

**INVITATION TO BID -**

Sealed bids for the Century High School 2018 Boiler Replacement project will be received and opened by a Representative of the Board of Trustees of School District No. 25, Bannock County, Idaho, at 3115 Pole Line Road., Pocatello, Idaho 83201, until 9:00 AM on March 14, 2018.

**2018 BOILER REPLACEMENT  
FOR  
CENTURY HIGH SCHOOL**

Specifications or additional details (including bid forms) may be secured from Engineered Systems Associates, Inc. located at 1355 East Center, Pocatello, Idaho 83201. All bids must be on the forms furnished, all blank spaces filled in, and signed with the name, address, and license number of the Bidder. No qualified bids will be read.

Each bid shall be accompanied by a certified check, cashier's check or a bidder's bond (executed by a qualified surety company with the power to do business in the State of Idaho) in the sum of not less than five percent (5%) of the total bid, made payable to School District No. 25, Bannock County, Pocatello, Idaho. This surety shall be forfeited by the bidder in the event of failure to enter into a contract. Personal and company checks will not be accepted. Compliance with Idaho Public Works Law is required.

The Board of Trustees reserves the right to reject any or all bids or to waive any informalities, or to accept the bid or bids deemed best for School District No. 25, Bannock County, Pocatello, Idaho.

A **mandatory** pre-bid walk-through will be held on February 27, 2018, 4:00 PM at Century High School, 701 West Diamond Back Drive, Pocatello, Idaho 83204. All prime bidders are required to attend. Contact person for this project is Alan Spidell, School Plant Coordinator.

Plans, specifications, proposal forms, and other information are on file for examination at the following locations.

Engineered Systems Associates, Inc.  
1355 East Center, Pocatello, Idaho 83201  
208-233-0501

Pocatello School District Maintenance Shop  
185 East Maple Street  
Pocatello, Idaho 83201

One set of documents may be obtained by licensed mechanical and electrical contractors from the Engineer for a refundable deposit of \$100.00. Others may obtain documents at cost, non-refundable.

Jacob Gertsch, Clerk  
School District No. 25

*Publish dates:* February 21, 2018 and February 28, 2018.

IDAHO STATE JOURNAL

SPECIFICATIONS  
FOR  
BOILER REPLACEMENT  
FOR  
CENTURY HIGH SCHOOL  
POCATELLO SCHOOL DISTRICT #25  
POCATELLO, IDAHO  
FEBRUARY 2018



Prepared  
by

Engineered Systems Associates, Inc.  
1355 East Center  
Pocatello, Idaho 83201  
(208) 233-0501

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### 2018 BOILER REPLACEMENT FOR CENTURY HIGH SCHOOL

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The Board of Trustees reserves the right to reject any or all bids or to waive any informalities, or to accept the bid or bids deemed best for School District No. 25, Bannock County, Pocatello, Idaho.

A **mandatory** pre-bid walk-through will be held on February 27, 2018, 4:00 PM at Century High School, 701 West Diamond Back Drive, Pocatello, Idaho 83204. All prime bidders are required to attend. Contact person for this project is Alan Spidell, School Plant Coordinator.

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Jacob Gertsch, Clerk  
School District No. 25

*Publish dates:* February 21, 2018 and February 28, 2018.

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## **INSTRUCTIONS TO BIDDERS**

### **BIDS:**

Sealed "Bids" will be received on or before the time and date set forth under "INVITATION TO BID."

The owner reserves the right to accept or reject any part of a bid, a single bid or all bids.

Bidders submitting a "Bid" on this work will be required to figure and furnish everything as called for by these plans, specifications, and the requirements of the "Bid" sheet.

All bids shall be in a sealed envelope addressed to the Board of Trustees of School District No. 25, 3115 Pole Line Road, Pocatello, Idaho. The following shall be written on the exterior of the envelope:

### **BIDS FOR 2018 BOILER REPLACEMENT -CENTURY HIGH SCHOOL**

Bids to be opened on March 14, 2018 at 9:00 AM, at the District Office, 3115 Pole Line Rd. Pocatello, Idaho. Bids not hand-delivered at the time of the bid opening must be received in the mail or at the Pocatello/Chubbuck School District No. 25 office no later than 4:00 PM the day prior to the bid opening.

### **MANDATORY PRE-BID WALK-THROUGH**

A mandatory pre-bid walk-through will be held on February 27, 2018. It is required that all prime bidders attend. The walk-through will begin at 4:00 PM at CENTURY HIGH SCHOOL, 7801 West Diamond Back Drive, Pocatello, Idaho 83204. Access to the building after the walk through must be arranged thru Alan Spidell, (208) 233-2604.

### **EVIDENCE OF QUALIFICATIONS:**

Upon request of the owner, a bidder whose bid is under consideration for award of the contract shall submit, promptly, satisfactory evidence of his financial resources, his experiences, and the organization and equipment he has available for performance of the contract.

### **BID GUARANTEE:**

As a guarantee that, if awarded the contract, the bidder will execute same and furnish bond, each bid will be accompanied by a Certified Check, Cashier's Check or Bid Bond for not less than five percent (5%) of the base bid payable to the Owner. **NO PERSONAL OR COMPANY CHECKS WILL BE ACCEPTED.**

### **OBJECTIONS:**

Written objections to specifications or bid procedures must be received by the clerk, secretary, or other authorized official of the District at least one (1) business day before the date and time upon which bids are scheduled to be received, per Idaho Code Section 68-2806(c).

### **INSURANCE:**

All contractors who provide goods or services to the District are required to provide the District with certificates of insurance for General Liability, Auto Liability, Workers Compensation, and Professional Liability, if applicable.

The General Liability and/or Professional Liability certificate must name the District as an additional insured under the contractor's policy.

Certificates are to be provided to the district prior to any work commencing on District property. This would include the placement of any equipment or materials at the work site.

Minimum Insurance Limits

General Liability	\$1,000,000 per occurrence \$1,000,000 products and completed operations \$1,000,000 annual aggregate
Auto Liability	\$1,000,000 per occurrence
Workers' Compensation	Statutory

**HOLD HARMLESS AGREEMENTS:**

The District expects your work to conform with professional standards. The contractor is expected to hold the District harmless for all damages or claims arising out of the work performed by the contractor. The District will not agree to hold the contractor harmless for damages or claims.

**PERFORMANCE BOND:**

The successful bidder will be required to furnish an 100% performance bond when entering into the contract work, per Idaho Code Section 54-1926, "...conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions thereof."

**PAYMENT BOND:**

The successful bidder will be required to furnish a 100% payment bond when entering into the contract work, per Idaho code Section 54-1926, "solely for the protection of persons supplying labor or materials, or returning, leasing, or otherwise supplying equipment to the contractor or his subcontractors in the prosecution of the work provided for in such contract."

**CONTRACTOR'S LICENSE:**

In compliance with the Idaho Laws, the contractor must be registered with the State of Idaho, and hold the required Public Works Contractor's License before obtaining the contract documents and before submitting a bid for this work

**RETAINAGE:**

The Owner will retain 5% of the Contractor's earned sum to ensure faithful performance and verify that all taxes are paid on projects. The State Tax Commission requires up to 30 days to provide the verification to the Owner.

The five percent retainage may be used by Owner to offset any and all losses incurred by Owner in the course of the performance of the Contract by Contractor, including but not limited to tax liens, defective performance, defective products – including those of subcontractors or other damage caused by Contractor in the performance of this Contract. Owner shall provide Contractor with a written itemization of all sums retained by Owner at the time of its issuance of final payment. Under no circumstances shall Owner retain more than five percent of the contract price without written agreement of Contractor.

**OWNER/CONTRACTOR AGREEMENT:**

Unless otherwise required in the Bidding documents, the Agreement of the Work will be written on a contract similar to AIA Document A101, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a stipulated sum.

**EMPLOYMENT OF RESIDENTS OF IDAHO:**

In compliance with Idaho Laws, Sections 44-1001 and 44-1002 Idaho Code, the contractor "...must employ ninety-five percent (95%) bona fide Idaho residents as employees on any such contracts except where under such contracts fifty (50) or less persons are employed the contractor may employ ten percent (10%) nonresidents, provided however, in all cases such employers must give preference to the employment of bona fide Idaho residents in the

performance of such work...”

**TIME FRAME:**

It is essential that this work be completed on schedule. Construction will begin May 25, 2018, and all work must be complete by August 3, 2018. The successful contractor will be required to work double shifts, overtime, or other arrangements as necessary to insure the project will be completed on time. See section 01142 Liquidated Damages.

**BID SERVICE:**

This project will not be run through the bid service. All sub-bids are to be bid directly to the Prime Bidding Contractors.

**STATE TAX:**

The successful bidder shall within thirty (30) days of award of bid, file appropriate documents with the State Tax Commission as required by the Idaho Code Section 54-1904 A.

END OF INSTRUCTIONS TO BIDDERS



**CENTURY HIGH SCHOOL BOILER REPLACEMENT**

**BID FORM**

TO:

GENTLEMEN:

The Undersigned hereby submits the following proposals:

1. BID ITEM:

Having carefully examined the Specifications and Drawings entitled:

2018 – BOILER REPLACEMENT  
FOR  
CENTURY HIGH SCHOOL

as well as the premises and conditions affecting the work, the undersigned proposes to furnish all labor and materials and to perform all work as required by and in strict accordance with the above-named documents for the following sum:

BASE BID: (\$ \_\_\_\_\_)

---

2. CONTRACT:

If the undersigned be notified of the acceptance of this proposal,  
\_\_\_\_\_ agrees to execute a contract for  
the above work, for a compensation of the above stated amount.

3. COMPLETION DATE:

The Undersigned hereby also agrees to complete the work contemplated on or before July 31, 2018, and agrees to the Liquidated Damages for work not substantially complete by this date.

The Undersigned acknowledges receipt of addenda numbers \_\_\_\_, \_\_\_\_, \_\_\_\_.

4. ALCOHOL AND DRUG-FREE WORKPLACE:

Pursuant to Idaho Code, Section 72-1717 I, the undersigned certify that

\_\_\_\_\_  
(Name of contractor)

is in compliance with the provisions of Idaho Code, Section 72-1717 and will maintain such program throughout the life of this contract and shall subcontract work only to subcontractors meeting the requirements of Idaho Code, Section 72-1717 (1)(a).

Dated at \_\_\_\_\_ this \_\_\_\_\_ day  
of \_\_\_\_\_ 2018.

Very truly yours,

\_\_\_\_\_  
Bidder

\_\_\_\_\_  
Street or Building Address

\_\_\_\_\_  
Authorized Signature, Title

\_\_\_\_\_  
City State Zip

\_\_\_\_\_  
Idaho Public Works License No.

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
WORKERS COMPENSATION AND EMPLOYEE LIABILITY EXPIRATION DATE: \_\_\_\_\_

SUB-CONTRACTORS WHO SHALL BE UTILIZED ON THIS CONTRACT:

PLUMBING: (name) \_\_\_\_\_

(Address): \_\_\_\_\_

Idaho Public Works Contractors License No.: \_\_\_\_\_

Idaho Plumbing Contractors License No.: \_\_\_\_\_

HEATING & AIR CONDITIONING (Name) : \_\_\_\_\_

(Address): \_\_\_\_\_

Idaho Public Works Contractors License No.: \_\_\_\_\_

ELECTRICAL (Name): \_\_\_\_\_

(Address): \_\_\_\_\_

Idaho Public Works License No.: \_\_\_\_\_

Idaho Electrical Contractor's License No.: \_\_\_\_\_

**END OF BID FORM FOR CENTURY HIGH SCHOOL BOILER REPLACEMENT**

## CONSTRUCTION CONTRACT

This contract is made and entered into, effective as of «**ContractDate**», by and between School District No. 25, Bannock County, Idaho, («**Owner**»), and «**Company**», («**Contractor**»), a company duly licensed as a public works contractor in the State of Idaho, as follows:

1. **DESCRIPTION OF WORK.** Contractor shall perform the following described work, in accordance with the contract plans and specifications, more particularly described below:

2018 BOILER REPLACEMENT  
FOR  
CENTURY HIGH SCHOOL

2. **CONTRACT DOCUMENTS.** The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings Specifications, Addenda issues prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreement either written or oral.
3. **CONTRACT PRICE.** Owner agrees to pay Contractor, for the work described, the total price of «**ContractAmount**». Payment of this amount is subject to additions or deductions in accordance with the provisions of this contract.
4. **UNIT PRICES.** Unit prices, if any, are as follows:  
**UNIT PRICES GO HERE OR STATE "NONE"**
5. **PAYMENT SCHEDULE.** Based upon applications for payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in these Contract Documents.

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

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

Owner shall make final payment to Contractor no later than 30-days after the issuance of the Architect's final Certificate for Payment or within thirty (30) days after the work is completed, if the contract is at that time fully performed, and subject to the condition that final payment shall not be due until Contractor has delivered to Owner a complete release of all liens arising out of the contract, or receipts in full covering all labor, materials, and equipment for which a lien could be filed. Notwithstanding the above, Owner will retain five percent of the contract price from the final payment to be released to the Contractor when the Owner receives a tax release from the Idaho State Tax Commission. The five percent retainage may be used by Owner to offset any and all losses incurred by Owner in the course of the performance of the Contract by Contractor, including but not limited to tax liens, defective performance, defective products – including those of subcontractors or other damage caused by Contractor in the performance of this Contract. Owner shall provide Contractor with a written itemization of all sums retained by Owner at the time of its issuance of final payment. Under no circumstances

shall Owner retain more than five percent of the contract price without written agreement of Contractor. In the event that progress payments will be made under this contract, the payment schedule will be set forth below or in an attachment hereto:

*Provided that an Application for Payment is received by the Owner not later than the Twenty Fifth (25<sup>th</sup>) day of a month, the Owner shall make payment to the Contractor not later than the Fifteenth (15<sup>th</sup>) day of the following month. If an Application for Payment is received by the Owner after the application date fixed above, payment shall be made by the Owner not later than Thirty (30) days after the Owner receives the Application for Payment."*

6. **EFFECT OF PAYMENT.** Owner by making payment waives all claims except those arising out of:
  - A. Faulty work appearing after final payment is made;
  - B. Work that does not comply with this contract;
  - C. Outstanding claims of lien;
  - D. Failure of Contractor to comply with any special guarantees required by the contract. Contractor, by accepting final payment, waives all claims except those that he has previously made in writing, and which remain unsettled at the time of acceptance.
  
7. **STARTING AND COMPLETION DATES.** Construction under this contract shall begin on May 25, 2018, and be completed by August 3, 2018.
  
8. **RESPONSIBILITIES OF OWNER.** Owner shall furnish all necessary surveys for the work, and shall secure and pay for easements for permanent structures or permanent changes in existing structures or facilities on the work site, or which are necessary for its proper completion.

Owner reserves the right to let other contracts for construction work to be performed at the work site. Contractor shall cooperate with all other contractors to the effect that their work shall not be impeded by his construction, and shall give such other contractors access to the work site necessary to perform their contracts.
  
9. **RESPONSIBILITIES OF CONTRACTOR.** Contractor's duties and rights in connection with the above-described project are as follow:
  - A. Responsibility for the Supervision of Construction. Contractor shall be solely responsible for all construction under this contract, including the techniques, sequences, procedures, and means, and for coordination for all work. Contractor shall supervise and direct the work to the best of his ability, and give it all the attention necessary for such proper supervision and direction. The project shall be completed in a proper, workmanlike manner, consistent with the highest standards of quality in the community.
  - B. Furnishing of Labor, Materials, etc. Contractor shall provide and pay for all labor, materials, and equipment, including tools, equipment, and machinery, utilities, including water, transportation, and all other facilities and services necessary for the proper completion of work on the project in accordance with the contract. Ninety-five percent (95%) of Contractor's employees must be bona fide Idaho residents as required by Idaho Code § 44-1001.
  - C. Procurement of Licenses and Permits. Contractor shall pay all taxes required by law in connection with work on the project in accordance with this contract including sales, use, and similar taxes, and shall secure all licenses and permits necessary for proper completion of the work, paying the fees for such licenses and permits. Contractor represents that he is authorized to do business in the State of Idaho and, pursuant to Idaho Code §63-1502, shall provide evidence that he is so qualified.
  - D. Payment of Taxes.
    - i Pursuant to Idaho Code §63-1503, Contractor agrees to pay promptly when due all taxes (other

than on real property), excises and license fees due to the state, its subdivisions, and municipal and quasi-municipal corporation therein accrued or accruing during the term of this contract, whether or not the same shall be payable at the end of such term. If the said taxes, excises, and license fees are not payable at the end of said term, but liability for the payment thereof exists, even though the same constitute liens upon his property, to secure the same to the satisfaction of the respective officers charged with the collection thereof. In the event of the Contractor's default in the payment or securing of such taxes, excises, and license fees, the Contractor hereby consents that the Owner may withhold from any payment due to the Contractor under this contract, the estimated amount of such accrued and accruing taxes, excises, and license fees for the benefit of all taxing units to which said Contractor is liable.

- ii Pursuant to Idaho Code §63-1502, Contractor shall provide evidence that he has paid or secured to the satisfaction of the respective taxing units, as defined in Idaho Code §63-1501, all taxes for which he or his property is liable then due or delinquent.
  - iii Pursuant to Idaho Code §63-1504, before Owner shall approve any claim on account of construction work performed as required by this contract, Contractor (or any sub-contractor claimant) must furnish evidence to Owner that he (i.e. Contractor or any sub-contractor, as the case may be) has paid all taxes, excises and license fees due to the state and its taxing units, due and payable during the term of this contract for such construction, and that he has secured all such taxes, excises, and license fees liability for the payment of which has accrued during the term of this contract, notwithstanding they may not yet be due or payable.
- E. Except as otherwise provided in Idaho Code §44-1002, Contractor must employ ninety-five percent (95%) bona fide Idaho residents as employees on the project unless fifty (50) or less persons are employed in which event Contractor may employ ten percent (10%) nonresidents, provided however, in any case Contractor must give preference to the employment of bona fide residents in the performance of said work.
- F. Compliance With Construction Laws and Regulations. Contractor shall comply with all laws and ordinances, and the rules, regulations, or orders of all public authorities relating to the performance of the work under and pursuant to this contract. If any of this contract is at variance with any such laws, ordinances, rules, regulations, or orders, he shall notify Owner promptly on discovery of such variance.
- G. Responsibility for Negligence of Employees and Subcontractors. Contractor assumes full responsibility for acts, negligence, or omissions of all his employees on the project, for those of his subcontractors and their employees, and for those of all other persons doing work under a contract with him. Smoking and alcohol are prohibited on school property. Unauthorized persons are not allowed on the job site.
- H. Warranty of Fitness of Equipment and Materials. Contractor represents and warrants to Owner that all equipment and materials used in the work, and made a part of the structures on such work, or placed permanently in connection with such work, will be new, of good quality, free of defects, and in conformity with this contract. It is understood and agreed between the parties to this contract that all equipment and materials not so in conformity will be considered defective.
- I. Clean-up. Contractor agrees to keep the work premises and adjoining ways free of waste material and rubbish caused by his work or that of his subcontractors. Contractor further agrees to remove all such waste material and rubbish on termination of the project, together with all of his tools, equipment, machinery, and surplus materials. Contractor agrees, on terminating his work at the site, to conduct general clean-up operations, including the cleaning of all glass surfaces, paved streets and walks, steps, and interior floors and walls.
- J. Indemnity and Hold Harmless Agreement.
- i Contractor agrees to indemnify and hold harmless Owner, and its agents and employees, from and against any and all claims, damages, losses, and expenses, including reasonable attorney's fees in case it shall be necessary to file an action, arising out of performance of the work in this contract,

that is (a) for bodily injury, illness, or death, or for property damage, including loss of use, and (b) caused in whole or in part by Contractor's intentional and/or negligent act or omission, the act of an employee or agent of the Contractor or that of a subcontractor.

- ii Contractor further agrees to indemnify, save harmless, and make whole, Owner from any and all defects appearing or developing in the workmanship or materials performed or furnished under this Contract for a period of one (1) year after the acceptance thereof by Owner.

K. Performance and Payment Bonds. Contemporaneously with the execution of this contract, Contractor shall provide performance and payment bonds in the form required by Idaho Code § 54-1926. The bonds shall be eighty-five percent (100%) of the contract price and shall provide Owner with security for faithful performance of the contract and also provide security for protection of persons supplying labor and/or materials for the contract.

10. **TIME OF ESSENCE; EXTENSION OF TIME.** All times stated in this contract are of the essence. The time stated in this contract may be extended by a change order from Owner for such reasonable time as it may determine, when in its opinion Contractor is delayed in work progress by changes ordered, labor disputes, fire, prolonged transportation delays, injuries, or other causes beyond Contractor's control or which justify the delay. Otherwise, in the event the project is not completed by the scheduled completion date, Contractor shall be required to pay Owner as liquidated damages the sum of \$500 for each calendar day, after the scheduled completion date, that the project is unfinished.

11. **SUBCONTRACTORS.** Contractor agrees to furnish Owner, prior to the execution of this contract, with a list of names of subcontractors to whom he proposes to award the principal portions of the work to be subcontracted by him.

A subcontractor, for the purposes of this contract, shall be a person with whom Contractor has a direct contract for work at the project site.

Contractor agrees not to employ a subcontractor to whose employment Owner reasonably objects, nor shall Contractor be required to hire a subcontractor to whose employment he reasonably objects.

All contracts between Contractor and subcontractor shall conform to the provisions of this contract, and shall incorporate in them the relevant provisions of this contract.

12. **ARBITRATION.** All claims and disputes relating to this contract shall be subject to arbitration at the option of either Owner or Contractor in accordance with the Arbitration Rules of the American Arbitration Association for the construction industry.

- A. A formal written demand for Arbitration shall be filed with BOTH the other party to this contract AND with the American Arbitration Association, within a reasonable time after the dispute has arisen, but NOT LATER THAN SIXTY (60) DAYS after the claim or dispute arose.
- B. A "claim" or "dispute" under this Paragraph arises when the claiming or disputing party FIRST knew or reasonably should have known of the subject matter of the "claim" or "dispute." The purpose of this Paragraph is to encourage the prompt resolution of any and all "claims" or "disputes." As a result, any doubts regarding the determination of when such notice occurred shall be resolved by giving all due deference to the EARLIEST date of notice. The determination of when a "claim" or "dispute" occurred shall not be determined by reference to the date where an "impasse" had occurred.
- C. The Arbitrator is authorized to award reasonable attorney fees to the prevailing party.

13. **INSURANCE.** Contractor agrees to keep in force at his own expense during the entire period of construction on the project such liability insurance as will protect him from claims, under workers' compensation and other employee benefit laws, for bodily injury and death, and for property damage, that may arise out of work under this contract, whether directly or indirectly by Contractor, or directly or indirectly by a subcontractor. The

minimum liability limits of such insurance shall not be less than the limits required by law for that type of damage claim. Proof of such insurance shall be filed by Contractor with Owner within a reasonable time after execution of this contract. Contractor shall be responsible for insuring all construction materials, tools and equipment stored at the job site.

14. **CORRECTING WORK.** When it appears to the Owner or the Contractor during the course of construction that any work does not conform to the provisions of this contract, Contractor shall make necessary corrections so that such work will so conform, and in addition will correct any defects caused by faulty materials, equipment, or quality of performance in work supervised by him or by a subcontractor, appearing within one (1) year from the date of final payment, or within such longer period as may be prescribed by law.

15. **WORK CHANGES.** Owner reserves the right to order work changes in the nature of additions, deletions, or modifications, without invalidating this contract, and agrees to make corresponding adjustments in the contract price and time for completion.

All changes will be authorized by a written change order signed by Owner. The change order will include conforming changes in the contract price and completion time.

Work shall be changed, and the contract price and completion time shall be modified only as set out in the written change order. No work is to be initiated without the written change order in place.

Any adjustment in the contract price resulting in a credit or a charge to Owner shall be determined by mutual contract of the parties, or by arbitration, before starting the work involved in the change.

The total allowance for combined overhead and profit for changes shall be included in the total cost to the owner and shall be based on the following schedule.

- A. For the Contractor, 10% over cost.
- B. For the Sub-Contractor, 15% over cost to be divided 10% for Sub-Contractor and 5% for Contractor.
- C. For any Sub-Subcontractor, 15% over cost to be divided 5% for Contractor, 5% for Sub-Contractor, and 5% for Sub-Subcontractor.

16. **CONTRACTOR'S TERMINATION.** Owner may, on five days notice to Contractor, terminate this contract before the completion date specified in this contract, or extended times provided by approved change orders, and without prejudice to any other remedy they may have, if Contractor defaults in performance of any provision in this contract, or fails to carry out his work in accordance with the provisions of the contract documents. If the unpaid balance on the contract price at the time of such termination exceeds the expense of finishing the work, owners will pay such excess to Contractor. If the expense of finishing the work exceeds the unpaid balance at the time of termination, Contractor agrees to pay the difference to Owners.

17. **GOVERNING LAW.** It is agreed that this contract shall be governed by, construed, and enforced in accordance with the laws of the State of Idaho.

18. **GENDER AND NUMBER.** As used in this contract, the masculine, feminine, or neuter gender, and the singular or plural number, each shall be deemed to include the other whenever the context so indicates.

19. **ATTORNEY FEES.** In the event that any action, including Arbitration, is filed in relation to this contract, the unsuccessful party in the action shall pay to the prevailing party, in addition to all the sums that either party may be called on to pay at Arbitration, a reasonable sum for the successful party's attorney's fees.

20. **ENTIRE AGREEMENT.** This contract shall constitute the entire agreement between the parties and any prior understanding or representation of any kind preceding the date of this contract shall not be binding upon either party except to the extent incorporated in this contract.

21. **MODIFICATION OF AGREEMENT.** Any modification of this contract or additional obligation assumed by either party in connection with this agreement shall not be binding upon either party except to the extent an amendment in writing, executed by both the Owner and the Contractor.

22. **NOTICES.** Any notice provided for or concerning this contract shall be in writing and be deemed sufficiently given when sent by certified or registered mail and addressed as follows:

To: Owner	To: Engineered Systems Assoc., Inc.
School District No. 25	1355 East Center
3115 Poleline Rd.	Pocatello, Idaho 83201
Pocatello, Idaho 83201-6119	

23. **ASSIGNMENT OF RIGHTS.** The rights of each party under this contract are personal to that party and may not be assigned or transferred to any other person, firm, corporation, or other entity without the prior, express, and written consent of the other party.

24. **PARAGRAPH HEADINGS.** The titles to the paragraphs of this contract are solely for the convenience of the parties and shall not be used to explain, modify, simplify, or aid in the interpretation of the provisions of this contract.

**IN WITNESS WHEREOF** the parties have executed this contract on the date indicated below:

**CONTRACTOR:**  
«Company»

Dated: \_\_\_\_\_

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

Title: \_\_\_\_\_

Attest: \_\_\_\_\_

**OWNER:**  
School District No. 25  
Bannock County, Idaho

Dated: \_\_\_\_\_

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

Bart J. Reed  
Director of Business Operations

Attest: \_\_\_\_\_

10018M.wpd  
REVISED February 2018.cbg  
Reviewed/Approved/BR



KNOW ALL MEN: That we \_\_\_\_\_, Principal,  
\_\_\_\_\_, Surety,

are held firmly bound unto \_\_\_\_\_, Owner,  
in the sum of \_\_\_\_\_ Dollars  
(\$\_\_\_\_\_)

for the payment of which we bind ourselves, our legal representatives, successors, and assigns, jointly and severally, firmly by the presents.

WHEREAS, Principal has executed contract with Owner, dated  
for

copy of which contract is by reference made a part hereof.

NOW, THEREFORE, if Principal shall faithfully perform such contract and pay all persons who have furnished labor or material for use in or about the improvement and shall indemnify and save harmless the Owner from all cost and indemnify and save harmless the Owner from any defect or defects in any of the workmanship or materials entering into any part of the work which shall develop or be discovered within one year after the final acceptance of such work, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

Provided, that the liability hereunder for defects in materials or workmanship for a period of one year after final acceptance of the work shall not exceed the sum of: \_\_\_\_\_  
Dollars  
(\$\_\_\_\_\_)

All persons who have furnished labor or materials for use in or about the improvement shall have a direct right of action under the bond, subject to the Owner's priority.

The Contract, including the completion thereof after default, if any, shall be prosecuted under full supervision of a duly qualified Engineer.

Any payment of payments under the bond shall reduce its penalty to the extent of such payment of payments.

No suit or action may be maintained under the bond unless it shall have been instituted within two years from date on which final payment under the contract falls due.

The Owner and Engineer shall cooperate with and assist Surety in prosecuting its rights and claims, if any, against Principal and others by supplying testimony, books, records, and documentary evidences in their possession.

The Surety hereby waives notice of any alterations, extensions, or forbearance made or extended by the Owner or Principal.

In event Principal is in default under the contract as defined therein, Surety will (a) within fifteen days of determination of such default, take over and assume completion of said contract and become entitled to the payment of the balance of the contract price, or (b) pay the Owner in cash the reasonable cost of completion, less the balance of the contract price including retained percentage. The cost of completion shall be fixed by taking bids from at least three responsible contractors, one chosen by the Owner, one by the Engineer, and one by the Surety. The Surety will make such payment within fifteen days after the cost of completion shall have been so determined.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_ 2018.

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

(Principal)

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

(Surety)

## **DIVISION 01 - GENERAL PROVISIONS**

### **01002 SCOPE OF WORK**

1. The work to be done under this specification includes the furnishing of all labor, equipment, and materials to do all work as specified and shown on the drawings. It is the intent of these specifications that the work shall be complete and ready for operation before acceptance. The work shall include, but is not necessarily limited to, the following:
  - a. Replacement of the existing Boiler systems, new electrical, motor control center, and cutting and patching and concrete work required for the replacement work.

### **01005 INTERPRETATIONS**

1. Questions regarding drawings and specifications should be addressed to Engineered Systems Associates, 1355 East Center, Pocatello, Idaho 83201. Questions will be answered by bulletin or addendum addressed to all Bidders. All addenda issued during the time of bidding will be incorporated into the contract. Questions received less than 48 hours before bid time cannot be answered. Contact with District Staff, Board of Trustees, or Administration will be by written permission only.

### **01010 ORDINANCES**

1. The work shall be installed in accordance with the local plumbing and electrical codes, any other government code or ordinance that pertains to this type of work, and to the rules and regulations of the local utility companies.
2. Should these specifications and drawings conflict with any regulatory codes, the most stringent requirement shall govern the proper installation of the work and no extra charge shall be made for any changes required to comply with the code.
3. The contractor hereby binds himself to protect and save harmless the owner from all damages arising from the violation of any and all Federal, State, County, City, and all other laws, rules, regulations, in the performance of the terms of the contract.

### **01015 WORKMANSHIP**

1. Workmanship shall be the best quality of its kind for respective industries, trades, crafts, and practices and shall be acceptable in every respect to the Owner, making good and perfect work in all details of construction.

### **01018 EXAMINATION OF SITE AND CONDITIONS**

1. Before submitting a proposal, Bidders shall carefully examine the drawings and specifications, visit the worksite and fully inform themselves of all existing conditions and limitations, and shall include in their proposal a sum to cover the cost of all items included in the contract and shall rely entirely on their own examination in making their proposal.

### **01020 FEES & PERMITS**

1. The Contractor shall procure all necessary permits, pay for the same and shall obtain all official license for the construction of the work and for temporary obstructions, enclosures, openings of streets for pipes, walls, etc. arising from the construction and completion of the work as mentioned in the specifications. He shall be responsible for all violations of the law for any reason in connection with the construction of the work or caused by obstructing streets, sidewalks, etc., and he shall give all requisite notice to public authorities.

### **01040 HOLD HARMLESS AGREEMENT**

1. In addition to obtaining insurance coverage as required by the Contract Documents above, Contractor shall indemnify and save harmless Owner from and against any and all liability, demands, causes of action, or claims thereof, whether well-founded or otherwise, including the cost of defending the same, for bodily injury to any person whomsoever, (including employees of Owner) or damage to property of any person in the course of, or in connection with, the operations by Contractor under this Contract. No subcontractor shall relieve the Contractor of any of his liability or obligations under the contract. Contractor agrees that he is fully responsible to Owner for acts or omissions of his sub-contractors and their material men and of persons either directly or indirectly employed by them.

#### **01045 LIENS AND ENCUMBRANCES**

1. The Contractor, before receiving final payment of the job, shall furnish evidence of satisfactory and complete release on all liens and encumbrances of any nature that he may have placed thereon.
2. All sub-contractors furnishing material must be paid in full and receipted bills therefrom be submitted before final payment is made.

#### **01050 EXECUTION, CORRELATION AND INTENT OF DOCUMENTS**

1. Perfect coordination of all the documents comprising the contract is sought in their preparation. The formal contract document shall, however, be construed as precedent to and as superseding provisions in, or inferences drawn from provisions in any or all other documents of the contract in disagreement therewith. In case of disagreement between the drawings and the specifications, the specifications' requirements shall prevail. Requirements shown on the drawings and not cited or contradicted in the specifications or requirements cited in the specifications and not shown on the drawings, shall be as binding upon the parties as though cited in the specifications and shown on the drawings.

#### **01055 DETAIL DRAWINGS AND INSTRUCTIONS**

1. Contractor shall check all drawings and any supplementary drawings which may be furnished by the Engineer and shall promptly notify the Engineer of any discrepancies. Each Contractor shall compare all drawings and verify figures before laying out his work and will be responsible for any errors which might have been avoided thereby. When measurements are affected by conditions already established, the Contractor shall take measurements, notwithstanding the giving of scale, or figure, dimensions on the drawings. All questions regarding the figures, drawings, plans and specifications and the interpretation thereof and resolving of conflicts and inconsistencies therein shall be determined by the Engineer, and the work shall be performed in accordance with such determinations and instructions of the Engineer.
2. The omission from the drawings or specifications or the description of details of work which is evidently necessary to carry out the intent of the drawings and specifications, or which is customarily performed, shall not relieve the Contractor from performing such omission and details of work but they shall be performed as if fully, correctly set forth and described in the drawings and specifications.

#### **01060 CHANGES IN THE WORK**

1. The owner, without invalidating the contract, may order extra work or make changes by altering, adding to or deducting from the work, the contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract, except that any claim for extension of the time caused thereby shall be adjusted at the time of ordering such change.
2. The total allowance for combined overhead and profit for changes shall be included in the total cost to the owner and shall be based on the following schedule: A. For the Contractor, 10% over cost.; B. For the Sub-Contractor, 15% over cost to be divided 10% for Sub-Contractor and 5% for Contractor; and C. For any Sub-Subcontractor, 15% over cost to be divided 5% for Contractor, 5% for Sub-Contractor, and 5% for Sub-Subcontractor.

#### **01065 BRAND NAMES AND SUBSTITUTIONS**

1. Reference in this specification to any product or material by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limited competition. The Contractor may, at his option, use any product or material that conforms with this specification for which he has received written approval five days prior to bid opening.
2. Substitution request shall include complete submittal data showing compliance with the specified items and listing any differences from that specified.

#### **01070 EQUIPMENT SUBMITTAL**

1. Equipment and materials proposed for installation shall be submitted in six copies to the Engineer by the Contractor for the Engineer's approval or rejection. The schedules shall include catalogs, cuts, drawings and such other descriptive data or samples that are requested by the Engineer. The submittals must be in the Engineer's office not later than ten (10) days after award of contract. Contractor shall not order any equipment until he has received written approval from the Engineer.
2. The contractor shall provide all labor, materials, tools, and equipment, etc. necessary for the complete and substantial execution of everything described in the plans and specifications.

#### **01075 CONTRACTOR SHALL VISIT THE SITE**

1. The Contractor shall visit the site before placing his bid in order to become familiar with existing conditions. No extra charge will be paid to the Contractor due to his failure to completely ascertain existing conditions.

#### **01080 MATERIALS, EQUIPMENT AND ACCESSORIES**

1. Unless otherwise specified, all equipment, accessories and materials shall be new and undamaged, and the workmanship shall be of the best quality for use intended and shall be acceptable to the Engineer or Owner.
2. Equipment, accessories and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer.
3. The contractor shall make arrangement and coordinate with the Maintenance Dept. for storage of materials and equipment. Any damages of life or property caused by storage of materials on the above indicated place shall be paid for by the contractor, who shall hold the owner harmless for any damages concerning the same.

#### **01085 REMOVING OF DEBRIS, ETC.**

1. The contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his employees or work, and at the completion of the work he shall remove all his rubbish from and about the building and all tools and surplus materials and shall leave his work clean. In case of dispute, the owner shall remove the rubbish and surplus materials and charge the cost to the contractor.
2. Upon completion of the work remove all surplus materials and rubbish. Clean all spots resulting from this work from hardware, floors, glass, walls, etc. Do all required patching up and repair of work of other trades damaged by this division of the work and leave the premises in a clean, orderly condition.

#### **01090 INSPECTIONS**

1. The Contractor must at all times allow the Owner's authorized representative to come on the job for the purpose of inspection and lend any assistance necessary to help this work along.

## **01092 MAINTENANCE & OPERATING MANUALS**

1. Prior to the pre-final project review, this Contractor shall compile two (2) sets of Maintenance and Operating Instructions. Bind each set in a three-ring loose leaf binder. Manuals shall include, but shall not be limited to, the following:
  - a. Provide a master index at beginning of Manual showing items included. Use plastic index tabs for sections of Manual.
  - b. First section shall have an index tab labeled "General" and shall contain the following information:
    1. One sheet consisting of names, addresses, and phone numbers of Mechanical & Electrical Engineers, General Contractor, and Subcontractors.
    2. One sheet entitled List of Suppliers which gives a complete list of equipment installed with name, address, and phone number of vendor for each item of equipment.
    3. Sheets entitled Description of System which give a general description of the mechanical system. The information should be broken into three categories:
      - Major Equipment Location
      - Descriptions of Systems and Operations
      - Suggested Maintenance and Routines:
        - a) Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
        - b) List of mechanical equipment used indicating name, model, serial number, and name plate data of each item together with number and name associated with each system item.
  - c. The second section shall have an index tab labeled "Equipment" and shall be followed by an index tab for each type of equipment, including plumbing fixtures, temperature controls, doors, ceilings, floor, and electrical.
    1. Include approved copies of submittals for each piece of equipment. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
    2. Include manufacturer's published maintenance and operating instructions for each piece of equipment.
      - a) Instructions shall include name of vendor, installation instructions, parts numbers & lists, operation instructions of equipment, and maintenance & lubrication instructions.
      - b) Step-by-step procedure to follow in putting each piece of mechanical equipment into operation.
      - c) Provide schematic control diagrams for each separate fan system, refrigeration system, heating system, control panel, etc. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control instrument on these diagrams.
      - d) Provide diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays.
      - e) Provide a drawing of each temperature control panel identifying components on the panels and their function.
      - f) Provide a sequence of control as part of the temperature control section.
  - d. Provide an index tab for the Air Balance and Test Run Reports and insert the reports.
2. These manuals shall be submitted to the Engineer for approval and distribution prior to the pre-final project review.

## **01100 BUILDING DAMAGE**

1. This Contractor shall be responsible for any damage to the building, carpets, furnishings, etc., caused by his workmen. Special care shall be taken to cover all carpets, floors, protect wall and ceilings. If floors are damaged repairs will be at the Contractors expense. If carpets are soiled by this Contractor, he shall clean the carpets at his expense. If building walls are soiled, he shall be required to clean the walls or repaint them. Take special care in moving about in this building facility. Protect stairs with covering and plywood.

2. All walls, floors and ceilings shall be protected in the areas of construction and the areas of access to the construction. Any damage to existing surfaces shall be patched and repaired to match the existing conditions as approved by the Engineer at the Contractor's expense.

#### **01105 CONTRACTOR USE OF BUILDING FACILITIES**

1. This Contractor will not be allowed the use of the building rest room facilities, showers, cooking facilities, refrigerators, etc., or to occupy other areas of the building such as classroom facilities. Lunches and food should be eaten in the mechanical room or outside of the building. The Contractor will be responsible to clean the facilities when he leaves the project.
2. The Contractor shall provide onsite temporary toilet facilities for use of Contractor's employees during the period of work on this contract.

#### **01110 CO-ORDINATION AND SCHEDULING**

1. Contractor shall confer with the Owner at site to determine most suitable time to perform the work. Once started, the installation shall be completed promptly to get the system back in service as soon as practical.

#### **01115 TEST RUN**

1. Contractor shall operate system for such time as necessary to demonstrate satisfactory performance. Make required adjustments and instruct Owner's representative in its proper operation and maintenance.

#### **01120 GUARANTEE**

1. Contractor shall warrant and guarantee all work performed by him directly and by his sub-contractors, and shall make good any defect in workmanship or materials which may develop in his work within one year from the date of final acceptance thereof. Any repairs, adjustments or replacements must be made promptly after notification from the Owner of such defects.

#### **01122 PATCHING AND PAINTING EXCEPT WHERE NOTED OTHERWISE.**

1. Necessary openings shall be cut to approximately the required size with neat workmanship and with openings properly located for the proper operation of the system and the utility of the space considered. Necessary patching shall be done in such a way that brick and concrete if removed shall be restored as it was. Plaster shall be restored as it was; plaster shall be spackled or re-plastered as required. All surfaces shall be restored with first quality materials of a color to properly match the existing materials surrounding the opening or place where patching has been done.
2. All equipment furnished in finished painted condition by this Contractor shall be left without mark or scratch. Any necessary refinishing to match original shall be done.
3. It is the Contractors responsibility to patch and repair all openings or unfinished areas left by the Contractor and subcontractors due to the demolition of the existing equipment and piping or installation of new equipment and piping except where noted. Areas shall be patched to match the existing conditions where noted. Painting will be done by the Owner.

#### **01125 APPLICATIONS FOR PAYMENTS**

1. At least ten (10) days before the request for the first payment on the contract the Contractor shall furnish to the Engineer, for his approval, a schedule of values or a breakdown of the various parts of the work as subdivided in the specifications (for the total equaling the contract price) on forms approved by the Engineer in triplicate. The approved values shall become the basis for determining progress payments and for negotiating change orders. Reference be made to the Contract Agreement, a copy of which is bound with these specifications.

2. At least ten (10) days before each payment falls due, the Contractor shall submit to the Engineer three copies of a statement of the form described above showing the proportionate part of the work performed and materials on the site up to the first of the month, which date shall be the termination of the period covered by the payment. Such statement shall be made in the form approved by the Engineer, but it shall not be binding against the Engineer's judgment.
3. Application for payments dated on or prior to the 25<sup>th</sup> of the month, shall be made by the 15<sup>th</sup> of the following month. Application for payments dated after the 25<sup>th</sup> of the month, payment shall be made within the next pay cycle.
4. The first payment on this project will be made after July 1, 2018.

#### **01130 CONTRACTOR'S LIABILITY FOR TAXES**

1. In accordance with Section 3, Chapter 246, Idaho Session Laws, 1937, the Contractor in consideration of securing the business of erecting or construction public works in the state, recognizing that the business in which he is engaged is of a transitory character and that in the pursuit thereof, his property contained therein may be without the state when taxes, excises or license fees to which he is liable become payable, agrees:
  - a. To pay promptly when due all taxes (other than real property) and license fees due to the state, its subdivisions and municipal or quasimunicipal corporation therein accrued or accruing during the term of this Contract, whether or not the same shall be payable at the end of such term.
  - b. That if said taxes, excises and license fees are not payable at the end of such term, both liability for the payment thereof, exists, even though the same constitute liens upon his property to secure the same to the satisfaction of the respective officers charged with the collection thereof;
  - c. That, in the event of his default in the payment of securing of such taxes, excises and license fees, to consent that the department, officer, board or taxing unit entering into the Contract may withhold from any payments due him hereunder the estimated amount of such accrued and accruing taxes, excises and license fees for the benefit of all taxing units to which said Contractor is liable.
  - d. The Contract Sum and any agreed variations there, includes all Federal, State and Local taxes imposed by law.

#### **01135 OWNERSHIP OF REMOVALS**

1. The Owner shall have first right to claim any of the existing equipment or materials being removed. The Contractor shall notify the Owner when he is ready to do the demolition and the Owner shall have a maximum of one week to make his wishes known to the Contractor. A list of Owner desired equipment will be issued as an addendum.
2. The Contractor shall be responsible for any or all other removals as may be necessary and required to entirely complete the work included under this contract.
3. All apparatus, equipment, fixtures, electrical work, mechanical work, utilities, piping and all other salvageable materials of whatever character shall carefully be removed by the Contractor and/or Subcontractors and same shall be the property of the Contractor, except where specifically called out on the drawings or listed in the addendum.

#### **01136 DEMOLITION**

1. The Contractor shall contain demolition work required in each room or area so as to minimize any dust and damage to other parts of the building.
2. Protect all walls, floors and ceilings where demolition takes place.



3. Remove all material from the building as soon as possible and protect areas of exit from damage from the removed material and equipment.

**01140 ROOFING REPAIRS**

1. All roofing and patching related to any new work on the roof to be performed by a metal roofing Contractor. The curbs are to extend a minimum of 12 inches above the roof surface. Roofing Contractor shall inspect existing roof where new work is to be done to verify condition and protection required.

**01142 ASBESTOS**

1. Any asbestos encountered shall be called to the attention of the engineer and the owner.
2. All asbestos removal work will be taken care of by the school district under separate contract.

**01144 DATA, FIRE ALARM AND SECURITY**

1. Any changes necessary to the existing data, fire alarm, security, or speaker system to complete the work specified shall be called to the attention of the engineer and the owner.
2. The owner shall take care of any changes to the existing data, fire alarm, security system, or speaker system under separate contract or with their own forces.

**01146 LIQUIDATED DAMAGES**

1. The Owner will suffer financial loss in an amount that is difficult to quantify if the Project is not Substantially Complete on the date set forth in the Contract Documents. The Contractor (and his Surety) shall be liable for and shall pay to the Owner the sums hereinafter stipulated as fixed, agreed and liquidated damages, and not as a penalty, for each calendar day of delay until work is Substantially Complete:.

Five Hundred and no/100-----Dollars (\$500.00)

**01147 SUPERINTENDENT**

1. The Contractor shall employ a competent Superintendent who shall be in attendance at the project site during the performance of any work by the Contractor or his sub-contractors. The Superintendent shall represent the Contractor and communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing.
2. The Superintendent shall not be changed except with the consent of the Engineer unless the Superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. Under this circumstance the new Superintendent shall also be satisfactory to the Engineer and the Owner.
3. The Superintendent shall coordinate all work of the sub-contractors so as to insure the work is completed on time and coordinate between all sub-contractors.
4. The Superintendent shall have safety and coordination meetings with all contractors and sub-contractors at least weekly.

**01148 CONSTRUCTION MEETINGS**

1. At the pre-construction meeting all contractors and sub-contractors shall be present. A construction schedule shall be presented by the contractor.
2. Construction meetings will be scheduled for the project. All contractors and sub-contractors working at the time are expected to be present for the construction meetings.

3. The Owners representative and the Engineer will be present at all construction meetings.

**01150 GENERAL CONDITIONS**

1. By reference, the Standard Form of the American Institute of Architects for General Conditions of the Contract, A.I.A. Document A 201 is a part of this contract.

**END OF DIVISION 01**

**DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING**

**23 0000 HEATING, VENTILATING, AND AIR-CONDITIONING**

- 23 0501 COMMON HVAC REQUIREMENTS
- 23 0502 DEMOLITION AND REPAIR
- 23 0514 VARIABLE FREQUENCY DRIVE SYSTEM
- 23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
- 23 0593 TESTING, ADJUSTING, AND BALANCING
- 23 0715 HOT WATER HEATING & RETURN PIPING INSULATION
- 23 0800 FIRE STOPPING

**23 2000 HVAC PIPING AND PUMPS**

- 23 2113 HYDRONIC PIPING
- 23 2125 CLEANING AND FLUSHING WATER CIRCULATING SYSTEMS

**23 5000 CENTRAL HEATING EQUIPMENT**

- 23 5134 FLUES
- 23 5230 GAS BOILER

END TABLE OF CONTENTS

## SECTION 23 0501 – COMMON HVAC REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Furnish labor, materials, and equipment necessary for completion of work as described in Contract Documents.
- B. It is the intent of these specifications that the systems specified herein are to be complete and operational before being turned over to the owner. During the bidding process, the contractor is to ask questions or call to the engineer's attention any items that are not shown or may be required to make the system complete and operational. Once the project is bid and the contractor has accepted the contract, it is his responsibility to furnish and install all equipment and parts necessary to provide a complete and operational system without additional cost to the owner.
- C. Furnish and install fire stopping materials to seal penetrations through fire rated structures and draft stops.
- D. Includes But Not Limited To:
  - 1. General procedures and requirements for HVAC.
- E. Related Sections:
  - 1. Section 23 0593: Testing, Adjusting, and Balancing for HVAC.

#### 1.3 SUBMITTALS

- A. Substitutions: By specific designation and description, standards are established for specialties and equipment. Other makes of specialties and equipment of equal quality will be considered provided such proposed substitutions are submitted to the Architect for his approval, complete with specification data showing how it meets the specifications, at least 5 working days prior to bid opening. A list of approved substitutions will be published as an addendum.
  - 1. Submit a single copy of Manufacturer's catalog data including Manufacturer's complete specification for each proposed substitution.
  - 2. The Architect or Engineer is to be the sole judge as to the quality of any material offered as an equal.
- B. Product Data, Shop Drawings: Within 30 days after award of contract, submit 6 sets of Manufacturer's catalog data for each manufactured item.
  - 1. Literature shall include enough information to show complete compliance with Contract Document requirements.
  - 2. Mark literature to indicate specific item with applicable data underlined.
  - 3. Information shall include but not be limited to capacities, ratings, type of material used, guarantee, and such dimensions as are necessary to check space requirements.
  - 4. When accepted, submittal shall be an addition to Contract Documents and shall be in equal force. No variation shall be permitted.
  - 5. Even though the submittals have been accepted by the Engineer, it does not relieve the contractor from meeting all of the requirements of the plans and specifications and providing a complete and operational system.
- C. Drawings of Record: One complete sets of blue line mechanical drawings shall be provided for the purpose of showing a complete picture of the work as actually installed.
  - 1. These drawings shall serve as work progress report sheets. Contractor shall make notations neat and legible therein daily as the work proceeds.
  - 2. The drawings shall be kept at the job at a location designated by the Mechanical Engineer.
  - 3. At completion of the project these "as-built" drawings shall be signed by the Contractor, dated, and returned to the Architect.

- D. Operating Instructions and Service Manual: The Mechanical Contractor shall prepare 2 copies of an Operation and Maintenance Manual for all mechanical systems and equipment used in this project. Manuals shall be bound in hard-backed binders and the front cover and spine of each binder shall indicate the name and location of the project. Use plastic tab indexes for all sections. Provide a section for each different type of equipment item. The following items shall be included in the manual, together with any other pertinent data. This list is not complete and is to be used as a guide.
1. Provide a master index at the beginning of the manual showing all items included.
  2. The first section of the manual shall contain:
    - a. Names, addresses, and telephone numbers of Architect, Mechanical Engineer, Electrical Engineer, General Contractor, Plumbing Contractor, HVAC Contractor, and Temperature Control Contractor.
    - b. List of Suppliers which shall include a complete list of each piece of equipment used with the name, address, and telephone number of vendor.
    - c. General Description of Systems including –
      - 1) Location of all major equipment
      - 2) Description of the various mechanical systems
      - 3) Description of operation and control of the mechanical systems
      - 4) Suggested maintenance schedule
    - d. Copy of contractor's written warranty
  3. Provide a copy of approved submittal literature for each piece of equipment.
  4. Provide maintenance and operation literature published by the manufacturer for each piece of equipment which includes: oiling, lubrication and greasing data; belt sizes, types and lengths; wiring diagrams; step-by-step procedure to follow in putting each piece of mechanical equipment in operation.
  5. Include parts numbers of all replaceable items.
  6. Provide control diagram and operation sequence, along with labeling of control piping and instruments to match diagram.
  7. Include a valve chart indicating valve locations.
- E. Include air balance and/or water balance reports.
- F. Include Start-up Reports.

#### 1.4 SUBMITTALS FOR COMMON HVAC REQUIREMENTS

- A. Quality Assurance / Control:
1. Manufacturer's installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.
  2. Specification data on sealer proposed for sealing ductwork.
- B. Quality Assurance
1. Requirements: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA HVAC Duct Construction Standards.
  2. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.

#### 1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. Perform work in accordance with applicable provisions of local and state Plumbing Code, Gas Ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
  2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.
- B. Applicable Specifications: Referenced specifications, standards, and publications shall be of the issues in effect on date of Advertisement for Bid.
1. "Heating, Ventilating and Air Conditioning Guide" published by the American Society of Heating and Air Conditioning Engineers.
  2. "Engineering Standards" published by the Heating, Piping, and Air Conditioning Contractors National Association.
  3. "2015 International Building Code", "2015 International Mechanical Code", and "2015 International Fire Code" as published by the International Conference of Building Officials.

4. 2015 Idaho Plumbing Code as published by the International Association of Plumbing and Mechanical Officials.
5. "National Electrical Code" as published by the National Fire Protection Association.
6. "2015 International Energy Conservation Code".

C. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

#### 1.6 INSPECTIONS AND PERMITS

A. Pay for permits, fees, or charges for inspection or other services. Local and state codes and ordinances must be properly executed without expense to Owner and are considered as minimum requirements. Local and state codes and ordinances do not relieve the Contractor from work shown that exceeds minimum requirements.

#### 1.7 ADDITIONAL WORK:

A. Design is based on equipment as described in the drawing equipment schedule. Any change in foundation bases, electrical wiring, conduit connections, piping, controls and openings required by alternate equipment submitted and approved shall be paid for by this division. All work shall be in accordance with the requirements of the applicable sections.

### **PART 2 - NOT USED**

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION

A. Site Inspection:

1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Drawings:

1. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc, and do not attempt to show complete details of building construction which affect installation. This Contractor shall refer to site visit for additional building detail which affect installation of his work.
  - a. Follow mechanical drawings as closely as actual building construction and work of other trades will permit.
  - b. No extra payments will be allowed where piping and/or ductwork must be offset to avoid other work or where minor changes are necessary to facilitate installation.
  - c. Everything shown on the mechanical drawings shall be the responsibility of Mechanical Contractor unless specifically noted otherwise.
2. Because of small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions. Do not scale drawings for locations of equipment or piping.

C. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
2. If non-specified equipment is used and it will not fit job site conditions, this Contractor assumes responsibility for replacement with items named in Contract Documents.

#### 3.2 PREPARATION

A. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
2. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

### 3.3 INSTALLATION

- A. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

### 3.4 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and assume complete responsibility for losses due to any cause whatsoever. Storage shall not interfere with traffic conditions in any public thoroughfare.
- B. Protect completed work, work underway, and materials against loss or damage.
- C. Close pipe openings with caps or plugs during installation. Cover fixtures and equipment and protect against dirt, or injury caused by water, chemical, or mechanical accident.

### 3.5 COOPERATION

- A. Cooperate with other crafts in coordination of work. Promptly respond when notified that construction is ready for installation of work under Division 23000. Contractor will be held responsible for any delays which might be caused by his negligence or failure to cooperate with the other Contractors or crafts.

### 3.6 SUPERVISION

- A. Provide a competent superintendent in charge of the work at all times. Anyone found incompetent shall be removed at once and replaced by someone satisfactory, when requested by the Engineer.

### 3.7 INSTALLATION CHECK:

- A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule shall visit the project to inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the project as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying the following:
  1. Equipment has been properly installed and lubricated.
  2. Equipment is in accurate alignment.
  3. Equipment is free from any undue stress imposed by connecting piping or anchor bolts.
  4. Equipment has been operated under full load conditions.
  5. Equipment operated satisfactorily.
- C. All costs for this installation check shall be included in the prices quoted by equipment suppliers.

### 3.8 CLEANING EQUIPMENT AND PREMISES

- A. Properly lubricate equipment before Owner's acceptance.
- B. Clean exposed piping, ductwork, equipment, and fixtures. Repair damaged finishes and leave everything in working order.
- C. Remove stickers from fixtures and exposed ductwork.
- D. At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

### 3.9 TESTS

- A. No piping work, fixtures, or equipment shall be concealed or covered until they have been inspected and approved by the inspector. Notify inspector when the work is ready for inspection.
- B. All work shall be completely installed, tested as required by Contract Documents and the city and county ordinances and shall be leak-tight before the inspection is requested.
- C. Tests shall be repeated to the satisfaction of those making the inspections.
- D. Heating/cooling piping shall be flushed out, tested at 100 psi and left under pressure of supply main or a minimum of 40 psi for the balance of the construction period.

### 3.10 WARRANTY

- A. Contractor shall guarantee work under Division 23 to be free from inherent defects for a period of one year from acceptance.
  - 1. Contractor shall repair, revise or replace any and all such leaks, failure or inoperativeness due to defective work, materials, or parts free of charge for a period of one year from final acceptance, provided such defect is not due to carelessness in operation or maintenance.
  - 2. In addition, the Contractor shall furnish all refrigeration emergency repairs, emergency service and all refrigerant required due to defective workmanship, materials, or parts for a period of one year from final acceptance at no cost to the Owner, provided such repairs, service and refrigerant are not caused by lack of proper operation and maintenance.
- B. In addition to warranty specified in General Conditions, heating, cooling, and plumbing systems are to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

### 3.11 SYSTEM START-UP, OWNER'S INSTRUCTIONS

- A. Off-Season Start-up
  - 1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
  - 2. Notify Owner 7 days minimum before scheduled start-up.
  - 3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
  - 4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.
- B. Owner's Instructions
  - 1. Instruct building maintenance personnel and Owner Representative in operation and maintenance of mechanical systems utilizing Operation & Maintenance Manual when so doing.
  - 2. Minimum instruction periods shall be as follows –
    - a. Mechanical - Two hours.
    - b. Temperature Control - Two hours.
  - 3. Instruction periods shall occur after Substantial Completion inspection when systems are properly working and before final payment is made.
  - 4. None of these instructional periods shall overlap another.

END OF SECTION 23 0501



## **SECTION 23 0502 - DEMOLITION AND REPAIR**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

#### 1.2 SUMMARY

- A. Under this section remove obsolete piping and mechanical equipment and relocate, reconnect or replace existing piping affected by demolition or new construction. Remove concealed piping abandoned due to demolition or new construction, or cap piping flush with existing surfaces.

#### 1.3 DRAWINGS AND EXISTING CONDITIONS

- A. All relocations, reconnections and removals are not necessarily indicated on the drawings. As such, the Contractor shall make adequate allowance in his proposal for this work as no extra charges will be allowed for these items.

### **PART 2 - NOT USED**

### **PART 3 - EXECUTION**

#### 3.1 TEMPORARY CONNECTIONS

- A. Where existing piping must remain in service to supply occupied areas during construction, provide temporary piping, connections, and equipment to maintain service to such areas. All shall be performed in a neat and safe manner to prevent injury to the building or its occupants.

#### 3.2 EXISTING CONDITIONS

- A. All required drilling, cutting, block-outs and demolition work required for the removal and/or installation of the mechanical system is the responsibility of this Contractor.
- B. No joists, beams, girders, trusses or columns shall be cut by any Contractor without written permission from the Architect.
- C. The patching, repair, and finishing to existing or new surfaces is the responsibility of this Contractor, unless specifically called for under sections of specifications covering these materials.
- D. Disconnect all equipment that is to be removed or relocated. Relocate any existing equipment that obstructs new construction.

#### 3.3 EXISTING TO REMAIN IN USE

- A. Where affected by demolition or new construction, relocate, replace, extend, or repair piping and equipment to allow continued use of same. Use methods and materials as specified for new construction.

#### 3.4 MATERIALS AND EQUIPMENT REMOVED

- A. All obsolete materials, piping, and equipment shall become the property of the Contractor and be removed from the site promptly.

END OF SECTION 23 0502

## SECTION 23 0514 – VARIABLE FREQUENCY DRIVE SYSTEM

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. This specification is to cover a complete Variable Frequency Drive (VFD aka: VSD, AFD, ASD, Inverter, AC Drive, et al) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.
- B. The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFDs that are manufactured by a third party and “brand labeled” shall not be acceptable. Drive manufacturers who do not build their own power boards and assemblies, or do not have full control of the power board manufacturing and quality control, shall be considered as a “brand labeled” drive. All VFDs installed on this project shall be from the same manufacturer.

#### 1.02 QUALITY ASSURANCE

- A. Referenced Standards and Guidelines:
  - 1. Institute of Electrical and Electronic Engineers (IEEE)
    - a. IEEE 519-1992, Guide for Harmonic Content and Control.
  - 2. Underwriters Laboratories (as appropriate)
    - a. UL508
    - b. UL508A
    - c. UL508C
  - 3. National Electrical Manufacturer’s Association (NEMA)
    - a. ICS 7.0, AC Adjustable Speed Drives
  - 4. International Electrotechnical Commission (IEC)
    - a. EN/IEC 61800-3
  - 5. National Electric Code (NEC)
    - a. NEC 430.120, Adjustable-Speed Drive Systems
  - 6. International Building Code (IBC)
    - a. IBC 2012 Seismic – referencing ASC 7-05 and ICC AC-156
- B. Qualifications:
  - 1. VFDs and options shall be UL508 listed as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR without the need for external input fuses.
  - 2. CE Mark – The base VFD shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2). Base drives that only meet the Second Environment (Category C3, C4) shall be supplied with filters to bring the drive in compliance with the First Environment levels.
  - 3. The entire VFD assembly, including the bypass (if specified), shall be seismically certified and labeled as such in accordance with the 2012 International Building Code (IBC):
    - a. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
    - b. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
    - c. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion.
    - d. Special seismic certification of equipment and components shall be provided by OSHPD preapproval.
  - 4. Acceptable Manufacturers
    - a. ABB ACH Series.
    - b. Alternate manufacturer’s requests must be submitted in writing to the Engineer for approval at least 20 working days prior to bid. Approval does not relieve the supplier of specification requirements.
  - 5. Factory authorized start up and owner training should be provided locally upon request.

#### 1.03 SUBMITTALS

- A. Submittals shall include the following information:
  - 1. Outline dimensions, conduit entry locations and weight.
  - 2. Customer connection and power wiring diagrams.
  - 3. Complete technical product description include a complete list of options provided. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.

#### 1.04 BUILDING INFORMATION MODELING (BIM)

- A. BIM objects shall contain IFC parameters and associated data applicable to building system requirements. These elements shall support the analytic process including size, clearance, location, mounting heights, and system information where applicable.

- B. VFD BIM models shall contain as a minimum the following attributes:
  - 1. Input voltage
  - 2. Current rating
  - 3. Model number
  - 4. Manufacturer
  - 5. Enclosure type

## PART 2 - PRODUCTS

### 2.01 VARIABLE FREQUENCY DRIVES

- A. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility.
- B. The VFD shall provide full rated output from a line of  $\pm 10\%$  of nominal voltage. The VFD shall continue to operate without faulting from a line of  $+30\%$  to  $-35\%$  of nominal voltage.
  - 1. VFDs shall be capable of continuous full load operation under the following environmental operating conditions:
    - a.  $-15$  to  $40^\circ$  C ( $5$  to  $104^\circ$  F) ambient temperature. Operation to  $50^\circ$  C shall be allowed with a 10% reduction from VFD full load current.
    - b. Altitude 0 to 3300 feet above sea level. Operation to 6600 shall be allowed with a 10% reduction from VFD full load current.
    - c. Humidity less than 95%, non-condensing.
- C. All VFDs shall have the following standard features:
  - 1. All circuit boards shall be coated to protect against corrosion.
  - 2. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
  - 3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
  - 4. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VFD programming shall be held in non-volatile memory and is not dependent on battery power
  - 5. The VFD’s shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
  - 6. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required, based on the temperature of and run command to the drive. VFD protection shall be based on thermal sensing and not cooling fan operation.
  - 7. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
  - 8. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
  - 9. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
  - 10. VFDs through 200 HP shall have internal swinging (non-linear) chokes providing impedance equivalent to 5% to reduce the harmonics to the power line. Swinging choke shall be required resulting in superior partial load harmonic reduction. Linear chokes are not acceptable. 5% impedance may be from dual (positive and negative DC bus) chokes, or 5% swinging AC line chokes. VFD’s with only one DC choke shall add an AC line choke.
  - 11. The input current rating of the VFD shall not be greater than the output current rating. VFD’s with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.122. Input and output current ratings must be shown on the VFD nameplate.
  - 12. The VFD shall include a coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV’s shall have a minimum 125 joule rating per phase across the diode bridge. VFDs that do not include coordinated AC transient surge protection shall include an external TVSS (Transient Voltage Surge Suppressor).
  - 13. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus. The loss-of-load condition sensing algorithm shall

- include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.
14. The VFD shall include multiple “two zone” PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for “two zone” control.
  15. If the input reference is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.
  16. The VFD shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.
- D. All VFDs to have the following adjustments:
1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
  2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
  3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
  4. Two (2) programmable analog inputs shall accept current or voltage signals.
  5. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.
  6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.
  7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable. Drives that have only two (2) relay outputs must provide an option card that provides additional relay outputs.
  8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display “start enable 1 (or 2) missing”. The safety input status shall also be transmitted over the serial communications bus.
  9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.
  10. Seven (7) programmable preset speeds.
  11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
  12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
  13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
  14. The VFD shall include password protection against parameter changes.
- E. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
1. Start-up assistant
  2. Parameter assistants
    - a. PID assistant
    - b. Reference assistant
    - c. I/O assistant
    - d. Serial communications assistant
    - e. Option module assistant

- f. Panel display assistant
  - g. Low noise set-up assistant
- 3. Maintenance assistant
- 4. Troubleshooting assistant
- 5. Drive optimizer assistants
- F. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
  - 1. Output Frequency
  - 2. Motor Speed (RPM, %, or Engineering units)
  - 3. Motor Current
  - 4. Motor Torque
  - 5. Motor Power (kW)
  - 6. DC Bus Voltage
  - 7. Output Voltage
- G. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
- H. Serial Communications
  - 1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. [Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.] Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
  - 2. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
    - a. Data Sharing – Read Property – B.
    - b. Data Sharing – Write Property – B.
    - c. Device Management – Dynamic Device Binding (Who-Is; I-Am).
    - d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
    - e. Device Management – Communication Control – B.
  - 3. Serial communication capabilities shall include, but not be limited to; run-stop controls, speed set adjustment, and lock and unlock the keypad. The drive shall have the capability of allowing the BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The BAS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
  - 4. Serial communication in bypass (if bypass is specified) shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.
  - 5. The VFD shall allow the BAS to control the drive digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the BAS system. This allows for remote monitoring of which (of up to 4) safeties are open.
  - 6. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.

- I. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2) with up to 100 feet of motor cable. Second environment (Category C3, C4) is not acceptable, no Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment (C2).
- J. DRIVE OPTIONS – Options shall be furnished and mounted by the drive manufacturer as defined on the VFD schedule. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
  - 1. Circuit Breaker - Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options. Circuit breaker option shall be available with or without systems requiring bypass.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.
- B. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

#### **3.02 START-UP**

- A. Factory start-up shall be provided for each drive by a factory authorized service center. A start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

#### **3.03 PRODUCT SUPPORT**

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line connected to factory support personnel located in the US shall be available. Technical support offered only through the local sales office is not acceptable.
- B. Training shall include installation, programming and operation of the VFD, bypass and serial communication. Factory authorized start up and owner training to be provided locally upon request.

#### **3.04 WARRANTY**

- A. PROPOSED: The VFD Product Warranty shall be 36 months from the date of factory shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION 23 0514

## SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 05 01 apply to this Section.

#### 1.2 SUMMARY

- A. Furnish and install identification of equipment and piping both new and existing as described in Contract Documents.
- B. Mechanical Contractor shall touch-up equipment where factory paint has been damaged. Repaint entire item where more than 20 percent of the surface is involved.
- C. Primary painting of walls, ceilings, ductwork, piping and plenums is covered in the general painting section of these Contract Documents.

### PART 2 - PRODUCTS

#### 2.1 PAINT

- A. Benjamin Moore Impervo or equivalent by Paint Manufacturer approved in Section 09 900.
- B. Use appropriate primer.

#### 2.2 LABELS

- A. Black Formica with white reveal on engraving.

#### 2.3 CODED BANDS

- A. Using colored bands and arrows to indicate supply and return, with colored reflective tape, color code all piping installed in this contract at not more than 20-foot intervals, at equipment, at walls, etc., in accordance with ANSI Standards.
- B. Approved Manufacturers:
  - 1. Seton
  - 2. Craftmark

#### 2.4 PIPE IDENTIFICATION

- A. In addition to the colored bands, stencil with black paint in 1/2 inch high letters a symbol and directional arrow for all fluids handled or use Seaton coded and colored pipe markers and arrows to meet ANSI Standards.
- B. Use appropriate primer.

#### 2.5 EQUIPMENT IDENTIFICATION

- A. Provide an engraved plastic plate for each piece of equipment stating the name of the item, symbol number, area served, and capacity. Label all control components with plastic embossed mechanically attached labels. Sample:  
Supply Fan SF-1 - North Classrooms  
10,000 CFM @ 2.5"

#### 2.6 VALVE IDENTIFICATION

- A. Make a list of and tag all valves installed in this work.
  - 1. Valve tags shall be of brass, not less than 1"x 2" round size, hung with brass chains.
  - 2. Tag shall indicate plumbing or heating service.

**PART 3 - EXECUTION**

**3.1 APPLICATION**

**A. Engraved Plates:**

1. Identify thermostats and control panels in mechanical rooms, furnaces, boilers and hot water heating specialties, duct furnaces, air handling units, electric duct heaters, and condensing units with following data engraved and fastened to equipment with screws –
  - a. Equipment mark noted on Drawings (i.e., SF-1)
  - b. Area served (i.e., North Classrooms)
  - c. Capacity (10,000 CFM @ 2.5)

**B. Stenciling:**

1. Locate identifying legends and directional arrows at following points on each piping system –(new and existing).
  - a. Adjacent to each item of equipment and special fitting.
  - b. At point of entry and exit where piping goes through wall.
  - c. On each riser and junction.
  - d. Every 50 feet on long continuous lines.
2. Hot Water Supply & Return, Gas, & Valve Identification —(new and existing).
  - a. Identify specific pipe contents by stenciling pipe with written legend and placing of arrows to indicate direction of flow.

**C. Painting:**

1. Background Color - Provide by painting of piping at identification locations –(new and existing).

Symbol	Name	Color
NG	Natural Gas	Yellow
HWS	Hot Water Supply	Lt. Green
HWR	Hot Water Return	Lt. Green

2. Identification stenciling and flow arrows shall be following colors for proper contrast:

<u>Arrows &amp; ID Stenciling</u>	<u>Color Shade of Pipe</u>
White	Red, Grays, & black
Black	Yellows, Oranges, Greens, & White

END OF SECTION 23 0553



## SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Division 23 - Basic Mechanical Requirements and Basic Mechanical Materials and Methods Sections apply to work of this section.

#### 1.2 SUMMARY SCOPE

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Hydronic Piping Systems.
    - a. Primary - Secondary Systems
    - b. Pumps
    - c. Boilers

#### 1.3 SUBMITTALS

- A. Agency Data:
  - 1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below. The firm or individuals performing the work herein specified may not be the installing firm.
- B. Engineer and Technicians Data:
  - 1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.
- C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.
- D. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC or NEBB are proposed.
- E. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below.
  - 1. Draft Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
  - 2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 4 complete sets of final reports.
  - 3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
    - a. General Information and Summary
- F. Report Contents: Provide the following minimum information, forms, and data:
  - 1. General information and Summary: Inside cover sheet to identify testing, adjusting, balancing agency, Contractor, Owner, Engineer, and Project. Include addresses and contact names and telephone numbers. Also include a certification sheet containing the seal and name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentation used for the procedures along with the instrument calibration sheet.
  - 2. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC or NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form. The report shall contain the following information, and all other data resulting from the testing, adjusting, and balancing work:
    - a. Actual metered running amperage for each phase of each motor on all pumps and air handling equipment.

- G. Calibration Reports:
  - 1. Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

#### 1.4 CERTIFICATION

- A. Agency Qualifications:
  - 1. Employ the services of a certified testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement, and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, recording and reporting the results, and operation of all systems to demonstrate satisfactory performance to the owner.
  - 2. The testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one person certified by NEBB or AABC as a Test and Balance supervisor, and a registered professional mechanical engineer, licensed in the state where the work will be performed.
- B. Codes and Standard:
  - 1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
  - 2. AABC: "National Standards for Total System Balance."
  - 3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

#### 1.5 PROJECT CONDITIONS

- A. Systems Operation: Systems shall be fully operation and clean prior to beginning procedures.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems within +10% to -5% of contract requirements.
- B. The report shall be approved by the Engineer. Test and balance shall be performed prior to substantial completion.

### **PART 2 - NOT USED**

### **PART 3 - EXECUTION**

#### 3.1 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - 1. Determine the balancing station with the highest percentage over indicated flow.
  - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  - 3. Record settings and mark balancing devices.

- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

### 3.2 RECORD AND REPORT DATA

- A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.
- B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- C. Report shall be certified and stamped by a registered professional mechanical engineer employed by the agency and licensed in the state where the work will be performed.

END OF SECTION 23 0593

## SECTION 23 0715 – HOT WATER HEATING & RETURN PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

#### 1.2 SUMMARY

- A. Furnish and install insulation on piping mains, branches, risers, fittings, and valves, pump bodies and flanges as described in Contract Documents.

### PRODUCTS

#### 1.3 MATERIAL

- A. 6 lb./cu.ft. heavy density fiberglass with fire retardant vapor barrier jacket with self sealing laps. Thickness shall be 1-1/2 inches on heating supply and return lines.
- B. Approved Manufacturers:
  - 1. Owens-Corning Fiberglass heavy density with ASJ-SSL jacket
  - 2. Equals by Johns-Manville or CTM.
  - 3. Zeston covers for valves and fittings.

### EXECUTION

#### 1.4 INSTALLATION

- A. Pipes:
  - 1. Install in accordance with manufacturer's directions on clean dry pipes.
  - 2. Butt joints firmly together.
  - 3. Seal vapor barrier longitudinal seam overlap with vapor barrier adhesive.
  - 4. Wrap butt joints with four inch strip of vapor barrier jacket material cemented with vapor barrier adhesive.
  - 5. Finish with bands applied at mid-section and at each end of insulation.
- B. Valves & Fittings:
  - 1. Insulate and finish by one of following methods:
    - a. With hydraulic setting insulating cement, or equal, to thickness equal to adjoining pipe insulation.
    - b. With segments of molded insulation securely wired in place.
    - c. With prefabricated covers made from molded pipe insulation finished with vapor barrier adhesive.
    - d. Zeston covers and factory applied insulation diapers.
  - 2. Finish fittings and valves with four ounce canvas and coat with vapor barrier adhesive or Zeston covers.
- C. Piping located outdoors and exposed to the weather shall be insulated as indicated above except the thickness shall be determined according to the worst weather extremes expected. The insulation shall then be protected with one of the following weatherproof finishes as indicated on contract drawings:
  - 1. Metal jacketing shall be 0.016" (0.4 mm) minimum aluminum or stainless steel with moisture barrier, secured in accordance with the jacket manufacturer's recommendations. Joints shall be applied so they will shed water and shall be sealed completely.
  - 2. UV resistant PVC jacketing may be applied in lieu of metal jacketing provided jacketing manufacturer's limitations with regard to pipe size, surface temperature, and thermal expansion and contraction are followed.
  - 3. Fittings shall be insulated as prescribed above, jacketed with preformed fitting covers matching outer jacketing used on straight pipe sections, with all joints weather sealed.
  - 4. On outdoor chilled water and refrigerant lines, the insulation system shall be completely vapor sealed before the weather-resistant jacket is applied. The outer jacket shall not compromise the vapor barrier by penetration of fasteners, etc. Vapor stops at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion.

END OF SECTION 23 0715

## **SECTION 23 0800 – FIRE STOPPING**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 05 01 apply to this Section.

#### 1.2 SUMMARY

- A. Furnish and install fire stopping as described in Contract Documents.

#### 1.3 QUALITY ASSURANCE

- A. Fire stopping material shall meet ASTM E814, E84 and be UL listed.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURED UNITS

- A. Material shall be flexible, long lasting, intumescent acrylic seal to accommodate vibration and building movement.
- B. Caulk simple penetrations with gaps of 1/4" or less with:
  - 1. Dow Corning Fire Stop Sealant
  - 2. Pensil 300
- C. Caulk multiple penetrations and/or penetrations with gaps in excess of 1/4" with:
  - 1. Dow Corning Fire Stop Foam
  - 2. Pensil 200
  - 3. IPC flame safe FS-1900
  - 4. Tremco "Tremstop 1A"

### **PART 3 - EXECUTION**

#### 3.1 INSTALLATION

- A. Follow manufacturer's installation instructions explicitly.
- B. Seal penetrations of ductwork, piping, and other mechanical equipment through one-hour and two-hour rated partitions as shown on Architectural and Mechanical Drawings.
- C. Install fire stopping material on clean surfaces to assure adherence.

END OF SECTION 23 0800

## SECTION 23 2113 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 05 01 apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes piping, special-duty valves, makeup water for these systems; blowdown drain lines; and condensate drain piping.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Failed test results and corrective action taken to achieve requirements.
- E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 23.

#### 1.4 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grooved Mechanical-Joint Fittings and Couplings:
    - a. Central Sprinkler Company; Central Grooved Piping Products.
    - b. Grinnell Mechanical Products.
    - c. Victaulic Company of America.
  2. Calibrated Balancing Valves:
    - a. Armstrong Pumps, Inc.
    - b. Flow Design, Inc.
    - c. Gerand Engineering Company.
    - d. Griswold Controls.
    - e. ITT Bell & Gossett; ITT Fluid Technology Corp.
  3. Pressure-Reducing Valves:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Conbraco Industries, Inc.
    - d. ITT Bell & Gossett; ITT Fluid Technology Corp.
    - e. Spence Engineering Company, Inc.
    - f. Watts Industries, Inc.; Watts Regulators.
  4. Safety Valves:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Conbraco Industries, Inc.
    - d. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
    - e. Kunkle Valve Division.
    - f. Spence Engineering Company, Inc.
  5. Automatic Flow-Control Valves:
    - a. Flow Design, Inc.
    - b. Griswold Controls.
  6. Expansion Tanks:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. ITT Bell & Gossett; ITT Fluid Technology Corp.
  7. Air Separators and Air Purgers:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. ITT Bell & Gossett; ITT Fluid Technology Corp.

## 2.2 PIPING MATERIALS

- A. General: All pipe and fittings to be from domestic manufacturer.

## 2.3 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
- F. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

## 2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40, black steel, plain ends.
- B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.
- C. Steel Pipe, NPS 14 through NPS 18: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 30, black steel, plain ends.

- D. Steel Pipe, NPS 20: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 20, black steel, plain ends.
  - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.
- E. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.
- F. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- G. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- H. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.
- I. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- J. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- K. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
- L. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- M. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- N. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.
- O. Plastic pipe and Fittings (Cooling Tower Lines only)
  - 1. CPVC Plastic Pipe: ASTM F 441, Schedules 40 and 80, plain ends.
  - 2. PVC Plastic Pipe: ASTM 1785, Schedules 40 and 80, plain ends.
  - 3. CPVC Plastic Pipe Fittings: Socket-type fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.
    - 1. CPVC Solvent Cement: ASTM F 493
  - 4. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.
    - 1. PVC Solvent Cement: ASTM D 2564.

## 2.5 VALVES

- A. Gate, globe, check, ball, and butterfly valves are specified in Division 22 Section "Valves."
- B. Refer to Part 3 "Valve Applications" Article for applications of each valve.
- C. Calibrated Balancing Valves, NPS 2 and Smaller: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.
- D. Calibrated Balancing Valves, NPS 2-1/2 and Larger: Cast-iron or steel body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.



- E. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.
- F. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.
- G. Automatic Flow-Control Valves: Gray-iron body, factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations, and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:
  1. Gray-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring.
  2. Brass or ferrous-metal body, designed for 300 psig at 250 deg F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.
  3. Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves, and designed for 300 psig at 250 deg F.

## 2.6 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection. Pipe discharge to drain line.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection. Pipe discharge to drain line.
- C. Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible bladder securely sealed into tank. Include drain fitting and taps for pressure gage and air-charging fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- D. Tangential-Type Air Separators: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air into expansion tank; tangential inlet and outlet connections; threaded connections for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger; threaded blowdown connection. Provide units in sizes for full-system flow capacity.
- E. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.
  1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.
- F. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- G. Basket Strainers: 125-psig working pressure; high-tensile cast-iron body (ASTM A 126, Class B), flanged-end connections, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- H. T-Pattern Strainers: 750-psig working pressure; ductile-iron or malleable-iron body, grooved-end connections, stainless-steel basket with 57 percent free area; removable access coupling and end cap for strainer maintenance.
- I. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Heat Pump Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints.

- B. Heat Pump Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints.

### 3.2 VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
  - 1. Shutoff Duty: Ball, and butterfly valves.
  - 2. Throttling Duty: Ball, and butterfly valves.
- B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

### 3.3 PIPING INSTALLATIONS

- A. Refer to Division 23 050: "Common HVAC Requirements" for basic piping installation requirements.
- B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- G. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- H. Anchor piping for proper direction of expansion and contraction.

### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with requirements below 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. cal runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Refer to Division 23 0501: "Common HVAC Requirements" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping.

### 3.6 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 in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
- C. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2 and larger.

- D. Install combination air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve; extend to nearest drain.
- E. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.
- F. Install expansion tanks. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.

### 3.7 TERMINAL EQUIPMENT CONNECTIONS

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

### 3.8 CHEMICAL TREATMENT (SEE SECTION 23 2125)

### 3.9 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 system with clean water. Clean strainers.
  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 trapped air. Use drains installed at low points for complete draining of liquid.
  3. Check expansion tanks to determine that they are not air bound and that system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design 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 either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of 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.

### 3.10 ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- B. Perform these adjustments before operating the system:
  1. Open valves to fully open position. Close coil bypass valves.
  2. Check pump for proper direction of rotation.
  3. Set automatic fill valves for required system pressure.
  4. Check 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. Check operation of automatic bypass valves.
  7. Check and set operating temperatures of boilers, and cooling towers to design requirements.
  8. Lubricate motors and bearings.

### 3.11 CLEANING

- A. See Section 23-2125.

END OF SECTION 23 2113

## **SECTION 23 2125 - CLEANING AND FLUSHING WATER CIRCULATING SYSTEMS**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 05 01 apply to this Section.

#### 1.2 SUMMARY

- A. Furnish labor and materials to thoroughly clean water circulating systems as described in Contract Documents.
- B. Mechanical contractor shall procure the services of an independent treatment contractor as described in this specification.

#### 1.3 QUALITY ASSURANCE

- A. System Additives: This Contractor shall not add any water treatment chemicals or "stop-leak" compounds to the system.

### **PART 2 - EXECUTION**

#### 2.1 FIELD QUALITY ASSURANCE

- A. Water circulating systems for project shall be thoroughly cleaned before placing in operation to rid system of dirt, piping compound, mill scale, oil, and other materials foreign to water being circulated.
- B. During construction extreme care shall be exercised to prevent dirt and other foreign matter from entering pipe or other parts of system. Pipe stored on project shall have open ends capped and equipment shall have openings fully protected. Before erection, each piece of pipe, fittings, or valve shall be visually examined and dirt removed.

END OF SECTION 23 2125

## **SECTION 23 5134 – FLUES**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 05 01 apply to this Section.

#### 1.2 SUMMARY

- A. Includes But Not Limited To:
  - 1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents.

#### 1.3 REFERENCES

- A. American Society For Testing And Materials:
  - 1. ASTM D 1785-03, 'Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120.'
  - 2. ASTM D 2564-02, 'Standard Specification for Solvent Cements for Poly(Vinyl Chloride)(PVC) Plastic Piping Systems.'
  - 3. ASTM D 2661-02, 'Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings.'
  - 4. ASTM D 2665-02, 'Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.'

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- A. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D 1785, ASTM D 2661, or ASTM D 2665.
- B. Piping Primer And Cement: Meet requirements of ASTM D 2564.

### **PART 3 - EXECUTION**

#### 3.1 INSTALLATION

- A. Installation For Condensing Boilers:
  - 1. Run individual vent and individual combustion intake piping from each boiler to concentric roof termination kit provided by Manufacturer. Slope lines downward toward boiler.
  - 2. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
  - 3. Use concentric roof termination kit provided by Boiler Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Manufacturer.
  - 4. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
  - 5. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.
  - 6. Paint exposed piping thru roof dark color to match roofing materials.
- B. Installation For Condensing Water Heaters:
  - 1. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water Heater Manufacturer. Slope lines downward toward water heater.
  - 2. Slope combustion chamber exhaust drain downward to floor drain.
- C. Support:
  - 1. Support concentric roof termination kit at ceiling or roof line with 20 ga sheet metal straps as detailed on Drawings.

2. Support horizontal sections of pipe in accordance with requirements of Section 23 0501. Anchor securely to structure, not allowing pipe to sway.
- D. Paint exposed piping thru roof dark color to match roof.

END OF SECTION 23 5134

## SECTION 23 5230 – GAS BOILER

### PART 1 - GENERAL

#### 1.1 SUMMARY

1. Contractor shall supply and install Qty.: 4 Laars MagnaTherm Model MGH 2000 rated at 1,999,000 BTU/hr input and 1,895,000 BTU/hr output.

### PART 2 – PRODUCTS

1. 4.9 Standard for Gas-Fired Low Pressure Steam and Hot Water Boilers. The unit(s) shall be designed and constructed in accordance with the ASME Boiler & Pressure Vessel Code, Section IV requirements for 160 psi (1103 kPa) maximum working pressure, and shall bear the ASME "H" Stamp and be listed by the National Board.
2. The boiler shall be listed with AHRI (Air Conditioning, Heating and Refrigeration Institute). The boiler shall have a minimum thermal efficiency of 95%.
3. The unit(s) shall be constructed to comply with the efficiency requirements of the latest edition of ASHRAE Standard 90.1.
- 4.. The boiler shall be certified for placement indoors and outdoors, where freezing conditions do not exist.
5. The boiler must have knockdown feature that allows the top section of the boiler to be removed, allowing for easy handling and installation.
6. The boiler shall be equipped with an ASME certified pressure relief valve set at 75psi 517 (kPa). Optional pressure relief valves with settings of 30psi (207kPa), 50psi (345 kPa), 60psi (413 kPa), 125psi (861 kPa) or 150psi (1034 kPa) shall be available.
7. The water tube heat exchanger shall be stainless steel, rated for 160 psi (1103 kPa) working pressure. The heat exchanger shall be a low water volume design with micro-fin tubing, welded construction, with no gaskets, o-rings or bolts in the header. Heat exchanger shall be accessible for visual inspection and cleaning of all internal surfaces. The boiler shall be fully condensing design with built-in condensate drain and trap. The heat exchanger shall have a limited ten-year warranty.
8. Each boiler shall be fully test fired, (with water, gas, and venting connected), and all safety components tested, at the factory.
9. The boiler shall be sealed combustion. The boiler jacket shall be a unitized shell finished with acrylic thermo-set paint baked at not less than 325°F (163°C). The frame shall be constructed of galvanized steel for strength and protection. Chamber shall include a sight glass for viewing flame. Boiler sides and back shall be certified for zero no more than 11 inches clearance to combustible surfaces.
10. The boiler shall be equipped with an engineered gas/air chamber that ensures proper mixing for stable combustion at all firing rates
- 11.. Boiler shall operate on 4-13" w.c. gas pressure, and shall need no component changes to operate at high altitude, up to 10,000 feet.
12. The boiler shall use a premix burner with a stainless steel woven metal fiber wrap, and a negative pressure gas valve to burn cleanly, with NOx emissions not exceeding 9ppm. The boiler shall meet the emissions requirements of SCAQMD 2012.
13. The boiler shall be designed for vertical or horizontal Category IV venting, up to 100 equivalent feet, with 6" (1600), 8" (2000 & 2500), 10" (3000 & 3500) or 12" (4000) diameter CPVC, polypropylene or stainless steel vent material.
14. Air may be taken from the room, or ducted directly to the boiler using up to 100 equivalent feet of 6" (1600), 8" (2000 & 2500), 10" (3000 & 3500) or 12" (4000) diameter of ABS, PVC, CPVC or galvanized pipe.
15. The boiler shall be a vertical, micro-finned tube exchanger design, with one control and one burner
16. The boiler control shall be an integrated electronic PID temperature and ignition control with large touchscreen and color display and shall control the boiler operation and firing rate. The boiler display shall be visible without the removal of any jacket panels or control panels.
17. The control shall have the ability to control the boiler pump, system pump and indirect domestic water pump, each with delay and exercise features.
18. The control shall have a variable speed boiler pump control option.
19. The control shall have the ability to integrate indirect domestic water heating with the boiler system. The control shall have domestic hot water priority, and shall have the ability to recognize a domestic water sensor or closure from tank stat on the same terminals.
20. The control shall have built-in outdoor reset feature with customizable reset curves, based on the outdoor temperature and desired system water temperature. The boiler shall be shipped with the outdoor reset sensor, as standard equipment.
21. The control shall easily allow the user to force the boiler into minimum or maximum firing rate, for setup and diagnostic purposes, and shall have a cleaning mode that allows the user to wipe the screen without activating any functions from the touchscreen.
21. The control shall have dry alarm contacts for ignition failure. The control shall monitor flue gas temperature and shall stop the boiler from firing if temperature is excessive.
22. Allowable control adjustments shall include: boiler temperature setpoint; domestic water temperature setpoint; automatic high limit; °F or °C display; setpoint for time of day input; DHW setpoint for time of day input; PID gain parameters; DHW PID gain parameters; manual firing rate control; pump delay time; pump exercise interval; outdoor reset selection; low boiler setpoint temperature (for outdoor reset operation); boiler temperature at high outdoor

- temperature (for outdoor reset operation); boiler setpoint at low outdoor temperature (for outdoor reset operation); warm weather shutdown; automatic remote signal detection; anti-shortcycle feature enable/disable.
23. The control shall have installer-level password, and verification feature to ensure that safety-related parameters are not altered by mistake.
  24. The control shall be able to cascade and lead-lag with other MagnaTherm controllers, for a total of eight MagnaTherm boilers, without additional system controllers.
  25. The burners shall be controlled to keep each one in the lowest firing rate possible, based on system demand, to maximize efficiency. For example, in multiple boiler systems, the master control shall choose to bring on all boilers at low firing rates, instead of one boiler at a high rate, to meet the system needs.
  26. A control that is chosen as master in a system with multiple controllers shall display an icon of each of the controls that it is controlling. The color of the icon shall indicate if the control is in normal operation, in lockout, in standby mode, in a hold state, or if there is a communication error.
  27. The control shall graphically depict the firing rate of each burner in the boiler, and/or each burner in system, if the controller is the master of other MGH boilers in a multiple boiler system. The control shall also show information about system, such as outdoor temperature and system temperature, where applicable.
  28. The control shall have the ability to accept a 4-20mA or 0-10VDC input connection from an external control or building automation system, to modulate the flame.
  29. The controller shall be able to send information through a Modbus connection, including (but not limited to) inlet and outlet water temperatures, stack temperature, DHW temperature and priority, central heating temperature, frost protection, warm weather shutdown, status of sensors, fan speed, setpoints, remote control input, burner status, lockout codes, alarm reasons, system pump status, boiler pump status and domestic water pump status.
  30. Control diagnostics shall include, at a minimum, the following: ignition failure, grounded flame rod, safety chain interrupt, boiler high limit exceeded, domestic water high limit exceeded, temperature rise limit exceeded, stack limit exceeded, pressure sensor fault, combustion pressure fault, blocked air intake, sensor errors (open or shorted), 24VAC voltage low or high, modulation fault, pump fault, AC input phases reversed, and fan speed proving rate failure.
  31. The control shall have a clock with a battery backup and will allow the user to access the burner run time, and cycle counts for the burner, DHW pump, system pump and boiler pump.
  32. The control shall differentiate between a lockout, a hold, or an alert. If an issue occurs, the system will display a brief description of the issue on the control screen. The user shall be able to tap the display to be presented with a more detailed explanation of the issue.

## 2.7 BOILER

1. The Boiler shall have an independent laboratory rating for Oxides of Nitrogen (NO<sub>x</sub>) of 20 ppm or less corrected to 3% O<sub>2</sub>. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
2. The Boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.
3. The Boiler shall be started up, adjusted and checked out by a manufacturer's authorized service agency. A start-up report shall be submitted to the owner and the contractor for inclusion in the O&M Manuals.

## 2.8 MANUFACTURERS

1. Laars - MagnaTherm

## 2.9 BUFFER TANK

1. Furnish and install in the system where shown a "Buffer Tank" or "Low Loss Header" as required by the boiler system design and recommended by the boiler manufacturer.
2. The Unit shall have flanged connections to match the heating pipe connections and shall include a high capacity air vent at the top and a ball valve drain at the bottom piped to the floor drain.
3. Units shall be rated for 250 gpm primary system flow and 60 gpm Boiler flow.
4. Manufacturers:
  - a. Lochinvar "Buffer Tank"
  - b. Spirovent "Quad"

END OF SECTION 23 5230

END OF DIVISION 23



**DIVISION 26: ELECTRICAL**

**26 0000                    ELECTRICAL**

- 26 0501        COMMON ELECTRICAL REQUIREMENTS
- 26 0502        ELECTRICAL DEMOLITION REQUIREMENTS
- 26 0519        LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
- 26 0526        GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
- 26 0533        RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

**26 2000                    LOW (LINE) VOLTAGE DISTRIBUTION**

- 26 2195        ELECTRICAL IDENTIFICATION
- 26 2816        ENCLOSED SWITCHES AND CIRCUIT BREAKERS

END OF TABLE OF CONTENTS

## **SECTION 26 0501 - COMMON ELECTRICAL REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. General electrical system requirements and procedures.
  - 2. Make electrical connections to equipment provided under other Sections.
  - 3. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.

#### **1.2 SUBMITTALS**

- A. Product Data:
  - 1. Provide following information for each item of equipment:
    - a. Catalog Sheets.
    - b. Assembly details or dimension drawings.
    - c. Installation instructions.
    - d. Manufacturer's name and catalog number.
    - e. Name of local supplier.
  - 2. Furnish such information for following equipment:
    - a. Section 26 2816: Enclosed switches and circuit breakers.
    - b. Section 26 6480: Motor Control Center.
  - 3. Do not purchase equipment before approval of product data.
  - 4. Submit six sets.
- B. Quality Assurance / Control:
  - 1. Report of site tests, before Substantial Completion.

#### **1.3 QUALITY ASSURANCE**

- A. Requirements of Regulatory Agencies:
  - 1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
  - 2. Material and equipment provided shall meet standards of NEMA or UL, or ULC, CSA, or EEMAC and bear their label wherever standards have been established and label service is available.
- B. Materials and equipment provided under following Sections shall be by same Manufacturer:
  - 1. Sections 26 2416, 26 2816, and 26 2913: Panelboards, Enclosed Switches And Circuit Breakers, and Enclosed Controllers.
- C. Contractor shall obtain all permits and arrange all inspections required by local codes and ordinances applicable to this Division.

#### **1.4 OWNER'S INSTRUCTIONS**

- A. Provide competent instructor for time required to adequately train maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

#### **1.5 OPERATION AND MAINTENANCE MANUALS**

- A. Prepare and submit (2) two complete copies of the O & M Manuals—manuals to contain information listed below. Place each manual in a tabbed three-ring binder upon completion of the project. Deliver to General Contractor upon completion.

1. Operation and Maintenance manual must contain the following items:
  - a. Copies of reviewed shop drawings.
  - b. Letter of 1-year guarantee of workmanship.
  - c. Copy of voltage and ammeter readings.
  - d. Copy of letter verifying owner's receipt of spare parts.
  - e. Manufacturers installation instructions and parts.

## **1.6 GUARANTEE**

- A. The following guarantee is a part of this specification and shall be binding on the part of the Contractor:
  1. "The Contractor guarantees that this installation is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance."

## **1.7 RECORD DRAWINGS**

- A. During the course of construction, the Electrical Contractor shall maintain a set of drawings upon which all deviations from the original layout are recorded. These marked-up prints shall be turned over to the Architect/Engineer at the conclusion of the work.

## **PART 2 - PRODUCTS: Not Used**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.
- B. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

### **3.2 INSTALLATION**

- A. General:
  1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
  2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough-in.
  3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.
- B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through walls, ceilings, and top plates of walls.

### **3.3 FIELD QUALITY CONTROL**

- A. Site Tests: Test systems and demonstrate equipment as working and operating properly. Notify Engineer before test. Rectify defects at no additional cost to Owner.
- B. Measure current for each phase of each motor under actual final load operation. Record this information along with full-load nameplates current rating and size of thermal overload unit installed for each motor.

END OF SECTION 26 0501

## **SECTION 26 0502 - ELECTRICAL DEMOLITION REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Includes But Not Limited To
  - 1. Demolition involving electrical system as described in Contract Documents.
- B. Related Sections
  - 1. Section 26 0501 - Common Electrical Requirements
  - 2. New and replacement work specified in appropriate specification Section.

### **PART 2 - NOT USED**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.

#### **3.2 PREPARATION**

- A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.
- B. Where affected by demolition or new construction, relocate, extend, or repair raceways, conductors, outlets, and apparatus to allow continued use of electrical system. Use methods and materials as specified for new construction.

#### **3.3 PERFORMANCE**

- A. Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Engineer.
- B. Remove concealed wiring abandoned due to demolition or new construction. Remove circuits, conduits, and conductors that are not to be re-used back to next active fixture, device, or junction box.
- C. Patch, repair, and finish surfaces affected by electrical demolition work, unless work is specifically called for under other Sections of the specifications.
- D. Coordinate electrical demolition with general demolition work being performed by the Prime Contractor.

#### **3.4 CLEANING**

- A. Remove obsolete raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.

END OF SECTION 26 0502

## SECTION 26 0519 - LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Quality of conductors used on Project except as excluded below.
- B. Related Sections:
  - 1. Section 26 0501: Common Electrical Requirements.

#### 1.2 DEFINITIONS

- A. Line Voltage: Over 70 Volts.

### PART 2 - PRODUCTS

#### 2.1 COMPONENTS

- A. Line Voltage Conductors:
  - 1. Copper with AWG sizes as shown:
    - a. Minimum size shall be No. 12 except where specified otherwise.
    - b. Conductor size No. 8 and larger.
  - 2. Insulation:
    - a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg C).
    - b. Standard Conductor Size No. 8 And Larger: 600V Type THW, THWN, or XHHW (75 deg C).
    - c. Higher temperature insulation as required by NEC or local codes.
  - 3. Colors:
    - a. 208Y / 120 V System:
      - 1) Black: Phase A.
      - 2) Red: Phase B.
      - 3) Blue: Phase C.
      - 4) Green: Ground.
      - 5) White: Neutral.
    - b. 480Y / 277 Volt System:
      - 1) Brown: Phase A.
      - 2) Orange: Phase B.
      - 3) Yellow: Phase C.
      - 4) Gray: Neutral.
      - 5) Green: Ground.
    - c. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
    - d. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.
- B. Standard Connectors:
  - 1. Conductors No. 8 And Smaller: Steel spring wire connectors.
  - 2. Conductors Larger Than No. 8: Pressure type terminal lugs.
  - 3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.
- C. Terminal blocks for tapping conductors:
  - 1. Terminals shall be suitable for use with 75 deg C copper conductors.
  - 2. Acceptable Products:
    - a. 16323 by Cooper Bussmann, St Louis, MO [www.bussmann.com](http://www.bussmann.com)
    - b. LBA363106 by Square D Co, Palatine, IL [www.squared.com](http://www.squared.com).
    - c. Equal as approved by Architect before bidding. See Section 01 6000.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  - 1. Conductors and cables shall be continuous from outlet to outlet.
  - 2. Do not use direct burial cable.
  
- B. Line Voltage Conductors (Over 70 Volts):
  - 1. Install conductors in raceway except where specifically indicated otherwise. Run conductors of different voltage systems in separate conduits.
  - 2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Drawings.
  - 3. Neutrals:
    - a. On three-phase, 4-wire systems, do not use common neutral for more than three circuits.
    - b. On single-phase, 3-wire systems, do not use common neutral for more than two circuits.
    - c. Run separate neutrals for each circuit where specifically noted on Drawings.
    - d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs so neutral conductors will carry only unbalanced current. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.
  - 4. Pulling Conductors:
    - a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
    - b. Do not use heavy mechanical means for pulling conductors.
    - c. Use only listed wire pulling lubricants.

END OF SECTION 26 0519

## SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Furnish and install grounding for electrical installation as described in Contract Documents except as excluded below.
- B. Related Sections:
  - 1. Section 26 0501: Common Electrical Requirements.

### PART 2 - PRODUCTS

#### 2.1 COMPONENTS

- A. Size materials as shown on Drawings and in accordance with applicable codes.
- B. Grounding And Bonding Jumper Conductors: Bare copper or with green insulation.
- C. Make grounding conductor connections to ground rods and water pipes using approved bolted clamps listed for such use.
- D. Service Grounding Connections And Cable Splices:
  - 1. Make by compression type connectors designed specifically for this purpose.
  - 2. Acceptable Products:
    - a. Burndy
    - b. Thomas & Betts.
    - c. Equal as approved by Architect before bidding.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Grounding conductors and bonding jumper conductors shall be continuous from terminal to terminal without splice. Provide grounding for following.
  - 1. Electrical service, its equipment and enclosures.
  - 2. Conduits and other conductor enclosures.
  - 3. Neutral or identified conductor of interior wiring system.
  - 4. Main panelboard, power and lighting panelboards.
  - 5. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.
- B. Grounding connection to main water supply shall be accessible for inspection and made within 6 inches of point of entrance of water line to building. Provide bonding jumpers across water meter and valves to assure electrical continuity.
- C. Ground identified common conductor of electrical system at secondary side of main transformer supplying building. Ground identified grounded (neutral) conductor of electrical system on supply side of main service disconnect.
- D. Pull grounding conductors in non-metallic raceways, in flexible steel conduit exceeding 72 inches in length, and in flexible conduit connecting to mechanical equipment.
- E. Provide grounding bushings on all feeder conduit entrances into panelboards and equipment enclosures.
- F. Bond conduit grounding bushings to enclosures with minimum #10 AWG conductor.
- G. Connect equipment grounds to building system ground.
  - 1. Use same size equipment grounding conductors as phase conductors up through #10 AWG.

2. Use NEC Table 250-95 for others unless noted otherwise in Drawings.
- H. Run separate insulated grounding cable from each equipment cabinet to electrical panel. Do not use intermediate connections or splices. Affix directly to cabinet.
- I. On motors, connect ground conductors to conduit with approved grounding bushing and to metal frame with bolted solderless lug.
- J. Ground each separately derived system neutral to nearest ground per NEC and local inspector.
- K. Provide a separate, insulated equipment green grounding conductor in all feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing and to all metallic enclosures. A conduit ground is not acceptable. Install grounding bushings on both ends of all feeder conduit and bond to ground system.

END OF SECTION 26 0526



## SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project but furnished under other Divisions.
  - 2. Furnish and install raceway, conduit, and boxes used on Project not specified to be installed under other Divisions.
  - 3. Furnish and install air / vapor barrier back boxes as described in Contract Documents.
  - 4. Furnish and install main electrical service raceway to comply with electrical utility company requirements.
- B. Related Sections
  - 1. Section 26 0501: General Electrical Requirements.

### PART 2 - PRODUCTS

#### 2.1 COMPONENTS

- A. Raceway And Conduit:
  - 1. Sizes:
    - a. 3/4 inch min. for exterior underground use.
    - b. 1/2 inch minimum elsewhere, all home runs shall be 3/4 inch min. unless indicated otherwise.
  - 2. Types: Usage of each type is restricted as specified below by product.
    - a. Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.
    - b. Galvanized Electrical Metallic Tubing (EMT):
      - 1) Allowed for use only in indoor dry locations where it is:
        - a) Not subject to damage.
        - b) Not in contact with earth.
        - c) Not in concrete.
      - 2) Flexible steel conduit or metal-clad cable required for final connections to indoor mechanical equipment.
    - c. Schedule 40 Polyvinyl Chloride (PVC) Conduit:
      - 1) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.
    - d. Listed, Liquid-Tight Flexible Metal Conduit:
      - 1) Use in outdoor final connections to mechanical equipment, length not to exceed 36 inches.
    - e. Pre-wired 3/8 Inch Flexible Fixture Whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed 72 inches.
  - 3. Prohibited Raceway Materials:
    - a. Aluminum conduit.
    - b. Armored cable type AC (BX) cable.
- B. Raceway And Conduit Fittings:
  - 1. Rigid Steel Conduit And IMC: Threaded and designed for conduit use.
  - 2. EMT:
    - a. Compression type.
    - b. Steel set screw housing type.
  - 3. PVC Conduit:
    - a. PVC type. Use PVC adapters at all boxes.
    - b. PVC components, (conduit, fittings, cement) shall be from same Manufacturer.
  - 4. Flexible Steel Conduit: Screw-in type.
  - 5. Liquid-tight Flexible Metal Conduit: Sealrite type.
  - 6. Expansion fittings shall be equal to OZ Type AX sized to raceway and including bonding jumper.
  - 7. Prohibited Fitting Materials:
    - a. Crimp-on, tap-on, indenter type fittings.
    - b. Cast set-screw fittings for EMT.
    - c. Spray (aerosol) PVC cement.

- C. Outlet Boxes:
1. Galvanized steel of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:
    - a. Provide metal supports and other accessories for installation of each box.
    - b. Equip ceiling and bracket fixture boxes with fixture studs where required.
    - c. Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.
  2. Telephone / data outlet boxes shall be 4' 11/16" deep box with single gang mud ring.

## 2.2 MANUFACTURERS

- A. Contact Information:
1. Cooper B-Line, Highland, IL [www.bline.com](http://www.bline.com).
  2. Hubbell Incorporated, Milford, CT [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  3. Square D, Palatine, IL [www.squared.com](http://www.squared.com).
  4. Steel City, Div Thomas & Betts, Memphis, TN [www.tnb.com](http://www.tnb.com).
  5. Thomas & Betts, Memphis, TN [www.tnb.com](http://www.tnb.com).
  6. Walker Systems Inc, Williamstown, [www.wiremold.com](http://www.wiremold.com).
  7. Wiremold Co, West Hartford, CT [www.wiremold.com](http://www.wiremold.com).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

### 3.2 INSTALLATION

- A. Interface With Other Work:
1. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
  2. Before rough-in, verify locations of boxes with work of other trades to insure that they are properly located for purpose intended.
    - a. Coordinate location of outlet for water cooler with Division 22.
    - b. Coordinate location of outlets adjacent to or in millwork before rough-in. Refer conflicts to Architect and locate outlet under his direction.
  3. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.
- B. Conduit And Raceway:
1. Conceal raceways within ceilings, walls, and floors, except at Contractor's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
  2. Keep raceway runs 6 inches minimum from hot water pipes.
  3. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.
    - a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
    - b. Radius of curve shall be at least minimum indicated by NEC.
  4. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
  5. Install insulated bushings on each end of raceway 1-1/4 inches in diameter and larger, and on all raceways where low voltage cables emerge. Install expansion fittings where raceways cross building expansion joints.
  6. Provide nylon pull string with printed footage indicators secured at each end of each empty conduit, except sleeves and nipples. Identify with tags at each end the origin and destination of each empty conduit, and indicate same on all empty or spare conduits on the as-built drawings.
  7. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL-listed foamed silicone elastomer compound. Fill void around perimeter of conduits with nonmetallic nonshrink grout in all concrete or masonry walls.
  8. Conduit And Raceway Support:
    - a. Securely support raceway with approved straps, clamps, or hangers, spaced as required.
    - b. Do not support from mechanical ducts or duct supports without Architect's written approval. Securely mount raceway supports, boxes, and cabinets in an approved manner by:
      - 1) Expansion shields in concrete or solid masonry.

- 2) Toggle bolts on hollow masonry units.
  - 3) Wood screws on wood.
  - 4) Metal screws on metal.
9. Prohibited Procedures:
- a. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.
  - b. Installation of raceway that has been crushed or deformed.
  - c. Use of torches for bending PVC.
  - d. Spray applied PVC cement.
  - e. Boring holes in truss members.
  - f. Notching of structural members.
  - g. Supporting raceway from ceiling system support wires.
  - h. Nail drive straps or tie wire for supporting raceway.
- C. Boxes:
1. Boxes shall be accessible and installed with approved cover.
  2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
  3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
  4. Install outlets flush with finished surface and level and plumb.
  5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
  6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.
  7. Install air / vapor barrier back boxes behind outlet boxes that penetrate vapor barrier.

END OF SECTION 26 0533

**SECTION 26 2195 - ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Nameplates and labels.
- B. Wire and cable markers.

**1.2 RELATED WORK**

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for electrical identification.
  - 1. Section 16010 - Basic Electrical Requirements
- B. In the event of conflict regarding electrical identification requirements between this Section and any other section, the provisions of this Section shall govern.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Nameplates: Engraved three-layer laminated plastic, minimum 3/16 inch high white letters on a black background.
- B. Wire and Cable Markers: Split sleeve or tubing type. Cloth or wraparound adhesive types not approved.
- C. Conductor-color Tape: Colored vinyl electrical tape.

**PART 1 - EXECUTION**

**1.1 INSTALLATION**

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates and labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts. Secure nameplate to outside face of panelboard doors.
- D. Embossed tape will not be permitted for any application.
- E. Electrical Contractor shall write the circuit number to which each device is connected on the inside of the box (clearly visible when device is removed) and on the backside of each coverplate. Use a permanent black marker.

**1.2 WIRE IDENTIFICATION**

- A. Conductors for power circuits to be identified per the following schedule.

	System Voltage	
<u>Conductor</u>	<u>480Y/277V</u>	<u>208Y/120V</u>
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Grounding	Green	Green
Isolated Ground	Green with yellow stripe	Green with yellow stripe
Switchleg (lighting)	Purple	Pink

### 1.3 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates of minimum letter height as scheduled below.
- B. Panelboards, Switchboards and Motor Control Centers: 3/16 inch; identify equipment designation. 1/8 inch; identify voltage rating and source.
- C. Individual Circuit Breakers, Switches, and Motor Starters in Switchboards, and Motor Control Centers: 1/8 inch; identify source to device and the load it serves, including location.
- D. Individual Circuit Breakers, Enclosed Switches, and Motor Starters: 1/8 inch; identify load served and source.

END OF SECTION 26 2195

## SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Includes But Not Limited To:
  - 1. Furnish and install disconnects as described in Contract Documents, except those provided integral with equipment.
- B. Related Sections:
  - 1. Section 26 0501: Common Electrical Requirements.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT

- A. Disconnects:
  - 1. Heavy-duty quick-make, quick-break type, non-fused unless indicated otherwise.
  - 2. Provide interlock to prevent opening of door when switch is in ON position.
  - 3. Provide means to lock switch in OFF position with padlock.
  - 4. Disconnects for motor circuits shall be horsepower rated
  - 5. Disconnects For Furnace Units And Unit Heaters: Provide manual starter with thermal overload relay. Provide overload relay to match motor full load amps.
  - 6. Enclosures:
    - a. Interior: NEMA / CEMA Type 1.
    - b. Exterior: NEMA / CEMA Type 3R.
  - 7. Fuses:
    - a. Fuse fused disconnects with dual-element time delay fuses.
    - b. Fuses on Project shall be from single manufacturer.
    - c. Approved Manufacturers.
      - 1) Cooper Bussmann, Chicago, IL [www.bussmann.com](http://www.bussmann.com).
      - 2) Edison Fusegear, Des Peres, MO (314) 391-3443.
      - 3) GEC Alstom Electrical Equipment, Hawthorne, NJ (800) 678-9322 or (201) 869-7777.
      - 4) Ferraz Shawmut, Newburyport, MA [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
      - 5) Littelfuse Inc, Des Plaines, IL [www.littelfuse.com](http://www.littelfuse.com).
  - 8. Approved Manufacturer.
    - a. Same as Manufacturer of Project's main panelboard.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install disconnects where shown on the drawings.
- B. Label disconnects to indicate equipment served, such as Condensing Unit CU-1. Use 1/16 inch thick laminated plastic composition material with contrasting color core. Engraved letters shall be 1/4 inch high. Attach labels with screws.
- C. Inspect for physical damage, proper alignment, anchorage, and grounding. Check tightness of all connections at disconnects.

END OF SECTION 26 2816

END OF DIVISION 26