immediately upon receipt of the Notice to Proceed.

SUBMITTED on \_\_\_\_\_, 2017.

State Contractor License No. \_\_\_\_\_. (If applicable)

If Bidder is:

An Individual

Name (typed or printed): \_\_\_\_\_

By: \_\_\_\_\_ (SEAL)

*(Individual's signature)*

Doing business as: \_\_\_\_\_

Business address: \_\_\_\_\_

\_\_\_\_\_

Phone No. \_\_\_\_\_ Fax No. \_\_\_\_\_

A Partnership

Partnership Name: \_\_\_\_\_ (SEAL)

By: \_\_\_\_\_

*(Signature of general partner -- attach evidence of authority to sign)*

Name (typed or printed): \_\_\_\_\_

Business address: \_\_\_\_\_

\_\_\_\_\_

Phone No. \_\_\_\_\_ Fax No. \_\_\_\_\_

A Corporation

Corporation Name: \_\_\_\_\_ (SEAL)

State of Incorporation: \_\_\_\_\_

Type (General Business, Professional, Service, Limited Liability): \_\_\_\_\_

By: \_\_\_\_\_

*(Signature -- attach evidence of authority to sign)*

Name (typed or printed): \_\_\_\_\_

Title: \_\_\_\_\_ (CORPORATE SEAL)

Attest \_\_\_\_\_

*(Signature of Corporate Secretary)*

Business address: \_\_\_\_\_

\_\_\_\_\_

Phone No. \_\_\_\_\_ Fax No. \_\_\_\_\_

Date of Qualification to do business is \_\_\_\_\_

**Attachment A**  
**Noncollusion Affidavit of Prime Bidder**

State of: \_\_\_\_\_

County of: \_\_\_\_\_

\_\_\_\_\_, being first duly sworn, deposes and says that:

- (1) He/She is the \_\_\_\_\_ of \_\_\_\_\_, the Bidder that has submitted the attached Bid;
- (2) He/She is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;
- (3) Such Bid is genuine and is not a collusive or sham bid;
- (4) Neither the said Bidder nor any of its officers, partners, owners agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, either directly or indirectly, with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement, or collusion or communication or conference with any other Bidder, firm, or person to fix the price or prices in the attached bid or that of any other Bidder, or, to fix any overhead, profit, or cost element of the bid price or the bid price or prices in the attached bid or that of any other Bidder, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against Bay Mills Township or any person interested in the proposed Contract.
- (5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties of interest, including this affiant.

Signed By:

\_\_\_\_\_  
(Title)

Subscribed and sworn to before me this \_\_\_\_\_ day

of \_\_\_\_\_, 2017

\_\_\_\_\_  
\_\_\_\_\_

My Commission Expires: \_\_\_\_\_

**Attachment B  
Bidder Information**

GENERAL

The Bidder must complete the following:

A. Active Projects -

	Year Began	Owner	Contract Price	Project Description
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

B. Completed Similar Projects -

	Year Began	Owner	Contract Price	Project Description
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

C. Bidder's approximate bonding capacity as of August 1, 2017,

D. Name of Bidder's superintendent who will be responsible for the project -

1. \_\_\_\_\_ (Two alternate names are acceptable)

1. General Experience

\_\_\_\_\_  
\_\_\_\_\_



Table of Contents

Division	Section Title	Pages
<b>DIVISION 03 - CONCRETE</b>		
033000	CAST-IN-PLACE CONCRETE.....	5
<b>DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)</b>		
230519	METERS AND GAGES FOR HVAC PIPING.....	21
230523.12	BALL VALVES FOR HVAC PIPING.....	11
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT.....	15
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.....	9
230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC.....	34
230719	HVAC PIPING INSULATION.....	37
231123	FACILITY NATURAL-GAS PIPING.....	27
232113	HYDRONIC PIPING.....	18
232116	HYDRONIC PIPING SPECIALTIES.....	8
235223	CAST-IRON BOILERS.....	14
<b>END OF SECTION</b>		

## **SECTION 033000 - CAST-IN-PLACE CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

#### **1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

#### **1.5 FIELD CONDITIONS**

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301.
  - 2. ACI 117.

### **2.2 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

### **2.3 REINFORCEMENT ACCESSORIES**

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- C. Zinc Repair Material: ASTM A 780/A 780M.

### **2.4 CONCRETE MATERIALS**

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, Type I, gray.
  - 2. Fly Ash: ASTM C 618, Class F.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330/C 330M, 1/2-inch nominal maximum aggregate size.

- E. Air-Entraining Admixture: ASTM C 260/C 260M.

## **2.5 FLOOR AND SLAB TREATMENTS**

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch sieve.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anti-Hydro International, Inc.
    - b. Dayton Superior.
    - c. L&M Construction Chemicals, Inc.
    - d. Lambert Corporation.
    - e. Metalcrete Industries.

## **2.6 RELATED MATERIALS**

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

## **2.7 FABRICATING REINFORCEMENT**

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## **PART 3 - EXECUTION**

### **3.1 FORMWORK INSTALLATION**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete

surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.2 VAPOR-RETARDER INSTALLATION**

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

### **3.3 JOINTS**

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

### **3.4 FINISHING FLOORS AND SLABS**

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

### **3.5 JOINT FILLING**

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### **3.6 CONCRETE SURFACE REPAIRS**

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

**END OF SECTION 033000**

## **SECTION 230519 - METERS AND GAGES FOR HVAC PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Test plugs.
  - 5. .
- B. Related Requirements:
  - 1. Section 231123 "Facility Natural-Gas Piping".

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include diagrams for power, signal, and control wiring.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 LIQUID-IN-GLASS THERMOMETERS**

- A. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Flo Fab Inc.
    - b. WATTS.
    - c. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.200.
  - 3. Case: Plastic; 6-inch nominal size.
  - 4. Case Form: Straight unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.
  - a. Design for Air-Duct Installation: With ventilated shroud.
  - b. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.2 DIAL-TYPE PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ashcroft Inc.
    - b. Flo Fab Inc.
    - c. Miljoco Corporation.
    - d. WATTS.
    - e. Weiss Instruments, Inc.
  2. Standard: ASME B40.100.
  3. Case: Liquid-filled Sealed type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
  4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  6. Movement: Mechanical, with link to pressure element and connection to pointer.
  7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  8. Pointer: Dark-colored metal.
  9. Window: Glass.
  10. Ring: Metal.
  11. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.

## 2.3 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## 2.4 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Flow Design, Inc.

2. Miljoco Corporation.
  3. Peterson Equipment Co., Inc.
  4. WATTS.
  5. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion in piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 200 psig at 200 deg F.
- F. Core Inserts: EPDM self-sealing rubber.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
  1. Inlet and outlet of each hydronic boiler.

#### **3.2 CONNECTIONS**

- A. Install meters and gages adjacent to machines and equipment to allow space for service and maintenance of meters, gages, machines, and equipment.

### **3.3 ADJUSTING**

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

### **3.4 THERMOMETER SCHEDULE**

- A. Thermometers at inlet and outlet of each hydronic boiler shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

### **3.5 THERMOMETER SCALE-RANGE SCHEDULE**

- A. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

### **3.6 PRESSURE-GAGE SCHEDULE**

### **3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

**END OF SECTION 230519**

## **SECTION 230523.12 - BALL VALVES FOR HVAC PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Steel ball valves.

#### **1.3 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. SWP: Steam working pressure.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded-end valves.
  - 2. ASME B16.5 for flanges on steel valves.
  - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Refer to HVAC valve schedule articles for applications of valves.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
  - 1. Include 2-inch stem extensions.
  - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.
- I. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRASS BALL VALVES

- A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Crane; Crane Energy Flow Solutions.
    - c. Hammond Valve.
    - d. Jomar Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. WATTS.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Forged brass.
    - f. Ends: Threaded.
    - g. Seats: PTFE.
    - h. Stem: Brass.

- i. Ball: Chrome-plated brass.
- j. Port: Full.

### 2.3 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Crane; Crane Energy Flow Solutions.
    - c. Hammond Valve.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
    - f. WATTS.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.
    - j. Port: Full.
    - k. Seats: PTFE.
    - l. Stem: Stainless steel.
    - m. Ball: Stainless steel, vented.
    - n. Port: Regular.

### 2.4 STEEL BALL VALVES

- A. Steel Ball Valves with Full Port and Stainless-Steel Trim, Class 150:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. Jamesbury; Metso.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-72.
    - b. CWP Rating: 285 psig.
    - c. Body Design: Split body.
    - d. Body Material: Carbon steel, ASTM A 216, Type WCB.
    - e. Ends: Flanged.
    - f. Seats: PTFE.
    - g. Stem: Stainless steel.
    - h. Ball: Stainless steel, vented.
    - i. Port: Full.

- B. Iron Ball Valves, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Apollo Flow Controls; Conbraco Industries, Inc.
    - c. WATTS.
  - 2. Description:
    - a. Standard: MSS SP-72.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Split body.
    - d. Body Material: ASTM A 126, gray iron.
    - e. Ends: Flanged.
    - f. Seats: PTFE.
    - g. Stem: Stainless steel.
    - h. Ball: Stainless steel.
    - i. Port: Full.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

### **3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
  - 1. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 2. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Steel Piping, NPS 5 and Larger: Flanged ends.

### **3.4 HEATING-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 and Smaller: bronze ball valves, two piece with bronze trim, and full port.
  - 1. Valves may be provided with solder-joint ends instead of threaded ends.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Iron ball valves, Class 125.
    - a. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
  - 2. Steel ball valves, Class 150.

**END OF SECTION 230523.12**

## **SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

#### **1.5 QUALITY ASSURANCE**

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

## 2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
  - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO International Corporation.
  - 3. National Pipe Hanger Corporation.
  - 4. Pipe Shields Inc.
  - 5. Rilco Manufacturing Co., Inc.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi ASTM C 552, Type II cellular glass with 100-psi or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. B-line, an Eaton business.
    - b. Hilti, Inc.
  - 2. Indoor Applications: Zinc-coated steel.

## 2.5 MATERIALS

- A. Carbon Steel: ASTM A 1011/A 1011M.

- B. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.
- C. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- D. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

### **3.2 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- H. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. .
  4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.4 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- E. Use thermal-hanger shield inserts for insulated piping and tubing.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  6. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  7. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  8. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Use or mechanical-expansion anchors instead of building attachments where required in concrete construction.

**END OF SECTION 230529**

## **SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

### **PART 2 - PRODUCTS**

#### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Champion America.
    - d. Craftmark Pipe Markers.
    - e. Marking Services, Inc.
    - f. Seton Identification Products.
  - 2. Material and Thickness: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 3. Letter Color: White
  - 4. Background Color: Black
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
  - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  - 7. Fasteners: Stainless-steel rivets or self-tapping screws

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Champion America.
    - d. Craftmark Pipe Markers.
    - e. Marking Services, Inc.
    - f. Seton Identification Products.
  2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
  3. Letter Color: White
  4. Background Color: Black
  5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  8. Fasteners: Stainless-steel rivets or self-tapping screws
  9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number,

## 2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Brady Corporation.
  2. Carlton Industries, LP.
  3. Champion America.
  4. Craftmark Pipe Markers.
  5. Marking Services Inc.
  6. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Red
- D. Background Color: White

- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

### **2.3 PIPE LABELS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Brady Corporation.
  - 2. Carlton Industries, LP.
  - 3. Champion America.
  - 4. Craftmark Pipe Markers.
  - 5. Marking Services Inc.
  - 6. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in **Section 099123 "Interior Painting."**
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
  - 1. Heating Water Piping: White letters on a safety-green background
  - 2. Natural Gas Piping: Black letters on a safety-yellow background

### **3.5 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION 230553**

## **SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Balancing Hydronic Piping Systems:
    - a. Constant-flow hydronic systems.
    - b. Variable-flow hydronic systems.
  - 2. Testing, Adjusting, and Balancing Equipment:
    - a. Boilers.
  - 3. Testing, adjusting, and balancing existing systems and equipment.
  - 4. Control system verification.

#### **1.3 DEFINITIONS**

- A. NEBB: National Environmental Balancing Bureau.
- B. TAB: Testing, adjusting, and balancing.
- C. TABB: Testing, Adjusting, and Balancing Bureau.
- D. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- E. TDH: Total dynamic head.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.

#### **1.5 QUALITY ASSURANCE**

- A. TAB Specialists Qualifications: Certified by AABC.
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

- B. TAB Specialists Qualifications: Certified by NEBB or TABB.
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
  - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

## 1.6 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- D. Examine system pumps to ensure absence of entrained air in the suction piping.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Hydronics:

- a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
- b. Piping is complete with equipment installed.
- c. Systems are flushed, filled, and air purged.
- d. Control valves are functioning per the sequence of operation.
- e. Shutoff and balance valves have been verified to be 100 percent open.
- f. Pumps are started and proper rotation is verified.
- g. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- h. Variable-frequency controllers' startup is complete and safeties are verified.
- i. Suitable access to balancing devices and equipment is provided.

### **3.3 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS**

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
  1. Check liquid level in expansion tank.
  2. Check highest vent for adequate pressure.
  3. Check flow-control valves for proper position.
  4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
  5. Verify that motor starters are equipped with properly sized thermal protection.
  6. Check that air has been purged from the system.

### **3.4 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS**

- A. Adjust pumps to deliver total design gpm.
  1. Measure total water flow.
    - a. Position valves for full flow through coils.
    - b. Measure flow by main flow meter, if installed.
    - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
  2. Measure pump TDH as follows:
    - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
    - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
    - c. Convert pressure to head and correct for differences in gage heights.
    - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
    - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
  3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

- B. Adjust flow-measuring devices installed in mains and branches to design water flows.
  - 1. Measure flow in main and branch pipes.
  - 2. Adjust main and branch balance valves for design flow.
  - 3. Re-measure each main and branch after all have been adjusted.
  
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - 1. Measure flow at terminals.
  - 2. Adjust each terminal to design flow.
  - 3. Re-measure each terminal after it is adjusted.
  - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
  - 5. Perform temperature tests after flows have been balanced.
  
- D. For systems with pressure-independent valves at terminals:
  - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
  - 2. Perform temperature tests after flows have been verified.
  
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - 1. Measure and balance coils by either coil pressure drop or temperature method.
  - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
  
- F. Verify final system conditions as follows:
  - 1. Re-measure and confirm that total water flow is within design.
  - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
  - 3. Mark final settings.
  
- G. Verify that memory stops have been set.

### **3.5 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS**

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
  
- B. Adjust the variable-flow hydronic system as follows:
  - 1. Verify that the differential-pressure sensor is located as indicated.
  - 2. Determine whether there is diversity in the system.
  
- C. For systems with no diversity:
  - 1. Adjust pumps to deliver total design gpm.
    - a. Measure total water flow.
      - 1) Position valves for full flow through coils.
      - 2) Measure flow by main flow meter, if installed.
      - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

- b. Measure pump TDH as follows:
        - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
        - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
        - 3) Convert pressure to head and correct for differences in gage heights.
        - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
        - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
      - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
2. Adjust flow-measuring devices installed in mains and branches to design water flows.
  - a. Measure flow in main and branch pipes.
  - b. Adjust main and branch balance valves for design flow.
  - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - a. Measure flow at terminals.
  - b. Adjust each terminal to design flow.
  - c. Re-measure each terminal after it is adjusted.
  - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
  - e. Perform temperature tests after flows have been balanced.
4. For systems with pressure-independent valves at terminals:
  - a. Measure differential pressure and verify that it is within manufacturer's specified range.
  - b. Perform temperature tests after flows have been verified.
5. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - a. Measure and balance coils by either coil pressure drop or temperature method.
  - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
6. Prior to verifying final system conditions, determine the system differential-pressure set point.
7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
8. Mark final settings and verify that all memory stops have been set.
9. Verify final system conditions as follows:
  - a. Re-measure and confirm that total water flow is within design.
  - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
  - c. Mark final settings.

10. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
  2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
  3. Adjust pumps to deliver total design gpm.
    - a. Measure total water flow.
      - 1) Position valves for full flow through coils.
      - 2) Measure flow by main flow meter, if installed.
      - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
    - b. Measure pump TDH as follows:
      - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      - 3) Convert pressure to head and correct for differences in gage heights.
      - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
      - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
    - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
  4. Adjust flow-measuring devices installed in mains and branches to design water flows.
    - a. Measure flow in main and branch pipes.
    - b. Adjust main and branch balance valves for design flow.
    - c. Re-measure each main and branch after all have been adjusted.
  5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
    - a. Measure flow at terminals.
    - b. Adjust each terminal to design flow.
    - c. Re-measure each terminal after it is adjusted.
    - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
    - e. Perform temperature tests after flows have been balanced.
  6. For systems with pressure-independent valves at terminals:
    - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
    - b. Perform temperature tests after flows have been verified.
  7. For systems without pressure-independent valves or flow-measuring devices at terminals:
    - a. Measure and balance coils by either coil pressure drop or temperature method.
    - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
  - a. Re-measure and confirm that total water flow is within design.
  - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
  - c. Mark final settings.
13. Verify that memory stops have been set.

### **3.6 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS**

- A. Balance the primary circuit flow first.
- B. Balance the secondary circuits after the primary circuits are complete.
- C. Adjust pumps to deliver total design gpm.
  1. Measure total water flow.
    - a. Position valves for full flow through coils.
    - b. Measure flow by main flow meter, if installed.
    - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
  2. Measure pump TDH as follows:
    - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
    - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
    - c. Convert pressure to head and correct for differences in gage heights.
    - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
  3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- D. Adjust flow-measuring devices installed in mains and branches to design water flows.
  1. Measure flow in main and branch pipes.
  2. Adjust main and branch balance valves for design flow.
  3. Re-measure each main and branch after all have been adjusted.

- E. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - 1. Measure flow at terminals.
  - 2. Adjust each terminal to design flow.
  - 3. Re-measure each terminal after it is adjusted.
  - 4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
  - 5. Perform temperature tests after flows have been balanced.
  
- F. For systems with pressure-independent valves at terminals:
  - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
  - 2. Perform temperature tests after flows have been verified.
  
- G. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - 1. Measure and balance coils by either coil pressure drop or temperature method.
  - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
  
- H. Verify final system conditions as follows:
  - 1. Re-measure and confirm that total water flow is within design.
  - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
  - 3. Mark final settings.
  
- I. Verify that memory stops have been set.

### **3.7 PROCEDURES FOR BOILERS**

- A. Hydronic Boilers:
  - 1. Measure and record entering- and leaving-water temperatures.
  - 2. Measure and record water flow.
  - 3. Record relief valve pressure setting.

### **3.8 CONTROLS VERIFICATION**

- A. In conjunction with system balancing, perform the following:
  - 1. Confirm that the sequences of operation are in compliance with Contract Documents.
  - 2. Verify that controllers are calibrated and function as intended.
  - 3. Verify that controller set points are as indicated.
  - 4. Verify the operation of lockout or interlock systems.
  - 5. Verify the operation of valve and damper actuators.
  - 6. Verify that controlled devices are properly installed and connected to correct controller.
  - 7. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
  - 8. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
  - 1. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to Verify the following:
  - 1. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
  - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
  - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
  - 3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
  - 4. Balance each air outlet.

### 3.10 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  - 1. Heating-Water Flow Rate: **Plus or minus 10 percent**
  - 2. >.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.11 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Manufacturers' test data.

2. Field test reports prepared by system and equipment installers.
  3. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB specialist.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:

- a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and unit size.
  - e. Manufacturer's serial number.
  - f. Fuel type in input data.
  - g. Output capacity in Btu/h.
  - h. Ignition type.
  - i. Burner-control types.
  - j. Motor horsepower and rpm.
  - k. Motor volts, phase, and hertz.
  - l. Motor full-load amperage and service factor.
  - m. Sheave make, size in inches, and bore.
  - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
  - b. Entering-air temperature in deg F.
  - c. Leaving-air temperature in deg F.
  - d. Air temperature differential in deg F.
  - e. Entering-air static pressure in inches wg.
  - f. Leaving-air static pressure in inches wg.
  - g. Air static-pressure differential in inches wg.
  - h. Low-fire fuel input in Btu/h.
  - i. High-fire fuel input in Btu/h.
  - j. Manifold pressure in psig.
  - k. High-temperature-limit setting in deg F.
  - l. Operating set point in Btu/h.
  - m. Motor voltage at each connection.
  - n. Motor amperage for each phase.
  - o. Heating value of fuel in Btu/h.
- F. Prepare test and inspection reports.

**END OF SECTION 230593**

## **SECTION 230719 - HVAC PIPING INSULATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
  - 1. Heating hot-water piping, indoors.

#### **1.3 ACTION SUBMITTALS**

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### **1.5 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### **1.6 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
  - 1. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
  - 2. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Block Insulation: ASTM C 552, Type I.
  - 2. Board Insulation: ASTM C 552, Type IV.
  - 3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
- I. Mineral-Fiber, Preformed Pipe Insulation:

### **2.2 INSULATING CEMENTS**

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

### **2.3 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
- C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

### **2.4 SEALANTS**

- A. Cellular-Glass, Phenolic, and Polyisocyanurate Joint Sealants:

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.3 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

### 3.4 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  - 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of cellular-glass insulation to valve body.
  - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.

### 3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers' recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturers' recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

### 3.8 INDOOR PIPING INSULATION SCHEDULE

A. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. NPS 12 and Smaller: Insulation shall be one of the following:
  - a. Cellular Glass: 1-1/2 inches thick.
  - b. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

**END OF SECTION 230719**

## **SECTION 231123 - FACILITY NATURAL-GAS PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping and tubing joining materials.
  - 3. Manual gas shutoff valves.

#### **1.3 ACTION SUBMITTALS**

- A. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
  - 1. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

#### **1.5 QUALITY ASSURANCE**

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

## 1.7 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
  - 1. Notify Owner no fewer than three days in advance of proposed interruption of natural-gas service.
  - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

### 2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.

- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.3 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating 125 psig
  - 2. Threaded Ends: Comply with ASME B1.20.1.
  - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
  
- B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
  
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.
    - b. BrassCraft Manufacturing Co.; a Masco company.
    - c. Lyall, R. W. & Company, Inc.
  - 2. Body: Bronze, complying with ASTM B 584.
  - 3. Ball: Chrome-plated bronze.
  - 4. Stem: Bronze; blowout proof.
  - 5. Seats: Reinforced TFE; blowout proof.
  - 6. Packing: Threaded-body packnut design with adjustable-stem packing.
  - 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 8. CWP Rating: 600 psig.
  - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

## **2.4 LABELING AND IDENTIFYING**

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

### **3.3 INDOOR PIPING INSTALLATION**

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Locate valves for easy access.
- F. Install piping free of sags and bends.

- G. Install fittings for changes in direction and branch connections.
- H. Verify final equipment locations for roughing-in.
- I. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- J. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- K. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- L. Connect branch piping from top or side of horizontal piping.
- M. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- N. Do not use natural-gas piping as grounding electrode.

### **3.4 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

### **3.5 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  2. Bevel plain ends of steel pipe.
  3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

### **3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

### **3.7 CONNECTIONS**

- A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### **3.8 LABELING AND IDENTIFYING**

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

### 3.9 PAINTING

- A. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Interior latex matching topcoat.
    - c. Topcoat: Interior latex flat
    - d. Color: Yellow
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### 3.10 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Use 3000-psi 28-day, compressive-strength concrete and reinforcement.

### 3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, distribution piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.

**3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG**

- A. Aboveground, distribution piping shall be **one of** the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
  2. Steel pipe with steel welding fittings and welded joints.

**3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
1. Two-piece, full port, bronze ball valves with bronze trim.

**END OF SECTION 231123**

## **SECTION 232113 - HYDRONIC PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes pipe and fitting materials and joining methods for the following:
  1. Steel pipe and fittings.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of the following:
  1. Pipe.
  2. Fittings.
  3. Joining materials.

#### **1.4 QUALITY ASSURANCE**

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
  1. Hot-Water Heating Piping: 100 psig at 200 deg F
  2. Blowdown-Drain Piping: 180 deg F
  3. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

#### **2.2 STEEL PIPE AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Grinnell Mechanical Products.
  - b. Victaulic Company.
2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

### **PART 3 - EXECUTION**

#### **3.1 PIPING APPLICATIONS**

- A. Hot-water heating piping, aboveground, NPS 2 and smaller shall be any of the following:
  1. Schedule 40 Grade B steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger range>, shall be any of the following:
  1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- D. Air-Vent Piping:
  1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
  2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

#### **3.2 PIPING INSTALLATIONS**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- C. Install piping to permit valve servicing.
- D. Install piping at indicated slopes.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- K. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

### **3.3 HANGERS AND SUPPORTS**

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet.
  - 2. NPS 1: Maximum span, 7 feet.
  - 3. NPS 1-1/2: Maximum span, 9 feet.

4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### **3.4 PIPE JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- F. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

### **3.5 TERMINAL EQUIPMENT CONNECTIONS**

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

### **3.6 FIELD QUALITY CONTROL**

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  1. Leave joints, including welds, uninsulated and exposed for examination during test.
  2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Set makeup pressure-reducing valves for required system pressure.
  4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  7. Verify lubrication of motors and bearings.

**END OF SECTION 232113**

## **SECTION 232116 - HYDRONIC PIPING SPECIALTIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Air-control devices.
- B. Related Requirements:
  - 1. Section 230523.12 "Ball Valves for HVAC Piping" for specification and installation requirements for ball valves common to most piping systems.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product:
  - 1. Include construction details and material descriptions for hydronic piping specialties.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
  - 3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For hydronic piping specialties to include in emergency, operation, and maintenance manuals.

#### **1.5 QUALITY ASSURANCE**

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Safety Valves and Pressure Vessels: Shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

### **PART 2 - PRODUCTS**

#### **2.1 AIR-CONTROL DEVICES**

- A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL, Inc.
    - b. Apollo Flow Controls; Conbraco Industries, Inc.
    - c. Armstrong Pumps, Inc.
    - d. Bell & Gossett; a Xylem brand.
    - e. Hays Fluid Controls.
    - f. TACO Comfort Solutions, Inc.
  2. Body: Bronze.
  3. Internal Parts: Nonferrous.
  4. Operator: Screwdriver or thumbscrew.
  5. Inlet Connection: NPS 1/2.
  6. Discharge Connection: NPS 1/8.
  7. CWP Rating: 150 psig.
  8. Maximum Operating Temperature: 225 deg F.
- B. Automatic Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett; a Xylem brand.
    - d. Spirotherm, Inc.
    - e. TACO Comfort Solutions, Inc.
  2. Body: Bronze or cast iron.
  3. Internal Parts: Nonferrous.
  4. Operator: Noncorrosive metal float.
  5. Inlet Connection: NPS 1/2.
  6. Discharge Connection: NPS 1/4.
  7. CWP Rating: 150 psig.
  8. Maximum Operating Temperature: 240 deg F.

## 2.2 CONNECTORS

- A. Stainless-Steel Bellow, Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
  2. End Connections: Threaded or flanged to match equipment connected.
  3. Performance: Capable of 3/4-inch misalignment.
  4. CWP Rating: 150 psig.
  5. Maximum Operating Temperature: 250 deg F.
- B. Spherical, Rubber, Flexible Connectors:
1. Body: Fiber-reinforced rubber body.
  2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
  3. Performance: Capable of misalignment.
  4. CWP Rating: 150 psig.
  5. Maximum Operating Temperature: 250 deg F.

## **PART 3 - EXECUTION**

### **3.1 VALVE APPLICATIONS**

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### **3.2 HYDRONIC SPECIALTIES INSTALLATION**

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

**END OF SECTION 232116**

## **SECTION 235223 - CAST-IRON BOILERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes cast-iron boilers, trim, and accessories for generating hot water.

#### **1.3 ACTION SUBMITTALS**

- A. Shop Drawings: For boilers, boiler trim, and accessories.
  1. Include plans, elevations, sections, and attachment details.
  2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.

#### **1.5 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace controls and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
  1. Warranty Period for Controls: One year from date of Substantial Completion.
  2. Warranty Period for Heat Exchangers: 10 years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.

- C. Mounting Frame: Steel rails used to mount assembled boiler package on concrete base.

## 2.2 MANUFACTURERS

- A. Manufacturers: Basis of design: Weil-McLain. Subject to compliance with requirements, voluntary alternates are:
  1. Burnham Hydronics.
  2. Viessmann Manufacturing Co. (US) Inc.

## 2.3 MANUFACTURED UNITS

- A. Description: Factory fabricated and assembled.
  1. Cast-iron sections shall be sealed pressure tight and held together with tie rods set on an insulated steel base, including insulated jacket and flue-gas vent connection.
- B. Cast-Iron Section Design:
  1. Number of Passes: Single or Multiple.
  2. Sectional Joints: High-temperature sealant to seal flue-gas passages not in contact with heating medium, fiber roping, and held together with tie rods.
  3. Drain and blowdown tappings.
  4. Return injection tube to equalize water flow to all sections.
  5. Crown inspection tappings with brass plugs.
  6. Cast in air elimination.
- C. Combustion Chamber: Equipped with ceramic-fiber target wall insulation and flame observation ports, front and back.
- D. Casing:
  1. Jacket: Sheet metal, with snap-in or interlocking closures and powder-coated protective finish.
  2. Insulation: Minimum 1-inch- thick, mineral-fiber insulation surrounding the heat exchanger.
  3. Draft Hood: Flue canopy and rear flue connection shall be constructed of aluminized or stainless steel containing adjustable outlet damper assembly.
  4. Control Cabinet: Sheet metal casing shall cover all controls, gas train, and burner.

## 2.4 ATMOSPHERIC-GAS BURNER

- A. Burner Tubes and Orifices: Stainless steel or Cast iron, for natural gas.
- B. Gas Train: Control devices and low-high-low control sequence shall comply with requirements in ASME CSD-1.
- C. Pilot: Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

- D. Burner Tubes and Orifices: Stainless steel Cast iron, for natural gas.
- E. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
- F. Pilot: Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
- G. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural gas.
- H. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor, with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.

## 2.5 TRIM FOR HOT-WATER BOILERS

- A. Include devices sized to comply with ASME B31.9.
- B. Combination high and operating temperature limit control with adjustable differential. Max temp 240F.
- C. Aquastat Controllers: Operating, firing rate, and high limit.
- D. Safety Relief Valve: ASME rated. Verify existing system pressure prior to utilizing standard 30 psig relief valve. Provide relief valve with setting above normal operating system pressure.
- E. Pressure and Temperature Gage: Minimum 3-1/2-inch- diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.
- F. Boiler Air Vent: Automatic.
- G. Transformer for controls.
- H. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
- I. Electronic low water cut off with manual reset.

## 2.6 CONTROLS

- A. Boiler operating controls shall include the following devices and features:
  - 1. Control transformer.
  - 2. Pilot proving with manual reset upon two failures.
  - 3. Main flame control.
  - 4. Intermittent electronic pilot ignition with proven low fire start and high fire run modes.
  - 5. Set-Point Adjust: Set points shall be adjustable.

6. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 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.
  - a. Include automatic, alternating-firing sequence for multiple boilers to provide equal runtime for boilers.
- B. Safety Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
  1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
  2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
  3. Fifteen second flame response timing with five minute lockout if pilot flame not proven.
  4. Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.
  5. Flame failure alarm panel that indicates Call for Heat, Pilot Proven, Main Flame Proven, and Flame Failure with audible alarm.
  6. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

## 2.7 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
  1. House in NEMA 250, Type 1 enclosure.
  2. Wiring shall be numbered and color coded to match wiring diagram.
  3. Install factory wiring outside of an enclosure in a metal raceway.
  4. Field power interface shall be to fused disconnect switch.
  5. Provide branch power circuit to each motor and to controls with disconnect switch or circuit breaker.
  6. Provide each motor with overcurrent protection.

## 2.8 CAPACITIES AND CHARACTERISTICS

- A. Hot-Water Heating:
  1. Refer to drawings.
- B. Minimum Combustion Efficiency: 85 percent.

## **2.9 SOURCE QUALITY CONTROL**

- A. Test and inspect factory-assembled boilers, before shipping, according to 2010 ASME Boiler and Pressure Vessel Code.
- B. 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.
- C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. 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 performance of the Work.
  - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for 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.

### **3.2 BOILER INSTALLATION**

- A. Equipment Mounting:
  - 1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble boiler sections in sequence and seal between each section.
- D. Assemble and install boiler trim.
- E. Install electrical devices furnished with boiler but not specified to be factory mounted.
- F. Install control wiring to field-mounted electrical devices.

### **3.3 CONNECTIONS**

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping" Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.

- C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.
- D. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to nearest floor drain.
- F. 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.

### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform installation and startup checks according to manufacturer's written 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. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
    - b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    - c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Boiler will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### **3.5 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers.

**END OF SECTION 235223**

# RENOVATIONS FOR: OTSEGO COUNTY ALPINE CENTER BOILER REPLACEMENT

Otsego County Alpine Center, Gaylord, Michigan

PROJECT NUMBER: 17-0063

ISSUE DATE: 08/02/2017

CONSTRUCTION DOCUMENTS



**LOCATION MAP**  
NO SCALE



**VICINITY MAP**  
NO SCALE



**811**  
Know what's below.  
Call before you dig.

IT IS UNDERSTOOD THAT THE CONTRACTOR SHALL PERFORM ALL WORK UNDER THIS CONTRACT IN ACCORDANCE WITH ALL APPLICABLE PROVISIONS, POLICIES, RULES AND STANDARDS OF THE MICHIGAN OCCUPATIONAL SAFETY AND HEALTH ACT (MOSHA), BEING ACT 154 OF THE PUBLIC ACTS OF 1974 AND AS AMENDED.

EXCEPT WHERE OTHERWISE INDICATED ON THE PLANS OR IN THE PROPOSAL SUPPLEMENTAL SPECIFICATIONS CONTAINED THEREIN, ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE APPLICABLE SECTIONS OF THE MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2012 EDITION, AND THE CURRENT SUPPLEMENTAL SPECIFICATIONS. (AVAILABLE AT WWW.MDOT.STATE.MI.US/SPECBOOK)

THROUGHOUT THE DRAWING SET, THE GRAYSCALE LEGEND ON THE EDGE OF TITLE BLOCKS SHOULD TRANSITION FROM WHITE THROUGH EIGHT SHADES OF GRAY TO SOLID BLACK. IF THE GRAYSCALE SHADES ARE NOT DISTINCT, THE DRAWING(S) HAVE NOT PRINTED CORRECTLY.

SHEET LIST	
SHEET NO.	SHEET NAME
0000	COVER SHEET
0010	BOILER REPLACEMENT PLAN





# COUNTY OF OTSEGO Administrative Policy Manual

<b>Policy No</b> 500.01	<b>Subject</b> <b>Purchasing</b>	<b>Date Issued</b> 4/13/04
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<p><b>Application</b></p> <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><b><u>General Fund Functions</u></b></p> <p><input checked="" type="checkbox"/> General Fund Departments</p> <p><input checked="" type="checkbox"/> 46<sup>th</sup> Trial Court</p> <p><input checked="" type="checkbox"/> Other Jointly Governed Organizations</p> <p><b><u>Special Revenue Functions</u></b></p> <p><input checked="" type="checkbox"/> Parks and Recreation</p> <p><input type="checkbox"/> Library</p> <p><input type="checkbox"/> Social Welfare (Family Independence Agency)</p> <p><input type="checkbox"/> Commission on Aging</p> <p><input type="checkbox"/> Other Special Revenue Funds</p> <p><input checked="" type="checkbox"/> Building Authority</p> </td> <td style="width: 50%; vertical-align: top;"> <p><b><u>Business-Type Functions</u></b></p> <p><input checked="" type="checkbox"/> Delinquent Tax Revolving</p> <p><input checked="" type="checkbox"/> Commissary</p> <p><input checked="" type="checkbox"/> Bus System</p> <p><input checked="" type="checkbox"/> Administrative Services</p> <p><input checked="" type="checkbox"/> Building and Grounds</p> <p><b><u>Component Units</u></b></p> <p><input type="checkbox"/> University Center</p> <p><input type="checkbox"/> Road Commission</p> <p><input type="checkbox"/> Ambulance</p> <p><input type="checkbox"/> Sportsplex</p> <p><input type="checkbox"/> Other:</p> </td> </tr> </table>	<p><b><u>General Fund Functions</u></b></p> <p><input checked="" type="checkbox"/> General Fund Departments</p> <p><input checked="" type="checkbox"/> 46<sup>th</sup> Trial Court</p> <p><input checked="" type="checkbox"/> Other Jointly Governed Organizations</p> <p><b><u>Special Revenue Functions</u></b></p> <p><input checked="" type="checkbox"/> Parks and Recreation</p> <p><input type="checkbox"/> Library</p> <p><input type="checkbox"/> Social Welfare (Family Independence Agency)</p> <p><input type="checkbox"/> Commission on Aging</p> <p><input type="checkbox"/> Other Special Revenue Funds</p> <p><input checked="" type="checkbox"/> Building Authority</p>	<p><b><u>Business-Type Functions</u></b></p> <p><input checked="" type="checkbox"/> Delinquent Tax Revolving</p> <p><input checked="" type="checkbox"/> Commissary</p> <p><input checked="" type="checkbox"/> Bus System</p> <p><input checked="" type="checkbox"/> Administrative Services</p> <p><input checked="" type="checkbox"/> Building and Grounds</p> <p><b><u>Component Units</u></b></p> <p><input type="checkbox"/> University Center</p> <p><input type="checkbox"/> Road Commission</p> <p><input type="checkbox"/> Ambulance</p> <p><input type="checkbox"/> Sportsplex</p> <p><input type="checkbox"/> Other:</p>	<p><b>Revised</b> 08/14/12</p> <hr/> <p><b>Applicable Forms</b></p>
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<b>Contact Department</b> Administration	<b>Contact Phone Number</b> 989-731-7520	<b>Contact Fax Number</b> 989-731-7529	<b>Contact E-Mail</b> jburt@otsegocountymi.gov
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**Summary**

The purpose of this policy is to establish procedures for the purchase of all supplies, equipment, vehicles, and all construction or altering of County facilities for any department of the County of Otsego in a manner that maximizes the purchasing value of public funds in procurement. This policy includes capital leases on any such item as listed above. When the procurement involves the expenditure of federal or state assistance or contract funds, the procurement shall be conducted in accordance with any mandatory applicable federal or state laws and regulations. Nothing in this policy shall prevent any public agency from complying with the terms and conditions of any grant, gift or bequest that is otherwise consistent with law. Professional service contracts and contracts for specific, non-repetitive services are exempt from the requirements of this Policy with the exception of the requirements contained in Sections 2.18 and 2.19 of the Policy.

**Procedures**

**1. Definitions**

1.1 ***Capital Outlay Items:*** Non-expendable items itemized in the County’s capital improvement budget/plan.

1.2 ***Competitive Bids:*** Prices received from vendors on items or services \$10,001 or more. Competitive bids are received as sealed bids only and are opened at advertised public bid openings. The requirement for sealed competitive bids shall not apply to intergovernmental contracts, contracts for professional services, contracts for specific, non-repetitive services, or emergency repairs, or for the reauthorization of contracts, which have been previously approved by the Otsego County Board of Commissioners.

1.3 ***Expendable/Recurrent Supplies:*** Routine supplies needed to carry on the County’s daily



# COUNTY OF OTSEGO

## Administrative Policy Manual

### Procedures

business (i.e. food, medical supplies, office supplies). Expendable supplies are generally acquired using preferred vendors.

1.4 **Final Approver:** Person(s) designated to utilize the electronic purchasing system with the authority to convert requisitions to purchase orders.

1.5 **Formal Bidding:** Formal bidding procedure should be used for purchases from \$5,001 to \$10,000. It includes solicitation of written bids through the mail, e-mail, and facsimile.

1.6 **Informal Bidding:** Purchases of \$501 to \$5000 are subject to informal bidding. Informal bids (quotes) includes solicitation of written bids and may be solicited by telephone, personal contact, or in writing.

1.7 **Public Bid Opening:** A place, date and time established to open competitive bids received on items and/or services being procured. Adequate public notice of the invitation for bids shall be given not less than 7 calendar days prior to the date set forth therein for the opening of bids. Such notice may include publication in a newspaper of general circulation within the County for a reasonable time prior to the bid opening.

1.8 **Request for Proposal (RFP):** A document issued by the County Administrator, which contains specifications and County bidding procedures for procurement of items and/or services. An RFP is sent out to vendors as a mechanism to solicit for competitive bids.

1.9 **Request for Quotation (RFQ):** A document (less formal than an RFP) issued by the County Administrator/Management Team Member, which contains specifications for the procurement of items and/or services. An RFQ is sent out to vendors as a mechanism to solicit for competitive quotes.

1.10 **Professional Service Contract:** A Contract for unique, technical, and/or infrequent functions performed by an independent contractor qualified by education, experience, and/or technical ability to provide services. In most cases, these services are of a specific project nature, and are not a continuing, ongoing responsibility of the institution.

1.11 **Service Contract:** an agreement whereby a contractor supplies time, effort and/or expertise instead of a good (tangible product).

**2. POLICY:** The County utilizes an electronic accounting system with a purchasing module that includes a requisition and purchase order system. Every purchase on behalf of the County (unless specifically exempted) shall require a requisition and purchase order. Except as otherwise specified herein, purchases / contracts will be awarded to a contractor or bidder based on price, record of performance, availability, dependability and experience. All purchases by contract, or otherwise, as herein authorized, will be in accordance with such appropriations as have been made by the Board of Commissioners for the support of the respective departments.



# COUNTY OF OTSEGO

## Administrative Policy Manual

### Procedures

It shall be unethical for any County employee to participate directly or indirectly in a procurement contract when (the County employee knows that) the County employee or any member of the County employee's immediate family has a financial interest pertaining to the procurement contract.

2.1 **Basic Purchases:** Items valued at \$500 or less are considered basic purchases. There are not any bidding requirements for these purchases; however, the requisition and purchase order system must be utilized. Management Team Members or their designee(s) are authorized to draft requisitions and act as the final approver. The responsible party shall exercise reasonable scrutiny when expending funds under the \$500 threshold.

2.2 **Informal Bidding:** Purchases of \$501 to \$5000 are subject to informal bidding. Individual employees, with approval of the County Administrator, may solicit informal bids as outlined below. Bids must be written. The County Administrator (their designee when absent) must act as final approver.

- A. Bid Information: To insure fairness in, each vendor solicited should be given the same information. This information should include:
- Description of items to be purchased
  - Special terms and/or specifications
  - Desired delivery date
- B. Record of Bids: All bids solicited shall be in writing and will be electronically recorded in the requisition "Post It" note window. Each record should contain:
- Bid Information
  - Record of all bids
  - Manager's explanation if lowest priced vendor not selected.

2.3 **Formal Bidding:** Purchases from \$5,001 to \$10,000 are subject to the formal bidding procedure. The respective department shall follow the formal bidding process. The Management Team Member must approve with the County Administrator or designee acting as the final approver. It includes solicitation of written quotations/bids through direct contact, public advertisement or any combination of the same.

- A. The solicitation/advertisement must include the following:
- Identification of item(s) to be bid upon
  - Location bids are to be submitted
  - Date and time of bid deadline for submission
  - Contact for further information
  - Statement of County's rights to reject bids
  - Contract compliance terms
  - Product specifications

- B. Record of Bids: All bids solicited shall be electronically recorded in the



# COUNTY OF OTSEGO

## Administrative Policy Manual

### Procedures

requisition “Post It” note window. Each record should contain:

- Bid Information
- Record of all bids
- Department Head explanation if lowest priced vendor not selected.

2.4 **Competitive Bidding:** Purchases with an anticipated obligation of \$10,001 or more are required to have sealed, competitive bidding and comply with Public Act 167 and 168 of 1993. Two (2) competitive bids are required for purchases of \$10,001 or more. Professional services, contracts for specific, non-repetitive services, and intergovernmental contracts and emergency repairs, or reauthorization of contracts that have been previously approved are exempted from this policy. The inability to obtain two (2) competitive bids, upon due diligence, shall not prevent the County from awarding the bid. **A copy of all bid document material must be provided to the Administration Department.**

A. If a bid document must be prepared (\$10,001 or more), it shall include:

- **Bid Reference Number as assigned by the Administration Department**
- Bid advertisement
- Bid preparation instructions
- Proposal
- Contract
- General conditions
- Special conditions
- General specifications
- Detailed specifications
- State or Federal guidelines (if necessary)

The County reserves the right to accept, reject or negotiate any or all bids, to waive or not waive informalities or irregularities in bids or bidding procedures, to rebid the project/purchase, and to accept any bid determined by the County to be in the best interest of the County, regardless of price. The reason for rejection may include past performance issues, and compatibility with existing equipment or software. Local Vendors, as defined below, are hereby granted a 5% cost variance for low bid determination.

A “local vendor” is defined as a business that has had a fixed office or distribution point located in and having a street address within the county for at least six months immediately prior to the issuance of the request for competitive bids (post office boxes do not qualify as a business address). In addition, the business must employ at least one full-time or two part-time employees whose primary residence is located within Otsego County, or if the business has no employees, shall be at least fifty percent owned by one or more persons whose primary residence(s) is located within Otsego County.

B. All bids shall be opened at the time, date and place specified, and the opening and inspection of all bids shall be made by the County Administrator. A complete



# COUNTY OF OTSEGO

## Administrative Policy Manual

### Procedures

summary of the bids, including the bidding firm's name, cost, qualifying data, and any other relevant information, shall be kept on file. Final approval, acceptance and selection of bids that are low bid and meet specifications shall be recommended by the County Administrator to the Board of Commissioners.

- 2.5 **Expendable Supplies:** For each expendable category of purchases, the County Administrator, with the assistance of the respective department staff (i.e. maintenance/jail food staff), will compile and maintain a list of preferred suppliers. Such lists will be reviewed and updated periodically. Typically one – three vendors will be listed to provide comparison pricing and selection options.
- 2.6 **Open Purchase Orders:** Open Purchase Orders shall be utilized for vendors that provide routine repetitive services. Open Purchase Orders may be opened and closed within any calendar month. Examples of authorized open purchase orders include: oil changes, car wash and other similar services.
- 2.7 **Emergency Purchase Orders:** In case of emergency needs, appropriate departments (maintenance, sheriff) are authorized to make emergency procurements of supplies, services or construction items when there exists a threat to public health, welfare or safety. Electronic access shall be provided to authorize the issuance of emergency purchase orders. Emergency procurements shall be made with such competition as is practicable under the circumstances and the cost shall not exceed \$5,000. An emergency purchase of up to \$10,000 may be made by the County Administrator without prior approval by the chair or vice-chair of the Board of Commissioners. The very nature of emergency expenditures may necessitate a significant financial decision without prior approval. All emergency expenditures in excess of \$10,000 shall be reported to the Board of Commissioners, in writing, within three business days.

In the case of emergency repairs where delays may cause further damage to county property, the County Administrator is authorized to spend up to \$10,000 without prior approval by the chair or Vice-Chair. Emergency repairs in excess of \$10,000 may be made by the County Administrator with advanced authorization from the chair or vice-chair.

- 2.8 **Cooperative Government Contracts:** Bidding requirements shall be waived if the County is able to secure favorable prices on purchases by joining with other local governments, or participating with the State of Michigan or the Federal Government in purchasing. The County Administrator is authorized to enter into the necessary agreements or contracts on behalf of the County.
- 2.9 **Exempted Purchases:** Exempted purchases include maintenance agreement billings, utility billings, contracted service invoices, insurance payments, and other like services as noted in the Otsego County Payables Policy. The appropriate account number and signature of a Management Team member is required for exempted purchases, and shall appear across the invoice.



## COUNTY OF OTSEGO Administrative Policy Manual

### Procedures

- 2.10 **Payment Procedure:** The respective Management Team member will be responsible for inspection of all orders, upon receipt of the order and prior to the acceptance of the delivery. Upon acceptance of items, verification that the packing slip matches the purchase order must accompany the invoice in order to obtain payment. Whenever a department rejects any orders, the County Administrator shall be notified immediately and given the reason for the rejection.
- 2.11 **Capital Leases:** The process for bidding capital leases shall be similar to other purchases. Should the price of the purchase not be reasonably known prior to engaging the bidding process, the Formal Bidding Process shall be used.
- 2.12 **Bid Specification Changes:** All changes in bid specifications shall be reported to all known potential bidders. Such notification shall provide appropriate time for all such potential bidders to have adequate time to make adjustments to their bids.
- 2.13 **Demo Models:** Bidding requirements shall be waived if the County is able to secure favorable prices on purchases by purchasing a demonstration model.
- 2.14 **Rebidding:** Should it become necessary to rebid a project/purchase, the County Administrator may waive the newspaper posting requirement for Competitive Bids, with notification being given to the Budget & Finance Committee members.
- 2.15 **Amending contracts on projects requiring bids:** The County Administrator may approve minor amendments to capital project contracts up to an amount of \$5,000, not to exceed more than 10% of the original contract amount. The County Administrator may approve minor amendments to capital project contracts up to an amount of \$10,000, not to exceed 10% of the original contract amount, with pre-notification to the Budget & Finance Committee. Any contract amendment beyond the limits specified above requires approval by the Board of Commissioners.
- 2.16 **Bond Requirements:** Bid bonds are required for construction or repair projects in the amount of \$100,000 or more. Bid bonds and performance bonds are required for construction or repair projects in the amount of \$250,000 or more. Bid bonds shall be in the amount of 10% of the total contract price. Performance bonds will be in the amount of 100% of the total contract price. Bond requirements cannot be waived.
- 2.17 **Lien Waivers:** For construction or repair projects in the amount of \$50,000 or more, the contractor is required to provide partial lien waivers, verifying all subcontractors and suppliers have been paid for their work to date, for payment requests beyond 25% of the total contract price. The final 10% of the contract price can be paid prior to receipt of lien waivers. The contractor will provide final lien waivers within 30 days of contract completion. In the event that a contractor does not provide the required lien waivers, the contract will not be eligible for future County projects without the consent of the County Infrastructure Committee.



# COUNTY OF OTSEGO

## Administrative Policy Manual

### Procedures

2.18 **Insurance Requirements:** All contractors and/or vendors are required to maintain the following Insurance:

- A. Workers Compensation and Employers' Liability, Michigan Statutory Limits of Liability.
- B. Commercial General Liability Insurance
- C. Motor Vehicle Liability Coverage, and Michigan No-Fault Coverages including all owned, non-owned, and hired vehicles.
- D. Otsego County will be named as Additional Insured on all insurance coverage, with the exception of Workers Compensation and Employers' Liability insurance.

Limits of Liability for General Liability, and Vehicle Liability shall be within the following guidelines based on contract amount:

- Projects up to \$750,000: Minimum of \$1,000,000 per occurrence and aggregate.
- Projects \$750,001 to \$1,750,000: Minimum of \$2,000,000 per occurrence and aggregate.
- Projects \$1,750,001 to \$2,750,000: Minimum of \$3,000,000 per occurrence and aggregate.
- The required amounts continue to escalate by adding \$1,000,000 to the beginning and ending project range and to the minimum insurance requirement.
- A Waiver of Subrogation is required on the certificate of liability insurance.
- The certificate of liability insurance is required to have a 30-day notice of cancellation.

2.19 **Professional Services Contracts Requirements:** Professional Liability Coverage (Errors and Omissions) is required for all contracts for professional services such as architect, engineer, design firm or similar professions, and the medical professions, etc.

- In the event that services delivered either directly or indirectly involve or require professional services (e.g. architectural, engineering, medical), Professional Liability Coverage (Errors and Omissions) insurance coverage must be provided with a limit of liability of not less than \$1,000,000 per occurrence and aggregate generally, and must further be in an amount to be equal to or greater than the total project cost.
- A Waiver of Subrogation is required on the certificate of liability insurance.



# COUNTY OF OTSEGO

## Administrative Policy Manual

### Procedures

- The certificate of liability insurance is required to have a 30-day notice of cancellation.
- 2.20 ***Other Contractor Insurance Requirements:*** For projects of over \$250,000, all vendor insurance must be obtained through an insurance company that has a financial strength rating of A or better by a reputable insurance rating company such as A.M. Best.
- 2.21 ***Purchases on Behalf of Other Agencies:*** For purchases made by Otsego County while acting as a grant fiduciary on behalf of other agencies, Otsego County will allow Preferred Vendors at the written request of an authorized representative from the requesting agency.
- 2.22 ***Nepotism:*** A County employee or grant administrator may not hire a person related to him/her to do contractual work until approved by the County Administrator for compliance with the spirit of the County's Purchasing Policy and Nepotism Policy. For the purposes of this policy, "related" shall cover the following relationships:
1. Parent (natural, step, or in-law)
  2. Child (natural or step)
  3. Brother/sister (natural, step, or in-law)
  4. Spouse
  5. Grandparent
  6. Legal Guardian

The County of Otsego will accept delivery of and authorize payment of only those services, supplies, merchandise or articles authorized for purchase, and acceptable under terms of the purchase agreement, in accordance with the procedures stated herein.

Payment for any services, supplies, merchandise or articles not authorized for purchase by the County Administrator and/or the Otsego County Board of Commissioners in accordance with the policies and procedures stated herein becomes the responsibility of the person or persons requesting such service, supplies, merchandise or article and the County may deny payment of the claim.

Any service being performed for the County that has not been authorized in accordance with the policies and procedures stated herein, shall be immediately discontinued and the original conditions restored at the expense of the person or persons requesting such service.

Payment in full for any service, supplies, merchandise or articles not acceptable for delivery or the use required, as put forth in the bid specifications or purchase agreement for such service, supplies, merchandise or articles, will be held in abeyance until such time as a replacement or replacements meeting the specifications put forth in the purchase agreement and acceptable for the use required are received.



# COUNTY OF OTSEGO Administrative Policy Manual

**Procedures**

**TABLE 1**

Dollar Amount	Bidding Requirement	Final Approval
\$0 - \$500	None	Management Team Member or Designee
\$501 - \$5,000	Informal Bid	County Administrator
\$5,001 - \$10,000	Formal or Competitive Quote	County Administrator
\$10,001 or more	Competitive Bids (2)	Board of Commissioners

**Approvals (name and department)**

Board of Commissioners

April 13, 2004