PROJECT MANUAL
FOR

OAKTION COMMUNITY COLLEGE
RAY HARTSTEIN CAMPUS
7701 LINCOLN AVENUE
SKOKIE, ILLINOIS 60077

OWNER

OAKTON COMMUNITY COLLEGE
1600 EAST GOLF ROAD
DES PLAINES, ILLINOIS 60016

ARCHITECT / ENGINEER

KLUBER, INC.
41 W. BENTON STREET
AURORA, ILLINOIS 60506

DATE: January 20, 2023
PROJECT NO. 22-315-1446

SECTION 00 01 01
PROJECT TITLE PAGE

PROJECT MANUAL

FOR

RAY HARTSTEIN CAMPUS BOILERS & HEAT EXCHANGERS

7701 LINCOLN AVENUE

SKOKIE, ILLINOIS

OWNER

OAKTON COMMUNITY COLLEGE

1600 EAST GOLF ROAD

DES PLAINES, IL 60016

ARCHITECT / ENGINEER

KLUBER ARCHITECTS + ENGINEERS

41 W. BENTON STREET

AURORA, ILLINOIS 60506

END OF DOCUMENT

SECTION 00 01 07
SEALS PAGE

1.01 DESIGN PROFESSIONALS' SEALS

D. MECHANICAL	E. ELECTRICAL
ENGINEER	ENGINEER

END OF DOCUMENT

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END OF DOCUMENT

SECTION 00 31 13
PRELIMINARY SCHEDULE

1.01 GENERAL

A. The following represents the preliminary construction schedule for the Work. This schedule is the current estimate of the Owner to be used for purposes of bidding. All Bidders shall include the costs of all overtime, double-shift, or so-called "premium" time that may be necessary to meet this milestone.

1.02 PRELIMINARY SCHEDULE

A. Board of Trustees Approval: March 21, 2023

B. Notice to Proceed: March 24, 2023

C. Commencement of Construction: May 15, 2023

D. Substantial Completion: September 15, 2023

END OF DOCUMENT

SECTION 00 41 13
BID FORM - STIPULATED SUM

SINGLE CONTRACT

PROJECT: **RAY HARTSTEIN CAMPUS BOILERS & HEAT EXCHANGERS**
7701 LINCOLN AVENUE
SKOKIE, ILLINOIS

BID TO: **OAKTON COMMUNITY COLLEGE**
1600 EAST GOLF ROAD
DES PLAINES, IL 60016

BID FROM:

CORPORATE NAME: _____
ADDRESS: _____
CITY, STATE, ZIP: _____
TELEPHONE NO.: _____
FAX NO.: _____
EMAIL ADDRESS: _____
CONTACT PERSON: _____

ACCEPTANCE

THE UNDERSIGNED BIDDER AGREES, IF THIS BID IS ACCEPTED, TO ENTER INTO AN AGREEMENT WITH THE OWNER, IN THE FORM INCLUDED IN THE BIDDING DOCUMENTS, TO PERFORM AND FURNISH THE WORK AS INDICATED IN THE BIDDING DOCUMENTS FOR THE BID PRICE AND WITHIN THE BID TIMES INDICATED IN THIS BID AND IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF THE CONTRACT DOCUMENTS.

1.01 ACKNOWLEDGMENTS

IN SUBMITTING THIS BID, THE BIDDER REPRESENTS THAT:

A. This Bid will remain open for acceptance for a period of 90 days from the Bid opening date;

B. The Owner has the right to reject this Bid;

C. The Bidder accepts the provisions of the Instructions and Supplementary Instructions to Bidders regarding the disposition of the Bid;

D. The Bidder agrees to sign and submit the Agreement and other documents required by the Bidding Requirements within 15 days after the Owner's Notice of Award;

E. The Bidder has examined the complete set of Bidding Documents;

F. The Bidder has visited the site and become familiar with the general, local, and site conditions;

G. The Bidder is familiar with Federal, State and Local Laws and Regulations;

H. The Bidder has correlated the information known to the Bidder; information and observations obtained from visits to the site, reports and drawings identified in the Bidding Documents and additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. This Bid is genuine and not made in the interest of or on behalf of an undisclosed person, firm, or corporation and is not submitted in conformity with an Agreement or rules or group, association, organization, or corporation;

J. The Bidder has not directly or indirectly induced or solicited another Bidder to submit a false or sham Bid; sought by collusion to obtain for itself an advantage over another Bidder or over the Owner;

K. The Bidder has received the following Addenda, receipt of which is hereby acknowledged:

1. Addendum No. _____Date _____

2. Addendum No. _____Date _____

3. Addendum No. _____Date _____

THE BIDDER UNDERSTANDS THAT, IN SUBMITTING THIS BID, HE WAIVES ALL RIGHT TO PLEAD ANY MISUNDERSTANDINGS REGARDING THE FOREGOING.

1.02 SINGLE CONTRACT - BASE BID PRICE:

A. Refer to Section 01 10 00 - Summary.

B. The Bidder will complete the Work of the Project in accordance with the Contract Documents for the following price:

1. Stipulated Sum Bid Price:

2. _____
(Use Numerals)

3. _____
(Use Words)

1.03 BID BOND

A. The Bidder has attached the required bid security in the form described by Document 00 43 13 - Bid Security Form with this Bid.

1.04 CONTRACT TIME

A. The Bidder agrees to begin and complete Work as indicated in Document 00 31 13 - Preliminary Schedule.

1.05 OTHER BID FORM SUPPLEMENTS

A. The following additional Documents are attached to and made a condition of this Bid:
   1. Document 00 43 13 - Bid Security Form.
   2. Forms as required in Oakton Community College Invitation to Bid #0208-23-04

1.06 SIGNATURES

A. Respectfully submitted this _____ day of _____, 20____.

B. Type of Firm: (check one)

_____ Individual

_____ Partnership

_____ Corporation

_____ Joint Venture

C. Corporate Seal:(SEAL)

D. Full name of firm: _____

E. Authorized Signing Officer: _____

Title: _____

F. Authorized Signing Officer: _____

Title: _____

END OF DOCUMENT

SECTION 00 43 13
BID SECURITY FORM

1.01 FORM OF BID BOND

A. AIA Document A310 (2017 Edition) - Bid Bond Form.

B. The above document may be examined at the Architect/Engineer's office or purchased at the American Institute of Architects, http://www.aia.org/contractdocs/.

END OF DOCUMENT

SECTION 00 52 00
AGREEMENT FORM

1.01 FORM OF AGREEMENT

A. AIA Document A101, Owner-Contractor Agreement Form - Stipulated Sum (2017 Edition), forms the basis of Contract between the Owner and Contractor.

B. The above document may be examined at the Architect's office or purchased at the American Institute of Architects, http://www.aia.org/contractdocs/.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions.

B. Document 00 73 00 - Supplementary Conditions.

END OF DOCUMENT

SECTION 00 72 00
GENERAL CONDITIONS

1.01 FORM OF GENERAL CONDITIONS

A. The General Conditions applicable to this contract is attached following this page.

B. AIA Document A201 - 2017 "General Conditions of the Contract for Construction" is the General Conditions between the Owner and Contractor.

C. The above document may be examined at the Architect's office or purchased at the American Institute of Architects, http://www.aia.org/contractdocs/.

1.02 RELATED REQUIREMENTS

A. SECTION 00 73 00 - Supplementary Conditions.

1.03 SUPPLEMENTARY CONDITIONS

A. Refer to Document 00 73 00 for amendments to these General Conditions.

END OF DOCUMENT

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

1.01 GENERAL

A. The Supplementary Conditions contain modifications and additions to AIA Document A201 - 2017 "General Conditions of the Contract for Construction". Where a portion of the General Conditions is modified, deleted or voided by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

B. The Owner's Document entitled "General Conditions For Construction And Maintenance Work At Oakton Community College, Des Plaines And Ray Hartstein Campuses" contains further modifications and additions to AIA Document A201 - 2007 "General Conditions of the Contract for Construction". Where a portion of the General Conditions is modified, deleted or voided by this Document, the unaltered portions of the General Conditions shall remain in effect. Where the provisions of the Owner's Document conflict with the provisions of AIA Document A201 or these Supplementary Conditions, the Owner's Document provisions shall prevail.

1.02 ARTICLE 1 GENERAL PROVISIONS

A. **1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

1. Add new Section 1.2.2.1 as follows:

"**§ 1.2.2.1** Sections of Division 1 - General Requirements govern the execution of the Work of all Sections of the specifications."

B. **1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE**

1. After the first sentence of Section 1.5.1, insert the following:

"These Instruments of Service are the tangible rendering of professional opinions and service for the Owner and are not, therefore, a commodity, product or good. No warranties, express or implied, are made by the Architect to the Contractor concerning those Instruments of Service."

1.03 ARTICLE 2 OWNER

A. **2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER**

1. Delete the third sentence of Section 2.2.1.
2. Delete Section 2.2.5 in its entirety and replace with the following:

"**§ 2.2.5** The Owner shall furnish to the Contractor one (1) PDF copy of the Contract Documents for the purposes of making reproductions pursuant to Section 1.5.2."

B. Add new Section 2.5 as follows:

"**§ 2.5 OWNER'S REMEDIES NOT EXCLUSIVE**

2.5.1 The rights and remedies of Owner stated in this Article 2 shall be in addition to and not in limitation of any other rights of the Owner granted in the Contract Documents or at law or in equity."

1.04 ARTICLE 3 CONTRACTOR

A. **3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTACTOR**

1. Delete Section 3.2.1 in its entirety and replace with the following:

"**§ 3.2.1** Execution of the Contract by the Contractor is a representation by the Contractor that, prior to the submission of its bid, the Contractor (a) has visited and examined the Project site and is familiar with all of the conditions thereon; (b) has examined the nature, location and character of the general area in which the Project is located, including, without limitation, its climactic conditions, available labor supply, labor costs and available equipment supply and costs; and (c) has examined the quality and quantity of materials, supplies, tools, equipment, labor and professional services necessary to complete the Work in the manner and within the cost and time frame required by the Contract Documents."

2. Delete Section 3.2.3.
3. Add new Section 3.2.5 as follows:

"**§ 3.2.5** Prior to any excavation, the Contractor shall determine the locations of all existing water, gas, sewer, electric, telephone, telegraph, television, irrigation, petroleum pipelines, and other underground utilities and structures. Where the locations of existing underground and surface utilities and structures are indicated, these locations are generally approximate, and all items that may be encountered during the work are not necessarily indicated. The Contractor shall determine the exact locations of all items indicated, and the existence and locations of all items not indicated."

B. **3.3 SUPERVISION AND CONSTRUCTION PROCEDURES**

1. Add new Sections 3.3.4 through 3.3.7 as follows:

"**§ 3.3.4** The Contractor has the responsibility to ensure that all material suppliers and Subcontractors, their agents, and employees adhere to the Contract Documents, and that they order materials on time, taking into account the current market and delivery conditions and that they provide materials on time. The Contractor shall coordinate its Work, including without limitation, deliveries, storage, installations, and construction utilities with that of all others on the Project. The Contractor shall be responsible for the space requirements, locations, and routing of its equipment. In areas and locations where the proper and most effective space requirements, locations and routing cannot be made as indicated, the Contractor shall meet with all others involved, before installation, to plan the most effective method of overall installation.

3.3.5 All manufactured articles, material and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer, unless herein specified to the contrary.

3.3.6 After commencing the work, the Contractor shall use every precaution to avoid interferences with existing underground and surface utilities and structures, and protect them from damage. The Contractor shall repair or pay for all damage caused by his operations to all existing utility lines, public property, and private property, whether it is below ground or above ground, and he shall settle in total cost of all damage suits which may arise as a result of his operations at no additional costs to the Owner. To avoid unnecessary interferences or delays, the Contractor shall coordinate all utility removals, replacements and construction with the appropriate utility company. The cost of temporarily relocating utilities for convenience of the Contractor, shall be paid by Contractor.

3.3.7 The Contractor shall establish and maintain benchmarks and all other grades, lines, and levels necessary for the Work, report errors or inconsistencies to the Owner and Architect before commencing Work, and review the placement of the building and permanent facilities on the site with the Owner and Architect after all lines are staked out and before foundation Work is started."

C. **3.4 LABOR AND MATERIALS**

1. Delete Section 3.4.2 in its entirety and replace with the following:

   "**§ 3.4.2** After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Section 01 60 00)."

2. Add new Section 3.4.4 as follows:

   "**§ 3.4.4** The Contractor and each Subcontractor shall pay not less than the general prevailing rate of hourly wages for work of a similar character in the locality in which the work is performed and not less than general prevailing rate of hourly wages for legal holidays and overtime work in the performance of work under this Contract, as established by the Illinois Department of Labor, pursuant to an act of the General Assembly of the State of Illinois. In accordance with applicable law, Contractor and each Subcontractor shall keep an accurate record showing the names and occupation of all laborers, workers and mechanics employed by them, and also showing the actual hourly wages paid to each such individual, which record shall be open at all reasonable hours to inspection by the Owner, its officers and agents, and to agents of the Illinois Department of Labor. The Contractor and each Subcontractor hereby agree, jointly and severally, to defend, indemnify and hold harmless the Owner from any and all claims, demands, liens or suits of any kind or nature whatsoever (including suits for injunctive relief) by the Illinois Department of Labor under the Illinois Prevailing Wage Act, or by any laborer, worker or mechanic employed by the Contractor or the Subcontractor who alleges that he has been paid for his services in a sum less than prevailing wage rates required by Illinois law. The Owner agrees to notify the Contractor or Subcontractor of the pendency of any such claim, demand, lien or suit. Contractor must pay prevailing wages in effect at time labor is performed."

D. **3.6 TAXES**

1. Delete Section 3.6 in its entirety and replace with the following:

   "**§ 3.6 TAXES**

   The Owner is exempt from the Illinois Use Tax Act and the Retailer's Occupation Tax. Any taxes for which the Owner is not exempt shall be paid by the Contractor." The College is tax exempt. Certificate to be furnished upon request.

E. **3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS**

1. Delete Section 3.7.4 in its entirety.

F. **3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES**

1. Delete Section 3.10.1 in its entirety and replace with the following:

   "§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall indicate the proposed completion dates for the various subdivisions of the Work, as well as the totality of the Work. The schedule shall be updated every thirty (30) days and submitted to Architect with Contractor's Applications for Payment. Each schedule shall contain a comparison of actual progress with the estimated progress for such point in time stated in the original schedule. If any schedule submitted sets forth a date for Completion for the Work or any phase of the Work beyond the date(s) of Completion established in the Contract (as the same may extended as provided in the Contract Documents), then Contractor shall submit to Architect and Owner for their review and approval a narrative description of the means and methods which Contractor intends to

employ to expedite the progress of the Work to ensure timely completion of the various phases of the Work as well as the totality of the Work. To ensure such timely completion, Contractor shall take all necessary action including, without limitation, increasing the number of personnel and labor on the Project and implementing overtime and double shifts. In that event, Contractor shall not be entitled to an adjustment in the Contract Sum of the schedule. The Owner may, in its discretion, choose to withhold any payment due the Contractor until an updated schedule is submitted. The Owner's or Architect's failure to object to a submitted schedule that exceeds time limits current under the Contract Documents shall not relieve the Contractor of its obligations to meet the time limits in the Contract Documents, nor shall it make the Owner or Architect liable for any of the Contractor's damages incurred as a result of increased construction time or not meeting the time limits in the Contract Documents. Similarly, the Owner's or Architect's failure to object to a Contractor's schedule showing completion in advance of the time limits in the Contract Documents shall not create or infer any rights in favor of the Contractor for acceleration of the Work."

G. **3.18 INDEMNIFICATION**

1. Delete Section 3.18.1 and replace with the following:

"**§ 3.18.1** To the fullest extent permitted by law, the Contractor shall waive any right of contribution against the Owner and shall indemnify and hold harmless the Owner and the Architect and their officers, officials, employees, volunteers and agents from and against all claims, damages losses and expenses, including, but not limited to, legal fees (attorney's and paralegal's fees, expert fees and court costs), arising out of or resulting from the performance of the Contractor's work provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or injury to or destruction of property, other than the work itself, including the loss of use resulting therefrom to the extent it is caused in whole or in part by any wrongful or negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right to indemnity which the Owner would otherwise have. The Contractor shall similarly, protect, indemnify and hold and save harmless, the Owner, its officers, officials, employee, volunteers and agents against and from any and all claims, costs, causes, actions and expenses, including, but not limited to, legal fees, incurred by reason of Contractor's breach of any of its obligations under, or Contractor's default of any provisions of the Contract."

2. Add new Section 3.18.1.1 as follows:

"**§ 3.18.1.1** The Contractor and every subcontractor expressly waive all so-called Kotecki rights under the Illinois workers' compensation statutes even though owner has retained all such rights."

1.05 ARTICLE 7 CHANGES IN THE WORK

A. **7.1 GENERAL**

1. Add new Section 7.1.4 as follows:

"**§ 7.1.4** For adjustments to the Contract Sum based on other than the unit price method, overhead, profit and general conditions combined shall be calculated at the following percentages of the cost attributable to the change in the work:

.1 For the Contractor, for any Work performed by the Contractor's own forces: 10 percent of the cost.

.2 For the Contractor, for Work performed by his Subcontractor: 5 percent of the amount due the Subcontractor.

.3 For each Subcontractor or Sub-subcontractor involved, for any Work performed by the Subcontractor's own forces: 10 percent of the cost.

.4 For each Subcontractor, for Work performed by his sub-contractors: 5 percent of the amount due the Sub-subcontractor.

.5 All proposals, except those less than $200.00, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over $200.00 be approved without such itemization."

B. **7.3 CONSTRUCTION CHANGE DIRECTIVES**

1. In the first sentence of Section 7.3.7, delete the words: "as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount." and replace with the words: "in accordance with Section 7.1.4".

1.06 ARTICLE 9 PAYMENTS AND COMPLETION

A. **9.3 APPLICATIONS FOR PAYMENT**

1. Add new Section 9.3.1.3 as follows:

   "**§ 9.3.1.3** Until substantial completion, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments."

2. Add new Section 9.3.2.1 as follows:

   "**§ 9.3.2.1** In accordance with Section 9.3.2, the Contractor shall be permitted to make written petition to the Owner requesting payment for 75% of the cost of materials and equipment suitably stored off the site at a location agreed upon in writing between the Owner and the Contractor. In order to receive such payment, title to the materials and/or equipment must pass to the Owner; the materials and/or equipment must be stored in a protected, insured facility agreed to by the Owner, with the Owner named as an additional insured; and all storage costs and costs associated with handling and transporting the materials and/or equipment to the Project site must be paid for by the Contractor."

B. **9.8 SUBSTANTIAL COMPLETION**

1. Delete the last sentence of Section 9.8.5 and replace with the following: "The payment shall be sufficient to increase the total payments to 95 percent of the Contract sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims."

C. **9.10 FINAL COMPLETION AND FINAL PAYMENT**

1. Delete Section 9.10.4 in its entirety.

D. Add the following Section 9.11 and Sections 9.11.1, 9.11.2 and 9.11.3:

"**§ 9.11 ACTUAL AND LIQUIDATED DAMAGES**

9.11.1 The Owner will assess liquidated damages of $1000.00 per day for each calendar day the Work or any portion thereof remains incomplete beyond the date of Substantial Completion set forth in the Contract. The Contractor and the Contractors' surety shall be liable for and shall pay the Owner the total liquidated damages assessed by the Owner.

9.11.2 The parties further agree that actual damages are hard for a public entity such as the Owner to estimate for the inconvenience of not having its public improvement and that a per-day amount of $1,000.00 per day is a reasonable and fair amount for such inconvenience.

Because the amount is fair, the parties agree that liquidated damages of $1,000.00 per day is not a penalty or a spur to the Contractor.

9.11.3 In addition to the damages in Section 9.11.1, the following apply:

.1 Failure of the Contractor to achieve Completion of Work by the date of Substantial Completion set forth in the Contract will result in the Contractor being responsible to the Owner for any additional Architect's Fees paid by the Owner for Architectural services necessitated by the Contractor's failure.

.2 If more than one inspection for Completion of the Work is required the Contractor shall be responsible to the Owner for additional Architectural fees for additional inspections by the Architect.

.3 The Owner may be liable to the Architect for fees to cover all time spent by the Architect relative to the Work. Additional fees can include but are not limited to the following: site visits and inspections, report preparation for the Owner, meeting attendance requested by the Owner, phone calls, and all time deemed necessary by the Owner and Architect for satisfactory completion of the project. Any additional fees paid by the Owner will be deducted from the amount due the Contractor."

1.07 ARTICLE 11 INSURANCE AND BONDS

A. 11.1 CONTRACTOR'S LIABILITY INSURANCE

1. Delete the semicolon at the end of Clause 11.1.1.1 and append the following: ", including private entities performing work at the site and exempt from the coverage on account of number of employees or occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for the duration of the project;"
2. Delete the semicolon at the end of Clause 11.1.1.2 and append the following: ", or persons or entities excluded by statute from the requirements of Clause 11.1.1.1 but required by the contract documents to provide the insurance required by that clause;"
3. Delete the semicolon at the end of Clause 11.1.1.6 and append the following: ", and coverage should be written on a comprehensive automobile policy which will include coverage for owned, non-owned and hired motor vehicles."
4. Add new Section 11.1.2.1 as follows:

"**§ 11.1.2.1** The insurance required by Section 11.1.1 shall be written for not less than the following limits, or greater if required by law:

1) Workers' Compensation:
   a) State: Statutory Limit.
   b) Applicable Federal (e.g., Longshoremen's): Statutory
   c) Employer's Liability
      (1) $500,000.00 Per Accident
      (2) $500,000.00 Disease, Policy Limit
      (3) $500,000.00 Disease, Each Employee
2) If written under Comprehensive General Liability Policy Form (including sub-lines specified in Clause 11.1.1.8):
   a) Bodily Injury:
      (1) $1,000,000.00 Per Occurrence
      (2) $2,000,000.00 Aggregate Per Project
   b) Property Damage:
      (1) $500,000.00 Per Occurrence
3) If written under Commercial General Liability Policy Form:

a) $2,000,000.00 General Aggregate Per Project
b) $1,000,000.00 Products Completed Operations Aggregate
c) $1,000,000.00 Personal and Advertising Injury
d) $1,000,000.00 Per Occurrence

4) Business Automobile Liability (including owned, non-owned and hired vehicles):
   a) Bodily Injury and Property Damage Combined:
      (1) $1,000,000.00 Per Occurrence
5) Catastrophe (Umbrella):
   a) $3,000,000.00 - Liability insurance may be used to satisfy limits."

5. Add new Sections 11.1.2.2 through 11.1.2.6 as follows:

"**§ 11.1.2.2** Liability insurance should be written on the comprehensive general liability basis, and shall include, but not be limited to the following sub-lines:

1) Premises and Operations including x, c, u coverages (explosion, collapse, underground).
2) Products and Completed Operations.
3) Independent Contractor's Protective.
4) Broad Form Comprehensive General Liability Endorsement:
   a) Contractual Liability, including contractors obligation under Section 3.18.
   b) Personal Injury & Advertising Injury Liability
   c) Premises Medical Payments
   d) Host Liquor Law Liability
   e) Fire Legal Liability - Real Property
   f) Broad Form Property Damage Liability (including completed Operations)
   g) Incidental Medical Malpractice Liability
   h) Non-owned Watercraft Liability
   i) Limited Worldwide Liability
   j) Additional Persons Insured, including employees for personal and advertising injury.
   k) Extended Bodily Injury Liability
   l) Automatic Coverage - Newly acquired Organizations (90 days)

11.1.2.3 If liability insurance is written under the new simplified form Commercial General Liability, the above listed coverages should be included.

11.1.2.4 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or retroactive date shall predate the contract; the termination date of the policy shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Section 9.10.2, and extended period endorsement "Supplemental Tail", must be purchased."

11.1.2.5 All policies of insurance purchased or maintained in fulfillment of Section 11.1.1 shall name the Owner and Architect as additional insureds on a primary and noncontributory basis thereunder.

11.1.2.6 The Contractor shall provide the Owner with the Original policy and shall furnish the Architect with a memorandum copy of said policy. The additional insureds on the Contractor's Liability policy shall be:

Oakton Community College
1600 East Golf Road
Des Plaines, Illinois 60016

KLUBER, INC.
41 W. Benton Street
Aurora, Illinois 60506

6. In Section 11.1.3:
   a. In the second sentence, delete the words "Section 11.1" and replace with the words "Article 11".
   b. Append the following sentence to the end of the Section:
      1) "On the Certificate of Insurance, delete in the cancellation provision the following words, "Endeavor to" and "but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives"."
7. Add new Section 11.1.3.1 as follows:

   "**§ 11.1.3.1** Failure of the Owner to demand any certificate, policy, endorsement or other evidence of full compliance with the insurance requirements of Article 11 or failure of the Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain such insurance. The Contractor agrees that the obligation to provide the insurance required by these documents is solely its responsibility and that this is a requirement which cannot be waived by any conduct, action, inaction or omission by the Owner."
8. Add new Section 11.1.5 as follows:

   "**§ 11.1.5** Nothing contained in the insurance requirements of the Contract Documents is to be construed as limiting the liability of the Contractor, the liability of any Subcontractor or any tier or either of their respective insurance carriers. The Owner, does not in any way, represent that the coverages or limits of insurance specified is sufficient or adequate to protect the Owner, Contractor, Architect, or any Subcontractor's interests or liabilities but are merely at minimums. The obligation of the Contractor, the Architect, and any Subcontractor of any tier to purchase insurance, shall not, in any way, limit their obligations to the Owner in the event the Owner should suffer an injury or loss in excess of the amount recoverable through insurance, or any loss or portion of the loss which is not covered by either the Contractor's or any Subcontractor's insurance."

B. **11.3 PROPERTY INSURANCE**

1. In the last sentence of Section 11.3.1, after "Owner, " insert "the Architect,".
2. Delete Section 11.3.1.2. in its entirety.
3. Delete Section 11.3.1.3. in its entirety.
4. Delete Section 11.3.3 in its entirety.
5. Delete Section 11.3.5 in its entirety.
6. Delete Section 11.3.6 in its entirety.
7. Delete Section 11.3.7 in its entirety.
8. In the third sentence of Section 11.3.9 delete the phrase ", or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor.".

C. **11.4 PERFORMANCE AND PAYMENT BOND**

1. Delete Section 11.4.1 in its entirety and replace with the following:

   "**§ 11.4.1** The Contractor, before commencing the Work, shall furnish a Performance Bond and a Labor and Material Bond. The Performance Bond shall be in an amount equal to 100% of the full amount of the Contract Sum as security for the faithful performance of the

obligation of the Contract Documents, and the Labor and Material Payment Bond shall be in an amount equal to 100% of the full amount of the Contract Sum as security for the payment of all persons performing labor and furnishing materials in connections with the Contract Documents. Such bonds shall be on standard AIA Documents, issued by the American Institute of Architects, shall be issued by a surety satisfactory to the Owner, and shall name the Owner as primary co-obligee.

11.4.1.1 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds shall be furnished.

11.4.1.2 The Contractor shall require the attorney-in-fact who executed the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney."

2. Add new Section 11.4.3 as follows:

"**§ 11.4.3** Whenever the Contractor shall be and is declared by Owner to be in default under the Contract, the Surety and the Contractor are each responsible to make full payment to the Owner or any and all extra Work incurred by the Architect as a result of the Contractor's default, and to pay to Owner all attorney's fees and court costs incurred by Owner as a result of the Contractor's default, and in protecting Owner's rights under the Agreement to remedy Contractor's default."

3. Add new Section 11.4.4 as follows:

"**§ 11.4.4** The Contractor shall (i) furnish all Surety Company's bonds through Surety Company's local agents approved by and/or as directed by Owner; (ii) fully covered and guarantee with said bond the faithful performance and completion of the entire Contract, including without limitation, the faithful performance of prevailing wage requirements; and (iii) guarantee with said bond payment in all cases by the Contractor or by the Surety Company for all labor performed, material and supplies furnished with the entire Work in the Contract. Said Bond shall remain in full force and effect during the entire period of all general guarantees given by the Contractor with the Contract as called for in the Specifications and Contract, except in cases where other bonds are specifically called for in the specifications and Contract in connection with special guarantees."

D. Add new Section 11.5 as follows:

"**§ 11.5 OWNERS AND CONTRACTORS PROTECTIVE LIABILITY INSURANCE**

11.5.1 The Contractor shall purchase and maintain Owners and Contractors Protective (OCP) liability insurance covering the Owner's contingent liability for claims which may arise from operations under the Contract and that will protect the Owner and the Architect and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work specifically pertaining to the Illinois Structural Works Act, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury or to destruction of tangible property (other than the work itself) including the loss of use resulting therefrom and (2) is cause in whole or in part by any negligent act of omission of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, including by assignment, regardless of whether or not it is caused in part by a party to whom insurance is afforded pursuant to this paragraph. The minimum Per Occurrence and Aggregate limits of liability purchased for such coverage shall be equal, respectively, to the Per Occurrence and Aggregate limits required for the Contractor's Liability insurance, as listed

in Section 11.1.2.1, above.

11.5.2 In any and all claims against the Owner or the Architect or any of their agents or employees by any employee of the Contractor, any other contractor assigned to the Contractor, Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the insurance obligation under this Section shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under Workmen's Compensation Acts, disability benefit acts or other employee benefit acts.

11.5.3 The insurance obligations of the Contractor under this Section shall not extend to the liability of the Architect, his agents or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications or (2) the giving of or failure to give directions or instruction by the Architect, his agents or employees provided that such giving or failure to give is the primary cause of the injury damage.

11.5.4 The Contractor shall provide the Owner with the Original policy and shall furnish the Architect with a memorandum copy of said policy. The named insured on the Owners and Contractors Protective (OCP) liability policy shall be:

Oakton Community College
1600 East Golf Road
Des Plaines, Illinois 60016

KLUBER, INC.
41 W. Benton Street
Aurora, Illinois 60506

1.08 ARTICLE 13 MISCELLANEOUS PROVISIONS

A. **13.6 INTEREST**

1. Delete Section 13.6 in its entirety. All references to interest payments throughout the Contract Documents are hereby voided.

B. Add Section 13.8 as follows:

"**§ 13.8 REGULATIONS**

13.8.1 The Contractor or Subcontractor warrants that he is familiar with and he shall comply with Federal, State and local laws, statutes, ordinances, rules and regulations and the orders and decrees of any courts or administrative bodies or tribunals in any manner affecting the performance of the Contract including without limitation Workmen's Compensation Laws, minimum salary and wage statutes and regulations, laws with respect to permits and licenses and fees in connection therewith, laws regarding maximum working hours. No plea of misunderstanding or ignorance thereof will be considered.

13.8.2 Whenever required, the Contractor or Subcontractor shall furnish the Architect and Owner with satisfactory proof of compliance with said Federal, State and local laws, statutes, ordinances, rules, regulations, orders, and decrees.

13.8.3 Each bidder shall carefully examine the Occupational Safety and health Act as issued by the Federal Register (OSHA), and the specific regulations governing procedures, techniques, safety precautions, equipment design, and the configuration of the same as required under this Act and each bidder agrees as evidenced by his submission of a bid to comply with all terms of the Act and to perform and complete in a workmanlike manner all work

required in full compliance with said Act.

13.8.4 Each bidder agrees as evidenced by his submission of a bid to comply with all terms of the Equal Employment Opportunity Clause of the Illinois Fair Employment Practices Commission.

13.8.5 At all times Contractor shall remain in compliance with the Illinois Public Works Employment Discrimination Act (775 ILCS 10/1, et seq.,) and the Illinois Human Rights Act (775 ILCS 5/2-101, et seq.,) and in addition shall at all times comply with Section 2-105 of the Illinois Human Rights Act.

13.8.6 By execution of this Contract, the Contractor understands, represents and warrants to the Owner that the Contractor and its Subcontractors (for which the Subcontractor takes responsibility to insure that they comply with the above-mentioned Acts) are in compliance with all requirements provided by the Acts set forth in Article 13 and that they will remain in compliance for the entirety of the Work. A violation of any of the Acts set forth in this Article is cause for the immediate cancellation of the Contract. However, any forbearance or delay by the Owner in canceling this Contract shall not be considered as, and does not constitute, Owner's consent to such violation and a waiver of any rights the Owner may have, including without limitation, cancellation of this Contract."

1.09 ARTICLE 15 CLAIMS AND DISPUTES

A. **15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES**

1. Delete Section 15.1.6 in its entirety.

B. **15.2 INITIAL DECISION**

1. Delete Section 15.2.1 in its entirety and replace with the following:

"**§ 15.2.1** Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9 and 11.3.10, may be referred to the Initial Decision Maker for action. A decision by the Initial Decision Maker shall not be binding and shall not be required as a condition precedent to litigation."

END OF SECTION

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: RAY HARTSTEIN CAMPUS BOILERS & HEAT EXCHANGERS.

B. Owner's Name: Oakton Community College.

C. Architect/Engineer's Name: Kluber Architects + Engineers.

D. The Project consists of the construction of replacement of the campus heating system. New system shall include high efficiency condensing boilers, plate and frame heat exchangers, pumps, piping, ventilation, controls and electrical work..

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings.

B. Scope of alterations work is indicated on drawings.

C. HVAC: Replace existing system with new construction.

D. Electrical Power and Lighting: Alter existing and add new construction.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

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

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Use of site and premises by the public.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Existing building spaces may be used for storage.

E. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.

2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
3. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

B. Construction shall require work over a weekend.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions and Document 00 73 00 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

B. Section 00 73 00 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.

C. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values to the Architect/Engineer at earliest possible date, but no later than 14 days prior to first Pay Request Meeting.
   1. After review by the Architect/Engineer, revise and resubmit Schedule as directed.

D. Format: Utilize the Table of Contents of this Project Manual as a format for the listing of the Work.

E. Identify as separate line items on the Schedule the costs for the following items:
   1. Bonds.
   2. Insurance.
   3. Site Mobilization.
   4. Construction Submittals.
   5. General Conditions.
   6. Demonstration and Training.
   7. Closeout Submittals

F. Submit Schedule of Values in sufficient detail for the Architect/Engineer to use in evaluation of Applications for Payment.
   1. Itemize the cost of the work of:
      a. Contractor's own labor forces.
      b. Subcontractors.
      c. Suppliers of products and equipment.

G. Revise Schedule of Values to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

H. Submit one pencil/draft copy of each Application for Payment to the Architect/Engineer at least 7 days prior to the due date for the submission of the Application.

I. Contractor or Architect/Engineer may schedule a Pay Request Meeting to review the pencil/draft copy of the Application for agreement with the progress of the Work.

J. After receipt of Architect/Engineer's review comments, submit three final copies, signed and notarized, of each Application for Payment.

K. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 30 00.
   2. Construction progress schedule, revised and current as specified in Section 01 30 00.
   3. Contractor's partial waiver of lien in the amount of the Application for Payment as well as trailing partial waivers of lien for subcontractors and suppliers who were included in the previous Application for Payment, to the extent of that payment.
      a. When an Application shows completion of a subcontractor or supplier item, submit a final or full waiver for that item.
      b. Waivers of lien shall be submitted on forms and executed in a manner acceptable to the Owner.
   4. Certified payroll records for the Contractor and for all Subcontractors and Sub-subcontractors employed on the Project who performed work on the Project during the Payment Period.
      a. Contractor shall assemble his and all subcontractor and sub-subcontractor records prior to submitting each Application for Payment.

b. Applications for Payment submitted without certified payroll records or with incomplete certified payroll records will result in payment being delayed until the Contractor complies fully with the requirements set forth in the preceding paragraphs.

5. Affidavits attesting to products or equipment suitably stored off-site in a bonded warehouse. Payments for materials stored off-site shall be conditioned upon submission of bills of sale, applicable insurance, and any other documentation or procedures satisfactory to the Owner to establish the Owner's title to such materials, or otherwise protect the Owner's interest.

L. When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.

B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect/Engineer will issue instructions directly to Contractor.

C. For other required changes, Architect/Engineer will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.

D. For changes for which advance pricing is desired, Architect/Engineer will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within ten (10) days.

E. Contractor may propose a change by submitting a request for change to Architect/Engineer, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect/Engineer for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect/Engineer.
3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
4. For change ordered by Architect/Engineer without a quotation from Contractor, the amount will be determined by Architect/Engineer based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.

1. On request, provide the following data:
   a. Quantities of products, labor, and equipment.
   b. Taxes, insurance, and bonds.
   c. Overhead and profit.
   d. Justification for any change in Contract Time.
   e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
   a. Origin and date of claim.
   b. Dates and times work was performed, and by whom.
   c. Time records and wage rates paid.
   d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.

C. The submittal of Final Waiver of Lien and the acceptance of the final payment by the Contractor shall be held to be a waiver of any and all claims against the Owner arising from, out of, or in any connection with the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Submittals for review, information, and project closeout.

E. Architect/Engineer-provided CAD files.

F. Number of copies of Submittals.

G. Requests for Interpretation (RFI) procedures.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions: Dates for applications for payment.

B. Section 01 60 00 - Product Requirements: General product requirements.

C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Conform to requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect/Engineer:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Manufacturer's instructions and field reports.
   5. Applications for payment and change order requests.
   6. Progress schedules.
   7. Coordination drawings.
   8. Correction Punch List and Final Correction Punch List for Substantial Completion.
   9. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Attendance required:
   1. Owner.
   2. Architect/Engineer.
   3. Contractor.
   4. Contractors of major trades as invited to attend meeting.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and .
   6. Procedures and processing of field decisions, Submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect/Engineer.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of Submittals schedule and status of Submittals.
   6. Review of RFIs log and status of responses.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to work.

E. Record minutes and distribute copies within 2 days after meeting to participants, with copies to Architect/Engineer, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 7 days after date of the Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 7 days.

C. Submit updated schedule with each Application for Payment.

3.04 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in the Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of the Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Owner.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from the Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in conformance to requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
      a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect/Engineer, and any of its consultants, due to processing of such RFIs.

E. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.
   5. Identify and include improper or frivolous RFIs.

F. Review Time: Architect/Engineer will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect/Engineer within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.

B. Submit to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. After review, provide copies and distribute in accordance with Submittal PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at Project Closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.

5. Other types as indicated.

D. Submit for Owner's benefit during and after Project completion.

3.07 ARCHITECT/ENGINEER-PROVIDED CAD FILES

A. After the execution of the Contract, Architect/Engineer will provide, free of charge, upon receipt of a properly completed and signed request utilizing “Electronic Data Transfer Consent Form” at the end of this Specification Section, CAD files depicting graphic information for the project as follows:
   1. Architectural Floor Plans: Column grid, walls, floors, stairs, doors, windows, room numbers, ceiling grid, mechanical diffusers, plumbing fixtures, sprinkler heads (if depicted in Bid Documents) and lights.

B. Contractor acknowledges and accepts that the Architectural Floor Plans do not contain structural, mechanical, electrical, plumbing, fire protection and other building systems information depicted in the Bidding Documents. Examples of information not contained in these files include, but are not limited to, title blocks, keynotes, schedules, mechanical ductwork and equipment, electrical device symbols, circuit numbers and home runs, plumbing equipment, piping runs and riser diagrams, and architectural/engineering text or details. No other CAD files, data or information will be provided.

C. Only requests from Prime Contractors will be honored. Subcontractors must obtain the files from their respective Prime Contractors.

D. In submitting a request, Contractor acknowledges that:
   1. Architect/Engineer bears no responsibility for the data or its transmission,
   2. Use of the data by the Contractor or his Subcontractors in no way relieves the Contractor of his obligations under the Contract,
   3. Contractor is solely liable for any and all claims arising from any and all products generated by the Contractor or its Subcontractors employing the data,
   4. Contractor and its Subcontractors have a limited, non-exclusive license to use the data solely in connection with the Work of the Project, and that
   5. Architect/Engineer retains all rights, including copyright, to the data.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

3.09 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect/Engineer.

6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
7. Provide space for Contractor and Architect/Engineer review stamps.
8. When revised for resubmission, identify all changes made since previous submission.
9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
11. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
2. Do not reproduce the Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

F. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

G. Provide space for Contractor and Architect/Engineer review stamps.

H. When revised for resubmission, using clouds, highlights or other means acceptable to the Architect, identify all changes made since previous submission. Resubmittals that do not clearly identify all changes may be delayed and/or returned to the Contractor unreviewed.

I. The Contractor is entitled to 1 Resubmittals of any Shop Drawing, Product Data, or Closeout Submittal item rejected by the Architect or returned by the Architect for further action. Thereafter, the Contractor shall pay the cost of all further Architect's reviews of Shop Drawing, Product Data or Closeout Submittal, at a rate of $200.00/hour. Cost of such further reviews will be deducted from the Contract Sum by Change Order.

J. Submittal reviews may be delayed and/or Submittals may be returned unreviewed for any of the following reasons:
1. Submittals submitted outside the scheduled dates of the Submittal Schedule.
2. Submittals are incomplete or are missing information.

3. Submittals are not submitted in accordance with procedures outlined in this Section (i.e. spec Section number not indicated, missing Contractor's review stamp, submitted items not correlated with specified products).

3.10 SUBMITTAL REVIEW

A. Submittals for Review: Architect/Engineer will review each submittal, and approve, or take other appropriate action.

END OF SECTION

ELECTRONIC DATA TRANSFER CONSENT FORM

Project Name: OAKTON COMMUNITY COLLEGE – RAY HARTSTEIN CAMPUS - BOILERS & HEAT EXCHANGERS
7701 LINCOLN AVENUE
SKOKIE, IL 60077

Project No.: 22-315-1446

Owner: OAKTON COMMUNITY COLLEGE

Your Work: _____

KLUBER, INC. (hereinafter referred to as "Kluber") an Illinois corporation, is providing electronic data to you solely at your request and for your convenience. By accepting and opening any of the electronic data files, you agree that Kluber bears no liability for the data or its transmission to you and that you are solely liable for any and all claims referring or relating to any and all products you, or your Subcontractors, may generate with the data.

You acknowledge that you have a limited non-exclusive license to use the information solely in connection with your work on the project captioned above, and that Kluber retains all rights, including copyright, to the data.

Acknowledged by: _____ _____
(Printed Name) (Signature)

Company: _____

Date: _____ Email: _____

Architectural Floor Plans are transmitted for the contractors' use as backgrounds for shop drawings and as-built drawings, and, as such, contain graphic information for column grid, walls, floors, stairs, doors, windows, room numbers, ceiling grid, lights, diffusers and sprinkler heads where indicated on Bid Documents. Plans do not contain title blocks, keynotes, schedules, mechanical ductwork and equipment, electrical device symbols, circuit numbers and home runs, plumbing equipment, piping runs and riser diagrams, and architectural/engineering text and details. Plans depict entire floors and are not formatted, partial plans as depicted in the Bidding Documents. Files are provided in R2013 .DWG format.)

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Control of installation.

C. Manufacturers' field services.

D. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 41 00 - Regulatory Requirements.

B. Section 01 42 00 - References.

C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect/Engineer's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

D. Manufacturer's Field Reports: Submit reports for Architect/Engineer's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.04 REGULATORY REQUIREMENTS - SEE SECTION 01 41 00

1.05 REFERENCES AND STANDARDS - SEE SECTION 01 42 00 - SEE SECTION 01 4200

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.03 DEFECT ASSESSMENT

A. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General.

B. Definitions.

C. Quality Assurance.

D. Regulatory Requirements.

1.02 RELATED SECTIONS

A. Section 01 10 00 - Summary.

B. Section 01 42 00 - References.

1.03 GENERAL

A. Comply with all applicable laws, rules, regulations, codes and ordinances.

B. If the Contractor observes that the Contract Documents may be at variance with specified codes, notify the Architect/Engineer immediately. Architect/Engineer shall issue all changes in accordance with the General Conditions.

C. It shall not be the Contractor's primary responsibility to make certain that the Contract Documents are in accordance with all applicable laws, rules and regulations, however, when the Contractor performs work knowing or having reason to know that the work in question is contrary to applicable laws, rules, and regulations, and fails to notify the Architect/Engineer, the Contractor shall pay all costs arising therefrom.

1.04 DEFINITIONS

A. Definitions:
   1. Codes: Codes are statutory requirements, rules or regulations of governmental entities.
   2. Standards: Standards are requirements that have been established as accepted criteria, set general consent.

1.05 QUALITY ASSURANCE

A. The Architect/Engineer has designed the project to applicable code requirements and has copies of said codes available for the Contractor's inspection.

B. The Contractor shall:
   1. Ensure that copies of codes and standards referenced herein or specified in individual specifications sections are available to Contractor's personnel, agents, and Sub-Contractors.
   2. Ensure that Contractor's personnel, agents, and Sub-Contractors are familiar with the workmanship and requirements of applicable codes and standards.

1.06 REGULATORY REQUIREMENTS

A. Source and Requirements: Verify amendments with local code officials.
   1. Local code requirements:

a. ICC International Building Code, 2018 Edition.
b. ICC International Mechanical Code, 2018 Edition.
c. ICC International Fire Code, 2018 Edition.
d. ICC International Property Maintenance Code, 2018 Edition.
e. National Electrical Code, 2020 Edition.

2. State code requirements:
   a. Capital Development Board (CDB):
      1) Illinois Accessibility Code, 2018 Edition.
      2) Illinois Energy Conservation Code (ICC International Energy Conservation Code, 2018 Edition, with State of Illinois modifications.
   b. Illinois Department of Public Health (IDPH):
      1) Illinois Plumbing Code (Illinois Administrative Code, Title 77, Chapter I, Subchapter r, Part 890), 2014 Edition.
   c. Illinois Environmental Protection Agency (IEPA):
      1) Air-Pollution Standards.
      2) Noise Pollution Standards.
      3) Water Pollution Standards.
      4) Public Water Supplies
      5) Solid Waste Standards.
      6) Illinois Recommended Standards for Sewage Works (Illinois Administrative Code, Title 35, Subtitle C, Chapter II, Part 370).
   d. Illinois State Fire Marshal (OSFM):
      1) Illinois Rules & Regulations for Fire Prevention & Safety (as amended).
3. Information and Requirements for Utility Services: Local utility companies.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 00
REFERENCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drawing symbols, abbreviations and acronyms.

B. Definitions of terms used throughout the Contract Documents.

C. Explanation of specification format and content.

D. Requirements relating to referenced standards.

E. Applicability of referenced standards.

F. List of industry organizations and certain of their respective documents.

1.02 DRAWING SYMBOLS AND CONVENTIONS

A. Abbreviations and graphic symbols are defined on the General Notes, Symbols & Abbreviations sheet of the drawings.

B. Generally, symbols used on the mechanical and electrical drawings conform to those recommended by ASHRAE, though, where appropriate, these symbols are supplemented by more specific symbols as recommended by ASME, ASPE, or the IEEE.

1.03 DEFINITIONS

A. Where the terms "indicated", "noted", "scheduled", "shown", or "specified" are used it is to help locate the reference; no limitation on location is intended except as specifically noted.

B. Where the terms "directed", "requested", "authorized", "approved", are used as in "directed by the Architect/Engineer", no implied meaning shall be construed to extend the Architect/Engineer's responsibilities into the Contractor's purview of construction supervision.

C. Where the term "approved" is used in conjunction with the Architect/Engineer's action on submittals, requests or applications it is limited to the duties of the Architect/Engineer as described in the Agreement, and the General and Supplemental Conditions of the Contract. Such use of the term "approval" shall not limit or release the Contractor from his responsibility to fulfill Contract requirements.

D. Where the term "regulations" is used it means all applicable statutes, laws, ordinances, and orders issued by authorities having jurisdiction, as well as construction industry standards, rules, or conventions that address performance of the Work.

E. Where the term "furnish" is used it means supply, deliver, and unload to the construction site ready for assembly and incorporation into the Work.

F. Where the term "install" is used it is meant to describe operations at the job site to include unloading, assembling, placing, anchoring, finishing, protecting, cleaning and all other similar operations required to fully incorporate an item into the Work.

G. Where the term “provide” is used it means “furnish and install” as defined above.

H. The "Project Site" is the space available to the Contractor for performance of construction activities. The Project Site may be for the exclusive use of the Contractor and his activities or may be used in conjunction with others with others performing other construction or related activities on the Project. The Extent of the Project Site is indicated on the Drawings.

I. Where the term "refurbish" is used it means to refinish, repair and otherwise restore to like-new condition.

J. Where the terms "remove" or "demolish" are used they mean safely disconnect from existing utilities, permanently extract from the Work and the Project Site, and legally dispose of off-site.

K. Where the terms "temporarily remove" or "salvage" are used they mean safely disconnect from existing utilities and carefully extract from the Work so as to prevent damage to the item and the Work.
   1. Is the item is to be reinstalled or relocated as part of the Work, these terms also mean clean, adjust, lubricate and otherwise restore to best possible condition without repair or refinishing.
   2. Otherwise, these terms can also mean clean item surfaces and turn over to the Owner for storage and possible future use.

L. Where the term "reinstall" is used it means the same as "install", with respect to a temporarily removed, salvaged or relocated item.

M. Where the term "relocate" is used it means temporarily remove and reinstall in a new location.

1.04 SPECIFICATION FORMAT AND CONTENT

A. These Specifications are based on the Construction Specification Institute's 49 Division format and numbering system.

B. Language used in the Specifications and other Contract Documents is an abbreviated type. Implied words and meanings will appropriately interpreted.

C. Requirements expressed in imperative and streamlined language are to be performed by the Contractor. At certain locations in the text, subjective language may be used to describe responsibilities that must be fulfilled indirectly by the Contractor or others.
   1. Whenever a colon (:) is used within a sentence or phrase, it shall be construed to mean the words "shall be".

D. Use of certain terms such as "carpentry" is not intended to imply that certain activities must be performed by accredited or unionized individuals of a corresponding generic name. The Specifications do, however, require that certain construction activities shall be performed by specialists who are recognized experts in the operations to be performed. Specialists shall be used for said activities, however the final responsibility for fulfilling the requirements of the Contract remains the Contractor's.

1.05 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by the Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect/Engineer before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect/Engineer shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

1.06 APPLICABILITY OF INDUSTRY STANDARDS

A. Construction industry standards shall have the same force and effect as if bound or copied directly in the Contract Documents, except where more stringent requirements are specified. All such applicable standards are made a part of the Contract Documents by reference.
   1. Where compliance with two or more standards are referenced and conflicting requirements for quality or quantities occur, comply with the more stringent requirements. Refer questions regarding apparently conflicting standards to the Architect for a decision before proceeding.
   2. The standard of quality or quantity levels specified, shown, or referenced shall be the minimum to be provided or performed. Refer questions regarding standards of minimum quality or quantity to the Architect before proceeding.

1.07 CONSTRUCTION INDUSTRY ORGANIZATIONS AND DOCUMENTS

A. AGA -- AMERICAN GAS ASSOCIATION

B. ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

C. ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

D. AWS -- AMERICAN WELDING SOCIETY

E. CDA -- COPPER DEVELOPMENT ASSOCIATION, INC.

F. CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION

G. ETL -- ETL TESTING LABORATORY

H. FM -- FACTORY MUTUAL RESEARCH CORPORATION

I. HI -- THE HYDRONICS INSTITUTE

J. ICC -- INTERNATIONAL CODE COUNCIL, INC.

K. ICEA -- INSULATED CABLE ENGINEERS ASSOCIATION

L. IEEE -- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS

M. ISO -- INTERNATIONAL STANDARDS ORGANIZATION

N. MICA -- MIDWEST INSULATION CONTRACTORS ASSOCIATION

O. MSS -- MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC.

P. NECA -- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

Q. NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

R. NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

S. UL -- UNDERWRITERS LABORATORIES INC.

1.08 UNITED STATES GOVERNMENT AND RELATED AGENCIES/DOCUMENTS

A. CFR -- CODE OF FEDERAL REGULATIONS

B. CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION

C. EPA -- ENVIRONMENTAL PROTECTION AGENCY

1.09 STATE GOVERNMENT AND RELATED AGENCIES/DOCUMENTS

A. CDB -- ILLINOIS CAPITAL DEVELOPMENT BOARD

B. IDOL -- ILLINOIS DEPARTMENT OF LABOR

C. IDPH -- ILLINOIS DEPARTMENT OF PUBLIC HEALTH

D. IEPA -- ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

E. OSFM -- OFFICE OF THE ILLINOIS STATE FIRE MARSHAL.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

C. Temporary controls: Barriers.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

1.02 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. One (1) mobile cellular telephone for each of Contractor's and any Subcontractor's field personnel.

1.03 TEMPORARY SANITARY FACILITIES

A. Use of existing facilities is permitted.

B. Maintain daily in clean and sanitary condition.

1.04 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.06 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.07 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Designed, manufactured, and tested in accordance with industry standards.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site and place in location directed by Owner's representative; obtain Owner's signature on receipt for delivery prior to final payment. Submit signed receipts with Closeout Submittals.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Substitutions Prior To Bid Opening: Architect/Engineer will consider a written request for substitution provided that such request is received at least seven (7) days prior to the Bid opening date. Requests received after that time will not be considered.
   1. If a request is approved, the Architect/Engineer will issue and appropriate addendum not less than three (3) days prior to the Bid opening date.

B. Substitutions After Notice of Award: Architect/Engineer will consider a request for substitution only under one or more of the following conditions:
   1. Substitution is required for compliance with final interpretation of code requirements or insurance regulations.
   2. Specified product is not available through no fault of the Contractor.
   3. Specified product is not compatible with other specified materials/equipment.
   4. Manufacturer will not certify or warranty specified product as required.

C. Document each request utilizing Substitution Request Form following this section with complete data substantiating compliance of proposed substitution with Contract Documents. Incomplete requests will not be considered. Submit a separate Substitution Request Form and accompanying documentation for each proposed substitution.

D. Provide the following minimum documentation with each Substitution Request Form:
   1. Product identification, manufacturer, product data including dimensions and weight, performance and installation instructions.
   2. Side-by-side itemized comparison of proposed substitution with specified product.
   3. Coordination information including other modifications required as a result of proposed substitution.
   4. Cost information including the effect of the proposed substitution on the Contract Sum.

E. Sign and date the Substitution Request Form.

F. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Agrees to reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction over the Project.

G. Architect/Engineer will notify submitter in writing of decision to accept or reject request.

H. Substitutions of products or product characteristics/components/options/accessories will not be considered when they are indicated or implied on Contractor's submittals, without separate written request, or when acceptance will require revision to the Contract Documents, whether rejection of said substitutions is expressly identified by Architect/Engineer on Contractor's submittals or not.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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Architects + Engineers

www.kluberinc.com

SUBSTITUTION REQUEST FORM

PROJECT: OAKTON COMMUNITY COLLEGE – RAY HARTSTEIN CAMPUS – BOILERS & HEAT EXCHANGERS

SPECIFIED ITEM: _____

Specification Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

_____

Attached data includes project description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

_____
Printed Name

_____
Signature Date

_____
Firm

_____
Telephone

_____
Email

For Use By The Architect/Engineer:

☐ Accepted ☐ Accepted As Noted

☐ Not Accepted ☐ Received Too Late

By: _____

Date: _____

Remarks:

Bloomington Office
2401 East Washington Street
Bloomington, Illinois 61704
309.430.6460

Chicago Office
222 South Riverside Street Plaza
Chicago, Illinois 60606
312.667.5670

Aurora Office
41 W. Benton Street
Aurora, IL 60506
630.406.1213

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Cleaning and protection.

D. Starting of systems and equipment.

E. Demonstration and instruction of Owner personnel.

F. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures.

B. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

C. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

D. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

A. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

B. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. Coordinate completion and clean-up of work of separate sections.

F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

3.04 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Architect/Engineer before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on Drawings.
   2. Relocate items indicated on Drawings.

C. Services (Including but not limited to Plumbing and Electrical): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment ; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

E. Clean existing systems and equipment.

F. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

G. Do not begin new construction in alterations areas before demolition is complete.

H. Comply with all other applicable requirements of this section.

3.05 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.06 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.07 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.08 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.10 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean site; sweep paved areas, rake clean landscaped surfaces.

E. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect/Engineer and Owner.

B. Notify Architect/Engineer when work is considered ready for Architect/Engineer's Substantial Completion inspection.

C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect/Engineer's Substantial Completion inspection.

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect/Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect/Engineer.

E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

F. Notify Architect/Engineer when work is considered finally complete and ready for Architect/Engineer's Substantial Completion final inspection.

G. Complete items of work determined by Architect/Engineer listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Substantial Completion Procedures.

B. Final Completion Procedures.

1.02 RELATED REQUIREMENTS:

A. Section 01 10 00 - Summary.

B. Section 01 78 00 - Closeout Submittals.

1.03 SUBSTANTIAL COMPLETION PROCEDURES

A. Pre-Substantial Completion Conference:
   1. General Contractor to schedule a Pre-substantial Completion Conference 15 days prior to the date of Substantial Completion, prepare an agenda with copies for the participants and preside over the meeting.
   2. Attendance Required: Contractor, Architect/Engineer and Owner.
   3. Minimum Agenda:
      a. Schedule dates of Substantial Completion and Owner occupancy.
      b. Schedule dates for Initial Punch Lists of respective Subcontractors to be produced.
      c. Schedule date for written request for Substantial Completion.
      d. Schedule target date for completion of Initial Punch List items.
      e. Schedule delivery times for Owner-furnished items to be installed by Contractor, Owner's own forces or others under separate Contracts.
      f. Schedule dates for Demonstration and Training of equipment and systems specified.
      g. Schedule completion dates of testing and balancing reports for engineered Systems.
      h. Scheduling and Sequencing of Construction operations around areas partially occupied.
      i. Review job site security during transition of Owner occupancy.
      j. Schedule dates for final inspections from authorities having jurisdiction for Occupancy Permits.
      k. Review protocol for claims from potential move-in damage.
      l. Review procedures for final cleaning.
      m. Review potential concerns regarding environmental conditions.
   4. Record minutes and distribute copies within three days after meeting to participants and those affected by decisions made.

B. Substantial Completion Procedures will be in accordance with the General Conditions of the Contract for Construction, Article 9.8 and include the following:
   1. When the Work or a portion of the Work is considered to be substantially complete, the Contractor inspects the project and prepares a comprehensive list of outstanding items to be completed or corrected, Initial Punch List.
   2. Contractor submits notice of Substantial Completion.
   3. Contractor completes items on the Initial Punch List.
   4. Architect/Engineer inspects the project to verify substantial completion and prepares a Final Punch List.

5. Architect/Engineer prepares Certificate of Substantial Completion, acceptance is required by Owner and Contractor.

1.04 FINAL COMPLETION PROCEDURES

A. Final Completion Procedures will be in accordance with the General Conditions of the Contract for Construction, Article 9.10, and include the following:
   1. When items on Initial and Final Punch Lists are complete, the Contractor submits notice of final completion and final application for payment.
   2. Contractor submits Final Closeout Submittals as specified in Section 01 78 00.
   3. Architect inspects project and verifies the Work is acceptable and conforms with the Contract Documents.
   4. Architect processes final application for payment and closeout submittals.

1.05 CORRECTION PERIOD

A. Correction Period commences on the date of Substantial Completion and expires one year from that date.

B. Owner: document non-conforming or defective work over course of Correction Period. Notify Contractor in writing of nonconforming or defective work. Copy Architect/Engineer.
   1. Life safety issues requiring immediate corrective work: Contact Contractor for action.

C. Post Construction Walk Through:
   1. Time: eleven months after the date of Substantial Completion convene a meeting on site.
   2. Attendees: Architect/Engineer, Owner's Representative, End User and Maintenance Staff.
   3. Minimum Agenda:
      a. Review Owner's list of non-conforming or defective work.
      b. Conduct a walk through of the building and grounds
      c. Prepare a list of additional non-conforming or defective work items.
   4. Architect/Engineer:
      a. Prepare written report of findings within two weeks of meeting.
      b. Notify Contractor of impending corrective work requiring action.
      c. Monitor execution of corrective Work.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION - NOT USED.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect/Engineer with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content as required prior to final submission.
   4. Submit revised final documents in final in PDF file format on USB flash drive form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Include manufacturer's printed operation and maintenance instructions.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

J. Additional Requirements: As specified in individual product specification sections.

3.04 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into PDF file "manual" for Owner's personnel use, with data arranged in the same sequence as, and bookmarked by, the specification sections.
1. Media: USB flash drive of capacity sufficient to store entire PDF file, fragmented.
2. Attach a tag or label flash drive with Project name, date, and the title "O&M Manual".

B. Where systems involve more than one specification section, provide separate bookmark for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Cover Page: Populate the first page of the PDF file with: printed title "OPERATION AND MAINTENANCE MANUAL; identify title of Project; identify subject matter of contents.

F. Project Directory: Beginning on the second page of the PDF file; provide Title and address of Project; names, addresses, and telephone numbers of Architect/Engineer, Consultants, Contractor and subcontractors, with names of responsible parties.

G. Table of Contents: List every item identified by a bookmark, using the same identification as in the title of the bookmark.

H. Bookmarks: Bookmark each separate product and system; identify the contents in the title of the bookmark; on the bookmarked page provide a description of product and major component parts of equipment.

I. Content: Manufacturer's printed data, legibly scanned, in color where applicable, at 300 dpi resolution.

J. Drawings: Legibly scanned, in color where applicable, at 300 dpi resolution; PDF file page size to match native sheet size of original drawing.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Warranties and bonds.

3.05 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include color, 300 dpi resolution scans of each in Operation and Maintenance Manual PDF file, bookmarked indexed separately in Table of Contents.

F. Manual: Bind original copies of warranties and bonds in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. Plumbing equipment.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect/Engineer for transmittal to Owner.
   2. Submit not less than two weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. FM 4991 - Approval Standard for Firestop Contractors 2013.

1.03 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Joint: Interruption to a fire-rated assembly occurring at interface between 1) adjacent sections of wall, 2) intersecting walls, 3) top of wall and ceiling, structural floor or roof deck, 4) wall and edge of structural floor, 5) adjacent sections of structural floor.

F. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations and joints.

G. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.04 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
   1. Provide manufacturer's qualified engineering judgements for non-standard applications.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and:

1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
2. Verification of minimum three years documented experience installing work of this type.
3. Verification of at least five satisfactorily completed projects of comparable size and type.
4. Licensed by local authorities having jurisdiction (AHJ).

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original, unopened packaging with legible manufacturer's identification.

B. Coordinate delivery with scheduled installation date to minimize storage time at site.

C. Store materials in a clean, dry, ventilated location. Protect materials from freezing if required by manufacturer.

1.07 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Penetrations By:
   1. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 100 Intumescent Firestop Sealant.
      b. 1 and 2 Hour Construction: UL System W-L-1558; HoldRite HydroFlame 200 Intumescent Firestop Sealant.
   2. Electrical Cables Not In Conduit:
      a. 1 and 2 Hour Construction: UL System W-L-3453; HoldRite HydroFlame 200 Intumescent Firestop Sealant.

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

B. Acceptable Manufacturers: As listed in UL (FRD) for specific UL Design Number.

C. Fill, Void or Cavity Materials: Conform to UL (FRD) - XHHW.

D. Firestop Devices: Conform to UL (FRD) - XHJI.

E. Forming Materials: Conform to UL (FRD) - XHKU.

F. Mechanical Joint Assemblies: Conform to UL (FRD) - XHLP.

G. Packing Material: As required by specific UL Design Number for joint system or through-penetration firestop system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.
   1. Verify barrier joints and penetrations are properly sized and in suitable condition for application of materials.

3.02 PREPARATION

A. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in UL (FRD) or fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

B. Patch or replace firestopping damaged by work of other sections.

END OF SECTION

SECTION 23 05 16
EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards Tenth Edition.

1.04 SUBMITTALS

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

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

C. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Mercer Rubber Company.
   2. The Metraflex Company.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:
   1. Mercer Rubber Company.
   2. The Metraflex Company.

3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Soldered.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

2.03 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:
   1. The Metraflex Company; Metraloop.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.

C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.

D. Flexible Connectors: Grooved, braided type with wetted components of stainless steel, sized to match piping.
   1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
   2. End Connections: Same as specified for pipe jointing.
   3. Provide necessary accessories including, but not limited to, swivel joints.
   4. Provide necessary accessories.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

E. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

SECTION 23 05 19
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).

B. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).

1.04 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Manufacturers:
   1. Dwyer Instruments, Inc.
   2. Moeller Instrument Company, Inc.
   3. Omega Engineering, Inc.
   4. Miljoco Corporation.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc.
   2. Omega Engineering, Inc.
   3. Weksler Glass Thermometer Corp.
   4. Miljoco Corporation.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear shatter proof polycarbonate.
   3. Stem: 2.5 inches NPT brass
   4. Accuracy: 2 percent per ASTM E77.
   5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

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

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

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

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

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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

C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.

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

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

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

G. Locate test plugs where indicated.

3.02 SCHEDULE

A. Pressure Gages, Location and Scale Range:
   1. Pumps, 0 to 50 psi.
   2. Expansion tanks, 0 to 50 psi.

B. Pressure Gage Tappings, Location:
   1. Control valves 3/4 inch & larger - inlets and outlets.
   2. Heat exchangers - inlets and outlets.
   3. Boiler - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:
   1. Heat exchangers - inlets and outlets, 0 to 212 degrees F.
   2. Boilers - inlets and outlets, 30 to 240 degrees F.

D. Thermometer Sockets, Location:
   1. Control valves 1 inch & larger - inlets and outlets.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags. Key to control schematic.

B. Control Panels: Nameplates.

C. Heat Transfer Equipment: Nameplates.

D. Major Control Components: Nameplates.

E. Piping: Pipe markers.

F. Pumps: Nameplates.

G. Thermostats: Nameplates.

H. Valves: Tags.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc.
   2. Kolbi Pipe Marker Co..
   3. Seton Identification Products.
   4. Letter Color: Black.
   5. Letter Height: 1/2 inch.
   6. Background Color: White.
   7. Plastic: Conform to ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Brady Corporation.
   2. Brimar Industries, Inc.
   3. Kolbi Pipe Marker Co..
   4. Seton Identification Products.

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

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation.
   2. Brimar Industries, Inc.
   3. Kolbi Pipe Marker Co..
   4. Seton Identification Products.

B. Color: Conform to ASME A13.1.

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

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

E. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
   2. Flammable Fluids: Yellow with black letters. Indicate gas pressure.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

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

B. Install tags with corrosion resistant chain.

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

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

E. Identify pipe service, flow direction, and pressure.

F. Install pipe markers in clear view and align with axis of piping.

G. Location of pipe identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

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

B. Measurement of final operating condition of HVAC systems.

C. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods 2016, with Errata.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
   6. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect/Engineer.

g. Project Contractor.
h. Report date.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA (TAB).

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

C. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

D. TAB Supervisor Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Hydronic systems are flushed, filled, and vented.
5. Pumps are rotating correctly.
6. Proper strainer baskets are clean and in place.
7. Service and balance valves are open.

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

C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

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

3.04 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

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

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

3.05 WATER SYSTEM PROCEDURE

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

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

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

D. Effect system balance with automatic control valves fully open to heat transfer elements.

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

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

G. Systems installed with pressure independent control valves shall not require terminal level hydronic system balancing. Field verify installation and operating differential pressure range of all pressure independent control valves. Twenty-five percent of the total installed product shall be randomly checked for individual conformance. Any individual adjustments for the pressure independent valve assembly (valve and actuator combination) for field conditions shall be performed using the pressure independent control valve manufacturer's documented procedure following the guideline of the National Environmental Balancing Bureau and the Testing Adjusting Balancing Bureau.

3.06 COMMISSIONING

A. Perform prerequisites prior to starting commissioning activities.

B. Fill out Prefunctional Checklists for:
   1. Water side systems.

C. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

D. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.07 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Packaged Steel Fire Tube Boilers.
   3. Heat exchangers.

3.08 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Service.
   6. Design flow rate, pressure drop, BHP.
   7. Actual flow rate, pressure drop, BHP.
   8. Discharge pressure.
   9. Suction pressure.
   10. Total operating head pressure.
   11. Shut off, discharge and suction pressures.
   12. Shut off, total head pressure.

C. Combustion Equipment:
   1. Boiler manufacturer.
   2. Model number.
   3. Serial number.
   4. Firing rate.
   5. Gas pressure at meter outlet.
   6. Heat input.
   7. Burner manifold gas pressure.
   8. Percent carbon monoxide (CO).
   9. Percent carbon dioxide (CO2).
   10. Percent oxygen (O2).
   11. Percent excess air.

12. Flue gas temperature at outlet.
13. Ambient temperature.
14. Net stack temperature.
15. Percent combustion efficiency.
16. Heat output.

D. Heat Exchangers:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Primary water entering temperature, design and actual.
8. Primary water leaving temperature, design and actual.
9. Primary water flow, design and actual.
10. Primary water pressure drop, design and actual.
11. Secondary water leaving temperature, design and actual.
12. Secondary water flow, design and actual.
13. Secondary water pressure drop, design and actual.

E. Flow Measuring Stations:
1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Design Flow rate.
8. Design pressure drop.
9. Actual/final pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.

C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

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

1.05 QUALITY ASSURANCE

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

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

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

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

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

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Johns Manville Corporation.
   3. Knauf Insulation.
   4. Owens Corning Corporation.

B. Insulation: ASTM C547and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation.
      b. Proto Corporation.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, color as scheduled.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

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

D. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: Up to and including 1-1/2 inch.
            a) Thickness: 1-1/2 inch.
         2) Pipe Size Range: 2 inch and above.
            a) Thickness: 2 inch.
   2. Glycol Heating Supply and Return:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: Up to and including 1-1/2 inch.
            a) Thickness: 1-1/2 inch
         2) Pipe Size Range: 2 inch and above.
            a) Thickness: 2 inch

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Variable frequency drives.
   5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 79 00 - Demonstration and Training: Scope and procedures for Owner personnel training.

C. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

D. Section 23 09 23 - Direct-Digital Control System for HVAC.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process 2012.

1.04 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full print out of all schedules and set points after testing and acceptance of the system.
5. Electronic copy on disk of the entire program for this facility.
6. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
7. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
8. Control equipment component submittals, parts lists, etc.
9. Warranty requirements.
10. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
11. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

D. Project Record Documents: See Section 01 78 00 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

E. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish

startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide temperature and pressure taps in accordance with the contract documents.
   1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.

6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. All control strategies and sequences not tested during controlled equipment testing.

H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:
1. Sequential staging ON of equipment; optionally demonstrate manually.
2. Optimum start-stop functions.
3. Miscellaneous equipment current or status for duty cycling and demand limiting.
4. Equipment optimum start/stop functions.

I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 for additional requirements.

B. Add design intent documentation furnished by Architect/Engineer to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 01 79 00 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the minimum durations of four hours training:

E. Provide the services of manufacturer representatives to assist instructors where necessary.

F. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control Valves:
   1. Globe pattern.
   2. Butterfly pattern.
   3. Electronic operators.

C. Pressure independent valves and actuators.

D. Input/Output Sensors:
   1. Temperature sensors.
   2. Carbon monoxide sensors.

E. Thermostats:
   1. Electric room thermostats.
   2. Line voltage thermostats.
   3. Room thermostat accessories.
   4. Outdoor reset thermostats.

F. Transmitters:
   1. Pressure transmitters.
   2. Water pressure transmitters (liquid differential pressure transmitters).
   3. Temperature transmitters.

G. Energy Metering:
   1. Hydronic BTU (J) meters.

H. Flow Sensors:
   1. Insertion turbine meters.

1.02 RELATED REQUIREMENTS

A. Section 23 05 19 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.

B. Section 23 09 23 - Direct-Digital Control System for HVAC.

C. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 1989 (Corrigendum 2019).

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a two year period after Substantial Completion.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.03 CONTROL VALVES

A. Butterfly Pattern:
   1. Iron body, bronze disc, resilient replaceable seat for service to 250 degrees F wafer or lug ends, extended neck.
   2. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.

B. Electronic Operators:

1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
2. Select operator for full shut off at maximum pump differential pressure.

2.04 PRESSURE INDEPENDENT VALVES AND ACTUATORS

A. Manufacturers:
   1. Danfoss.
   2. Griswold Controls.
   3. Flow Control Industries.

B. Size 2 inch and Smaller:
   1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
   2. Metal construction materials consist of bronze or brass.
   3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2.5 inch and Larger:
   1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
   2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.

D. Actuator Requirements:
   1. Assembly: Factory-mounted.
   2. Input: As selected by temperature controls contractor configured for proportional control.
   3. Accessories: Provide with fail-safe battery pack, manual override, and valve position indicator.

2.05 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
   2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
   3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
   4. Temperature Sensing Device: Compatible with project DDC controllers.
   5. Performance Characteristics:
      a. RTD:
         1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
         2) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
         3) Range: Minus 40 degrees F through 220 degrees F minimum.
      b. Thermistor:
         1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
         2) Range: Minus 25 degrees F through 122 degrees F minimum.
         3) Heat Dissipation Constant: 2.7 mW per degree C.
      c. Sensing Range:

1) Provide limited range sensors if required to sense the range expected for a respective point.
2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.
3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.

d. Wire Resistance:
1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.

e. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
f. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
g. Insertion Elements:
1) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.

B. Equipment Operation Sensors:
1. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.

C. Carbon Monoxide Sensors, for Single-Gang Electrical Box Mounting:
1. General:
a. Provide gas platform, wired to the building controller, with replaceable sensor.
b. Input Power: Class 2; 15 to 30 VDC/24 VAC plus/minus 20 percent, 50/60 Hz.
c. Relay Ratings: 1A/30VAC/DC, normally open.
d. Operating Temperature Range: Minus 4 degrees F to 122 degrees F.
e. Operating Humidity Range: 0 to 90 percent RH non-condensing.
f. Terminal Block Wire Size: 30 AWG (0.255 mm) by 12 AWG (2.05 mm).
g. Terminal Block Torque: 0.37 to 0.44 inch-lbf.
h. Protection Class: IP20 in accordance with IEC 60529.
2. Sensor:
a. Sensor Type: Electrochemical.
b. Measurement Range: 0 to 200 ppm.
c. Accuracy: Plus/minus 5 percent of range.
d. Resolution: 1 ppm.
e. Sensor Warranty: 2 years from manufacture date.
f. Low Setpoint Value: 25 ppm or 50 ppm switch selectable.
g. High Setpoint Value: 180 ppm (fixed).
h. Operating Temperature Range: Minus 4 degrees F to 122 degrees F.
i. Operating Humidity Range: 0 to 90 percent RH non-condensing.

2.06 THERMOSTATS

A. Line Voltage Thermostats:
1. Dead Band: Maximum 2 degrees F.
2. Rating: Motor load.

B. Room Thermostat Accessories:
   1. Insulating Bases: For thermostats located on exterior walls.

C. Outdoor Reset Thermostats:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
   2. Scale range: Minus 10 to 70 degrees F.

2.07 TRANSMITTERS

A. Pressure Transmitters:
   1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

B. Water Pressure Transmitters (Liquid Differential Pressure Transmitters):
   1. General: Provide wet media differential pressure transducers with 6 ft (1.83 m) armored cable, to allow remote pressure sensing capability using existing plumbing runs.
      a. Input Power: Class 2; 15 to 30 VDC, 24VAC nominal, 50/60 Hz.
      b. Output: 3-wire transmitter; user-selectable, 4 to 20 mA (0 to 5V/0 to 10V).
      c. Sensor:
         1) Media Compatibility: 17 to 4 PH stainless steel.
         2) Status Indication: Dual color LED.
         3) Proof Pressure: 2x max. F.S. range.
         4) Burst Pressure: 5x max. F.S. range.
         5) Accuracy at 77 degrees F for less than or equal 20 ft:
            a) Ranges A and B: Plus/minus 1 percent F.S. typical.
            b) Range C: Plus/minus 1.5 percent F.S. typical.
         6) Long Term Stability: Plus/minus 0.25 percent.
         7) Zero Offset (Bidirectional and Port Swap Modes Only: 0.5 percent.
      d. Pressure Ranges:
         1) 0 psi to 50 psi (Gauge): 5 psid/10 psid/25 psid/50 psid (pressure differential).
         2) 0 psi to 100 psi (Gauge): 10 psid/20 psid/50 psid/100 psid (pressure differential).

2.08 ENERGY METERING

A. Hydronic BTU (J) Meters:
   1. Manufacturers:
      a. Onicon; Model 10.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Provide BTU (J) meter with wall mount hardware capable of being installed remotely from the flow meter.
   3. Include LCD display for local indication of energy rate including settings and parameters during configuration.
   4. Factory configure to the specific application with field configuration by the user via the front panel keypad without the requirement of a computer or special interface.
   5. Output to indicate energy rate, energy total, flow rate, and supply/return temperature.
   6. Integral transmitter to provide a linear analog or configurable pulse output signal representing the energy rate with the signal compatible with the building automation system DDC hardware to which the output is connected.

2.09 FLOW SENSORS

A. Insertion Turbine Flow Meters:
   1. Manufacturers:
      a. Onicon; Model F-1200.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Furnish dual axial turbine flowmeter with all installation hardware required to enable insertion and removal of the meter without system shutdown.
   3. All Parts: Meet or exceed the pressure classification of the piping system installed in.
   4. Accuracy for the Insertion Turbine Flow Meter: Plus/minus 0.5 percent of the rate at calibrated velocity, within plus/minus of the rate over a 10 to 1 turn down and within plus/minus 2 percent of the rate over a 50 to 1 turn down.
   5. Repeatability: Plus/minus 0.25 percent of reading.
   6. The meter flow sensing element to operate over a range suitable for the installed location with a pressure loss limited to 1 percent of operating pressure at maximum flow rate.
   7. Include dry contact outputs, 4 to 20 mA, 0 to 10 VDC.
   8. Fabricate the turbine rotor assembly of Series 300 stainless steel and use Teflon seats.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

C. Provide blue colored conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Controller software.

E. Rough-in, wiring to, and final connections to products specified in this Section.

1.02 RELATED REQUIREMENTS

A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Expand building control system to interface with new equipment and perform the sequence of operation specified. Modify automation system graphics to delete removed equipment and add new equipment.

B. Provide a color graphical representation of all systems. The graphical display shall include all points indicated in the pints list and any others required to achieve the sequences of operation. The graphical user interface shall consist of the following as a minimum;
   1. Menu bar navigation via windows-like bars.
   2. Navigation will also be available via an image of the building profile from which the user clicks on floors to bring up individual floor plans.
   3. Clicking on a floor plan zone shall bring up a dynamic color graphic of the mechanical equipment that serves that zone.
   4. Each major piece of mechanical equipment (boiler, heat exchangers, pumps, energy usage, etc.) shall have a pictorial dynamic color graphic. The central plant equipment may be combined as appropriate on one or more graphic page.
   5. Text-based (non-pictorial) summary screens will also be provided so that the operator may view critical information on multiple units at once. Summary screens will be provided for terminal units and air handling units.
   6. Clicking on a unit on any summary screen shall bring up the complete graphic for that unit.
   7. Outside air temperature shall be displayed on each graphic screen.

1.05 SUBMITTALS

A. Product Data: Provide data for each system component and software module.

B. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
3. Indicate description and sequence of operation of operating, user, and application software.

C. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.

D. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a two year period after Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Automated Logic Chicago.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

E. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. PC Based Work Station:
   1. Existing to remain.

2.04 CONTROLLERS

A. CUSTOM APPLICATION CONTROLLERS
   1. General:
      a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
      b. Share data between networked, microprocessor based controllers.
      c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
      d. Utilize real-time clock for scheduling.
      e. Continuously check processor status and memory circuits for abnormal operation.
      f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
      g. Communication with other network devices to be based on assigned protocol.
   2. Communication:
      a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
      b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
   3. Anticipated Environmental Ambient Conditions:
      a. Outdoors and/or in Wet Ambient Conditions:
         1) Mount within waterproof enclosures.
         2) Rated for operation at 40 to 150 degrees F.
      b. Conditioned Space:
         1) Mount within dustproof enclosures.
         2) Rated for operation at 32 to 120 degrees F.
   4. Provisions for Serviceability:
      a. Diagnostic LED's for power, communication, and processor.
      b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
   5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
   6. Power and Noise Immunity:
      a. Maintain operation at 90 to 110 percent of nominal voltage rating.
      b. Perform orderly shutdown below 80 percent of nominal voltage.
      c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. APPLICATION SPECIFIC CONTROLLERS
   1. General:

a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
b. Customized for operation within the confines of equipment served.
c. Communication with other network devices to be based on assigned protocol.

2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
   b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Local Keypad and Display for each Controller:
   a. Use for interrogating and editing data.
   b. System security password prevents unauthorized use.
5. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
6. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
7. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

C. INPUT/OUTPUT INTERFACE
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).

b. Compatible with and field configurable to commonly available sensing devices.

6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.

2.05 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.06 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

C. LAN Data Speed: Minimum 19.2 Kb.

D. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

E. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.

F. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.07 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.
      b. Alarms to be routed to appropriate workstation.
      c. Reporting Options:
         1) Start programs.
         2) Print.
         3) Logged.
         4) Graphical displays.

F. Sequencing: Application software based upon specified sequences of operation shown on the Drawings.

G. PID Control Characteristics:
   1. Direct or reverse action.
   2. Anti-windup.
   3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
   4. User selectable controlled variable, set-point, and PED gains.

H. Anti-Short Cycling:
   1. All binary output objects protected from short-cycling.
   2. Allows minimum on-time and off-time to be selected.

2.08 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

B. Optimal Run Time:
   1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
   2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
   3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
   4. Use outside air temperature to determine early shut down with ventilation override.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

C. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Provide blue conduit and electrical wiring in accordance with Section 26 06 20.26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
   1. Provide blue conduit for all control wiring exposed to view. This includes but is not limited to all storage rooms, mechanical rooms, and similar spaces.
   2. Provide blue conduit for all control wiring concealed in inaccessible spaces. This includes but is not limited to wiring above/behind drywall and plaster ("hard") ceilings or soffits, and wiring within vertical chase spaces, regardless of whether access doors are provided or not.
   3. Control wiring that is concealed above readily accessible ceilings such as acoustical lay-in ceilings, need not be run in conduit.

E. All exposed conduit wiring that is not located above an accessible ceiling shall be installed in blue conduit. This includes all storage room, mechanical rooms, etc.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide basic operator training for 2 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 8 hours dedicated instructor time. Provide training on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 23 11 23
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 23 52 16 - Condensing Boilers.

1.03 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators 2019.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

D. ASME B31.1 - Power Piping 2022.

E. ASME B31.9 - Building Services Piping 2020.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2022.

H. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.

I. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.02 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

2.04 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends.

2.05 PLUG VALVES

A. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged ends. Provide lever operator with set screw.

2.06 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Compliance Requirements:
   1. Appliance Regulator: ANSI Z21.18/CSA 6.3.

B. Materials in Contact With Gas:
   1. Housing: Aluminum, steel (free of non-ferrous metals).
   2. Seals and Diaphragms: NBR-based rubber.

C. Maximum Inlet Operating Pressure: 10 psi.
   1. Appliance Regulator: 10 psi.

D. Output Pressure Range: 1 inch wc to 80 inch wc.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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

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

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

E. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

3.03 APPLICATION

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

B. Provide plug valves or U.L. Listed ball valves in natural gas systems for shut-off service.

3.04 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inches to 3 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
      d. Pipe Size: 4 inches to 6 inches:
         1) Maximum Hanger Spacing: 10 ft.

2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, above grade.

C. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Gate valves.
   2. Ball valves.
   3. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.

B. Section 23 07 19 - HVAC Piping Insulation.

C. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

D. ASME B31.9 - Building Services Piping 2020.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2022.

G. ASTM B32 - Standard Specification for Solder Metal 2020.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

J. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.

K. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.

L. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.

M. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 2020.

N. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

O. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers 1992 (Reapproved 2022).

P. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

Q. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.04 SUBMITTALS

A. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

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

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
   2. Isolate equipment using gate valves with lug end flanges.
   3. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
   4. For shut-off and to isolate parts of systems or vertical risers, use gate valves.

E. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.02 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
   1. Fittings: ASME B16.18, cast brass/bronze or ASME B16.22, wrought copper and bronze.
   2. Solder Joints:
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466 or D2467, PVC.
   2. Joints: Solvent welded in accordance with ASTM D2855.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

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

C. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.

G. Vertical Support: Steel riser clamp.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

I. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

J. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.

C. Dielectric Connections:
   1. Waterways:
      a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      b. Construct of galvanized steel with threaded end connections to match connecting piping.
      c. Suitable for the required operating pressures and temperatures.
   2. Flanges:
      a. Dielectric flanges with same pressure ratings as standard flanges.
      b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      c. Construct of galvanized steel with threaded end connections to match connecting piping.
      d. Suitable for the required operating pressures and temperatures.
   3. Unions:
      a. 1/2 to 1 Inches: Brass solder to galvanized FPT.
      b. 1/2 to 2 Inches: Brass solder to galvanized FPT.
      c. 1/2 to 1 Inches: Brass to galvanized FPT or FIP (Female Iron Pipe).
      d. 3/4 to 1/2 Inch Reducer: Brass solder to galvanized FPT.
      e. Service: 250 psi, minus 20 to 180 deg F.

2.06 GATE VALVES

A. Manufacturers:
   1. Nibco, Inc.
   2. Stockham.
   3. Grinnell.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lockshield stem, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder ends.
   2. Nibco Model S-134.

C. Over 2 Inches:
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.
   2. Nibco Model F-617-0.

2.07 BALL VALVES

A. Manufacturers:
   1. Nibco, Inc; Model S-585-70-66.
   2. Watts.
   3. Apollo.

B. Up To and Including 2 Inches:
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

2.08 SWING CHECK VALVES

A. Manufacturers:
   1. Nibco, Inc.
   2. Stockham.
   3. Grinnell.
   4. Jomar.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
   2. Nibco Model S-433-Y.

C. Over 2 Inches:
   1. Iron body, bronze trim, bronze faced rotating swing disc, renewable disc and seat, flanged ends.
   2. Nibco Model F-918-B.

2.09 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Nibco, Inc.
   2. Hammond Valve.
   3. Milwaukee Valve Company.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, glycol, piping to ASME B31.9 requirements.

C. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully inserted in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

D. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

E. Route piping in orderly manner, parallel to building structure, and maintain gradient.

F. Install piping to conserve building space and to avoid interfere with use of space.

G. Group piping whenever practical at common elevations.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
   1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.

J. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Support horizontal piping as scheduled.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.

L. Use eccentric reducers to maintain top of pipe level.

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

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.

3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Dirt/air separators.

D. Strainers.

E. Suction diffusers.

F. Combination pump discharge valves.

G. Pressure-temperature test plugs.

H. Combination flow controls.

I. Flow meters.

J. Radiator valves.

K. Relief valves.

L. Pressure reducing valves.

M. Glycol system.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

B. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Project Record Documents: Record actual locations of flow controls.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

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

PART 2 PRODUCTS

2.01 EXPANSION TANKS

A. Manufacturers:
   1. Armstrong Fluid Technology.
   2. Amtrol Inc.
   3. ITT Bell & Gossett.
   4. Taco, Inc.

B. Maximum Rated Working Pressure: 150 psi.

C. Maximum Allowable Service Temperature: 240 degrees F.

D. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 150 psi, with flexible, replaceable EPDM bladder sealed into tank.

E. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to psi as scheduled on Drawings.

F. Size: As scheduled on the Drawings.

2.02 AIR VENTS

A. Manufacturers:
   1. ITT Bell & Gossett.
   2. Taco, Inc.
   3. Armstrong Fluid Technology.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Maximum Fluid Pressure: 150 psi.

E. Maximum Fluid Temperature: 250 degrees F.

2.03 DIRT/AIR SEPARATORS

A. Coalescing Air/Dirt Separators:
   1. Manufacturers:
      a. Spirotherm, Inc.
      b. Armstrong Fluid Technology.
      c. ITT Bell & Gossett.

d. Amtrol.
e. Taco, Inc.

2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1; for 150 psi operating pressure and 270 degrees F maximum operating temperature; subject to the requirements of the application and the manufacturer's standard maximum operating conditions.
3. Coalescing Medium: Provide stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to the top of the separator.
5. Inlet and Outlet Connections: Threaded for 2 NPS and smaller; Class 150 flanged connections for 2-1/2 NPS and larger.
6. Blowdown Connection: Threaded.
7. Maximum Fluid Service Pressure: 150 psi.
8. Maximum Fluid Service Temperature: 250 degrees F.

2.04 STRAINERS

A. Manufacturers:
1. ITT Bell & Gossett.
2. Armstrong Fluid Technology.
3. Taco, Inc.

B. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
1. Provide flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron:
1) Steam: Up to 125 psi at 350 degrees F.
2) Liquids: Up to 200 psi at 150 degrees F.

D. Size 5 inch and Larger:
1. Provide flanged iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.
2. Liquid Fluid Service: Up to 285 psi at 100 degrees F.

2.05 SUCTION DIFFUSERS

A. Manufacturers:
1. Armstrong Fluid Technology.
2. ITT Bell & Gossett.
3. Taco, Inc.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter

openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.

C. Class 125:
   1. Horizontally or vertically mounted angle-pattern fitting with integral-cast vanes, fine particle mesh screen and magnetic drain plugs for particle removal without disassembly.
   2. Maximum Operating Service: 175 psi and 300 degrees F.
   3. Sizes, Material, and Connection:
      a. 2 inch and Smaller: Cast iron body, threaded.
      b. 2-1/2 to 12 inch: Ductile iron body, flanged.

D. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.06 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
   1. Armstrong Fluid Technology.
   2. ITT Bell & Gossett.
   3. Armstrong Fluid Technology.
   4. Taco, Inc.

B. Triple-Duty Globe Type: Flanged cast-iron angle pattern body with bolt-on bonnet, position indicator, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, metering connectors, flow shutoff mechanism, and adjustable flow handle.

2.07 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
   1. Ferguson Enterprises Inc.
   2. Peterson Equipment Company Inc.
   3. Sisco Manufacturing Company Inc.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.08 AUTOMATIC FLOW CONTROLS

A. Manufacturers:
   1. Nexus.
   2. Flow Design.
   3. Griswold controls.
   4. Hays Fluid Controls.

B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

D. Control Mechanism:

1. Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring. Internal flow cartridge shall be permanently marked with GPM and spring range. Cartridge shall be removable for changeout.
2. Precision sculptured brass or polyphenylsulfone orifii with high temperature elastomeric diaphragm. Internal flow parts shall be permanently marked with flow performance. Components shall be removable for changeout.

E. Size: Match system flow capacity.

F. Accessories: In-line strainer on inlet and ball valve on outlet.

2.09 RADIATOR VALVES

A. Angle or straight pattern, rising stem, inside screw globe valve for 125 psi working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lockshield key cap and set screw memory bonnet for balancing service.

2.10 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

B. Steam Relief at Maximum Vessel Pressure: As indicated.

2.11 GLYCOL SYSTEM

A. Manufacturers:
1. Armstrong Fluid Technologies; Model GLA-S-HP-1.
2. B&G.
3. John Woods.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Pump System:
1. Storage: 53 gal polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
2. Pump:
   a. Thermally protected 1/4 hp motor at 115 to 120 VAC, single phase rated for indoor service.
   b. Maximum Service Operation: 125 psi at 85 degrees F.
3. Mechanical Accessories: System isolation valves, strainer, and pressure gauges.
4. Control Panel:
   a. Fused single-point system connection rated at 115 to 120 VAC, single phase.
   b. Interface: Hand switches with indicating lights for ON, FAULT, and LOW LEVEL.
   c. Pressure Switch: Panel-mounted and prewired for 10 psi cut-in and 40 psi cut-out, adjustable.
   d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation.
   e. Auxiliary Dry Contacts: Low level, high level, and fault/alarm for remote monitoring.

C. Glycol Solution:
1. Water-based solution mix containing 40 percent ethylene glycol by volume required for heating system operating temperature range.

2.12 MULTI-PORT PRESSURE MANIFOLD

A. Manufacturers:
   1. Flow Conditioning Corp: Trumpet Valve.
   2. Hydronic Monitor Co., Inc.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. One piece manifold of brass construction with ports for connection to hydronic system. Spring return pushbuttons, gauge connection port and test port connection for gauge calibration.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide dirt/air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Provide pump suction fitting on suction side of floor mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

G. Provide combination pump discharge valve on discharge side of floor mounted centrifugal pumps where indicated.

H. Support pump fittings with floor mounted pipe and flange supports.

I. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

J. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

K. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

L. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at as scheduled on Drawings..

M. Perform tests determining strength of glycol and water solution and submit written test results.

N. Multi-port pressure manifold shall be attached to system piping with heavy bracket at height to permit easy pushbutton operation and gauge observation.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vertical in-line pumps.

1.02 RELATED REQUIREMENTS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 21 13 - Hydronic Piping.

C. Section 23 21 14 - Hydronic Specialties.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. UL 778 - Standard for Motor-Operated Water Pumps Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

1.06 WARRANTY

A. Provide two year manufacturer parts and labor warranty for pumps and variable frequency drives.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Fluid Technologies.

B. ITT Bell & Gossett.

C. Taco, Inc..

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.03 SENSORLESS VARIABLE SPEED PUMP

A. Manufacturers
   1. Armstrong Pumps Inc.; 4300 IVS.
   2. Xylem; Bell & Gossett.
   3. Taco.

B. Pump
   1. Provide split-coupled/closed-coupled type as scheduled Vertical In-Line HVAC pumping units, with rigid spacer type couplings and supplied with NEMA Premium efficiency motors and NEMA/UL type-12 enclosure integrated controls. NEMA/UL type 1 enclosure is not acceptable for integrated controls. Refer to pump schedule for pump flows and heads and motor speed, enclosure and power requirements and other system conditions.
   2. The controls shall be integrated with the pumping unit to 75hp/55kW motor size for a self-contained pump, motor and integrated controls combination to ensure optimum component matching and protection from motor overloading at any operating point. The pumping package shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108. Controls for motors above 75hp will be supplied as separate items
   3. Pump Construction: Pump Casing - Cast Iron with ANSI-125 / PN16 flanges for working pressure to 175 psig (12 bar) at 150°F (65°C) or Ductile Iron with ANSI-250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (65°C). Suction and discharge connections shall be equally sized ANSI flanges, and shall be drilled and tapped for seal flush and gauge connections.
   4. Impeller - Bronze, fully enclosed type. Dynamically balanced. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.
   5. Shaft - Provide Stainless Steel pump shaft.
   6. Split-coupled coupling - Rigid spacer type of high tensile aluminum alloy with a fully enclosed ANSI B15.1 Sect 8 and OSHA 1910.219 compliant guard. Pump design must such that the mechanical seal is replaceable without disturbing the pump or motor.
   7. Mechanical Seals - Shall be Stainless Steel multi-spring outside balanced type with Viton® secondary seal, carbon rotating face and silicon carbide stationary seat. Provide a 316 stainless steel gland plate.

C. Closed-coupled pump Motor;
   1. Permanent Magnet Motor: To IE5 efficiency.
      a. Horsepower: As scheduled.
      b. Enclosure: TEFC.
      c. Efficiency: IE5 efficiency To IEC 60034-30-1.
      d. Power supply: 380 - 480 V, 60 Hertz.

D. Integrated Controls
   1. Controls shall be of the VVC-PWM type providing near unity displacement power factor at all loads and speeds without the need for external power factor correction capacitors. The controls

shall incorporate DC link chokes for the reduction of mains borne harmonic currents to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. This shall be at least equivalent to a 5% input filter. The controls shall be UL and C-UL Listed & CE Marked showing compliance with both the EMC Directive 89/336/EEC and the Low Voltage Directive 72/23/EEC. RFI filters shall be incorporated within the controls to ensure it meets the emission and immunity requirements of EN61800-3 to the 1st Environment Class C1 (EN55011 unrestricted sales class B) and supports IEEE 519-1992 requirements. The controls and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over voltage, under voltage, motor over temperature, inverter overload, over current. Over current is not allowed ensuring units will not overload the motor at any point in the operating range of the unit.

2. The controls shall incorporate an integrated graphical user interface that shall provide running and diagnostic information and identify faults and status in clear English language. Faults shall be logged / recorded for interrogation at a later date. It shall be possible to upload parameters from one control hardware into the non-volatile memory of a computer and download the parameters into other control requiring the same settings. The keypad shall incorporate Hand-Off-Auto pushbuttons to enable switching between BAS/BMS and manual control. The controls shall incorporate a USB port for direct connection to a PC and an BAS interface protocol of: BACnet™ TCP/IP.
3. Programmable skip frequencies and adjustable switching frequency must be available for noise / vibration control
4. Software shall be available in the unit to provide automatic speed control in variable volume systems for duty or duty / standby pump control without the need for pump mounted (internal/external) or remotely mounted differential pressure feedback sensor. Control mode setting and minimum / maximum head set-points shall be set at the factory and be user adjustable via the inbuilt programming interface.
5. The controls shall have the following additional features:
   a. Sensorless override by BMS
   b. Manual pump control
   c. Closed loop PID control for a remote sensor
   d. Auto alarm reset
   e. Motor pre-heat function
   f. Six programmable digital inputs
   g. Two analog inputs
   h. One programmable analog / digital output
   i. Two volt-free contacts.

E. The 4300 IVS (IVS Sensorless) pumping unit shall be capable of operating in any of the following control modes:
   1. Duty Pump & Standby pump with Sensorless Control

F. The 4380 IVS (IVS Sensorless) pumping units shall be capable of operating in any of the following control modes.
   1. For multiple pump configuration ensure parallel Sensorless pump control with best efficiency staging is applied
   2. Parallel pump staging will be provided without the use of BAS / BMS. Min / max speed / frequency based staging shall not be acceptable and a locally mounted logic controller shall be used for best efficiency staging.

3. The parallel sensorless pump control will have in-built redundancy features including:
   a. Factory installed power connection to each pump controller
   b. Controller 'offline' operational protection preventing loss of system flow

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Lubricate pumps before start-up.

F. Provide side-stream filtration system for closed loop systems. Install across pump with flow from pump discharge to pump suction from pump tappings.

G. Controls: Interface each pump starter or VFD with HVAC controller; see Section 23 09 23.

END OF SECTION

SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials.
   1. System cleaner.
   2. Closed system treatment (water).

B. By-pass (pot) feeder.

C. Water meter.

D. Test equipment.

E. Side-stream filtration equipment.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

B. Section 23 21 14 - Hydronic Specialties.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AmSolv-Amrep, Inc.

B. GE Water & Process Technologies.

C. Nalco, an Ecolab Company.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Perform work in accordance with local health department regulations.

2.03 MATERIALS

A. System Cleaner:
   1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.

B. Closed System Treatment (Water):
   1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
   2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
   3. Conductivity enhancers; phosphates or phosphonates.

2.04 BY-PASS (POT) FEEDER

A. Manufacturers:
   1. Griswold Controls.
   2. J. L. Wingert Company.
   3. Neptune, a brand of the Dover Company.

B. 5 gal quick opening cap for working pressure of 175 psi.

2.05 WATER METER

A. Manufacturers:
   1. Badger.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

C. Electrical Characteristics:
   1. 120 volts, single phase, 60 Hz.

2.06 TEST EQUIPMENT

A. Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10 ml zeroing titrating burettes and associated reagents.

B. Provide the following test kits:
   1. Alkalinity titration test kit.
   2. Chloride titration test kit.
   3. Sulphite titration test kit.
   4. Total hardness titration test kit.
   5. Low phosphate test kit.
   6. Conductivity bridge, range 0 - 10,000 micro-ohms.
   7. Creosol red pH slide complete with reagent.
   8. Portable electronic conductivity meter.
   9. High nitrite test kit.

2.07 SIDE-STREAM FILTRATION SYSTEM

A. System: Flow indicator, filter housing with cartridge filter, shut-off valves, and flow control valve.

B. Performance: Design flow 5 gal/min with maximum pressure drop of 5 psi.

C. Hot Water Filter Housing: Glass reinforced nylon plastic suitable for 220 degrees F and 200 psi operating conditions.

D. Cartridges: 30 micron for start-up and 10 micron for system operation.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

3.02 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Hot Water Heating Systems:
   1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
   3. Circulate for 6 hours at design temperatures, then drain.
   4. Refill with clean water and repeat until system cleaner is removed.

C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.

D. Flush and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder and sidestream filter on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

3.05 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
   1. Provide minimum of two hours of instruction for two people.
   2. Have operation and maintenance data prepared and available for review during training.
   3. Conduct training using actual equipment after treated system has been put into full operation.

END OF SECTION

SECTION 23 52 16
CONDENSING BOILERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Boiler construction.

B. Boiler trim.

C. Fuel burning system.

D. Factory installed controls.

1.02 RELATED REQUIREMENTS

A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

B. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.

B. AHRI 1500 - Performance Rating of Commercial Space Heating Boilers 2015.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2021.

E. HI BTS-2000 - Testing Standard, Method to Determine Heating Efficiency of Commercial Space Heating Boilers 2007.

F. NFPA 54 - National Fuel Gas Code 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

D. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels.
   1. Burner and Hydrostatic Test: Factory pressure test gas train, test fire burner and gas train assembly, and perform a functional controls test for all safety devices; perform hydrostatic test.
   2. Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.

B. The boiler shall have an ASME Section IV pressure vessel rated for a maximum allowable working pressure of 160 PSIG and a maximum allowable working temperature of 210°F.

C. The entire boiler system and its installation shall conform to the manufacturer's instructions, applicable codes and associated National Board requirements.

D. The equipment shall be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. The pressure vessel shall be guaranteed against thermal shock for the lifetime of the boiler when utilized in a closed loop hydronic heating system with a temperature differential of 120 °F or less. The boiler pressure vessel shall be guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.

C. The pressure vessel, tubes and tube sheets (heat exchanger) shall be guaranteed against flue gas corrosion and materials/workmanship for a period of 15 years. The condensate collection box shall be guaranteed for 20 years. The burner cylinder shall be warranted for a period of 5 years.

D. All parts not covered by the above warranties shall carry a 2 year parts and labor warranty from startup, or 30 months from shipment, whichever occurs first. This shall include all electrical components and burner components.

PART 2 PRODUCTS

2.01 HIGH MASS FIRETUBE STAINLESS STEEL CONDENSING BOILERS

A. Manufacturers;
   1. Cleaver Brooks; Model CFC-E.
   2. Alternate manufacturers;
      a. Viessmann; Model Vitocrossal 300-CT3.

b. Fulton; Model VTG.

B. "Near condensing" copper fin designs, watertube, cast iron, cast aluminum, or "add-on" secondary condensing exchangers will not be considered. Boilers with minimum flow requirements also will not be considered.

C. Description: Each unit shall be a down-fired firetube type complete with burner and automatic controls. The boiler, with all piping and wiring, shall be a factory package. Each boiler shall be neatly finished, thoroughly tested and properly packaged for shipping. Boiler design and construction shall be in accordance with Section IV of the ASME Code for hot water heating boilers with a maximum working pressure of 125 PSIG.

D. Heat Exchanger: Duplex stainless steel tubes, tube sheets, and combustion chamber. The heat exchanger shall be a single-pass, counter-flow arrangement.
   1. The firetubes shall be duplex stainless steel, fitted with aluminum internal heat transfer fins.

E. Pressure Vessel: Carbon steel with welded heads and tube connections.

F. The boiler pressure vessel shall have a minimum of 42 gallons of water volume/1000 MBH input.

G. The boiler shall be low flow tolerant without minimum flow requirements or the use of a flow switch.

H. The boiler shall have a minimum of 200 sqft/1000 MBH of effective fireside heating surface.

I. Burner: Natural gas, forced draft burner mounted in and integral with the boiler hinged top door so when the door is opened the burner head, furnace, tubesheet, and tube entrances are exposed. The burner door shall utilize easy removable threaded handles, and the burner shall swing upward on gas assist piston arms, one on each side to provide open support of the burner assembly.
   1. The burner shall be a linkage-less, self-regulating, air-fuel ratio gas valve-venturi system. Burner regulation shall be accomplished without the use of fuel/air mixing valves.
   2. The burner shall be achieve sub 20 ppm NOx when firing on natural gas at all firing rates.
   3. Burner and fireside access shall be able to be performed by one service technician.

J. Burner Head: shall be constructed of a stainless steel metal fiber for solid body radiation of the burner flame. Combustion shall take place on the surface of the burner mantle, which shall be constructed of a woven stainless steel metal fabric resulting a 360 degree low temperature radiant flame.
   1. Burner shall be minimum 10:1 fully modulating turndown.
   2. Burner shall maintain no more than 7% O2 levels throughout the firing rate without additional sensors, linkages, or controls.
      a. The pre-mix design shall utilize a variable speed fan connected to a venturi to simultaneously modulate the fuel and air for a minimum 10:1 turndown. The valve-venturi design shall also act as a method for compensating for changes in barometric pressure, temperature, and humidity so the excess air levels are not adversely affected by changes in atmospheric conditions. External linkages and single speed fans shall not be acceptable.

K. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
   1. The blower motor shall have a variable speed ECM motor with integrated drive electronics. Constant speed motors and variable frequency AC drives are not acceptable.

L. Gas Train: The gas train shall meet the requirements of CSA/UL and ASME CSD-1 and shall include:
   1. Low Gas Pressure Interlock, manual reset.
   2. High Gas Pressure Interlock, manual reset.
   3. Upstream and downstream manual test cocks.
   4. Ball Type manual shutoff valve upstream of the main gas valve.
   5. Unibody double safety gas valve assembly.
   6. Gas Pressure Regulator.
   7. Union connection to permit burner servicing.

M. Ignition: Pilot ignition with 100 percent main-valve shutoff with UV scanner for flame supervision.

N. Combustion air proving switch shall be furnished to ensure sufficient combustion airflow is present for burner ignition firing.

O. To ensure that the flue is not blocked, the burner shall include a High Air Pressure Switch sensing the outlet pressure connection relative to stack backdraft.

P. Casing:
   1. Jacket: 18 gauge metal cabinet with snap-in or interlocking closures.
   2. Control Compartment Enclosures: NEMA 250, Type 1A.
   3. Finish: Powder-coated protective finish.
   4. Insulation: Minimum 2-inch thick, mineral-fiber insulation surrounding the heat exchanger.
   5. Combustion-Air Connections: Inlet and vent duct collars.
      a. Combustion air inlet filter.

2.02 TRIM

A. Safety valve(s) shall be ASME Section IV approved side outlet type mounted on the boiler air vent outlet. Size shall be in accordance with code requirements and set to open at **75** psig.

B. Temperature and pressure gauge shall be mounted on the water outlet.

C. Solid State Low water cut-off probe control with manual reset and test switch.

D. Manual Reset High Limit Temperature sensor; range not to exceed 210 deg F and shall be an integral device of the Boiler Burner Control and UL Recognized as a limit control.

E. Outlet water supply sensing probe for operating water limit setpoint.

F. Return water-sensing probe for operating limit setpoint.

G. Drain valve,

H. Automatic air vent.

I. Auxiliary low water cutoff.

J. Alarm lights and horn (general alarm light – red, fuel valve light – green, load demand light – white, low water light - amber).

K. Alarm horn (electronic sounder).

L. Stack temperature sensor – UL Recognized as a limit control.

M. Condensate neutralization kit combination tank and trap.

N. Automatic isolation valve, including valve, actuator, and transformer to power isolation valve through the boiler. The valve, actuator, and transformer shall ship loose for field installation and wiring.
   1. The isolation valve shall be Bray 2-way resilient seated butterfly valve, model ABL or approved equal, with ANSI 150# flanges, lugged style.
   2. The electric actuator shall a Bray Commercial actuator, or approved equal, 24VAC, fail in position, with auxiliary end switch.

2.03 CONTROLS

A. The Boiler shall include a Falcon Computerized Boiler Burner control which shall be an integrated, solid state digital micro-processing modulating device, complete with sequence indication, fault reset, mode selection, and parameter set-point. It shall be mounted at the front of the boiler panel for easy access and viewing.

B. Controller shall provide for both flame safeguard and boiler control through separate power supplied CPU's (to meet NFPA) and shall perform the following functions:
   1. Burner sequencing with safe start check, pre-purge, Electronic direct spark ignition and post purge. A UV scanner shall be used to prove combustion.
   2. Flame Supervision. The control shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent fifteen lockouts. The control shall be connected to a touchscreen display interface that will display this information in clear English text descriptions.
   3. Safety Shutdown with display of lockout or hold condition.
   4. PID modulating control of the variable speed fan for firing capacity relative to load requirements; i.e. to meet supply water temperature set point.
   5. Gas pressure supervision, high and low.
   6. Combustion Air Proving Supervision.
   7. High Air Pressure [back draft too high] Supervision.
   8. The supply temperature and set-point temperature shall be displayed at all times on the touch screen display.
   9. Controller shall be equipped with a touch screen display for set up, trouble shooting, and operational display, and shall include ModBus communication capability of this information.
   10. Include the programming of circulating pump or isolation valve control and support the control of 2 heating demand loops.

C. All parameter input control set-points shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions -- settings are to be configured at the time of initial jobsite operation.

D. All controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to UL and CSA requirements.

E. Electrical power supply shall be 115 volts, 60 cycle single phase.

F. When multiple boilers are to be installed together, a system integration control shall be provided to stage up to 8 boilers. The control shall include automatic selection of needed boilers based on

energy demand, an adjustable outdoor reset schedule, domestic hot water priority, and a system digital display. The control shall stage and modulate the boilers utilizing firing rate threshold staging and parallel modulation to optimize condensing potential while minimizing energy wasting short cycling. This strategy takes full advantage of the inverse efficiency characteristic (lower fire rate, higher efficiency) of condensing boilers. The control shall monitor supply water temperature, return water temperature and shall communicate between boilers via RS-485 network wiring.

G. Boilers shall communicate with **BACnet I/P** building management system utilizing a protocol translator for requirements other than the native ModBus RTU.
   1. Protocol translator mounted in a NEMA 1 panel with power supply and terminals.
   2. Protocol translator shipped loose for installation in boiler control panel with required power supply.

H. The boiler controls shall include provisions for outdoor air reset.

I. The boiler controls shall include provisions for sending signal to;
   1. Start/stop primary boiler pump.
   2. start/stop primary boiler pump and vary pump speed based on boiler firing rate.
   3. open/close automatic isolation valve.

J. Boiler shall have capability to have 24/7 remote monitor without connections to a BMS through an encrypted secure channel. The remote interface shall have the following features and capabilities;
   1. Display real time boiler system operation, cycle counts, temperature readings, and runs hours, firing rate, steam pressure, inlet/outlet water temps, alarms, stack temperature, and more.
   2. View data on mobile app and customizable online dashboard.
   3. Multiple user authorization with different levels of access.
   4. Multiple site integration to allow user to see all boiler plants and control individual plants.
   5. Email and text alerts.
   6. Data trending.

2.04 ELECTRICAL POWER

A. Single-Point Field Power Connection: Factory-installed and -wired electrical devices necessary shall provide a single-point field power connection to boiler. Separate power and control connections will not be allowed.
   1. House in NEMA 250, Type 1 enclosure.
   2. Wiring shall be numbered and color coded to match wiring diagram.
   3. Install factory wiring outside of an enclosure in a metal raceway or conduit.
   4. Field power interface shall be to non-fused disconnect switch.

2.05 VENTING

A. Exhaust Stack
   1. Vent system shall be an insulated positive stack pressure system and Category IV vent material in accordance to ANSI Standard (AGA) and CGA standards. Boiler venting shall be provided through stainless steel Grade AL 29-4C and shall be able to handle positive pressure and flue gas condensate.
   2. Seams shall be plasma welded and joints shall overlap 3 inches with two ridges to prevent migration of condensation by capillary action to the outside. Complete joints with high temperature siliconed and locking band with ceramic fiber gasket.

3. Provide all necessary fittings, supports and termination. Include connector pieces and condensate drain connections.

B. Combustion-Air Intake
   1. Complete system, galvanized steel pipe, vent terminal with screen, inlet air coupling and sealant.
   2. Combustion air filters.

C. System design and configuration must be approved by the boiler manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
   1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 BOILER INSTALLATION

A. Install equipment on 4” concrete housekeeping pad.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.03 CONNECTIONS

A. Install boilers level on concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting:
   1. Install flue venting kit and combustion-air intake.

2. Connect full size to boiler connections.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the instructions.
   2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
   3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.05 DEMONSTRATION

A. Engage a factory representative or a factory-authorized service representative for boiler startup. Start-up sheet shall be completed and a copy shall be sent to the Engineer and the Manufacturer. A combustion analysis shall be completed and the gas valve adjusted per the Installation and Operations manual and note in start-up report.

B. Factory representative or a factory-authorized representative shall provide Owners training to instruct maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION

SECTION 23 57 00
HEAT EXCHANGERS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plate type heat exchangers.

B. Accessories and trim.

1.02 RELATED REQUIREMENTS

A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

B. Section 23 21 13 - Hydronic Piping.

C. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

1.04 SUBMITTALS

A. Product Data: Provide data with dimensions, locations, and size of tappings and performance data.

B. Shop Drawings: Indicate dimensions, locations, and size of tappings and performance data.
   1. Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.

C. Certificates: Certify that Products meet or exceed specified requirements.

D. Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.

E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Plate Type Heat Exchanger Tools: One set of wrenches for disassembly.

1.05 REGULATORY REQUIREMENTS

A. Conform to ASME BPVC-VIII-1 for manufacture of tubular heat exchangers and heat exchanger shells.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect internals from entry of foreign material by temporary caps on flanged openings.

1.07 WARRANTY

A. Provide two year manufacturer parts and labor warranty for heat exchangers.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME BPVC-VIII-1 for manufacture of tubular heat exchangers and heat exchanger shells.

2.02 PLATE AND FRAME TYPE HEAT EXCHANGER

A. Manufacturer:
   1. Armstrong Fluid Technology
   2. Alfa Laval.
   3. Xylem; B&G.

B. Plate Heat Exchanger:
   1. A plate and frame, water to water, type heat exchanger of the sizes and capacities noted on the schedule. The heat exchanger shall consist of stainless steel heat transfer plates, steel end plates, and a carbon steel carrying bar, of single pass configuration. Unit's shall be specifically designed for 150 PSIG working pressure at 230°F. Heat exchanger selection shall be optimized by the manufacturer to provide minimum heat transfer surface area requirements under specified capacity and pressure drops.
   2. The plate heat exchanger shall be shipped to the site as completely assembled units. The heat exchanger shall be pressure tested and flushed clean at the factory prior to shipment. All nozzle connections shall be factory sealed prior to shipment to prevent the entrance of foreign matter into the heat exchanger during shipment, storage, and installation.
   3. Corrugated channel steel plates shall be of type 304 or 316 SS. Channel plate ports shall be double gasketed to prevent cross contamination of hot and cold side fluids. Gaskets shall be of a one piece design formulated from Nitrile rubber. Plates shall be grooved to accept the gaskets and gasket clips to minimize movement.
   4. Channel carrying bar shall be of carbon steel, aluminum or stainless steel with zinc yellow chromate finish.
   5. Fixed frame plates and movable pressure plates shall be corrosion resistant epoxy painted carbon steel. Flow through the plates shall be of a counter flow design to maximize the heat transfer capability of the unit.
   6. Connection 2” and smaller shall be carbon steel NPT tappings. Connections 4” and larger shall be studded port design to accept ANSI flange connection. Connection ports shall be integral to the frame or pressure plate.
   7. Unit to be supplied with OSHA approved splash guard, enclosing exterior channel plate and gasketed surfaces. Heat exchanger shall be provided with the scheduled square footage of heat transfer area.
   8. Unit shall be constructed in accordance with ASME Code Rules and shall have a manufacturer's data report for pressure vessels, form No. U-1. Form U-1 shall be furnished to the engineer for the owner upon request. An authorized inspector, holding a National Board commission, certifying that construction conforms to the latest ASME Code for pressure vessels must sign this form. The ASME "U" symbol should also be stamped on the Heat Exchanger(s). In addition, each unit registered with the National Board of Boiler and Pressure Vessel Inspectors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to permit removal of plates with minimum disturbance to installed equipment and piping.

C. Support heat exchangers on concrete housekeeping pad.

3.02 WATER TO WATER HEAT EXCHANGER TRIM

A. Water Inlets and Outlets: Thermometer wells, pressure gage tappings.

B. Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, valved drain; refer to Section 23 21 14.

END OF SECTION

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit heaters.

1.02 RELATED REQUIREMENTS

A. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Section 23 21 13 - Hydronic Piping.

D. Section 23 21 14 - Hydronic Specialties.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Product Data: Provide typical catalog of information including arrangements.

B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. Provide two year manufacturer's parts and labor warranty for unit heaters.

PART 2 PRODUCTS

2.01 HYDRONIC UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company.
   2. Sterling Hydronics, a Mestek Company.

3. Vulcan.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Perform factory run test under normal operating conditions, water, and steam flow rates.

D. Casing: Minimum 18 gage, 0.0478 inch thick sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 18 gage, 0.0478 inch thick sheet steel top and bottom plates for vertical projection models.

E. Finish: Factory applied baked enamel of color.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

G. Air Outlet: Adjustable pattern diffuser on vertical projection models and two or four way louvers on horizontal projection models.

H. Totally Enclosed Motors: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

I. Control: Local disconnect switch.

J. Electrical Characteristics: As scheduled on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Do not damage equipment or finishes.

C. Unit Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.

END OF SECTION

SECTION 26 05 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Basic Electrical Requirements and materials specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements. Section includes:
   1. Electrical Identification.
   2. Minor Demolition.
   3. Conductors and Devices.
   4. Raceways and Boxes.
   5. Supporting Devices.

1.03 REGULATORY REQUIREMENTS

A. Conform to building codes as adopted by the Illinois Community College Board..

B. Install electrical Work in accordance with the NECA Standard of Installation.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store and protect all materials as specified under the provisions of Section 01 60 00 and as specified herein.

B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

C. Ship products to the job site in their original packaging. Receive and store products in a suitable manner to prevent damage or deterioration. Keep equipment upright at all times.

D. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

1.05 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by Project conditions. Drawings have omitted certain branch circuitry in areas for ease of reading. All branch circuitry is to be provided by Contractor.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from Architect/Engineer before proceeding as specified under modification procedures.

1.06 QUALITY ASSURANCE

A. Provide Work as required for a complete and operational electrical installation.

B. All products shall be designed, manufactured, and tested in accordance with industry standards. Standards, organizations, and their abbreviations as used hereafter, include the following:
   1. American National Standards Institute, Inc (ANSI).
   2. American Society for Testing and Materials (ASTM).
   3. National Electrical Manufacturers Association (NEMA).
   4. Underwriters Laboratories, Inc. (UL).

C. Install all Work in accordance with the NECA Standard of Installation.

1.07 SUBMITTALS

A. Submit all requested items in Division 26 Sections under provisions of Section 01 30 00.

1.08 SUBSTITUTIONS

A. Substitutions will be considered only as allowed within the provisions of Section 01 60 00.

1.09 PROJECT RECORD DOCUMENTS

A. Cooperate and assist in the preparation of project record documents under the provisions of Section 01 78 00.

1.10 PROJECT MANAGEMENT AND COORDINATION

A. Proper project management and coordination is critical for a successful project. Manage and coordinate the Work with all other trades in accordance with Section 01 30 00 requirements. Reliance on the Drawings and Specifications only for exact project requirements is insufficient for proper coordination.

PART 2 PRODUCTS

2.01 WIRING METHODS

A. All exposed locations: Building wire in raceway.

B. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
   1. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet.

2.02 BUILDING WIRE

A. Manufacturers:
   1. Anixter.
   2. Southwire.
   3. Allied Wire and Cable.

B. Building Wire:
   1. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation.
   2. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, stranded conductor (solid for device terminations).
   3. Control Circuits: Copper, stranded conductor, 600 volt insulation.
   4. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

5. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
6. Use conductor not smaller than 12 AWG for power and lighting circuits.
7. Use conductor not smaller than 16 AWG for control circuits.

C. Locations:
1. Concealed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
2. Exposed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
3. Above Accessible Ceilings: Use only building wire with Type THHN insulation in raceway.
4. Wet or Damp Interior Locations: Use only building wire with Type THWN insulation in raceway.
5. Exterior Locations: Use only building wire with Type XHHW insulation in raceway.
6. Underground Installations: Use only building wire with Type XHHW insulation in raceway.

2.03 RACEWAY REQUIREMENTS

A. Use only specified raceway in the following locations:
1. Branch Circuits and Feeders:
a. Concealed Dry Interior Locations: Electrical metallic tubing.
b. Exposed Dry Interior Finished Locations: Electrical metallic tubing.
c. Exposed Dry Interior Unfinished Locations: Electrical metallic tubing.
d. All other locations: Galvanized Rigid Metallic Conduit.

B. Size raceways for conductor type installed.
1. Minimum Size Conduit Homerun to Panelboard: 3/4-inch.

2.04 METALLIC CONDUIT AND FITTINGS

A. Conduit:
1. Electrical metallic tubing: ANSI C80.3.
2. Flexible Conduit: UL 1, zinc-coated steel.
a. Liquidtight Flexible Conduit: UL360. Fittings shall be specifically approved for use with this raceway.

B. Conduit Fittings:
1. Metal Fittings and Conduit Bodies: NEMA FB 1.
a. EMT fittings: Use set-screw indentor-type fittings.

2.05 CONDUIT HANGERS

A. Manufacturers:
1. Minerrallac Electric Company.
2. Substitutions: Or Approved Equal.

B. Description:
1. Standard conduit hanger, zinc-plated steel with bolts.
2. Threaded rod and hardware: Plated finish, size and length as required for loading and conditions.

2.06 PENETRATION SEALANTS

A. Fire-rated assemblies: Provide firestopping of all penetrations made by Work under this Contract.

B. Thermal and Moisture Protection: Provide thermal and moisture protection made by Work under this Contract of all exterior wall, floor and roof penetrations.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Demolition Drawings are based on casual field observation and are intended to identify the limits of the construction site. Remove all electrical systems in their entirety in proper sequence with the Work.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

C. Beginning of demolition means installer accepts existing conditions.

D. Verify that supporting surfaces are ready to receive work.

E. Electrical boxes are shown on Drawings, in approximate locations, unless dimensioned.

3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove all existing electrical installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Relocate existing fire alarm devices affected by wall, ceiling and floor demolition.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

3.03 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Neatly train and secure wiring inside boxes, equipment, and panelboards.

E. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

F. Pull all conductors into raceway at same time.

G. Protect exposed cable from damage.

H. Neatly train and lace wiring inside boxes, equipment and panelboards.

I. Support cables above accessible ceilings to keep them from resting on ceiling tiles.

J. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.

K. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

L. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

M. Do not use powder-actuated anchors.

N. Do not drill or cut structural members.

O. Terminate spare conductors with electrical tape.

END OF SECTION

SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment and devices not and integral part of the electrical distribution system.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Provide conduit rough-in and electrical connection to powered equipment and devices identified in the Project Manual and on the Drawings. Refer specifically, but not limited to, these Specification Sections for further information:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC.
   2. Section 23 21 23 - Hydronic Pumps.
   3. Section 23 52 16 - Condensing Boilers.
   4. Section 23 82 00 - Convection Heating and Cooling Units.

B. Coordination: Determine connection locations and requirements for furniture, equipment and devices furnished or provided under other sections.
   1. Do not rely solely on the Drawings and Project Manual for execution of the Work of this Section.
   2. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions.
   3. Include necessary field evaluation time to inspect connection requirements.
   4. Coordinate with other trades to determine exact rough-in requirements.

C. Sequencing:
   1. Install rough-in of electrical connections before installation of furniture and equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.03 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches: As specified in Section 26 28 16.16.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

B. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

G. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com/#sle.

B. General Electric Company: www.geindustrial.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Lug Material: Copper suitable for terminating copper conductors only.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

M. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch, horse power rated.

N. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch, horse power rated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Install enclosed switches plumb.

E. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform field inspection in accordance with Section 01 40 00.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

E. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

GENERAL NOTES

ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH BY IBC 2018 AND SHALL CONFORM TO ALL OTHER APPLICABLE MUNICIPAL, STATE, AND FEDERAL REGULATIONS INCLUDING THE ILLINOIS ACCESSIBILITY CODE (2018) AND THE AMERICANS WITH DISABILITIES ACT.

A. GENERAL NOTES

1. ALL CONTRACTORS ARE REQUIRED TO VISIT THE SITE AND BE KNOWLEDGEABLE REGARDING EXISTING CONDITIONS AND THEIR EFFECT ON THE PROPOSED WORK. CONTRACTORS SHALL VERIFY AND BE RESPONSIBLE FOR, ANY CONDITIONS REQUIRING MODIFICATION BEFORE PROCEEDING WITH THE PROJECT.
2. NOTIFY THE OWNER'S REPRESENTATIVE A MINIMUM OF 72 HOURS PRIOR TO THE INTERRUPTION OF ANY UTILITY.
3. PROTECT AND KEEP IN SERVICE ACTIVE UNDERGROUND UTILITIES, PIPES, OR CONDUITS, WHETHER INDICATED ON THE DRAWINGS OR NOT, UNLESS SPECIFICALLY CALLED FOR TO BE REMOVED, RELOCATED, OR DISCONNECTED AND ABANDONED.
4. CONTRACTORS AND SUBCONTRACTORS SHALL COORDINATE THEIR WORK WITH THAT OF OTHER TRADES.
5. NO WORK WILL BE PERMITTED TO BE INSTALLED WITHOUT RECIPT AND SUBSEQUENT REVIEW OF FULL AND COMPLETE SUBMITTALS BY THE ARCHITECT/ENGINEER.
6. DO NOT SCALE DRAWINGS, DIMENSIONS INDICATED TAKE PRECEDENCE OVER SCALE.
7. VERIFY ALL DIMENSIONS AND ELEVATIONS IN THE FIELD. WHERE DISCREPANCIES ARE FOUND BETWEEN DIMENSIONS OR ELEVATIONS SHOWN AND ACTUAL FIELD CONDITIONS, NOTIFY ARCHITECT/ENGINEER.
8. WHERE CONFLICTS MAY EXIST BETWEEN THE REQUIREMENTS OF PORTIONS OF THE CONTRACT DOCUMENTS, THE GREATER QUANTITY, HIGHER QUALITY OR MORE STRINGENT REQUIREMENT SHALL GOVERN. THEREFORE, BY EXECUTING A CONTRACT FOR CONSTRUCTION, THE CONTRACTOR AGREES THAT, IF IT RAISED NO QUESTIONS REGARDING SUCH CONFLICTS DURING THE BIDDING PROCESS, AND IN THE ABSENCE OF A CLARIFYING ADDENDUM ISSUED DURING THE BIDDING PROCESS, IT HAS VOLUNTEERED TO COMPLY WITH THE MORE EXPENSIVE REQUIREMENT AS PART OF ITS BASE BID AND IS NOT ENTITLED TO ANY ADDITIONAL COMPENSATION TO RESOLVE THE CONFLICT.
9. THE CONTRACT DOCUMENTS REQUIRE THE CONTRACTOR TO FURNISH AND INSTALL COMPLETE PRODUCTS, SYSTEMS AND SERVICES. BY EXECUTING A CONTRACT FOR CONSTRUCTION, THE CONTRACTOR AGREES THAT THE DRAWINGS SET FORTH THE DESIGN INTENT AND, THEREFORE, MAY NOT EXPRESSLY DEPICT EVERY LENGTH, SEGMENT, PIECE, PART, COMPONENT OR UNIT OF A PRODUCT, SYSTEM OR SERVICE. THE CONTRACTOR FURTHER AGREES THAT, AS PART OF ITS BID, IT MUST FURNISH AND INSTALL EVERY LENGTH, SEGMENT, PIECE, PART, COMPONENT OR UNIT OF A PRODUCT, SYSTEM OR SERVICE AND, CONSEQUENTLY, THE CONTRACTOR IS NOT ENTITLED TO ANY ADDITIONAL COMPENSATION FOR ANY LENGTH, SEGMENT, PIECE, PART COMPONENT OR UNIT OF A PRODUCT, SYSTEM OR SERVICE BECAUSE IT IS NOT EXPRESSLY DEPICTED HEREIN.

B: MISCELLANEOUS AND DEMOLITION NOTES

1. COORDINATE PENETRATIONS AND/OR SLEEVES REQUIRED IN WALLS, FLOORS, CEILINGS OR ROOFS FOR MECHANICAL AND ELECTRICAL WORK REQUIRED BY ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS.
2. SEAL PENETRATIONS OF DUCTWORK, CONDUIT OR PIPES WITH UL APPROVED MATERIALS TO MAINTAIN THE FIRE RATING OF ASSEMBLIES. PROVIDE FIRE DAMPERS AS INDICATED ON THE DRAWINGS.
3. APPLY APPROPRIATE & COMPATIBLE SEALANT MATERIALS AS REQUIRED TO SEPARATE DISSIMILAR METALS, FILL GAPS IN EXISTING ASSEMBLIES OR WHERE NEW AND EXISTING ASSEMBLIES MEET OR WHERE OTHERWISE REQUIRED BY THE SPECIFICATIONS.
4. BRING ANY UNFORESEEN OR CONFLICTING CONDITIONS TO THE IMMEDIATE ATTENTION OF THE ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE WORK.
5. REPAIR, PATCH, OR REPLACE FINISH MATERIALS OR VISIBLE ASSEMBLIES THAT ARE SOILED, CUT OR DAMAGED IN ANY FASHION DURING THE COURSE OF THE WORK. PERFORM PATCHING SUCH THAT EDGES BLEND INTO CONTIGUOUS SURFACES SMOOTHLY, MATCHING TEXTURE AND COLOR OF ADJACENT SURFACES.

STANDARD ABBREVIATIONS

@	– AT	EXP	– EXPANSION	PL	– PLATE
A B	– ANCHOR BOLT	EXP CONST	– EXPOSED CONSTRUCTION	PL LAM	– PLASTIC LAMINATE
ABR	– ABRASIVE	FD	– FLOOR DRAIN	PL	– PLASTER
AT–(1)	– ACOUSTIC TILE CEILING (TYPE)	FDN	– FOUNDATION	PLB'G	– PLUMBING
AFF	– ABOVE FINISH FLOOR	FE	– FIRE EXTINGUISHER	PLB'G CONTR	– PLUMBING CONTRACTOR
AFG	– ABOVE FINISH GRADE	FEC	– FIRE EXTINGUISHER CABINET	PLYWD	– PLYWOOD
ACOUS	– ACOUSTIC	FHC	– FIRE HOSE CABINET	PNT	– PAINT
ADD'N	– ADDITION	FIN	– FINISH	PVC	– POLYVINYL CHLORIDE
ADD'L	– ADDITIONAL	FLR	– FLOOR	PL–(1)	– GYPSUM PLASTER (TYPE)
ADJ	– ADJACENT	FRT	– FIRE RETARDANT TREATED (RATED)	R OR RAD	– RADIUS
ADJT	– ADJUSTABLE	FUR CHN'L	– FURRING CHANNEL	R	– RISER
AL	– ALUMINUM	FTG	– FOOTING	RD	– ROOF DRAIN
ALT	– ALTERNATE	GA	– GAUGE	RO	– ROUGH OPENING
ANCH	– ANCHOR	GALV	– GALVANIZED	RF (1)	– RUBBER FLOORING (TYPE)
AP	– ACCESS PANEL	GEN CONTR	– GENERAL CONTRACTOR	RH	– RIGHT HAND
APPROX	– APPROXIMATE	GC	– GENERAL CONTRACTOR	REF	– REFERANCE
ASPH	– ASPHALT	GL	– GLASS	REINF	– REINFORCING
AUTO	– AUTOMATIC	GYP DB–(1)	– GYPSUM WALL BOARD (DRYWALL)(TYPE)	REQ'D	– REQUIRED
AVG	– AVERAGE	GYP PL–(1)	– GYPSUM PLASTER (TYPE)	RM	– ROOM
BSMT	– BASEMENT	H	– HIGH	SF	– SQUARE FOOT
BD	– BOARD	HD	– HEAVY DUTY	SI	– SQUARE INCH
BITUM	– BITUMINOUS/BITUMASTIC	HD	– HARD	SK	– SINK
BLDG	– BUILDING	HDNR	– HARDENER	SS	– STAINLESS STEEL
BLK'G	– BLOCKING (WOOD)	HD WD–(1)	– HARD WOOD (TYPE)	SSK	– SERVICE SINK
BM	– BEAM	HDWRE	– HARDWARE	SQ	– SQUARE
B.M.	– BENCH MARK	HGT	– HEIGHT	SCHED	– SCHEDULE
BT STL PL	– BENT STEEL PLATE	HM	– HOLLOW METAL	SEAL/HDNR	– SEALER/HARDENER
BRG	– BEARING	HP	– HIGH POINT	SEC	– SECTION
BRKT	– BRACKET	HORIZ	– HORIZONTAL	SHT	– SHEET
BRK	– BRICK	HTG	– HEATING	SIM	– SIMILAR
BTM	– BOTTOM	HVAC	– HEATING/VENTILATING/AIR CONDITIONING	SOG	– SLAB ON GRADE
BTW'N	– BETWEEN	IN	– INCH	SPEC	– SPECIFICATION(S)
CJ	– CONSTRUCTION/CONTRACTION JOINT	ID	– INSIDE DIAMETER	SPC'G	– SPACING
CAB	– CABINET	INCL	– INCLUDE (D)	SPK'R	– SPEAKER
CEM PL–(1)	– CEMENT PLASTER (TYPE)	INSUL	– INSULATION OR INSULATING	STN	– STN
CT PAV–(1)	– CERAMIC PAVER TILE (TYPE)	JT	– JOINT	STD	– STANDARD
CIPC	– CAST– IN– PLACE CONCRETE	KD	– KNOCK DOWN	STD WGT	– STANDARD WEIGHT
CLG	– CEILING	L	– LONG	STL	– STEEL
CLR	– CLEAR	LAM	– LAMINATED	STRUCT	– STRUCTURAL OR STRUCTURE
CO	– CLEAN OUT	LAV	– LAVATORY	SUSP	– SUSPEND(ED)
CMU	– CONCRETE MASONRY UNIT	LH	– LEFT HAND	SYM	– SYMMETRICAL
COL	– COLUMN	LP	– LOW POINT	T	– TREAD
COMB	– COMBINATION	LGT WGT	– LIGHTWEIGHT	T&G	– TONGUE AND GROOVE
COMP	– COMPRESSIBLE	LL	– LIVE LOAD	T/B	– TOP OF BEAM
COMPT'D	– COMPACTED	LLH	– LONG LEG HORIZONTAL	T/C	– TOP OF CURB
CONC	– CONCRETE	LLV	– LONG LEG VERTICAL	T/F	– TOP OF FOUNDATION
CONC OPNG	– CONCRETE OPENING	LVR	– LOUVER	T/S	– TOP OF SLAB
COND	– CONDITION	MO	– MASONRY OPENING	T/STL	– TOP OF STEEL
CONT	– CONTINUOUS	MT	– METAL THRESHOLD	T/W	– TOP OF WALL
CONTR	– CONTRACT (OR)	MAS'Y	– MASONRY	TB (4)	– TACKBOARD (LENGTH)
CPT–(1)	– CARPET (TYPE)	MAT'L	– MATERIAL	TOM	– TOP OF MASONRY
CT–(1)	– CERAMIC TILE (TYPE)	MAX	– MAXIMUM	TYP	– TYPICAL
CTR	– COUNTER	MB–(16)	– MARKERBOARD– (LENGTH)	UNO	– UNLESS NOTED OTHERWISE
CTR SK	– COUNTER SINK	MECH	– MECHANICAL	VBC	– VINYL BASE COVED
CTS	– CENTER(S)	MECH CONTR	– MECHANICAL CONTRACTOR	VBS	– VINYL BASE STRAIGHT
CUH	– CABINET UNIT HEATER	MFR	– MANUFACTURER	VCT	– VINYL COMPOSITION TILE
CUV	– CABINET UNIT VENTILATOR	MIN	– MINIMUM	VEN PL (1)	– VENEER PLASTER (TYPE)
DIA	– DIAMETER	MISC	– MISCELLANEOUS	VERT	– VERTICAL
DIM	– DIMENSION	MSB	– MOP SERVICE BASIN (SINK)	W	– WIDE OR WIDTH
DN	– DOWN	MT(D)	– MOUNT(ED)	W/	– WITH
DR	– DOOR	MTL	– METAL	W/O	– WITHOUT
DWG'S	– DRAWINGS	NIC	– NOT IN CONTRACT	WCG	– WALL CORNER GUARD
DTL	– DETAIL	NOM	– NOMINAL	WD	– WOOD
DWL'S	– DOWELS	NTS	– NOT TO SCALE	WDN	– WINDOW
EA	– EACH	NO	– NUMBER	WGT	– WEIGHT
EJ	– EXPANSION JOINT	OA	– OVERALL	WP	– WATER PROOF
EL	– ELEVATION	OC	– ON CENTER	WWF	– WELDED WIRE FABRIC
ELEC	– ELECTRIC/ELECTRICAL	OD	– OUTSIDE DIAMETER	WSB	– WALL SERVICE BASIN
ELEC CONTR	– ELECTRICAL CONTRACTOR	OF	– OUTSIDE FACE		
ELEV	– ELEVATOR	OPN'G	– OPENING		
EMBED	– EMBEDMENT	OPP	– OPPOSITE		
EMER	– EMERGENCY	OPP HD	– OPPOSITE HAND		
EP PNT	– EPOXY PAINT	PSF	– POUNDS PER SQUARE FOOT		
EQ	– EQUAL	PSI	– POUNDS PER SQUARE INCH		
EW	– EACH WAY	PT	– PRESSURE TREATED		
EWC	– ELECTRIC WATER COOLER	PTN	– PARTITION		
EWH	– ELECTRIC WATER HEATER	PAV'T	– PAVEMENT		
ER–(26)	– EXHIBIT RAIL (LENGTH)	PC	– PIECE		
EXIST	– EXISTING	PFM	– PERMANENT FLOOR MAT		

THE MATERIALS, ABBREVIATIONS, AND DRAFTING SYMBOLS LEGEND ARE EACH AN ALL INCLUSIVE MASTER LIST USED BY THIS FIRM. THE INCLUSION OF THESE LEGENDS INTO THESE DOCUMENTS DOES NOT IMPLY THAT ALL THE SYMBOLS OR MATERIALS INCLUDED IN THESE LEGENDS ARE INCORPORATED INTO THIS PROJECT.

DRAFTING MATERIALS LEGEND

DETAIL NUMBER / DRAWING NUMBER	8 / A12.24
DETAIL NUMBER / DRAWING NUMBER	23 / A7.19
DETAIL NUMBER / DRAWING NUMBER	2, 6, A9.16, 5, 3
DETAIL NUMBER / DRAWING NUMBER	1 / A6.05
COLUMN NUMBER	26
LOCATION ELEVATION	1ST FLR. 100'–0"
ROOM NUMBER	204
DOOR NO. NEW / DOOR NO. EXISTING	203.2 / 203.1X
NOMINAL THICKNESS / CONSTRUCTION TYPE / SPECIAL CONDITION	8 / 5
KEYNOTE IDENTIFICATION	23.211
WINDOW TYPE IDENTIFICATION	X
TOILET ACCESSORY IDENTIFICATION	X
SPOT ELEVATION	T/1ST FLR. = 100'–0"
STEEL	
EARTH	
CONCRETE	
INSULATION RIGID	
INSULATION BATT	
BRICK	
WOOD FINISHED	
BLOCKING DISCONTINUOUS	
BLOCKING CONTINUOUS	
CONCRETE MASONRY UNIT (RUNNING BOND)	
CONCRETE MASONRY UNIT (STACK BOND)	
BITUMINOUS CONCRETE	
ACOUSTIC CEILING PANEL	
GYPSUM WALL BOARD	
GRAVEL	
RAKED JOINT CJ / EJ	

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INDEX OF DRAWINGS

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SEALS & CERTIFICATES

I HAVE PREPARED, OR CAUSED TO BE PREPARED UNDER MY DIRECT SUPERVISION, THE ATTACHED PLANS AND SPECIFICATIONS AND STATE THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND TO THE EXTENT OF MY CONTRACTUAL OBLIGATION, THEY ARE IN COMPLIANCE WITH IBC 2018 EDITION, THE ENVIRONMENTAL BARRIERS ACT AND THE ILLINOIS ACCESSIBILITY CODE.

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ISSUED
BID DOCUMENTS
01/26/23

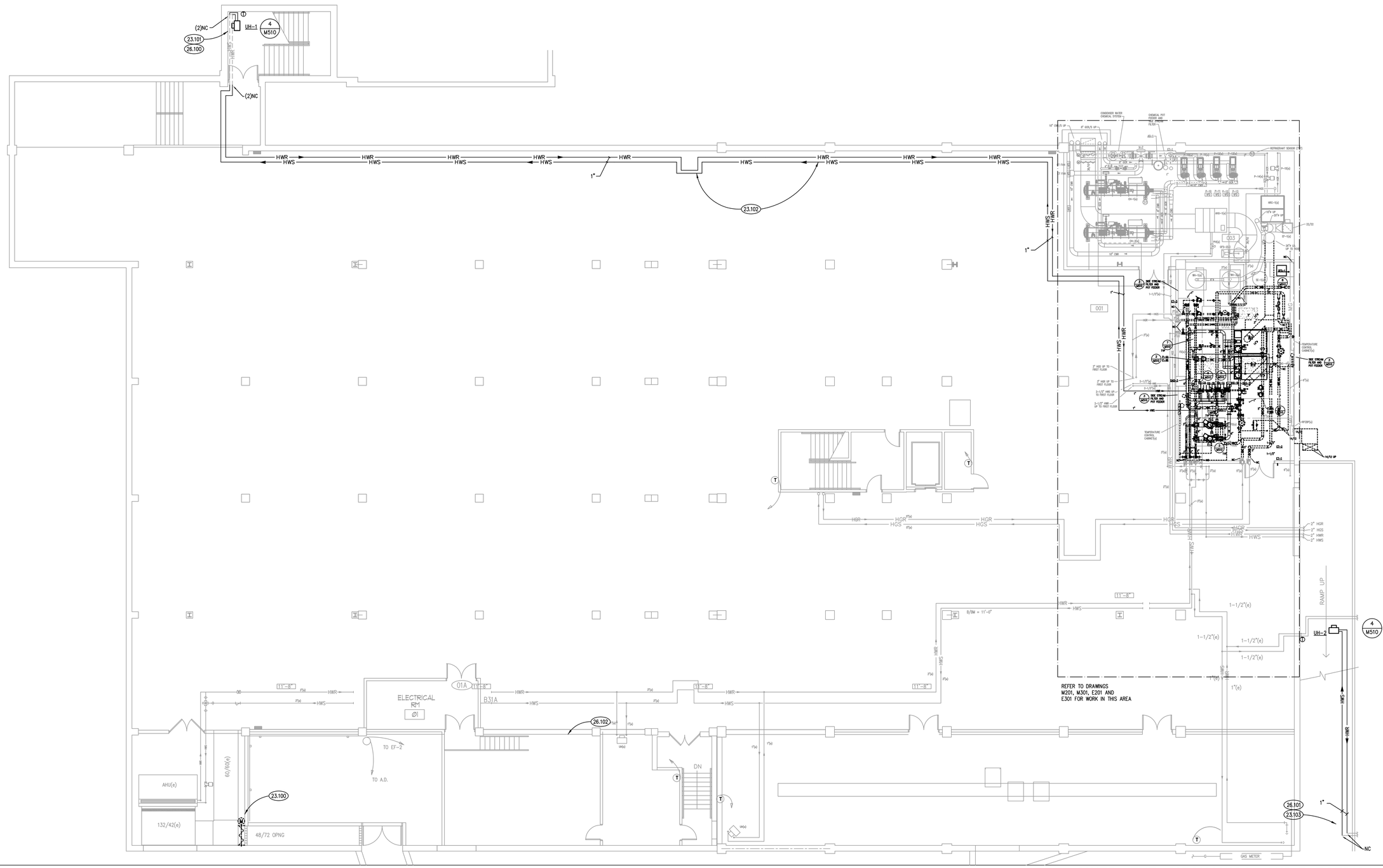
JOB NO.	22-315-1446
DRAWN	DDW
CHECKED	DDW
APPROVED	DDW

SHEET TITLE
COVER SHEET, GENERAL NOTES, SYMBOLS, & DRAWING INDEX

SHEET NUMBER
G100

P:\1446 - Oakton - Skokie Boilers & Heat Exchangers\00_Design\Dwgs\DD-CD\01_Cem\1446 - G0100.dwg, 1/19/2023 10:18:59 AM, DDW

NOTE: SCALES DEPICTED ON THIS DRAWING ARE NOT CORRECT UNLESS PLOTTED SHEET SIZE IS 30 X 42 INCHES.



LOWER LEVEL MECHANICAL AND ELECTRICAL PLAN (1)

SCALE: 1/8" = 1'-0"

GENERAL NOTES

1. REFER TO DRAWING G100 FOR PROJECT GENERAL NOTES.
2. ALL PIPING, DUCTWORK AND RACEWAYS ARE SHOWN DIAGRAMMATICALLY AND DO NOT SHOW ALL REQUIRED FITTINGS, OFFSETS, DROPS AND RISES. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL MATERIAL AND LABOR FOR A COMPLETE AND WORKING SYSTEM. COORDINATE WITH OTHER TRADES FOR SPACE AVAILABLE AND RELATIVE LOCATIONS OF EQUIPMENT, PIPING, DUCTWORK, ETC.
3. EXISTING PIPING, DUCTWORK AND RACEWAYS INDICATED ON THESE PLANS SHALL BE FIELD VERIFIED FOR EXACT LOCATIONS, QUANTITY AND SIZES.
4. SPACE ALLOCATION, COORDINATION WITH ELECTRICAL, ARCHITECTURAL & OTHER MECHANICAL COMPONENTS HAVE BEEN MADE WITH RESPECT TO ALL EQUIPMENT SCHEDULED ON THESE DRAWINGS AND IN THE SPECIFICATIONS OF THE FIRST NAMED MANUFACTURER ONLY. OTHER MANUFACTURERS ARE ACCEPTABLE PROVIDED THEY MEET PERFORMANCE REQUIREMENTS AND AFOREMENTIONED COORDINATION.
5. DO NOT CUT THROUGH THE MASONRY BOND BEAMS OR OTHER STRUCTURAL ELEMENT WHEN INSTALLING OPENINGS REQUIRED FOR ALL DUCTWORK, PIPING, CONDUITS OR OTHER WORK. COORDINATE WITH THE STRUCTURAL DRAWINGS AND MASON CONTRACTOR FOR ALL BOND BEAM AND STRUCTURAL ELEMENT LOCATIONS. CONTRACTOR CUTTING THROUGH OR OTHERWISE DAMAGING THESE ELEMENTS WILL BE RESPONSIBLE FOR ALL ASSOCIATED ENGINEERING FEES AND SUBSEQUENT RETRO-FIT/REINFORCING DEEMED NECESSARY TO REINSTATE THE CONTINUITY OF THE DISRUPTED ELEMENTS.
6. OBTAIN AND PAY ALL COSTS FOR PERMITS, LICENSES, CERTIFICATE FILING AND ALL INSPECTIONS BY AUTHORITIES HAVING JURISDICTION.

KEYNOTES

KEYNOTES ARE TYPICALLY NOT DUPLICATED WITHIN A GIVEN DETAIL. AN UN-KEYNOTED ITEM IN A DETAIL IS THE SAME AS A KEYNOTED ITEM HAVING THE SAME APPEARANCE WITHIN THE SAME DETAIL.

23.100 REMOVE DUCTWORK CONNECTING TO OUTSIDE AIR LOUVER. REMOVE DAMPERS AND ACTUATOR. CAP LOUVER WITH INSULATED PANEL AND SEAL AIR TIGHT.

23.101 REMOVE ELECTRIC UNIT HEATER, PIPING CIRCUIT SETTER AND ISOLATION VALVE IN STAIR. FLUSH EXISTING BRANCH PIPING LOCATED BETWEEN BASEMENT AND UNIT HEATER LOCATION. PROVIDE NEW HOT WATER UNIT HEATER, THERMOSTAT AND ASSOCIATED SPECIALTIES.

23.102 REMOVE 4-INCH ABANDONED PIPING ALONG NORTHSIDE OF BASEMENT BETWEEN CHILLER ROOM AND STAIR. PIPE HANGERS TO REMAIN IN PLACE FOR NEW PIPES. PROVIDE NEW 1-INCH HWS AND HWR PIPES BETWEEN BOILER ROOM AND NEW STAIR UNIT HEATER. PROVIDE EXPANSION LOOP WHERE SHOWN. PROVIDE ADDITIONAL HANGERS AS REQUIRED TO PROPERLY SUPPORT PIPES.

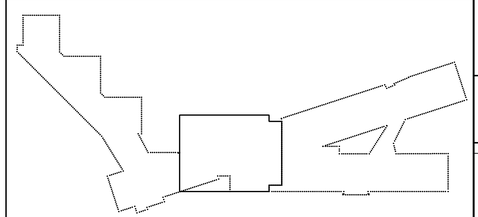
23.103 REMOVE HOT WATER UNIT HEATER AT TOP OF RAMP. PROVIDE NEW HOT WATER UNIT HEATER, THERMOSTAT AND SPECIALTIES NEAR BOTTOM OF RAMP AT VERTICAL WALL. PROVIDE PIPES FROM EXISTING 1-INCH BRANCH PIPES TO NEW UNIT HEATER LOCATION.

26.100 DISCONNECT AND PROTECT EXISTING ELECTRICAL CONNECTION TO ELECTRIC UNIT HEATER TO BE REPLACED. EXTEND EXISTING BRANCH CIRCUITRY TO NEW HOT WATER UNIT HEATER TO ENSURE A COMPLETE AND OPERATIONAL SYSTEM.

26.101 DISCONNECT AND PROTECT EXISTING ELECTRICAL CONNECTION TO HOT WATER UNIT HEATER TO BE REPLACED. PROVIDE PERMANENT SPLICE AND EXTEND EXISTING BRANCH CIRCUITRY TO NEW LOCATION TO ENSURE A COMPLETE AND OPERATIONAL SYSTEM. MATCH EXISTING.

26.102 LOCATION OF SWITCHBOARD BDL1.

KEY PLAN



PLAN NORTH

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ISSUED	
01/20/23	BID DOCUMENTS

JOB NO.	22-315-1446
DRAWN	KJL/ATR
CHECKED	DDW/MTK
APPROVED	DDW/MTK

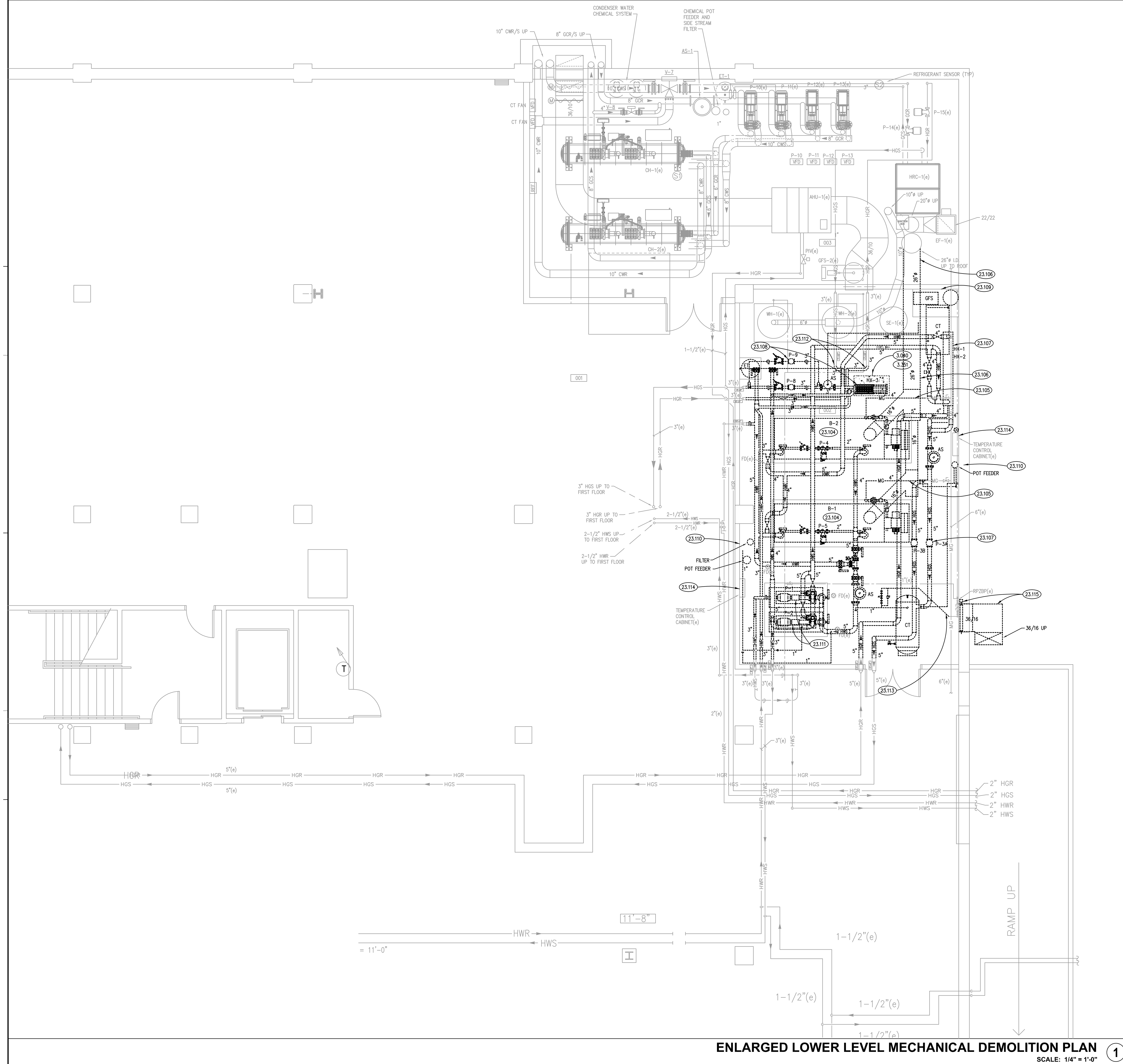
SHEET TITLE

LOWER LEVEL MECHANICAL AND ELECTRICAL PLAN

SHEET NUMBER

ME200

NOTE: SCALES DEPICTED ON THIS DRAWING ARE NOT CORRECT UNLESS PLOTTED SHEET SIZE IS 30 X 42 INCHES.



ENLARGED LOWER LEVEL MECHANICAL DEMOLITION PLAN (1)

SCALE: 1/4" = 1'-0"

KEYNOTES

KEYNOTES ARE TYPICALLY NOT DUPLICATED WITHIN A GIVEN DETAIL. AN UN-KEYNOTED ITEM IN A DETAIL IS THE SAME AS A KEYNOTED ITEM HAVING THE SAME APPEARANCE WITHIN THE SAME DETAIL.

3.040 EXISTING CONCRETE HOUSEKEEPING PAD TO BE REMOVED. AFTER REMOVAL, PATCH AND REPAIR EXISTING SLAB BELOW REMOVED PAD AS REQUIRED TO OBTAIN SMOOTH, FLAT SURFACE TO MATCH SURROUNDING EXISTING CONCRETE.

3.351 CAST-IN-PLACE CONCRETE ACCESSORY: PATCHING AND SURFACING COMPOUND.

23.104 REMOVE BOILER (DISASSEMBLE AS REQUIRED TO REMOVE THROUGH EXISTING DOORWAYS), BOILER PUMP, COMPRESSION TANK, AIR SEPARATOR AND ALL ASSOCIATED HOT WATER PIPING AS SHOWN TO LOCATION EXITING BOILER ROOM. PROVIDE TEMPORARY CAP FOR NEW CONNECTION.

23.105 REMOVE GAS PIPING BACK TO NEAR SHUT-OFF VALVE AND PROVIDE TEMPORARY CAP FOR NEW CONNECTION.

23.106 REMOVE BOILER EXHAUST VENTING FROM BOILER ROOM AND INTO CHILLER ROOM WHERE VENTING TURNS VERTICAL. VERTICAL VENTING SHALL REMAIN IN PLACE TO ACT AS SLEEVE FOR NEW BOILERS VENTING. REMOVE BOTTOM OF CHIMNEY AS REQUIRED TO ALLOW ELBOW TRANSITION UP.

23.107 DRAIN ETHYLENE GLYCOL AND RETAIN FOR REUSE. TEST GLYCOL PERCENTAGE AND REPORT TO OWNER. IF GLYCOL IS UNFIT FOR REUSE, DISPOSE OF IN ACCORDANCE WITH ALL REGULATORY REQUIREMENTS. REMOVE TWO SHELL AND TUBE HEAT EXCHANGER. REMOVE ASSOCIATED PUMPS, COMPRESSION TANK, AIR SEPARATOR, SPECIALTIES, AND HEATING GLYCOL PIPING AS SHOWN TO LOCATION EXITING BOILER ROOM. PROVIDE TEMPORARY CAP FOR NEW CONNECTION. RETAIN PUMPS IN CASE OF REQUIRED TEMPORARY USE UNTIL NEW PUMPS ARE INSTALLED.

23.108 DRAIN ETHYLENE GLYCOL AND RETAIN FOR REUSE. TEST GLYCOL PERCENTAGE AND REPORT TO OWNER. IT GLYCOL IS UNFIT FOR REUSE, DISPOSE OF IN ACCORDANCE WITH ALL REGULATORY REQUIREMENTS. REMOVE PLATE AND FRAME HEAT EXCHANGER. REMOVE ASSOCIATED PUMPS, EXPANSION TANK, AIR SEPARATOR, SPECIALTIES, AND HEATING GLYCOL PIPING AS SHOWN TO LOCATION EXITING BOILER ROOM. PROVIDE TEMPORARY CAP FOR NEW CONNECTION. RETAIN PUMPS IN CASE OF REQUIRED TEMPORARY USE UNTIL NEW PUMPS ARE INSTALLED

23.109 REMOVE GLYCOL FILL TANK, PUMPS AND ALL ASSOCIATED PIPING.

23.110 REMOVE POT FEEDER, FILTER AND ALL ASSOCIATED PIPING.

23.111 REMOVE HEATING PUMPS, INERTIA BASES AND ALL ASSOCIATED SPECIALTIES. RETAIN PUMPS IN CASE OF REQUIRED TEMPORARY USE UNTIL NEW PUMPS ARE INSTALLED.

23.112 REMOVE HEAT RECOVERY CHILLER HEATING GLYCOL PIPING TO LOCATION SHOWN AND PROVIDE TEMPORARY CAP FOR NEW CONNECTION.

23.113 REMOVE MAKE-UP WATER PIPING AND SPECIALTIES AND PROVIDE TEMPORARY CAP FOR NEW CONNECTION.

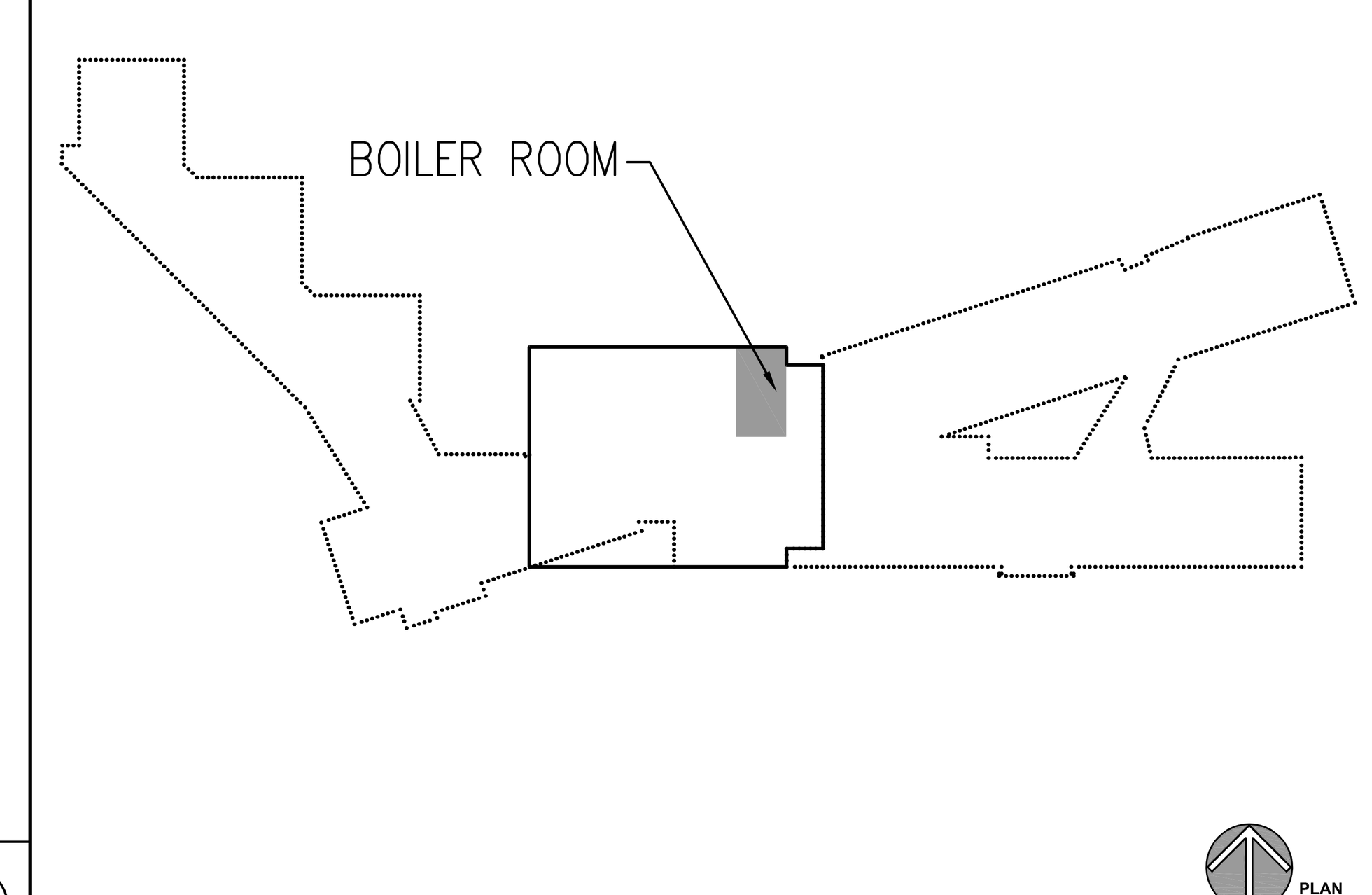
23.114 REMOVE ALL TEMPERATURE CONTROLS SENSORS AND OBSOLETE CONTROLLERS ASSOCIATED WITH HEATING SYSTEM.

23.115 REMOVE SCREENING, DAMPER AND ANY DUCTWORK FROM BOILER ROOM OPENING UP TO LOADING DOCK AREA.

GENERAL NOTES

1. REFER TO DRAWING G100 FOR PROJECT GENERAL NOTES.
2. ALL PIPING, DUCTWORK AND RACEWAYS ARE SHOWN DIAGRAMMATICALLY AND DO NOT SHOW ALL REQUIRED FITTINGS, OFFSETS, DROPS AND RISES. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL MATERIAL AND LABOR FOR A COMPLETE AND WORKING SYSTEM. COORDINATE WITH OTHER TRADES FOR SPACE AVAILABLE AND RELATIVE LOCATIONS OF EQUIPMENT, PIPING, DUCTWORK, ETC.
3. EXISTING PIPING, DUCTWORK AND RACEWAYS INDICATED ON THESE PLANS SHALL BE FIELD VERIFIED FOR EXACT LOCATIONS, QUANTITY AND SIZES.
4. SPACE ALLOCATION, COORDINATION WITH ELECTRICAL, ARCHITECTURAL & OTHER MECHANICAL COMPONENTS HAVE BEEN MADE WITH RESPECT TO ALL EQUIPMENT SCHEDULED ON THESE DRAWINGS AND IN THE SPECIFICATIONS OF THE FIRST NAMED MANUFACTURER ONLY. OTHER MANUFACTURERS ARE ACCEPTABLE PROVIDED THEY MEET PERFORMANCE REQUIREMENTS AND AFOREMENTIONED COORDINATION.
5. DO NOT CUT THROUGH THE MASONRY BOND BEAMS OR OTHER STRUCTURAL ELEMENT WHEN INSTALLING OPENINGS REQUIRED FOR ALL DUCTWORK, PIPING, CONDUITS OR OTHER WORK. COORDINATE WITH THE STRUCTURAL DRAWINGS AND MASON CONTRACTOR FOR ALL BOND BEAM AND STRUCTURAL ELEMENT LOCATIONS. CONTRACTOR CUTTING THROUGH OR OTHERWISE DAMAGING THESE ELEMENTS WILL BE RESPONSIBLE FOR ALL ASSOCIATED ENGINEERING FEES AND SUBSEQUENT RETRO-FIT/REINFORCING DEEMED NECESSARY TO REINSTATE THE CONTINUITY OF THE DISRUPTED ELEMENTS.
6. OBTAIN AND PAY ALL COSTS FOR PERMITS, LICENSES, CERTIFICATE FILING AND ALL INSPECTIONS BY AUTHORITIES HAVING JURISDICTION.

KEY PLAN



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SKOKIE, ILLINOIS 60077

ISSUED	
01/2023	BID DOCUMENTS

JOB NO.	22-315-1446
DRAWN	KJL
CHECKED	DDW
APPROVED	DDW

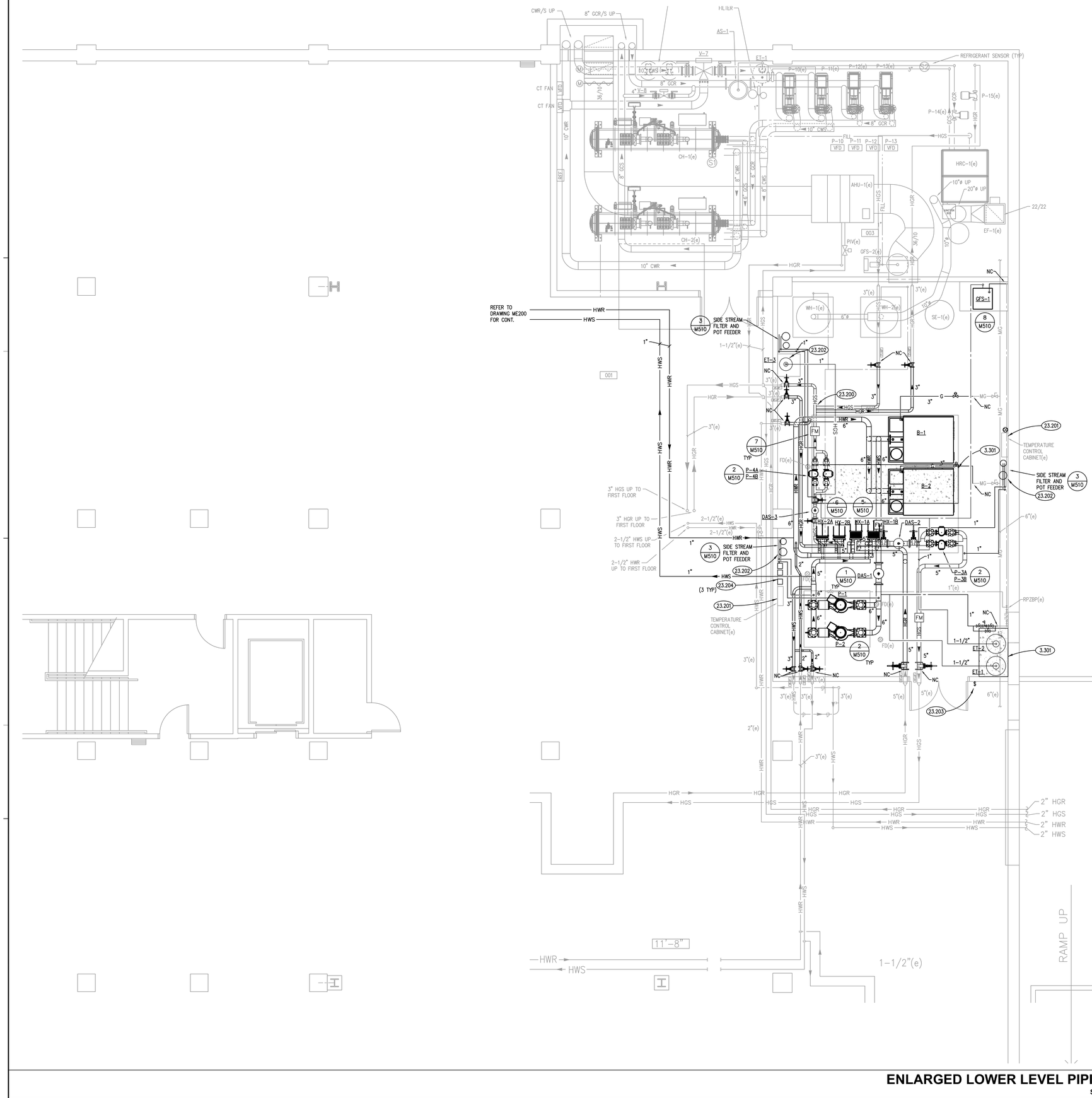
SHEET TITLE

ENLARGED LOWER LEVEL MECHANICAL DEMOLITION PLAN

SHEET NUMBER

M201

NOTE: SCALES DEPICTED ON THIS DRAWING ARE NOT CORRECT UNLESS PLOTTED SHEET SIZE IS 30 X 42 INCHES.



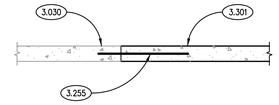
ENLARGED LOWER LEVEL PIPING PLAN (1)
SCALE: 1/4" = 1'-0"

KEYNOTES

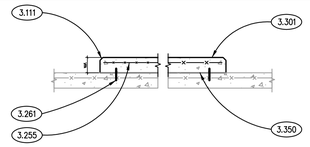
KEYNOTES ARE TYPICALLY NOT DUPLICATED WITHIN A GIVEN DETAIL. AN UN-KEYNOTED ITEM IN A DETAIL IS THE SAME AS A KEYNOTED ITEM HAVING THE SAME APPEARANCE WITHIN THE SAME DETAIL.

3.030 EXISTING CONCRETE HOUSEKEEPING PAD TO REMAIN.
3.111 CONCRETE FORMING AND ACCESSORIES: CONTINUOUS 3/4" CHAMFER U.N.O.
3.255 CONCRETE REINFORCING: #4 DOWEL X 2'-0" @ 1'-0" O.C. U.N.O. ANCHOR INTO EXISTING SLAB/WALL/FOOTING USING INJECTION ADHESIVE/EPOXY SYSTEM PER PROJECT SPECIFICATIONS. EMBEDMENT TO BE 6" U.N.O.
3.261 CONCRETE REINFORCING: #4 DOWEL X 5" LG. @ 2'-0" O.C. U.N.O. ANCHOR INTO EXISTING SLAB USING HILTI HY-150 INJECTION ADHESIVE. EMBEDMENT TO BE 3" U.N.O.
3.301 CAST-IN-PLACE CONCRETE: EQUIPMENT PAD IN-FILL. MATCH EXISTING EQUIPMENT PAD THICKNESS. CONCRETE MIX DESIGN PROPERTIES: f'c=4,000 PSI. FINISH EDGES AND TOP SURFACE TO MATCH EXISTING EQUIPMENT PAD. REFER TO TYPICAL DETAIL A/M301 & B/M301.
3.350 CAST-IN-PLACE CONCRETE ACCESSORY: BONDING AGENT. ROUGHEN BASE SLAB AS REQUIRED.

23.200 PROVIDE HEAT RECOVERY CHILLER CONNECTION TO HX-2A/2B HEATING GLYCOL LOOP. CONNECTIONS SHALL BE NO MORE THAN 3-5 PIPE DIAMETERS APART.
23.201 PROVIDE UPDATED CONTROLLERS FOR HEATING PLANT OPERATION. MODIFY BUILDING AUTOMATION POINTS AND GRAPHICS FOR NEW EQUIPMENT. SUBCONTRACT WITH OAKTON TEMPERATURE CONTROLS CONTRACTOR. AUTOMATED LOGIC, ERIE DONES, 630-470-3705.
23.202 SUBCONTRACT OAKTON CHEMICAL TREATMENT COMPANY FOR TREATMENT OF ALL HEATING SYSTEMS. GLOBAL WATER TECHNOLOGY, PATRICK MORGAN, 312-593-1804.
23.203 SUBCONTRACT OAKTON TEMPERATURE CONTROLS CONTRACTOR TO PROVIDE CONTROLS AS IDENTIFIED. AUTOMATED LOGIC, ERIE DONES, 630-470-3705.
23.204 PROVIDE ENERGY USAGE BTUH METER AND INTERFACE INTO BUILDING AUTOMATION SYSTEM.



TYP. NEW PAD TO EXIST. PAD DETAIL (B)
SCALE: N.T.S.



TYPICAL EQUIPMENT PAD DETAIL (A)
SCALE: N.T.S.

GENERAL NOTES

1. REFER TO DRAWING G100 FOR PROJECT GENERAL NOTES.
2. ALL PIPING, DUCTWORK AND RACEWAYS ARE SHOWN DIAGRAMMATICALLY AND DO NOT SHOW ALL REQUIRED FITTINGS, OFFSETS, DROPS AND RISES. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL MATERIAL AND LABOR FOR A COMPLETE AND WORKING SYSTEM. COORDINATE WITH OTHER TRADES FOR SPACE AVAILABLE AND RELATIVE LOCATIONS OF EQUIPMENT, PIPING, DUCTWORK, ETC.
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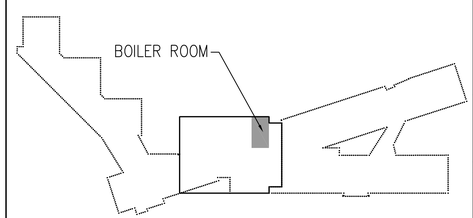
6. OBTAIN AND PAY ALL COSTS FOR PERMITS, LICENSES, CERTIFICATE FILING AND ALL INSPECTIONS BY AUTHORITIES HAVING JURISDICTION.

KEY PLAN



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DRAWN	KJL
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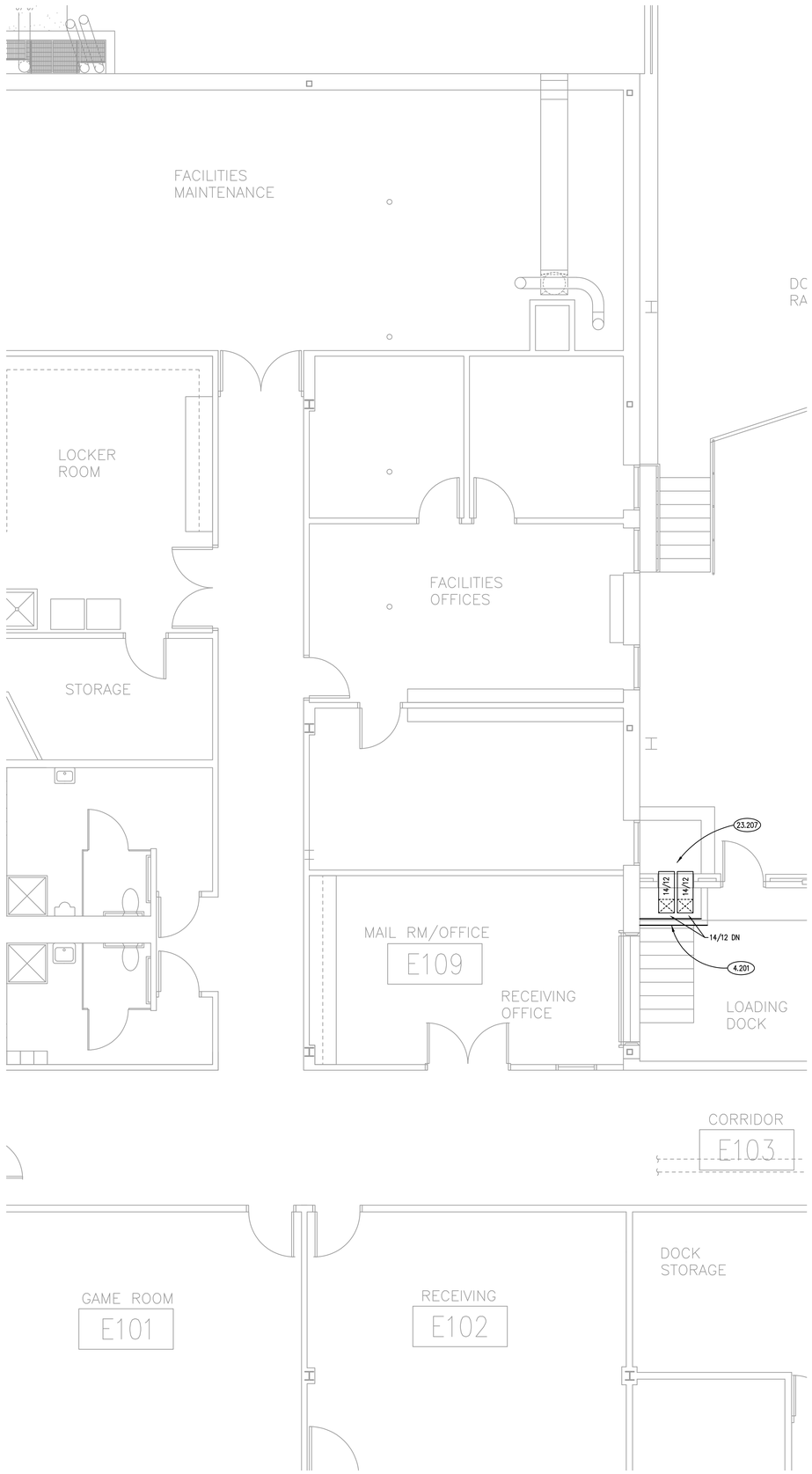
SHEET TITLE
ENLARGED LOWER LEVEL PIPING PLAN

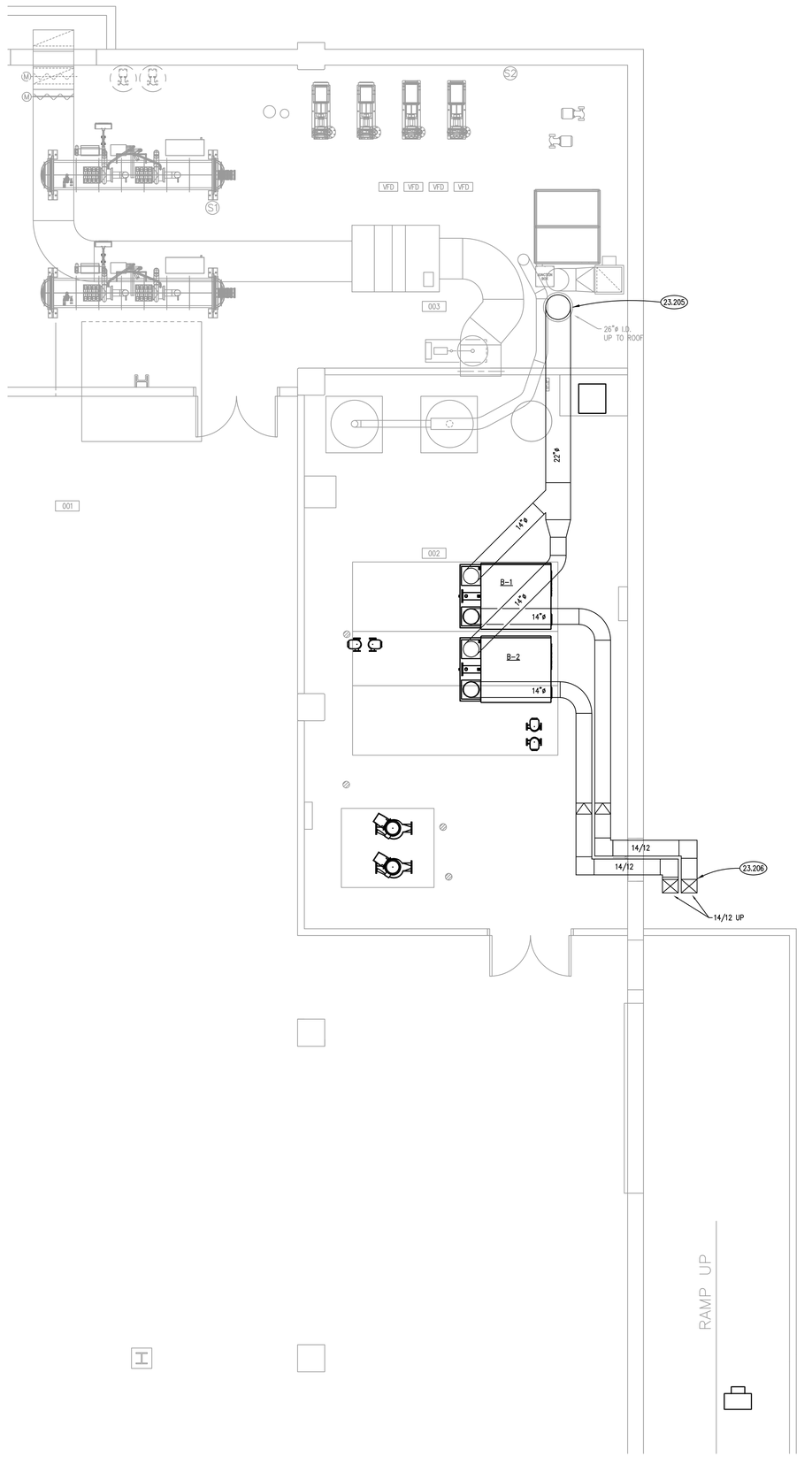
SHEET NUMBER
M301

PLAN NORTH



ENLARGED FIRST FLOOR VENTILATION PLAN (1)

SCALE: 1/4" = 1'-0"



ENLARGED LOWER LEVEL VENTILATION PLAN (1)

SCALE: 1/4" = 1'-0"

KEYNOTES

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4.201 MASONRY ASSEMBLY: DEMOLISH AND RE-BUILD PORTION OF EXISTING CONCRETE MASONRY UNIT WALL AS NECESSARY TO PERMIT ACCESS TO CHASE AND TO ALLOW PERFORMANCE OF DUCT INSTALLATION WORK; CAREFULLY CUT OUT AND REMOVE WHOLE CONCRETE MASONRY UNITS; TOOTH NEW MASONRY UNITS MATCHING EXISTING IN SIZE AND THICKNESS INTO EXISTING MASONRY; PERFORM RECONSTRUCTION IN ACCORDANCE WITH UL DESIGN NO. U906 FOR 2-HR FIRE-RATED WALL.

23.205 PROVIDE DOUBLE WALL STAINLESS STEEL CATEGORY IV FLUE EXHAUST VENTING BETWEEN BOILER AND EXHAUST STACK. STACK MAY BE TRANSITIONED TO SINGLE WALL STAINLESS STEEL FOR SLEEVING THOUGH EXISTING BASEMENT TO ROOF STACK. TERMINATE ON ROOF WITH VELOCITY CONE. SEAL EXHAUST VENT BETWEEN OLD VENT AND NEW VENTING AT BOTTOM OF STACK AND ON ROOF.

23.206 PROVIDE COMBUSTION AIR DUCTS FROM BOILERS UP EXISTING SHAFT TO LOADING DOCK AREA.

23.207 TERMINATE COMBUSTION AIR DUCTS 2 INCHES FROM FACE OF WALL AND COVER WITH GALVANIZED SCREEN. FLASH AROUND DUCTWORK AND WALL OPENING.

GENERAL NOTES

1. REFER TO DRAWING G100 FOR PROJECT GENERAL NOTES.
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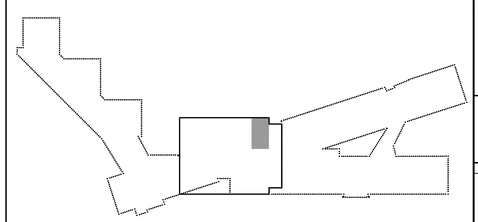
6. OBTAIN AND PAY ALL COSTS FOR PERMITS, LICENSES, CERTIFICATE FILING AND ALL INSPECTIONS BY AUTHORITIES HAVING JURISDICTION.

KEY PLAN



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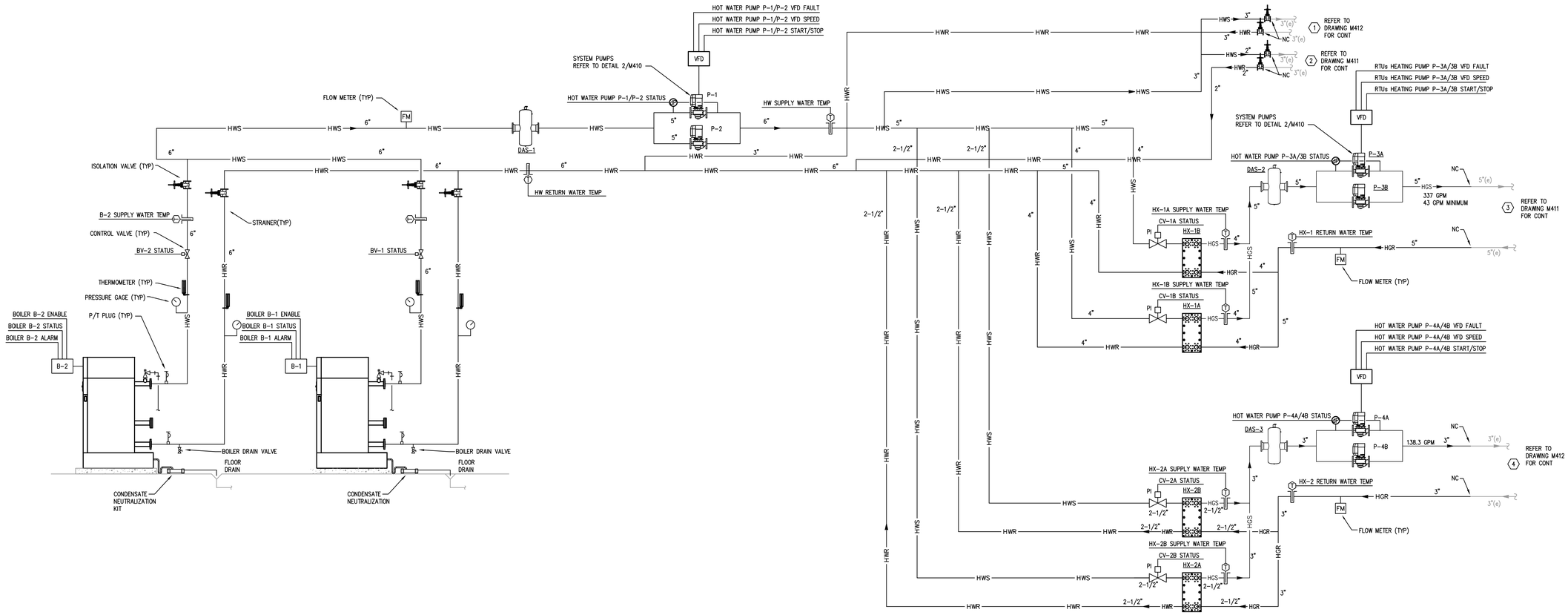
SHEET TITLE

ENLARGED LOWER LEVEL AND FIRST FLOOR VENTILATION PLANS

SHEET NUMBER

M302

BOILER ROOM PIPING AND CONTROLS SCHEMATIC



POINTS LIST

RTU HEAT EXCHANGERS

	HARDWARE				SOFTWARE			
	AI	AO	DI	DO	SCHED	TREND	ALARM	GRAPHIC
HEAT EXCHANGER ENABLE (HX-1A, HX-1B)				X	X			X
HEATING CONTROL VALVE (HX-1A, HX-1B		X					X	X
HEAT EXCHANGER PUMP START/STOP (P-3A, P-3B)				X			X	X
HEAT EXCHANGER PUMP STATUS (P-3A, P-3B)			X			X		X
HEAT EXCHANGER PUMP VFD SPEED (P-3A, P-3B)	X					X		X
HEAT EXCHANGER PUMP VFD FAULT (P-3A, P-3B)			X					X
GLYCOL HEATING SUPPLY TEMPERATURE	X					X	X	X
GLYCOL HEATING RETURN TEMPERATURE	X					X		X
GLYCOL FLOW RATE (FM-X)	X					X		X
RTU HEAT EXCHANGER FLOW RATE	X					X		X
RTU HEAT EXCHANGER ENERGY USAGE		X				X		X
GLYCOL FILL STATION LOW LEVEL ALARM			X				X	X

SEQUENCE OF OPERATIONS

HEAT EXCHANGER (HX-1A, HX-1B)

THE HEAT EXCHANGERS SHALL OPERATE IN A LEAD/LAG SEQUENCE. THE LEAD HEAT EXCHANGER SHALL BE ENABLED WHENEVER THERE IS A CALL FOR HEAT FROM ANY RTU-1 THROUGH RTU-6 OR MAU-1. THE OPERATOR SHALL BE ABLE TO DESIGNATE THE LEAD HEAT EXCHANGER AT THE BUILDING AUTOMATION SYSTEM. THE THE HEAT EXCHANGERS SHALL BE ALTERNATED AS LEAD ONCE EVERY WEEK (ADJ)

THE LEAD HEAT EXCHANGER CONTROL VALVE SHALL MODULATE TO MAINTAIN THE HEATING GLYCOL SUPPLY TEMPERATURE WHENEVER THERE IS A CALL FOR HEAT. THE HEATING GLYCOL SUPPLY TEMPERATURE SHALL BE RESET BASED ON AN OUTDOOR AIR TEMPERATURE. THE WATER TEMPERATURE SHALL BE 160 DEGREES F WHEN THE OUTDOOR AIR TEMPERATURE IS 0 DEGREES F. THE WATER TEMPERATURE SHALL BE 120 DEGREES WHEN THE OUTDOOR AIR TEMPERATURE IS 60 DEGREES F. TEMPERATURE RESET CURVES AND SETPOINTS SHALL BE ADJUSTABLE.

IF THE HEATING GLYCOL SUPPLY TEMPERATURE SET POINT IS NOT BEING MET BY MORE THAN 5 DEGREES F (ADJ) FOR MORE THAN 10 MINUTES (ADJ) OR THE LEAD HEAT EXCHANGER CONTROL VALVE IS MORE THAN 95% OPEN (ADJ), THEN THE LAG HEAT EXCHANGER SHALL BE ENABLED. BOTH HEAT EXCHANGER CONTROL VALVES SHALL MODULATE IN UNISON TO MAINTAIN THE HEATING GLYCOL SUPPLY TEMPERATURE. IF BOTH HEAT EXCHANGERS ARE IN OPERATION AND THE CONTROL VALVES ARE BELOW 40% (ADJ), THEN THE LAG HEAT EXCHANGER SHALL BE DISABLED.

RTU PUMPS (P-3A, P-3B)

THE HEAT EXCHANGER HEATING WATER PUMPS SHALL OPERATE IN A PARALLEL SEQUENCE. IF ONE PUMP FAILS THE SECOND PUMP SHALL CONTINUE TO OPERATE.

UPON A CALL FOR HEAT THE PUMPS SHALL BE ENERGIZED. THE PUMP SPEED SHALL MODULATE TO MEET THE SYSTEM DEMAND BASED ON SENSORLESS SYSTEM PRESSURE CONTROL.

AN ALARM SHALL BE GENERATED UPON A PUMP OR A VFD FAULT STATUS.

GLYCOL FILL STATION (GFS-1)

THE GLYCOL FILL STATION PRESSURE REDUCING VALVE SHALL BE SET AT THE MINIMUM COLD FILL PRESSURE. A LOCAL AUDIBLE ALARM BE ACTIVATED, ALARM AT THE BAS SHALL BE GENERATED, AND THE PUMP SHALL BE DISABLED.

POINTS LIST

AHU HEAT EXCHANGERS

	HARDWARE				SOFTWARE			
	AI	AO	DI	DO	SCHED	TREND	ALARM	GRAPHIC
HEAT EXCHANGER ENABLE (HX-2A, HX-2B)				X	X			X
HEATING CONTROL VALVE (HX-2A, HX-2B)		X					X	X
HEAT EXCHANGER PUMP START/STOP (P-4A, P-4B)				X			X	X
HEAT EXCHANGER PUMP STATUS (P-4A, P-4B)			X			X		X
HEAT EXCHANGER PUMP VFD SPEED (P-4A, P-4B)	X					X		X
HEAT EXCHANGER PUMP VFD FAULT (P-4A, P-4B)			X					X
GLYCOL HEATING SUPPLY TEMPERATURE	X					X	X	X
GLYCOL HEATING RETURN TEMPERATURE	X					X		X
GLYCOL FLOW RATE (FM-X)	X					X		X
AHU HEAT EXCHANGER FLOW RATE	X					X		X
AHU HEAT EXCHANGER ENERGY USAGE		X				X		X

SEQUENCE OF OPERATIONS

HEAT EXCHANGER (HX-2A, HX-2B)

THE HEAT EXCHANGERS SHALL OPERATE IN A LEAD/LAG SEQUENCE. THE LEAD HEAT EXCHANGER SHALL BE ENABLED WHENEVER THERE IS A CALL FOR HEAT FROM ANY AHU-1 THROUGH AHU-6. THE OPERATOR SHALL BE ABLE TO DESIGNATE THE LEAD HEAT EXCHANGER AT THE BUILDING AUTOMATION SYSTEM. THE THE HEAT EXCHANGERS SHALL BE ALTERNATED AS LEAD ONCE EVERY WEEK (ADJ)

THE LEAD HEAT EXCHANGER CONTROL VALVE SHALL MODULATE TO MAINTAIN THE HEATING GLYCOL SUPPLY TEMPERATURE WHENEVER THERE IS A CALL FOR HEAT. THE HEATING GLYCOL SUPPLY TEMPERATURE SHALL BE RESET BASED ON AN OUTDOOR AIR TEMPERATURE. THE WATER TEMPERATURE SHALL BE 140 DEGREES F WHEN THE OUTDOOR AIR TEMPERATURE IS 0 DEGREES F. THE WATER TEMPERATURE SHALL BE 100 DEGREES WHEN THE OUTDOOR AIR TEMPERATURE IS 60 DEGREES F. TEMPERATURE RESET CURVES AND SETPOINTS SHALL BE ADJUSTABLE.

IF THE HEATING GLYCOL SUPPLY TEMPERATURE SET POINT IS NOT BEING MET BY MORE THAN 5 DEGREES F (ADJ) FOR MORE THAN 10 MINUTES (ADJ) OR THE LEAD HEAT EXCHANGER CONTROL VALVE IS MORE THAN 95% OPEN (ADJ), THEN THE LAG HEAT EXCHANGER SHALL BE ENABLED. BOTH HEAT EXCHANGER CONTROL VALVES SHALL MODULATE IN UNISON TO MAINTAIN THE HEATING GLYCOL SUPPLY TEMPERATURE. IF BOTH HEAT EXCHANGERS ARE IN OPERATION AND THE CONTROL VALVES ARE BELOW 40% (ADJ), THEN THE LAG HEAT EXCHANGER SHALL BE DISABLED.

AHU PUMPS (P-4A, P-4B)

THE HEAT EXCHANGER HEATING WATER PUMPS SHALL OPERATE IN A PARALLEL SEQUENCE. IF ONE PUMP FAILS THE SECOND PUMP SHALL CONTINUE TO OPERATE.

UPON A CALL FOR HEAT THE PUMPS SHALL BE ENERGIZED. THE PUMP SPEED SHALL MODULATE TO MEET THE SYSTEM DEMAND BASED ON SENSORLESS SYSTEM PRESSURE CONTROL.

AN ALARM SHALL BE GENERATED UPON A PUMP OR A VFD FAULT STATUS.

POINTS LIST

BOILER PLANT

	HARDWARE				SOFTWARE			
	AI	AO	DI	DO	SCHED	TREND	ALARM	GRAPHIC
BOILER ENABLE (B-1, B-2)				X	X			X
BOILER STATUS (B-1, B-2)			X				X	X
BOILER ALARM (B-1, B-2)			X				X	X
BOILER CONTROL VALVE STATUS (BV-1, BV-2)			X					X
HOT WATER PUMP START/STOP (P-1, P-2)				X				X
HOT WATER PUMP STATUS (P-1, P-2)			X					X
HOT WATER PUMP VFD FAULT (P-1, P-2)			X				X	X
HOT WATER PUMP VFD SPEED (P-1, P-2)	X					X		X
BUILDING SUPPLY WATER TEMPERATURE	X					X	X	X
BUILDING RETURN WATER TEMPERATURE	X					X		X
BUILDING HOT WATER SETPOINT		X						X
BOILER SUPPLY WATER TEMPERATURE (B-1, B-2)	X					X		X
CARBON MONOXIDE LEVEL	X						X	X
OUTSIDE AIR TEMPERATURE	X							X
GAS KILL SWITCH STATUS			X				X	X
BOILER FLOW RATE FM	X					X		X
BOILER ENERGY USAGE		X				X		X

SEQUENCE OF OPERATIONS

BOILER (B-1, B-2):

THE BOILER CONTROLLER SHALL CONTROL THE OPERATION OF THE TWO BOILERS. THE LEAD BOILER SHALL BE ENABLED WHEN THE OUTSIDE AIR TEMPERATURE FALLS BELOW 60 DEGREES F (ADJ). THE BOILER CONTROL PANEL SHALL EQUALIZE THE RUN TIME OF THE TWO BOILERS AUTOMATICALLY AT SET INTERVALS.

THE LEAD BOILER CONTROL PANEL SHALL ENERGIZE THE BOILERS IN A CASCADING SEQUENCE. ON A CALL FOR HEAT THE LEAD BOILER CONTROL VALVE (BV-X) SHALL OPEN. THE LEAD BOILER SHALL MODULATE IT'S FIRING RATE TO MAINTAIN THE HEATING WATER TEMPERATURE SETPOINT. ONCE THE FIRST BOILER REACHES 50% OF ITS FIRING RATE THE LAG BOILER CONTROL VALVE (BV-X) SHALL OPEN. THE BOILER CONTROLLER SHALL CALCULATE THE RATE AT WHICH THE FIRST AND SECOND BOILER SHOULD FIRE TO MEET THE BUILDING LOAD. THE BOILERS SHALL THEN MODULATE THEIR FIRING RATE TOGETHER TO MAINTAIN THE HEATING WATER TEMPERATURE SETPOINT.

AS THE HEATING DEMAND DECREASES, THE BOILERS FIRING RATE SHALL MODULATE DOWN TOGETHER UNTIL THEY REACH A MINIMUM OF 10% OF THEIR FIRING RATE AT WHICH TIME THE LAG BOILER SHALL BE DENERGIZED AND THE ASSOCIATED CONTROL VALVE (BV-X) SHALL CLOSE. THE LEAD BOILER FIRING RATE SHALL THEN MODULATE TO MEET THE HEATING LOAD.

THE HEATING WATER TEMPERATURE SHALL BE RESET BASED ON OUTDOOR AIR TEMPERATURE. THE WATER TEMPERATURE SHALL BE 180 DEGREES F WHEN THE OUTDOOR AIR TEMPERATURE IS 0 DEGREES F. THE WATER TEMPERATURE SHALL BE 100 DEGREES F WHEN THE OUTDOOR AIR TEMPERATURE IS 60 DEGREES F. TEMPERATURE RESET CURVES AND SETPOINTS SHALL BE ADJUSTABLE.

AN ALARM SHALL BE GENERATED IF THERE IS A BOILER ALARM OR A LOW WATER LEVEL ALARM.

IF CARBON MONOXIDE IS DETECTED OVER 50 PPM (ADJ) IN THE BOILER ROOM, AN ALARM SHALL BE GENERATED AT THE BAS, A STROBE AND ALARM SHALL BE ENERGIZED OUTSIDE THE BOILER ROOM.

PUMP (P-1, P-2)

THE HEATING WATER PUMPS SHALL OPERATE IN A DUTY/STANDBY SEQUENCE. IF THE DUTY PUMP FAILS, THE STANDBY PUMP SHALL BE ENERGIZED. THE PUMPS SHALL BE ALTERNATED AS DUTY PUMP AT SET INTERVALS.

UPON A CALL FOR HEAT THE DUTY PUMP SHALL BE ENERGIZED. THE PUMP SPEED SHALL MODULATE TO MEET SYSTEM DEMAND BASED ON SENSORLESS SYSTEM PRESSURE CONTROL.

AN ALARM SHALL BE GENERATED UPON A PUMP OR A VFD FAULT STATUS.

AHU-1(e)

WHENEVER A WATER HEATER IS ENERGIZED, THE AIR HANDLING UNIT OUTSIDE AIR DAMPER SHALL OPEN, THE AIR HANDLING UNIT SHALL BE ENERGIZED AND THE HEATING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A DISCHARGE AIR TEMPERATURE OF 68 DEGREES F (ADJ).

EXISTING COOLING SEQUENCES TO BE INTERFACED TO NEW EQUIPMENT

DEDICATED HEAT RECOVERY CHILLER:
WHEN COOLING SYSTEM IS ENABLED AND HEAT IS REQUIRED FOR BUILDING P AIR HANDLING UNITS, TWO-WAY VALVES V-5 AND V-6 SHALL OPEN AND PUMPS P-14, P-15, ~~P-8(e) AND P-9(e)~~ P-4A AND P-4B SHALL BE ENABLED. ONCE FLOW HAS BEEN CONFIRMED DHRC-1 SHALL BE ENABLED IN HEAT MODE. DHRC-1 SHALL OPERATE IN HEATING MODE AND MAINTAIN A HOT WATER SUPPLY SETPOINT OF 140 DEGREES F (ADJ).

DEDICATED HEAT RECOVERY CHILLER PUMPS P-14, P-15:
THE PUMPS SHALL MODULATE FLOW BASED ON THE DIFFERENTIAL PRESSURE MEASURED AT THE DEDICATED HEAT RECOVERY CHILLER.

PUMPS ~~P-8(e), P-9(e)~~ P-4A, P-4B:
THE PUMPS SHALL OPERATE IN THE SAME SEQUENCE AS WHEN IN HEATING.
THE LEAD PUMP SHALL OPERATE WHEN;
1. AT LEAST ONE BUILDING P AIR HANDLING UNIT IS RUNNING AND REQUIRES REHEAT.
2. THE BOILER AND HEAT EXCHANGER CONTROL SHALL NOT BE ENABLED WHEN SYSTEM IS IN COOLING MODE. LAG PUMP SHALL OPERATE SIMILAR TO HEATING MODE.

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RAY HARTSTEIN CAMPUS - BOILER AND HEAT EXCHANGER REPLACEMENTS

OAKTON COMMUNITY COLLEGE
7701 N. LINCOLN AVENUE
SKOKIE, ILLINOIS 60077

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JOB NO.	22-315-1446
DRAWN	KJL
CHECKED	DDW
APPROVED	DDW

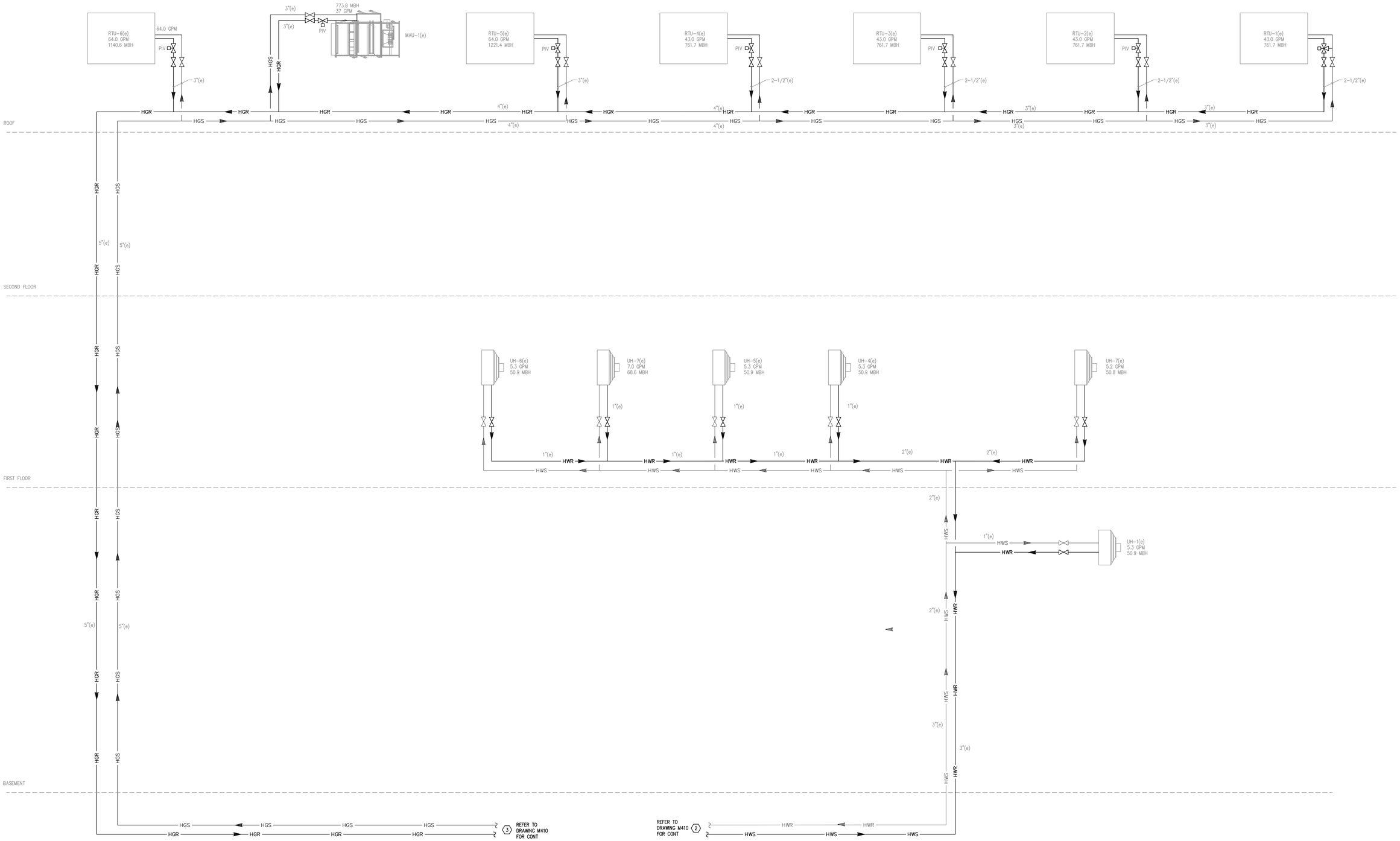
SHEET TITLE

BOILER ROOM PIPING AND CONTROL SCHEMATIC

SHEET NUMBER

M410

HEATING PIPING SCHEMATIC



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JOB NO.	22-315-1446
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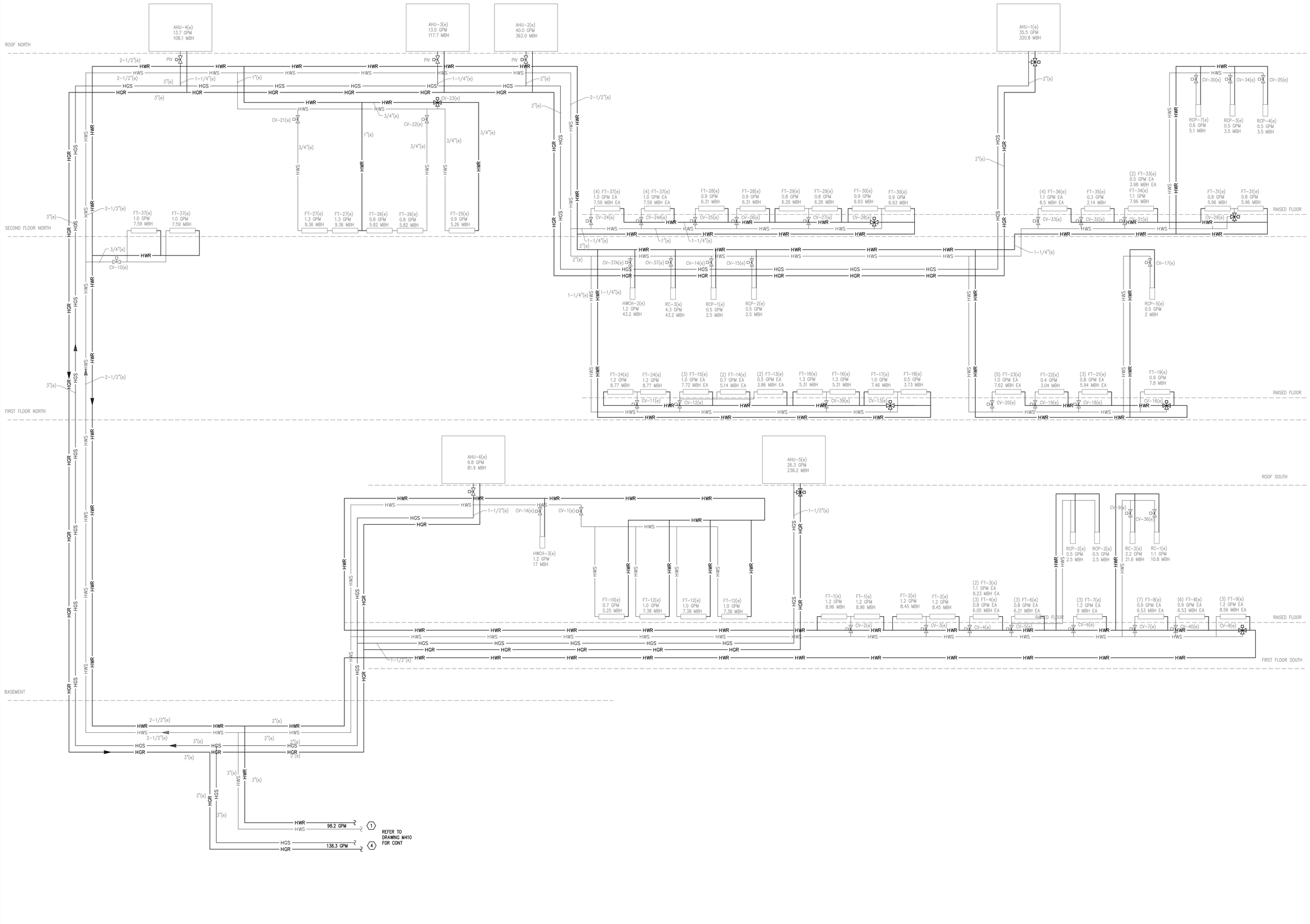
SHEET TITLE

HEATING PIPING SCHEMATIC - BUILDINGS A, B, C

SHEET NUMBER

M411

MECHANICAL HEATING SCHEMATIC



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JOB NO.	22-315-1446
DRAWN	KJD
CHECKED	DDW
APPROVED	DDW

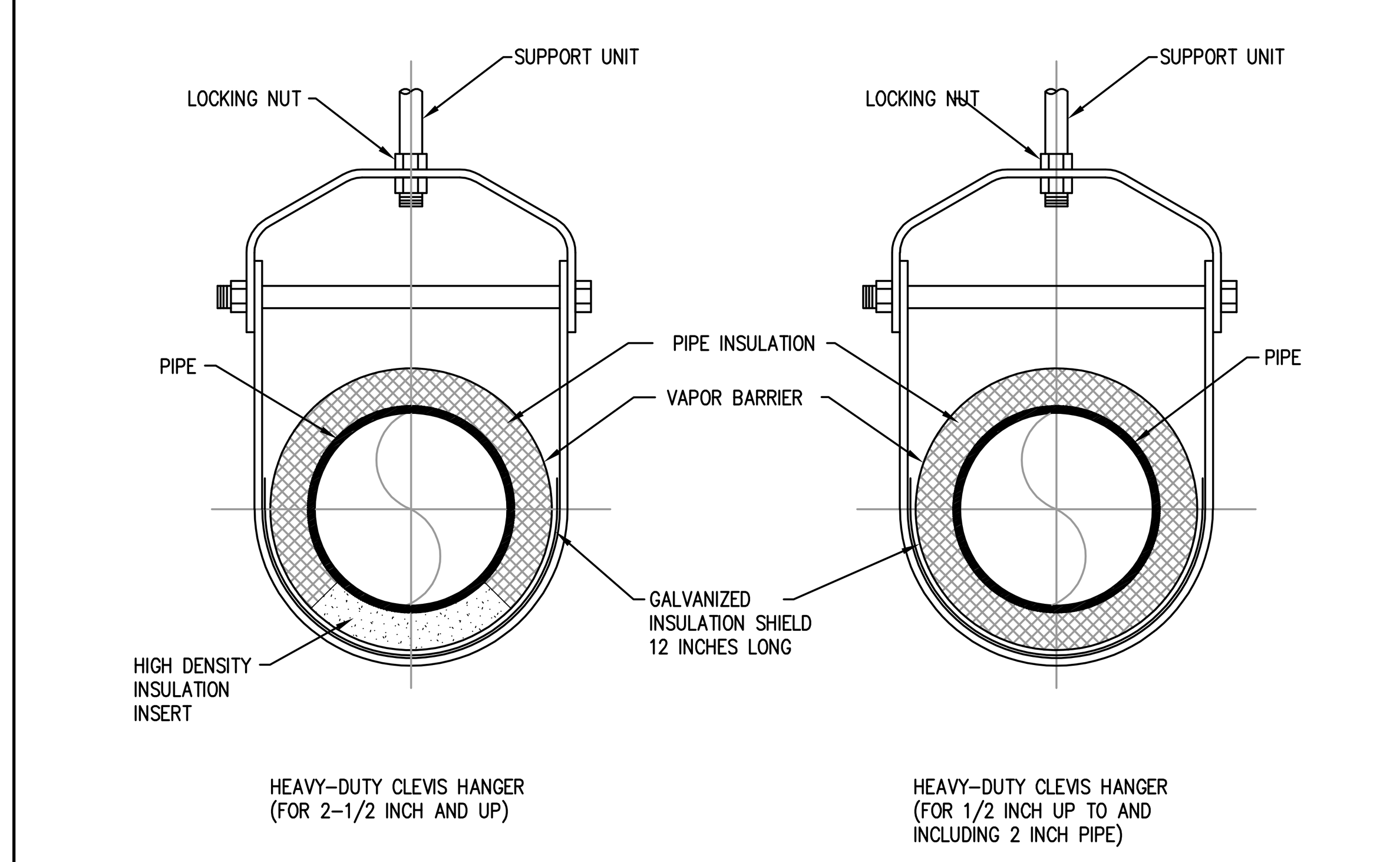
SHEET TITLE

HEATING PIPING SCHEMATIC - BUILDING P

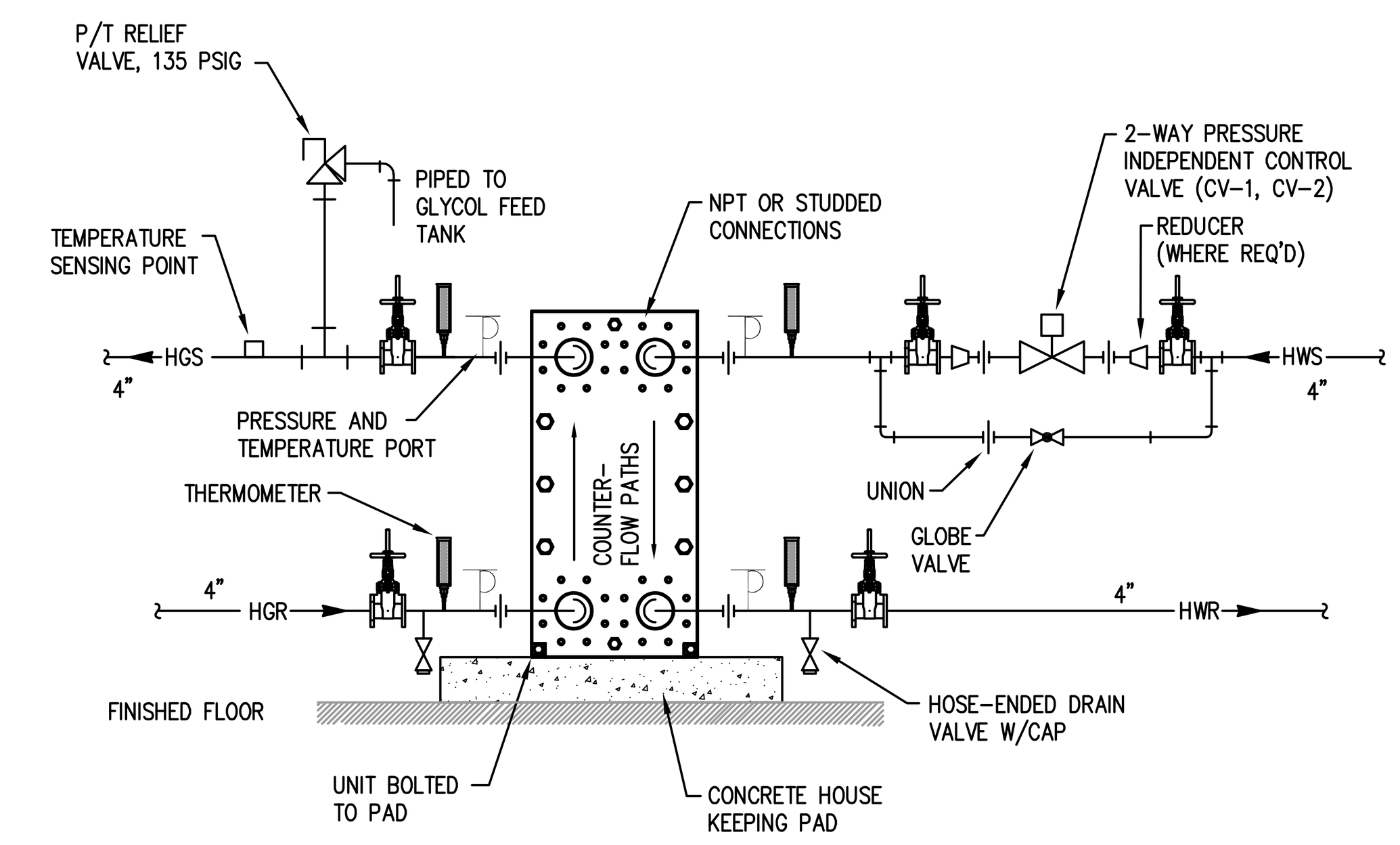
SHEET NUMBER

M412

NOTE: SCALES DEPICTED ON THIS DRAWING ARE NOT CORRECT UNLESS PLOTTED SHEET SIZE IS 30 X 42 INCHES.

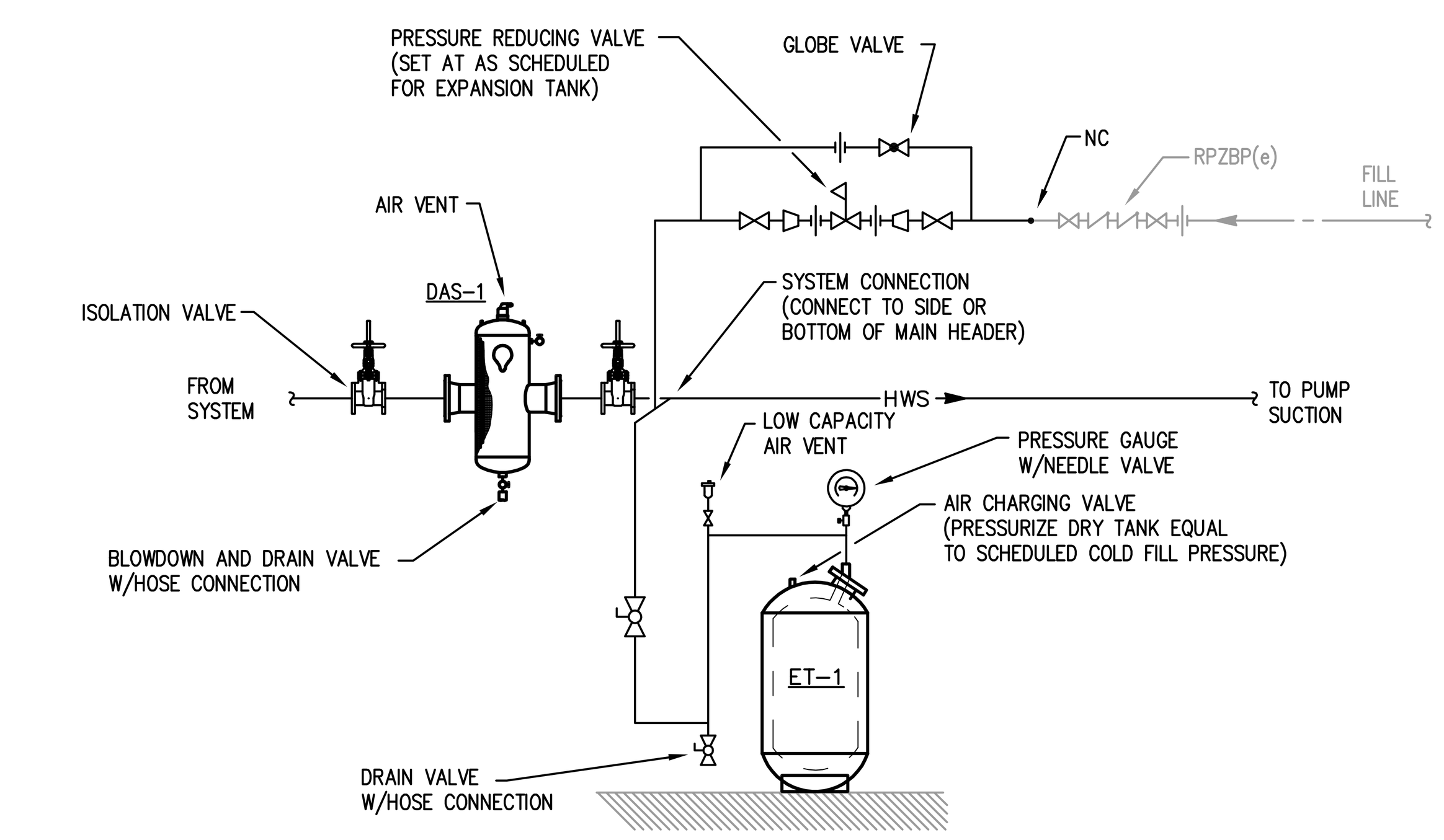


PIPE HANGER DETAILS (9)
SCALE: NTS

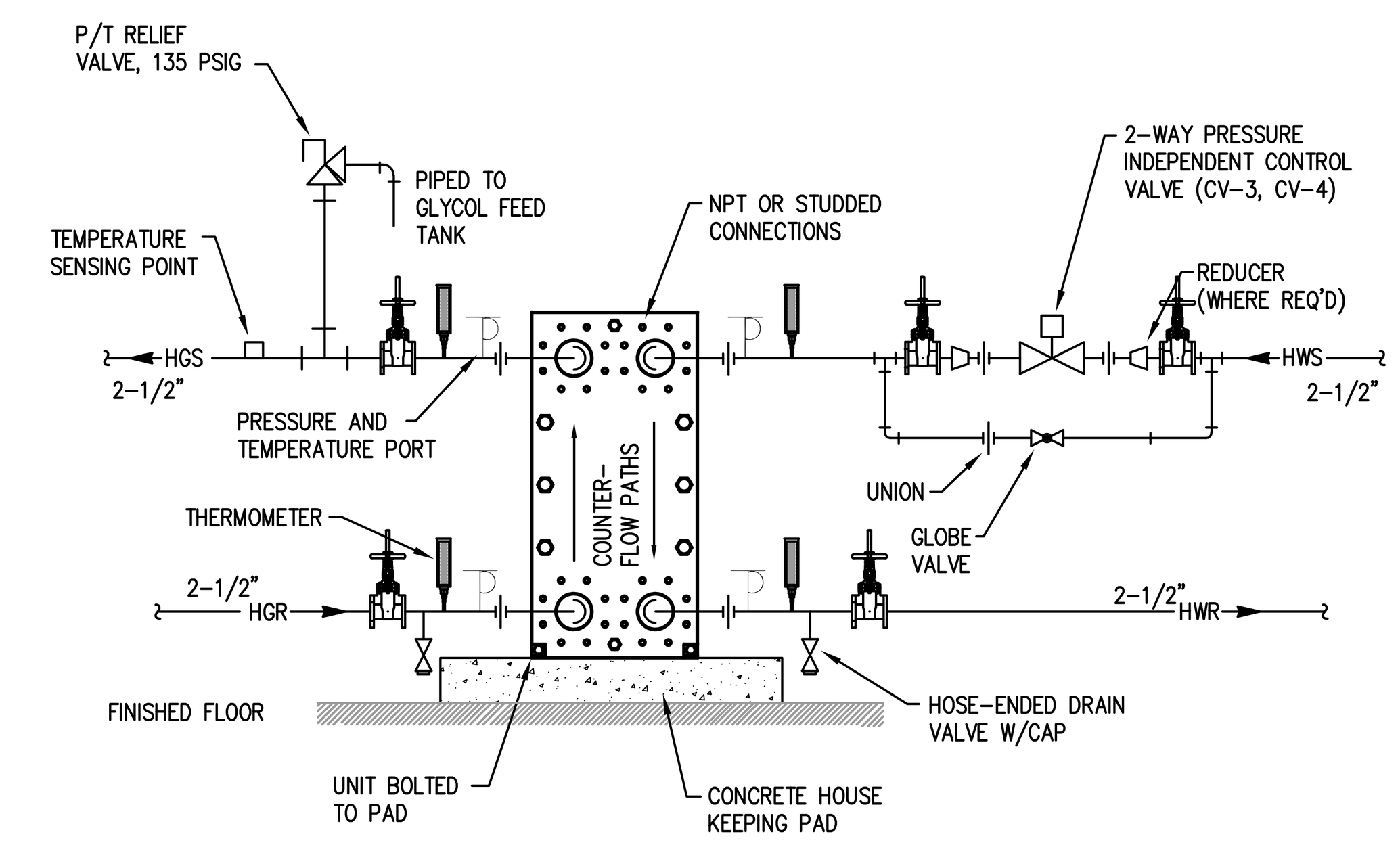


NOTES:
1. DETAIL TYPICAL FOR HX-1A AND HX-1B.
2. PROVIDE GLYCOL SAFETY RELIEF VALVE HIGH ENOUGH TO PIPE DISCHARGE TO GYLCOL FILL STATION TANK.

PLATE AND FRAME HEAT EXHANGER DETAIL (5)
SCALE: NTS

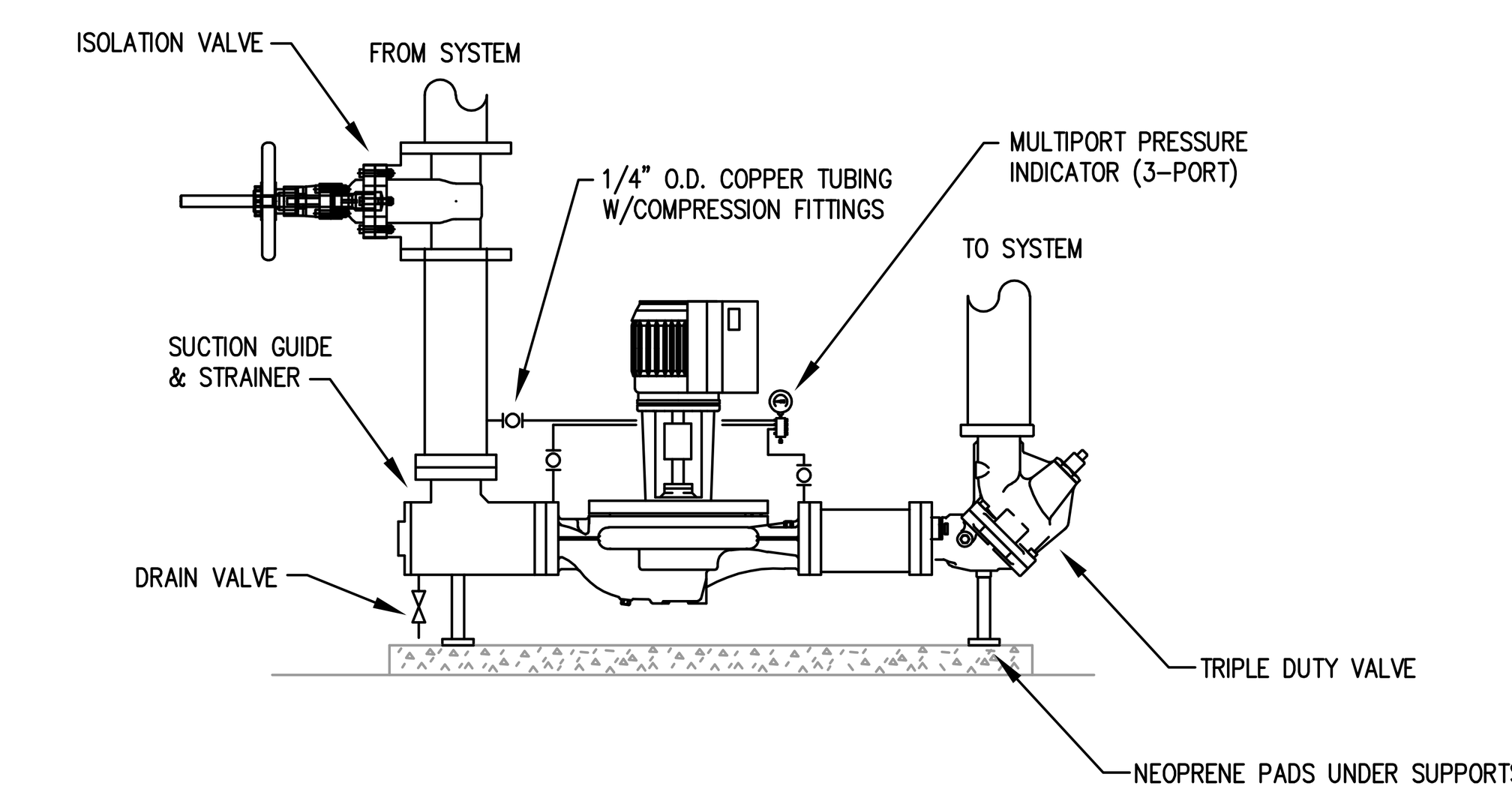


AIR/DIRT SEPARATOR & EXPANSION TANK DETAIL (1)
SCALE: NTS



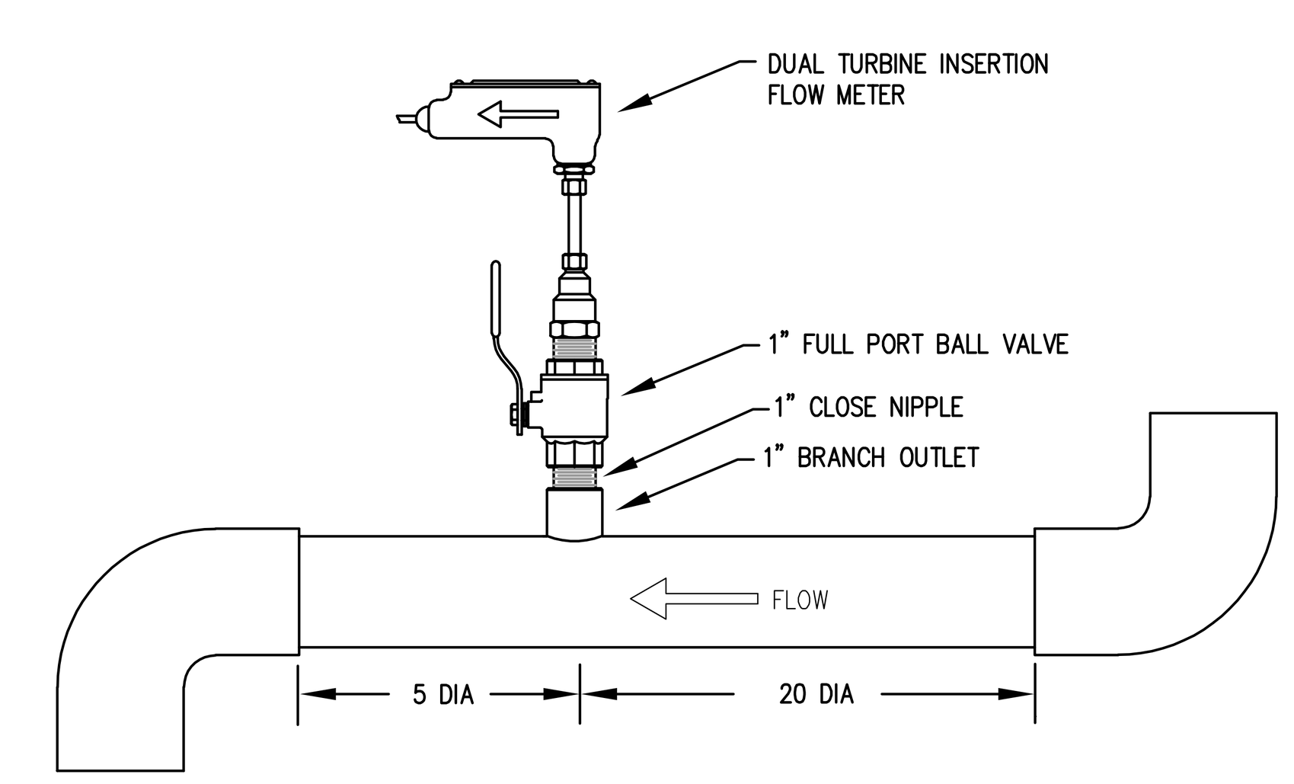
NOTES:
1. DETAIL TYPICAL FOR HX-2A AND HX-2B.
2. PROVIDE GLYCOL SAFETY RELIEF VALVE HIGH ENOUGH TO PIPE DISCHARGE TO GYLCOL FILL STATION TANK.

PLATE AND FRAME HEAT EXHANGER DETAIL (6)
SCALE: NTS

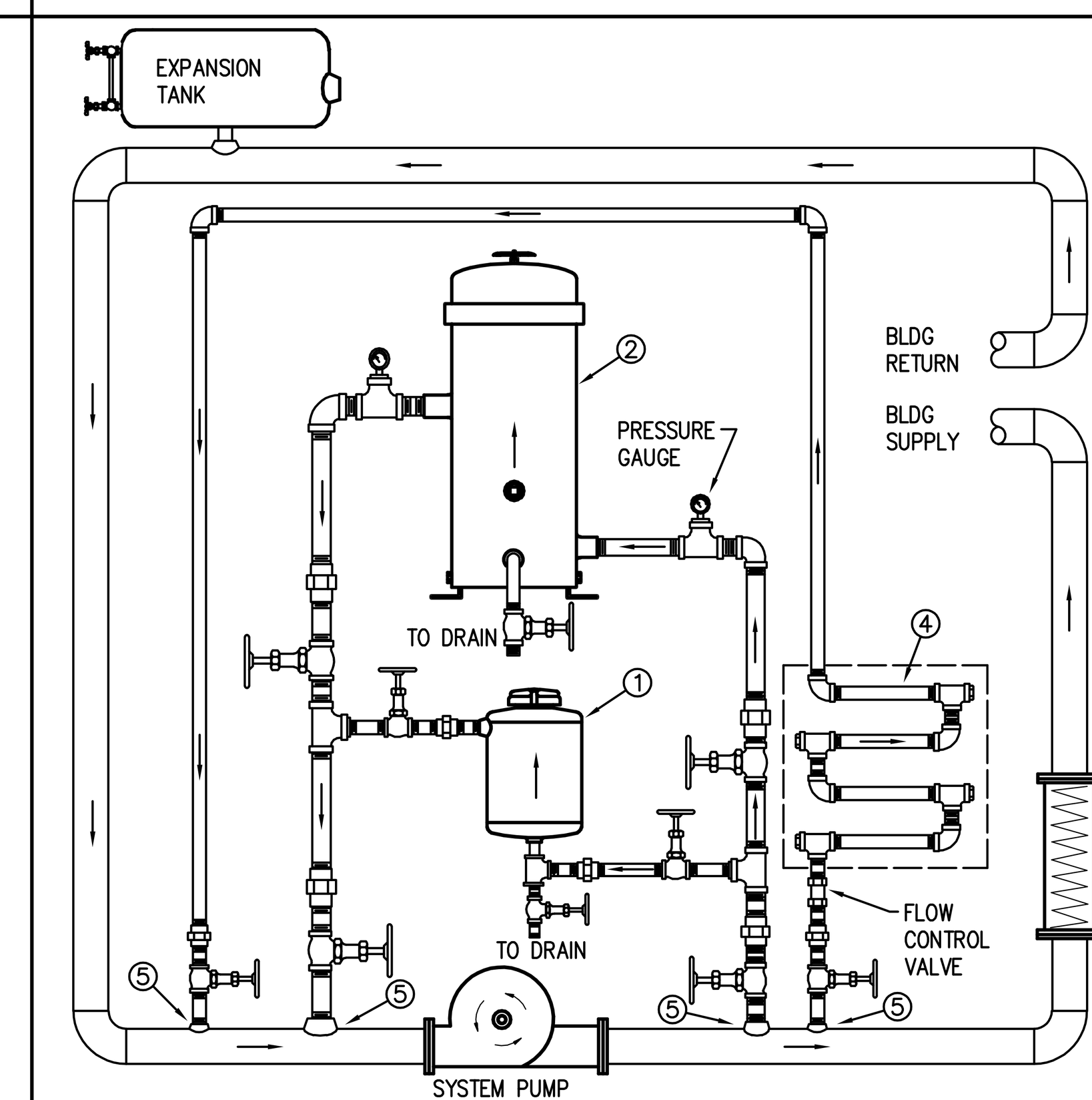


NOTES:
1. SUPPORT PUMP INACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS

VERTICAL IN-LINE PUMP DETAIL (2)
SCALE: NTS

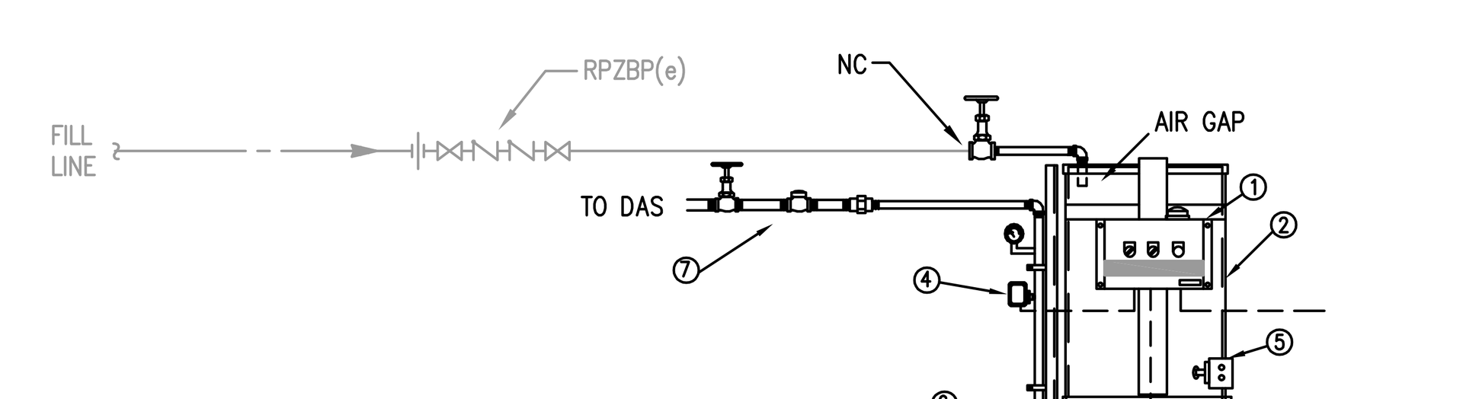


FLOW METER DETAIL (7)
SCALE: NTS



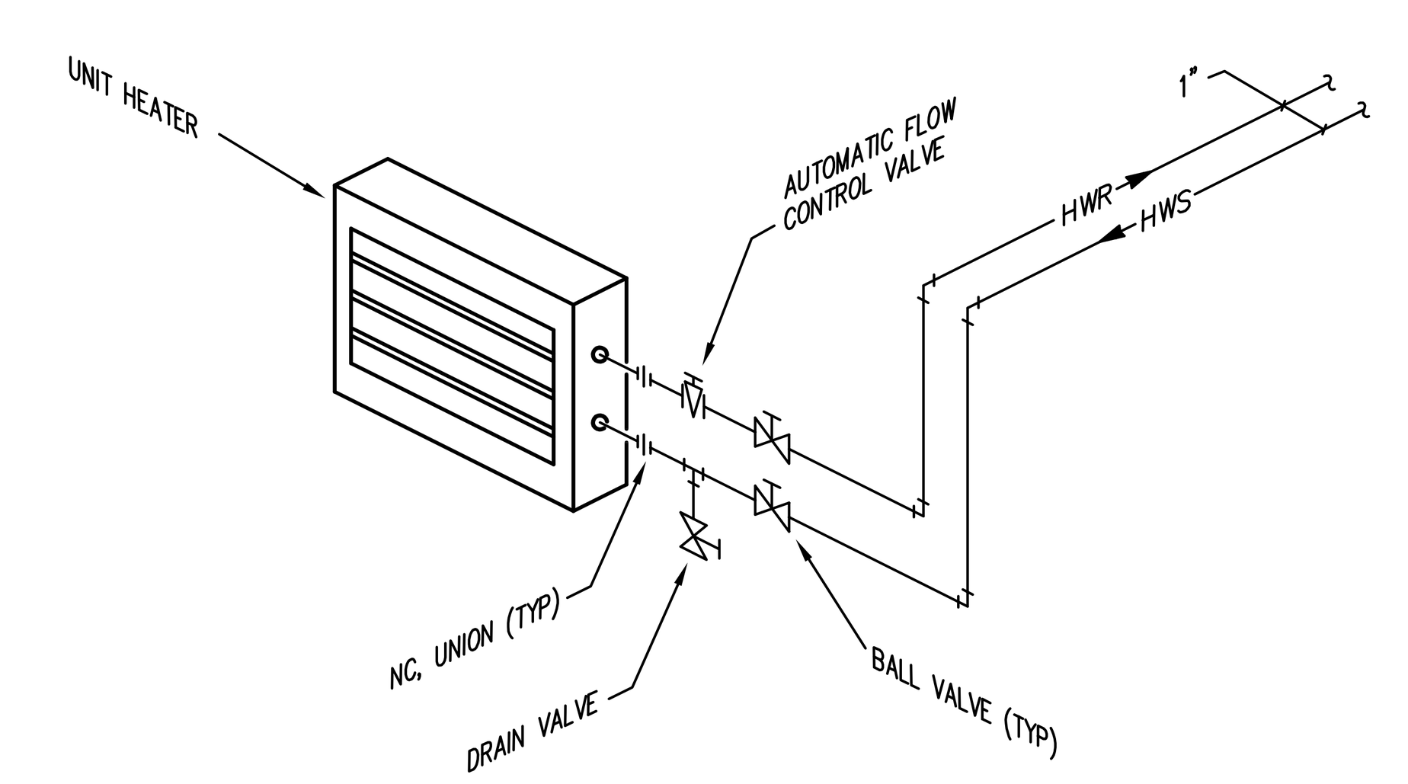
NOTES:
1. BYPASS FEEDER; 3/4" NPT.
2. SIDE-STREAM FILTER; 1-1/4" NPT BUSHING DOWN, 1" NPT.
3. NOT USED.
4. PRE-ASSEMBLED COUPON RACK WITH FLOW CONTROL; 1" NPT.
5. FILTER, BYPASS FEEDER AND COUPON RACK SUPPLY AND RETURN CONNECTIONS SHALL BE LOCATED AS CLOSE TO THE PUMP SUCTION AND DISCHARGE AS PRACTICAL.

CLOSED CHEMICAL TREATMENT DETAIL (3)
SCALE: NTS



NOTES:
1. CONTROL PANEL
2. POLYETHYLENE TANK AND STEEL STAND ASSEMBLY
3. INJECTION PUMP
4. PRESSURE SWITCH, SET PRESSURE TO SCHEDULED COLD FILL PRESSURE
5. LEVEL SWITCH
6. PRESSURE CONTROL, PRESSURE REDUCING VALVE, SHUT-OFF VALVE AND PRESSURE GAUGE
7. PROVIDE CONNECTION TO RTU AND AHU GLYCOL LOOPS. PROVIDE LOCKING BALL VALVE, CHECK VALVE AND UNION AT EACH CONNECTION

INDIRECT GLYCOLMAKE-UP SYSTEM DETAIL (8)
SCALE: NTS



UNIT HEATER PIPING DETAIL (4)
SCALE: NTS

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JOB NO.	22-315-1446
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SHEET TITLE
MECHANICAL DETAILS

SHEET NUMBER
M510

NOTE: SCALES DEPICTED ON THIS DRAWING ARE NOT CORRECT UNLESS PLOTTED SHEET SIZE IS 30 X 42 INCHES.

BOILER SCHEDULE

MARK	TYPE	WATER FLOW RATE (GPM)	MAX PRESS DROP (FT)	GAS INPUT (MBH)	GAS OUPUT (MBH)	EWT / LWT (°F)	ELECTRICAL (V/PH/HZ)	AHRI MINIMUM EFFICIENCY	MODEL	NOTES
B-1	FIRE TUBE	612	2.0	5000	4400	180 / 140	460/3/60	96	CFC-E 5000	1, 2
B-2	FIRE TUBE	612	2.0	5000	4400	180 / 140	460/3/60	96	CFC-E 5000	1, 2

NOTES
1. MODEL BASED ON CLEAVER BROOKS.

PUMP SCHEDULE

MARK	WATER FLOW RATE (GPM)	HEAD (FT)	TYPE	MOTOR POWER (HP)	ELECTRICAL (V/PH/HZ)	MOTOR SPEED (RPM)	SERVICE	MODEL	NOTES
P-1	612	83	VERT INLINE	20	460/3/60	1679	HEATING	4300 6x6x10	1, 3, 4
P-2	612	83	VERT INLINE	20	460/3/60	1679	HEATING	4300 6x6x10	1, 3, 4
P-3A/3B	170	73	VERT INLINE	5	460/3/60	3415	HTG 40% GLYCOL	4380 0205-005.0	2, 3, 5
P-4A/4B	70	66	VERT INLINE	3	460/3/60	2853	HTG 40% GLYCOL	4380 1505-003.0	2, 3, 6

NOTES
1. MODEL BASED ON ARMSTRONG PUMPS - DESIGN ENVELOPE IVS PUMPS.
2. MODEL BASED ON ARMSTRONG PUMPS - DESIGN ENVELOPE IVS PUMPS.
3. SENSORLESS VARIABLE SPEED WITH QUADRATIC PRESSURE CONTROL.
4. EFFICIENCY AT DESIGN = 80%
5. PUMPS SHALL HAVE PERMANENT MAGNET MOTORS AND OPERATE IN PARALLEL WITH A TOTAL SYSTEM FLOW OF 340 GPM @ 73 FT HD. EFFICIENCY AT DESIGN = 78%.
6. PUMPS SHALL HAVE PERMANENT MAGNET MOTORS AND OPERATE IN PARALLEL WITH A TOTAL SYSTEM FLOW OF 140 GPM @ 66 FT HD. EFFICIENCY AT DESIGN = 68%.

AIR / DIRT SEPARATOR SCHEDULE

MARK	SYSTEM	WATER FLOW (GPM)	MAX WPD (FT)	INLET / OUTLET SIZE (IN)	MAX DESIGN PRESSURE (PSIG)	MODEL	NOTES
DAS-1	HOT WATER	612	3.0	6 / 6	150	VHT600	1, 2 3, 4, 5
DAS-2	HTG 40% GLYCOL	340	2.0	5 / 5	150	VDT500	1, 2 3, 4
DAS-3	HTG 40% GLYCOL	140	2.0	3 / 3	150	VDT300	1, 2 3, 4

NOTES
1. MODEL BASED ON SPIROTHERM.
2. COALESCING TYPE SEPARATOR, CENTRIFUGAL TYPE NOT ACCEPTABLE.
3. UNIT SHALL REMOVE 100% OF FREE AND ENTRAINED AIR AND 99.6% OF DISSOLVED AIR AS TESTED BY AN INDEPENDENT LAB.
4. UNIT SHALL REMOVE 80% OF THE 30 MICRON PARTICLES IN 100 CIRCULATIONS.
5. HIGH VELOCITY UNIT.

EXPANSION TANK SCHEDULE

MARK	TANK VOLUME (GAL)	TANK ACCEPTANCE (MIN GAL)	LENGTH X DIAMETER (IN X IN)	SYSTEM VOLUME (GAL)	SYSTEM TEMP HIGH / LOW (°F)	FILL PRESSURE (PSIG)	MAXIMUM DESIGN PRESS (PSIG)	FLUID TYPE	SERVICE	LOCATION	MODEL	NOTES
ET-1	80	52	52 x 24	1572	180 / 40	16	67.5	WATER	BLDG HW	BOILER RM	A300-L	1
ET-2	80	52	52 X 24	1513	160 / 40	23	135	40% EG	RTU COILS	BOILER RM	A300-L	1, 2
ET-3	23	13	37 X 16	450	140 / 40	23	135	40% EG	AHU COILS	BOILER RM	85-L	1, 2

NOTES
1. MODEL BASE ON ARMSTRONG.
2. EXPANSION TANK MAXIMUM WORKING PRESSURE 175 PSIG OR ABOVE.

PLATE - PLATE HEAT EXCHANGER SCHEDULE

MARK	HOT SIDE					COLD SIDE					HEAT EXCHANGED (MBH)	NOMINAL DIMENSIONS (IN x IN x IN)	NUMBER OF PLATES	SERVICE	LOCATION	MODEL	NOTES
	FLUID CIRCULATED	FLOW RATE (GPM)	PRESSURE DROP (PSI)	ENT/LVG TEMP (°F)	CONNECTION SIZE IN/OUT (IN)	FLUID CIRCULATED	FLOW RATE (GPM)	PRESSURE DROP (PSI)	ENT/LVG TEMP (°F)	CONNECTION SIZE IN/OUT (IN)							
HX-1A	WATER	170.8	23.2	180/140	2.5/2.5	40% GLYCOL	170	23.2	120.0/163.5	2.5/2.5	3344.3	37 x 16 x 10	72	RTUs	BOILER ROOM	A20H-150-72-500	1
HX-1B	WATER	170.8	23.2	180/140	2.5/2.5	40% GLYCOL	170	23.2	120.0/163.5	2.5/2.5	3344.3	37 x 16 x 10	72	RTUs	BOILER ROOM	A20H-150-72-500	1
HX-2A	WATER	70.6	20.7	180/140	2.5/2.5	40% GLYCOL	70	20.7	100.0/143.9	2.5/2.5	1383.4	37 x 16 x 5	18	AHUs	BOILER ROOM	A20H-150-18-400	1
HX-2B	WATER	70.6	20.7	180/140	2.5/2.5	40% GLYCOL	70	20.7	100.0/143.9	2.5/2.5	1383.4	37 x 16 x 5	18	AHUs	BOILER ROOM	A20H-150-18-400	1

NOTES
1. MODEL BASED ON ARMSTRONG.
2. HEAT EXCHANGER MAXIMUM WORKING PRESSURE 150 PSIG.

UNIT HEATER SCHEDULE

MARK	AIR FLOW RATE (CFM)	EAT / LAT (° F)	WATER FLOW RATE (GPM)	WATER PRESS DROP (FT)	EWT / LWT (° F)	MIN CAPACITY (MBH)	SUPPLY FAN (HP)	ELECTRICAL (V/PH/HZ)	MODEL	AREA SERVED	NOTES
UH-1	1340	60 / 95	6.3	1.0	180 / 160	51.6	1/8	115/60/1	HC 86	NORTH STAIR	1, 2
UH-2	2010	60 / 92	7.0	2.5	180 / 159	71.7	1/8	115/60/1	HC 108	BSMT RAMP	1, 3

NOTES
1. MODEL BASED ON MODINE.
2. PROVIDE WITH STEP-DOWN TRANSFORMER, THERMOSTAT AND FINGER-PROOF FAN GUARD.
3. PROVIDE WITH THERMOSTAT.

PRESSURE INDEPENDENT CONTROL VALVE SCHEDULE

TAG	SIZE (IN)	MIN FLOW RATE (GPM @ 5 PSIG)	MAX FLOW RATE (GPM)	MAX FLOW VARIATION (%)	MIN DELTA P ACROSS VALVE (PSIG)	CLOSE OFF PRESSURE (PSIG)	BODY PRESSURE RATING (PSIG)	VALVE MATERIALS			CONNECTION TYPE	SERVICE	NOTES
								BODY	INTERNALS	SEALS			
CV-1A	4	–	175	5	4.4	232	200	CAST IRON	COPPER / 304 SS	EDPM	FLANGED	HX-1A	1, 2, 3, 4
CV-1B	4	–	175	5	4.4	232	200	CAST IRON	COPPER / 304 SS	EDPM	FLANGED	HX-1A	1, 2, 3, 4
CV-2A	2-1/2	–	85	5	4.4	232	200	CAST IRON	COPPER / 304 SS	EDPM	FLANGED	HX-2A	1, 2, 3, 4
CV-2B	2-1/2	–	85	5	4.4	232	200	CAST IRON	COPPER / 304 SS	EDPM	FLANGED	HX-2B	1, 2, 3, 4

NOTES
1. DESIGN BASIS: DANFOSS AB-QM.
2. VALVE SHALL HAVE LINEAR FLOW CHARACTERISTIC, FIELD ADJUSTABLE FLOW RATE AND MODULATING ACTUATOR.
3. PROVIDE WITH UNION, BALL VALVE AND STRAINER (#20 MESH).
4. PROVIDE WITH PRESSURE AND TEMPERATURE MEASUREMENT PORTS.

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JOB NO. 22-315-1446
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SHEET TITLE
MECHANICAL SCHEDULES

SHEET NUMBER
M610

ELECTRICAL SYMBOLS LIST

SYMBOL	DESCRIPTION
	COMBINATION STARTER/DISCONNECT SWITCH
	DISCONNECT SWITCH (AMPS/POLES/NEMA ENCLOSURE)
	JUNCTION BOX
	CONDUIT HOMERUN TO PANEL/SWITCHBOARD.
	480 VOLT SWITCHBOARD
T	DRY TYPE TRANSFORMER
	208 VOLT PANELBOARD.
	FLEXIBLE CONNECTION
26.XXX	KEYNOTE IDENTIFICATION

BDL1 (EXISTING)			600 AMPERE, 277/480 VOLT, 3 PHASE, 4 WIRE, WYE, FUSIBLE SWITCH STYLE SWITCHBOARD, NEMA1 ENCLOSURE SQUARE D QED2 POWER STYLE SWITCHBOARD				
CKT	FUSE	DESCRIPTION	SWITCH SIZE	A	B	C	TOTAL
1	150/3	1C-L1	200/3				0
2	200/3	2C-T1-PRI	200/3				0
3	150/3	1C-K1	200/3				0
4	-	SPACE	-				0
5	E	BL-1	100/3				0
6	E	BSL-1	60/3				0
7	40/3	P-1	60/3				0
8	40/3	HP-1	60/3				0
9	40/3	P-2	60/3				0
10	5/3	P-3	30/3				0
11	15/3	EF-1	30/3				0
12	15/3	EF-2	30/3				0
13	15/3	EF-3	30/3				0
14	15/3	B-1	30/3				0
15	E	P-4/P-5	30/3				0
16	15/3	B-2	30/3				0
17	5/3	AHU-1	30/3				0
18	-	SPACE	-				0

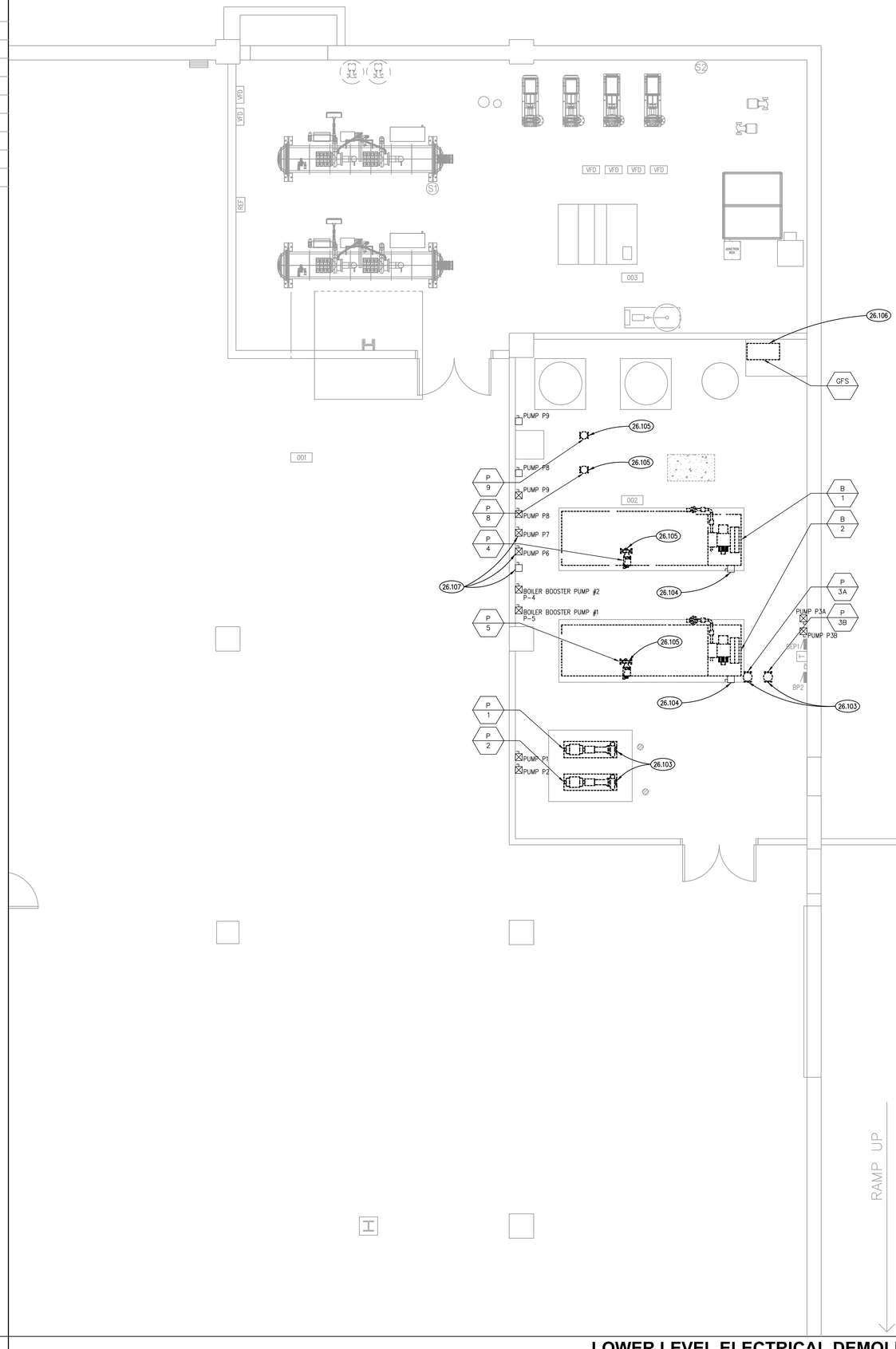
NOTES:					
DEMO	EXISTING DEMAND LOAD:	121733	121733	121733	365200
	NEW CONNECTED VA:	0	0	0	0
	NEW CONNECTED AMPS:	439	439	439	439
				NEW DEMAND VA:	365200
				NEW DEMAND AMPS:	439

PANEL : BP-2 — **225 AMPERE MAIN LUG ONLY**

CKT. NO.	BRKR	DESCRIPTION	PHASE A	PHASE B	PHASE C	DESCRIPTION	BRKR	CKT. NO.
1	1P20	WH-2				COMPRESSOR	3P20	2
3	1P20	WH-1				/		4
5	1P20	WATER HTR CIRC PUMP (RIGHT)				/		6
7	1P20	WATER HTR CIRC PUMP (LEFT)				GARAGE RCPT	1P20	8
9	1P20					GARAGE RCPT	1P20	10
11	1P20	GARAGE				GARAGE RCPT	1P20	12
13	1P20	GARAGE				U.H. RAMP	1P20	14
15	1P20	GARAGE				O.H. DOOR RAMP (TOP)	1P20	16
17	1P20	GARAGE				O.H. DOOR RAMP (BOTTOM)	1P20	18
19	1P20	OH DOOR @ LOAD DOCK				*EXISTING*	1P20	20
21	1P20	BAILER				*EXISTING*	1P20	22
23	1P20	UH-4				*EXISTING*	1P20	24
25	1P20	UH-5				TRASH COMPACTOR	3P50	26
27		UH-6				/		28
29		O.H. DOOR GARAGE				/		30
31		O.H. DOOR GARAGE				TRASH COMPACTOR	3PXX	32
33		RCPT TRASH RM				/		34
35		HWH EX FAN				/		36
37						WELDING RCPT GARAGE	3PXX	38
39		RCPT BOILER RM				/		40
41		BOILER CONTROL PNL				/		42

NOTES:			
TOTAL PHASE A:	0	MOUNTING:	SURFACE
TOTAL PHASE B:	0	RATING:	
TOTAL PHASE C:	0	ENCLOSURE:	NEMA 1
DEMAND VA:	0	FED FROM:	BDP1
DEMAND AMPS:	0	FEEDER SIZE:	EXISTING TO REMAIN
		LOCATION:	BOILER ROOM
		SQUARE D NQOD PANELBOARD	

VOLTAGE (LN): 120
VOLTAGE (LL): 208
PHASE: 3
WIRE: 4



LOWER LEVEL ELECTRICAL DEMOLITION PLAN

1

SCALE: 1/4" = 1'-0"

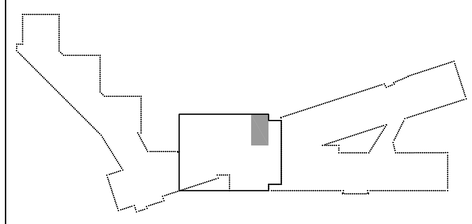
KEYNOTES

KEYNOTES ARE TYPICALLY NOT DUPLICATED WITHIN A GIVEN DETAIL. AN UN-KEYNOTED ITEM IN A DETAIL IS THE SAME AS A KEYNOTED ITEM HAVING THE SAME APPEARANCE WITHIN THE SAME DETAIL.

26.103 DEMOLISH BRANCH CIRCUITRY UP TO AND INCLUDING STARTER AND PROTECT EXISTING HOMERUN BRANCH CIRCUITRY FOR REUSE.
26.104 DISCONNECT AND PROTECT EXISTING BRANCH CIRCUITRY FOR BOILER TO BE REUSED.
26.105 DEMOLISH ELECTRICAL CONNECTION FOR PUMP TO BE REMOVED INCLUDING BRANCH CIRCUITRY TO SOURCE.
26.106 DISCONNECT AND PROTECT EXISTING BRANCH CIRCUITRY FOR GLYCOL FILL SYSTEM TO BE REUSED.
26.107 DEMOLISH EXISTING STARTER INCLUDING BRANCH CIRCUITRY TO SOURCE FOR PUMP PREVIOUSLY REMOVED.

GENERAL NOTES

KEY PLAN



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CHECKED	MTK
APPROVED	MTK

SHEET TITLE

ENLARGED LOWER LEVEL ELECTRICAL DEMOLITION PLAN

SHEET NUMBER

E201

PLAN NORTH

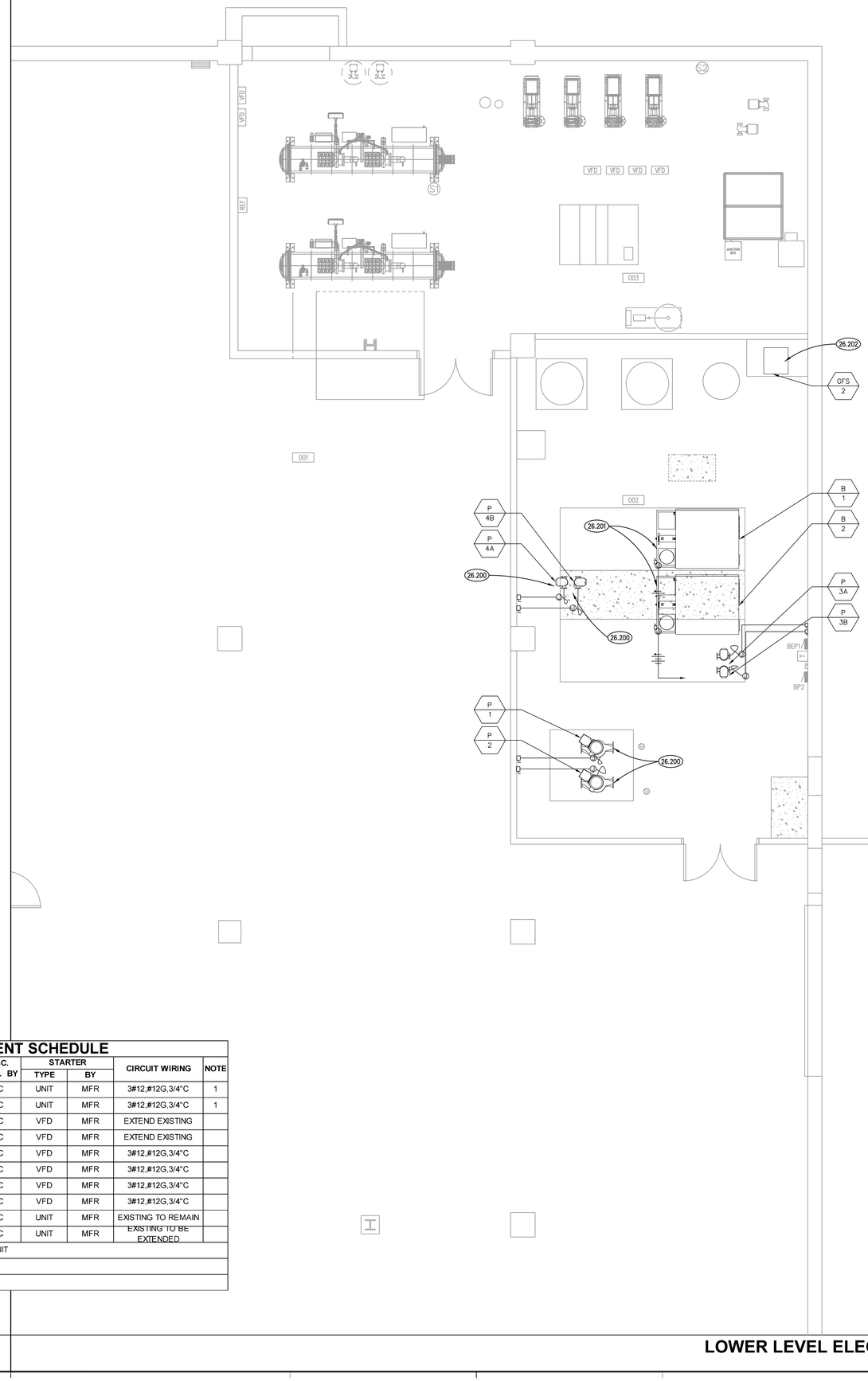
BDL1 (REMODELED)			600 AMPERE, 277/480 VOLT, 3 PHASE, 4 WIRE, WYE, FUSIBLE SWITCH STYLE SWITCHBOARD, NEMA1 ENCLOSURE SQUARE D QED2 POWER STYLE SWITCHBOARD				
CKT	FUSE	DESCRIPTION	SWITCH SIZE	A	B	C	TOTAL
1	150/3	1C-L1	200/3	E	E	E	0
2	200/3	2C-T1-PRI	200/3	E	E	E	0
3	150/3	1C-K1	200/3	E	E	E	0
4	-	SPACE	-				0
5	E	BL-1	100/3	E	E	E	0
6	E	BSL-1	60/3	E	E	E	0
7	40/3	**P-1**	60/3	**7479**	**7479**	**7479**	22437
8	40/3	HP-1	60/3	E	E	E	0
9	40/3	**P-2**	60/3	**7479**	**7479**	**7479**	22437
10	**15/3**	**P-3A/B**	30/3	**4210**	**4210**	**4210**	12631
11	15/3	EF-1	30/3	E	E	E	0
12	15/3	EF-2	30/3	E	E	E	0
13	15/3	EF-3	30/3	E	E	E	0
14	15/3	**B-1**	30/3	3518	3518	3518	10554
15	**15/3**	**P-4A/B**	30/3	**2659**	**2659**	**2659**	7978
16	15/3	**B-2**	30/3	3518	3518	3518	10554
17	5/3	AHU-1	30/3	E	E	E	0
18	-	SPACE	-	0	0	0	0

NOTES:					
NEW	EXISTING DEMAND LOAD:	121733	121733	121733	365200
	NEW CONNECTED VA:	28863	28863	28863	451790
	NEW CONNECTED AMPS:	439	439	439	543
				NEW DEMAND VA:	451790
				NEW DEMAND AMPS:	543

MECHANICAL/PLUMBING EQUIPMENT SCHEDULE

NO.	DESCRIPTION	FLA	KW	HP	VOL	PH	DISC. FURN. BY	STARTER TYPE	STARTER BY	CIRCUIT WIRING	NOTE
B-1	BOILER	12.7	-	-	480	3	EC	UNIT	MFR	3#12,#12G,3/4"C	1
B-2	BOILER	12.7	-	-	480	3	EC	UNIT	MFR	3#12,#12G,3/4"C	1
P-1	PUMP	-	-	20	480	3	EC	VFD	MFR	EXTEND EXISTING	
P-2	PUMP	-	-	20	480	3	EC	VFD	MFR	EXTEND EXISTING	
P-3A	PUMP	-	-	5	480	3	EC	VFD	MFR	3#12,#12G,3/4"C	
P-3B	PUMP	-	-	5	480	3	EC	VFD	MFR	3#12,#12G,3/4"C	
P-4A	PUMP	-	-	3	480	3	EC	VFD	MFR	3#12,#12G,3/4"C	
P-4B	PUMP	-	-	3	480	3	EC	VFD	MFR	3#12,#12G,3/4"C	
UH-1	HOT WATER UNIT HEATER	-	-	1/8	120	1	EC	UNIT	MFR	EXISTING TO REMAIN	
UH-2	HOT WATER UNIT HEATER	-	-	1/8	120	1	EC	UNIT	MFR	EXISTING TO BE EXTENDED	

1. PROVIDE 120V CONNECTION (15 AMPERE DEDICATED CIRCUIT) FOR BOILER CONTROL CIRCUIT



LOWER LEVEL ELECTRICAL PLAN

SCALE: 1/4" = 1'-0"

KEYNOTES

KEYNOTES ARE TYPICALLY NOT DUPLICATED WITHIN A GIVEN DETAIL. AN UN-KEYNOTED ITEM IN A DETAIL IS THE SAME AS A KEYNOTED ITEM HAVING THE SAME APPEARANCE WITHIN THE SAME DETAIL.

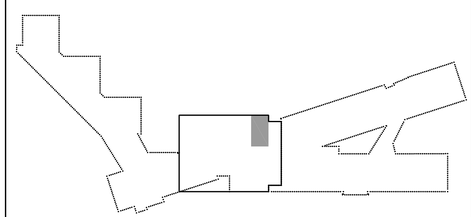
26.200 PROVIDE PERMANENT SPLICE AND EXTEND BRANCH CIRCUITRY TO NEW PUMP. PROVIDE FLEXIBLE CONNECTION TO EQUIPMENT. MATCH EXISTING.

26.201 RECONNECT EXISTING BRANCH CIRCUITRY TO NEW BOILER TO BE INSTALLED. PROVIDE TOGGLE DISCONNECT SWITCH AND FLEXIBLE CONNECTION TO EQUIPMENT. MATCH EXISTING.

26.202 RECONNECT EXISTING BRANCH CIRCUITRY TO NEW GLYCOL FILL SYSTEM TO BE INSTALLED. PROVIDE TOGGLE DISCONNECT SWITCH AND FLEXIBLE CONNECTION TO EQUIPMENT. MATCH EXISTING.

GENERAL NOTES

KEY PLAN



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RAY HARTSTEIN CAMPUS - BOILER AND HEAT EXCHANGER REPLACEMENTS

OAKTON COMMUNITY COLLEGE
7701 N. LINCOLN AVENUE
SKOKIE, ILLINOIS 60077

ISSUED
01/20/23 BID DOCUMENTS

JOB NO. 22-315-1446
DRAWN ATR
CHECKED MTK
APPROVED MTK

SHEET TITLE
LOWER LEVEL ELECTRICAL PLAN

SHEET NUMBER
E301

PLAN NORTH

NOTE: SCALES DEPICTED ON THIS DRAWING ARE NOT CORRECT UNLESS PLOTTED SHEET SIZE IS 30 X 42 INCHES.