BID DOCUMENTS COVER SHEET

CONTRACT DOCUMENTS

FOR

L-1093 HHW Boiler Isolation Valves

AT

Los Medanos College
2700 East Leland Road, Pittsburg, California 94565

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Consist of the following:

ADDENDUM #1

October 7, 2016
CONTRA COSTA COMMUNITY COLLEGE DISTRICT
L-1093 HHW Boiler Isolation Valves Project
Los Medanos College
ADDENDUM #1 Date: 10/07/16

NOTICE TO ALL PRE-QUALIFIED CONTRACTORS ONLY

You are hereby notified of the following changes, clarifications and/or modifications to the original Contract Documents, Project Manual, Drawings, Specifications and/or previous Addenda. This Addendum shall supersede the original Contract Documents and previous Addenda wherein it contradicts the same, and shall take precedence over anything to the contrary therein. All other conditions remain unchanged.

This Addendum forms a part of the Contract Documents and modifies the original Contract Documents dated 09/22/16. Acknowledge receipt of this Addendum in space provided on the Bid Proposal Form. Failure to acknowledge may subject Bidder to disqualification.

A. Pre-bid RFIs
1. Question, in the bid document, 2.3, under Variable speed drives, there is no information as to what make, and or, model of VFD's you would allow to be installed? Can you please supply me with the make and model numbers of the currently installed VFD's and the information on the make (model) you would prefer to have installed?

Response: New VFD should be ABB-ACH-550, or equal.

2. A) Part number provided on the scope of work for the Boiler Valve Controller is no longer available.
B) Are you using a combination space heating & DHW system? Or are you just using these as space heating boilers? I can’t see anything in the sequence that would require you to use a Boiler Valve Controller because the BST (boiler sequencing technology) already opens/closes the isolation valves when it sequencing the boilers. And when there is no load, it opens up all valves to ensure no deadheading for the pumps. You should be able to use BST built into the C-more to control the entire boiler plant.

Response: See revised Exhibit A with this Addendum; delete (1) Boiler Valve Controller and install (6) AERCO P 69102-3 pump control relays.

B. Deletions, Additions, Changes, Revisions
1. REPLACE with the attached SECTION 00100 NOTICE INVITING BIDS
2. REPLACE with the attached SECTION 00300 BID PROPOSAL FORM
3. REPLACE with the attached SECTION 23 00 00 HEATING VENTILATING & AIR CONDITIONING.
ADDENDUM #1

4. REPLACE Exhibit A with the attached revised Exhibit A, which has the following change:
   a. Delete “Furnish and install (1) AERCO 120V Boiler Valve Controller (Aerco P/N 64098, or equivalent).”
   b. Add “Furnish and install (6) AERCO PN 69102-3 pump control relays.”

5. ADD: Drawing M-2 Utility Building Boiler Isometric record drawing with new work indicated.

C. Pre-Bid Meeting Minutes. Note Bid Opening Date change to October 13, 2016 prior to 2:00PM

D. Pre-Bid Meeting Sign in Sheet.

If you have any questions regarding this Addendum, please contact:

   Jovan Esprit
   Contra Costa Community College District
   500 Court St., Martinez, CA 94553
   Email: jesprit@4cd.edu;
   Facsimile: 925-229-6959;

All other terms and conditions of BID are to remain the same.

END OF ADDENDUM #1
NOTICE INVITING BIDS
(INFORMAL BIDS)

L-1093 HHW Boiler Isolation Valves
Los Medanos College
2700 East Leland Road, Pittsburg, California 94565

SCOPE OF WORK: See attached Section 00800 1.1 of the Supplementary General Conditions

Important Information:

Mandatory Pre-Bid Meeting & Job Walk: Thursday September 29, 2016 @ 10:00 AM Rm PS2 20 (See Map)

Location: Los Medanos College
2700 East Leland Road
Pittsburg, CA 94565

Cost Estimate (Range): $50,000 to $60,000

CA License Required: C-4 Boiler, Hot Water Heating & Steam Fitting

Last Date for Bidder Questions: Tuesday, October 4, 2016 prior to 2:00 PM
Last Day to Issue Addendum: Friday, October 7, 2016 prior to 5:00 PM

BID OPENING: Thursday, October 13, 2016 prior to 2:00 PM
LOCATION: Lobby, CCCC District Office
500 Court St, Martinez, CA 94553

This project is a public works project and is subject to prevailing wage rate laws. A copy of the prevailing rates of wages is on file with the Contracts & Purchasing Office of the Contra Costa Community College District. Said rates of wages will be included in the contract for the work.

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the “Subletting and Subcontracting Fair Practices Act, effective July 1, 2014.

Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process including registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor’s obligation to submit Certified Pay Roll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.
Site Visit Certification (Section 00450) shall be authorized by the representative of the District and shall be submitted with the bid. Failure to submit all of the above may cause your bid to be non-responsive and disqualified for contract award.

All questions related to this project are to be directed in writing, no later than October 4, 2016 prior to 2:00 PM for any addenda to be issued by Jovan Esprit, Contracts Manager, Contra Costa Community College District, Email: jesprit@4cd.edu.

The successful bidder will be required to furnish a labor and material bond in an amount equal to one hundred percent (100%) of the contract price and a faithful performance bond in an amount equal to one hundred percent (100%) of the contract price, said bonds to be secured from a surety company acceptable to the Contra Costa Community College District and authorized to execute such surety in the State of California.

Certificates of Liability Insurance with proper endorsements shall be required for the successful bidder.

The contract time is **36 Calendar Days** between the Notice to Proceed date and the contract Substantial Completion date. Liquidated Damages shall be set for **Five Hundred Dollars ($500.00)** for each Calendar Day the Work is delayed beyond the contract Substantial Completion date; and **Two Hundred Fifty Dollars ($250.00)** for each Calendar Day Remaining Work is delayed beyond the Contract Final Completion Date. The Contra Costa Community College District reserves the right to reject any and all bids and/or waive any informality or irregularity in any bid received. No bidder may withdraw their Bid for a period of ten (10) Calendar Days after the date set for opening thereof.

END OF SECTION
SECTION 00300
BID PROPOSAL FORM
(INFORMAL BIDS)

L-1093 HHW Boiler Isolation Valves
Los Medanos College
2700 East Leland Road, Pittsburg, California 94565

BID DATE: October 13, 2016 prior to 2:00 PM

INSTRUCTIONS TO BIDDERS:

- Please send your BID Proposal in one of these methods:
  a) Email: jesprit@4cd.edu; b) Fax: 925-370-7512; c) Drop off at District Office
- Don't forget to include a Bid Bond for 10% of the Bid amount; (copy attached to Bid Proposal is accepted, original by mail to follow); and signed Certification of Site Visit;
- Bid results shall be sent to you via email message and posted at the District Website;
- For clarification, please call: Jovan Esprit, 925-229-6959 or jesprit@4cd.edu

Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process; registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor’s obligation to submit Certified Payroll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.

1. INTRODUCTION
   A. The Bidder proposes to perform the Work for the Contract Sum and within the proposed time, based upon an examination of the Job Site and Specifications.
   B. The Bidder certifies this proposal is submitted in good faith.
   C. The signed copy of the Certification of Visit to the Site shall be attached to the Proposal Form.
   D. The Bidder shall attach a Bid Security for ten percent (10%) of the Bid Amount in the form of Bid Bond, or Certified Check payable to the District.

   Please Note: PCC 20651 (b); In the event, the successful bidder fails to provide the required Payment and Performance bonds, the Bid Security shall be forfeited in favor of the District and Contractor shall not be entitled for contract award.

2. BID AMOUNT
   For labor, materials, insurances, bonds, fixtures, equipment, tools, transportation, services, sales taxes and other costs necessary to complete the public project in accordance with Specifications, for a stipulated Contract Sum in the amount of:

   Quote for the BASE BID Scope of Work: $ __________________________

   (Write amount of Base Bid)
3. ADDENDUM (if applicable): #1 Received Date: __________; #2 Received Date: __________;

4. SUBCONTRACTORS LIST (If Any)

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the “Subletting and Subcontracting Fair Practices Act, effective July 1, 2014.

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Subcontractor's Name</th>
<th>Address/Phone</th>
<th>Business License # &amp; DIR Registration #</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. COMPLETION TIME
   A. For establishing the Date of Substantial Completion, the contract time shall be **36 calendar days** after date of Notice to Proceed.
   B. Final Completion shall be **30 calendar days** after the date of Substantial Completion.
   C. Prior to the Notice to Proceed issued by the District, the Contractor shall provide a CPM construction schedule, prepared in Microsoft Project format, utilizing the entire time allowed to complete the project. Schedule shall be subject to District's approval.

5. ACCEPTANCE AND AWARD
   The District reserves the right to waive minor irregularities or reject all bids; or negotiate changes before or after execution of the Contract. This Bid shall remain open and shall not be withdrawn for a period of 10 days after Bid Opening date.

If written notice of acceptance of this Bid is mailed or delivered to the Bidder within 10 days after the date set for the receipt of this Bid, or other time before it is withdrawn, the Bidder shall execute and deliver to the District a Contract prepared by District with the required Surety Bonds and Certificates of Insurance, within 10 days after personal delivery or deposit in the mail of the notification of acceptance.
Notice of acceptance or request for additional information may be addressed to the Bidder at the address provided.

The undersigned hereby certifies under penalty of perjury under the laws of the State of California that all the information submitted by the bidder in connection with this proposal and all the representations herein made are true and correct.

_____________________________________________ CSLB License No.: ____________ Exp: _________
Firm Name

_____________________________________________ DIR Registration No.: _______________________
Address

_____________________________________________ Phone: _________________________________

_____________________________________________ Email: _________________________________

_____________________________________________ Print Name  Date
Authorized Signature
SECTION 230000

HEATING VENTILATING & AIR CONDITIONING

PART 1   GENERAL

1.1 Description & Scope

A. Work included: Engineering, materials, equipment, fabrication, installation, starting, testing and commissioning of the following:

1. Heating hot water system

2. Building Automation Systems (BAS)

B. Project Scope Summary

1. See Boiler Isolation Valve Project Exhibit A for the Scope of Work

C. Design/Build Approach

1. The work for this project will be built using a “design/build” approach. The design/build mechanical contractor (“Contractor”) shall be responsible for the design of the scope of work, as indicated herein.

2. The table below indicates engineering responsibility assignments for the Contractor and reviews by the Owner.

<table>
<thead>
<tr>
<th>Item</th>
<th>Contractor</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer-of-Record</td>
<td>P</td>
<td>–</td>
</tr>
<tr>
<td>Mechanical system program requirements</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Equipment sizing</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Equipment selection</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Hydronic distribution systems</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Control systems</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Construction details (see note below)</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Seismic restraints</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Completion of permit drawings</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Title 24 Compliance Documentation</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>HVAC related LEED Documentation</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Project construction management</td>
<td>P</td>
<td>N</td>
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<tr>
<td>Construction and all field work</td>
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<td>N</td>
</tr>
<tr>
<td>Construction quality control</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Start-up &amp; TAB</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Commissioning</td>
<td>P</td>
<td>R</td>
</tr>
</tbody>
</table>

3. Explanatory notes

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a. Primary (P) responsibility shall mean making all decisions and taking
engineer/contractor-of-record responsibility for the item.

b. Review (R) shall mean that the party shall review and comment on the work done by
the party with primary responsibility for the item.

c. No (N) responsibility shall mean the party will have no role with regard to the item.

d. “Construction details” includes wall, roof, and floor penetration details, piping,
ductwork, and equipment details and supports, vibration isolation details,
housekeeping pad layouts and dimensioning, etc.

e. Commissioning, while minor in nature due to the limited scope of work, will be
provided by the Contractor with oversight by the Owner.

4. The Contractor shall be the engineer-of-record as well as the contractor of record and
responsible for all required work.

1.2 Bid Instructions

A. This specification is intended to

1. Specify system performance/design criteria. The HVAC Contractor’s proposal shall not
deviate from these Design Criteria without written approval. Questions regarding the
appropriateness or correctness of requirements shall be directed to the General Contractor
in writing prior to bid. Any changes in design or performance criteria will be
disseminated to all bidders.

2. Establish the desired level of quality, including suggested design options that the Owner
feels will meet the performance requirements and design intent. HVAC Contractors’
proposals shall be based on the suggested approaches.

1.3 Reference Standards

A. Requirements of Regulatory Agencies

1. Nothing in Drawings or Specifications shall be construed to permit Work not conforming
to applicable laws, ordinances, rules, regulations.

2. When drawings or Specifications exceed requirements of applicable laws, ordinances,
rules and regulations, comply with documents establishing the more stringent
requirement.

3. Applicable codes include the current version of those listed below, in addition to others
specified in individual sections

   a. CBC – California Building Code

   b. CMC – California Mechanical Code

   c. City of Codes, Ordinances, and Code Amendments

   d. The State of California Codes
4. If any of above requirements is in conflict with one another, or with Specifications' requirements, the most stringent requirement shall govern. Where codes are silent on an issue, NFPA Standards shall apply.

B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Section

1. AABC - Associated Air Balance Council
2. ADC - Air Diffuser Balance Council
3. AMCA - Air Moving and Conditioning Association
4. ANSI - American National Standards Institute
5. AHRI - Air Conditioning, Heating and Refrigeration Institute
6. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. ETL - Intertek Semko (Formerly Electrical Testing Laboratories)
10. IEEE - Institute of Electrical and Electronic Engineers
11. NEMA - National Electrical Manufacturer's Association
12. NFPA - National Fire Protection Association
13. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
14. UL - Underwriters' Laboratories

C. Industry standards and manufacturers' recommendations, diagrams or requirements shall be strictly adhered to for installation of materials and equipment.

1.4 Quality Assurance

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

B. All items of a given type shall be the products of same manufacturer.

C. Supply all equipment and accessories new and free from defects.

D. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.3 of this section with all applicable national, state and local codes.

1.5 Definitions
A. Definitions of term used in Division 23 Sections may differ from those given in general and supplementary conditions and take precedence over them.

B. “Provide”: to supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. "Install": to erect, mount and connect complete with related accessories.

D. "Supply": to purchase, procure, acquire and deliver complete with related accessories.

E. "Work": labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

F. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

G. "Wiring": raceway, fittings, wire, boxes and related items.

H. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

I. "Exposed": not installed underground or "concealed" as defined above.

J. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or specifications.

K. "Similar" or "equal": of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product, conforming to PART 2 Materials.

L. "Reviewed," "satisfactory," or "directed": as reviewed, satisfactory, or directed by or to Architect.

M. "Motor Controllers": manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

N. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.6 Job Conditions

A. Examine site related work and surfaces before starting work of any Section.

1. Contractors shall be responsible for any conditions that can be visually observed at jobsite and in unconcealed, accessible areas.

2. Contractor shall not be responsible for any conditions in concealed areas that could not be reasonably anticipated at time of bid. Any additional work caused by these conditions shall be by change order.

1.7 Review Of Construction

A. Work may be reviewed at any time by Owner or Owner’s representative.
B. Advise Owner or Owner’s representative that work is ready for review at following times
   1. Prior to concealment of work in walls and above ceilings
   2. When all requirements of Contract have been completed
C. Do not conceal work without Owner’s representative review.
D. Maintain a set of Specifications and Drawings including all change orders on the job for use by Owner's representatives.

1.8 Design Documents

A. An employee of the HVAC Contractor shall serve as Engineer-of-Record. (A third party consulting engineer is acceptable only if consultant has significant design/build experience and a record of working with the HVAC Contractor on past projects of this size and complexity.)

B. The HVAC Contractor/engineer shall maintain a design and detailing schedule consistent with those of the architect and other engineers to produce working drawings and shop drawings in a timely and professional manner, consistent with the project construction schedule.

C. All HVAC system design documents shall be prepared under the supervision of the Engineer-of-Record.

D. Design documents
   1. All design drawings shall be provided in PDF format and primarily consist of control drawings.
   2. Drawings, at a minimum, shall include the following
      a. Control schematics

1.9 Submittals & Shop Drawings

A. Schedule
   1. Allow 10 working days for approval, unless Owner agrees to accelerated schedule.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified in this Section.

C. Submission Procedure
   1. Initial submittal
      a. Each submittal shall have a unique serial number such as “SUBMITTAL 230000-01”.
      b. Submittals may be submitted non-concurrently if required by the schedule.
c. Submit one electronic copy of product data in word-searchable format such as Adobe pdf. Provide separate files for each equipment type. Paper copies or scans of paper copies will not be accepted.

d. Submittal will be reviewed and comments returned to Contractor.

2. Resubmission

a. Each resubmittal shall have the original unique serial number plus unique revision number such as “SUBMITTAL 230000-01 REVISION 1”.

b. Make any corrections or change in submittals as required.

c. Resubmit for review in electronic format described above until no exceptions are taken.

d. Final approval: Once submission is accepted, Contractor shall provide printed and/or electronic copies for coordination with other trades as required by the General Contractor.

D. Contents of Submittals

1. HVAC Equipment Submittals

a. Manufacturer's name and model number

b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to

   1) A schedule, for all items of the same type shall be supplied. The schedule shall include the manufacturer, the model, size, specific information that makes that item unique, the service of the item, the system served by the item.

   2) Physical Data, as applicable

      a) Dimensions

      b) Weight

      c) Finishes and colors

   3) Performance Data, as applicable

      a) Rated capacities

      b) Performance curves

      c) Operating temperature and pressure

   4) Electrical and plumbing requirements

   5) Flow and wiring diagrams as applicable
6) Description of system operation

c. All other pertinent information requested in individual sections

2. HVAC Control System Submittals

   1) System architecture diagram
   2) Hardware
   3) Control schematics

b. Package 2. Submit a minimum of 30 days before field installation of programming.
   1) Sequence in plain English and programming
   2) Graphics screens for user interface

c. Package 3. Submit a minimum of 30 days prior to commissioning functional testing.
   1) Startup forms
   2) Functional test procedure forms

d. Package 4. Test, Adjust, and Balance (TAB) Submittal
   1) All test and report forms that will be submitted for the final TAB report
   2) A written description of the balance procedures
   3) Submit at least 30 days prior to any TAB work.

E. Operating Instructions & Maintenance Manuals

1. Before requesting acceptance of work, submit word-searchable electronic set for review by Owner. Use bookmarks to for each equipment type.

2. After review and making corrections noted, furnish word-searchable electronic set and five printed and bound sets in heavy three-ring binder. Provide separate tabs for each equipment type.

3. O&M manual shall include all submittal data submitted herein above, as installed. The intent of this section is that a single document contains all relevant information about each piece of equipment.

4. In addition to the submittal data, the O&M manual shall also include the following information
   a. Manufacturer's name, model number, service manual, spare-parts list, and descriptive literature for all components
b. Installation instructions

c. Maintenance instructions

d. Wiring diagrams

e. Listing of possible breakdown and repairs

f. Instruction for starting, operation and programming

g. Detailed and simplified one line, color coded flow and wiring diagram

h. Name, address and phone number of contractors equipment suppliers and service agencies

i. Guarantee period, including start and end period

j. Start up test readings, dated and signed by testing technician

F. Record Drawings of Controls

1. Update design/shop drawings to "as-built" conditions

a. Fully incorporate all revisions made by all HVAC crafts in course of work.

b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders

c. Exact location, type, and function of concealed valves, dampers, controllers, piping, air vents and piping drains

d. Exact size, elevations, and horizontal location of piping and ducts

e. Revise equipment schedules to reflect all substitutions

f. Complete for central plant heating hot water system controls. Show existing and new equipment

2. Submit in electronic format per Submittals above for approval.

3. Once approved

a. Provide one set of original Revit files on portable media (e.g. CD) including all referenced background models.

b. Load pdf of complete set of as-built drawings onto the control system front end computer.

c. Provide one full size set of drawings on bond paper.

1.10 Completion Requirements
A. Until the documents required in this section are submitted and approved, the system will not be considered “accepted” and final payment to contractor will not be made.

B. O&M Manual; see Section 1.9E.

C. Record Drawings: See 1.9F.

D. Test and Balance reports; see Section 3.11

E. Inspection and permit: Provide one copy of inspection certificates signed and approved by the local code authorities.

F. Trend Logs: see Paragraph 3.12B.5

G. Functional and demonstration test forms; see Paragraph 3.12B.6.c.1)

H. Training; see 3.12B.7

I. Warranty: Provide written guarantee and warranty documents for all equipment and systems, including the start and end date for each.

1.11 Schedule Of Work

A. Arrange design and construction work to conform to schedules established by the General Contractor and Architect.

B. In scheduling, anticipate means of installing equipment through available openings in structure.

C. Operating Building

1. Various parts of the building will remain operational during construction. Changes to systems that affect these areas must be minimal in impact and time out-of-service.

2. Include any charges, including overtime wages, required to perform work in phases and to minimize downtime of operating areas.

D. Schedule test, balance, and acceptance testing of mechanical systems

1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.

1.12 Guarantee

A. The HVAC Contractor shall guarantee the following

1. All new materials, new equipment, apparatus and workmanship shall be free of defective materials and faulty workmanship.

2. All equipment and material will produce the results specified.

3. All systems have been fully tested, adjusted, balanced, and commissioned.
B. The HVAC Contractor shall furnish written guarantee to replace all defective work, materials, and services furnished under this Section, at no additional cost to the Owner, for the warranty period.

C. The warranty period shall be one (1) year from date of filing of Notice of Completion or beneficial system usage, whichever comes first.

D. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the guarantees or relieving responsibility during the guarantee period.

E. The warranty shall not include
   1. Standard maintenance items
   2. Repairs or replacement of equipment damaged as a result of misuse, abuse, or lack of proper maintenance.
   3. Existing equipment and materials not provided by this contract.

1.13 System Design

A. General
   1. The HVAC system shall be selected and designed by the contractor to provide the specified performance requirements in the most life cycle cost optimum fashion. Suggested design concepts are listed in this section. They shall be used by the contractor, unless an alternative approach of similar or better quality and performance is suggested by the Contractor and approved by the Owner or the Owner’s Rep.

B. Water Distribution Systems
   1. General: Piping systems shall be designed using the prescriptive procedure described below. The prescriptive requirements of this section shall be met.
   2. Prescriptive Approach
      a. Piping shall be designed in accordance with the table below. “Noise Sensitive” spaces are spaces designed for NC 40 and below.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hot and Chilled Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noise Sensitive</td>
</tr>
<tr>
<td>½&quot;</td>
<td>2.2</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>4.5</td>
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<tr>
<td>1&quot;</td>
<td>8.5</td>
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<td>1-1/4&quot;</td>
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<tr>
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</table>
### 3. Balancing

**a. Constant flow systems**

1) For coils/devices with a design pressure drop exceeding 2 psi, flow as indicated by coil pressure drop using test plugs may be used in lieu of balancing valves.

2) At other locations, provide automatic flow control valves (Griswold, Flow Design) or calibrated balancing valves (e.g. B&G circuit-setters).

**b. Do not provide balancing valves at pumps (e.g. triple duty valves).**

### 4. Hot water systems

**a. Systems shall be stepped variable flow, variable speed. The flow shall vary as a function of the operating boilers/open boiler isolation valves.**

### C. Energy Conservation Measures

**1. Pumps**

**a. Variable flow systems shall have variable speed drives**

**b. Pumps in parallel shall be able to be staged with associated boiler using automatic isolation valve end switches to s.**

### PART 2 MATERIALS

**2.1 Hot Water Boilers**

**A. Isolation valves**

1. Belimo BELI F6100HD+DRCX24-3-T or equal

**B. Controls**

1. Isolation valves shall be controlled by (E) boiler controls/software.

2. End switches shall be installed for each isolation valve and connected to (E) BAS.
2.2 Flow Meter (FM)

A. FM-1: Ultrasonic Strap On Type Flow Meters

1. Clamp-on ultrasonic, differential transit time method in direct or reflect mode
2. Strap on type to allow flow meter removal without water supply system shutdown.
3. 4-20 mA transmitter proportional to flow or velocity.
4. Accuracy: ± 1% of reading from 1 to 40 fps
5. Flow range: 1 to 40 fps
6. Matched transducers and a built-in auto zero function
7. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer’s primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute of Standards and Technology (NIST).

8. Manufacturers:
   a. Onicon F-4200
   b. Or equal

B. FM-2: Magnetic Insertion Type Flow Meters

1. Magnetic Faraday point velocity measuring device.
2. Insertion type complete with hot-tap isolation valves to enable sensor removal without water supply system shutdown.
3. 4-20 mA transmitter proportional to flow or velocity.
4. Accuracy: ± 1% of reading from 0.25 to 20 fps
5. Flow range: 0.25 to 20 fps
6. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer’s primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute of Standards and Technology (NIST).

7. Manufacturers:
   a. Onicon F-3500
   b. FloCat YD20-A
   c. Marsh McBirney MultiMag 284
   d. SeaMetrics 100/200 Series
2.3 Variable Speed Drives

A. ABB, Danfoss, Cerus, equal

B. Electrical Characteristics

1. Efficiency shall be not less than 97% at rated voltage, current, and frequency and fundamental power factor shall not be less than 98% at all speeds and loads.

2. VFD shall maintain line noise (voltage harmonics) on the input electrical system at or below levels specified in IEEE 519 for a “General System.” Provide as a minimum 5% impedance line reactors. The 5% impedance may be from dual (positive and negative DC bus) reactors or 5% AC line reactors. VSDs with only one DC reactor shall include AC line reactors.

3. VSD shall include EMI/RFI filters that allow the VSD assembly to be CE Marked and meet product standard EN 61800-3 for the First Environment restricted level.

C. Features and Accessories

1. Plain language LCD display (code numbers not acceptable); all set-up parameters, indications, faults, warnings, and other information must be displayed in words, not codes

2. Displays and meters for the following
   a. Output voltage
   b. Output frequency
   c. Motor rpm
   d. Motor current
   e. Motor watts
   f. Speed signal input
   g. Last three faults

3. HOA switch and speed potentiometer

4. Input line fuses

5. Adjustable or multiple carrier frequencies up to 12 kHz. Include a carrier frequency control circuit that reduces the carrier frequency based on actual VSD temperature that allows the highest carrier frequency without derating the VSD or operating at high carrier frequency only at low speeds.

6. Isolated 4-20 mA or 0-10 Vdc speed signal input. If the input reference is lost the VSD shall, based on user selectable option, either (1) stopping and displaying a fault, (2)
running at a programmable preset speed, (3) hold the speed based on the last good reference received, or (4) cause a warning to be issued.

7. Analog outputs for kW and speed; kW shall be accurate to ±3%

8. Digital outputs for alarm and motor on/off status; latter shall be based on field adjustable motor current that can indicate broken belt or coupling

9. Auto-restart after trip due to
   a. Overcurrent
   b. Under-voltage
   c. Over-voltage
   d. Over-temperature
   e. Auto-restart upon correction of causative condition
   f. Include a maximum of 3 restart attempts for over-current only, with VFD shutting down and requiring manual restart after the third attempt; the attempt counter shall reset after 10 minutes of successful operation

10. Automatic limit speed to prevent over-current on pumps or fans with overloading characteristics

11. Provide manual bypass as indicated in Energy Conservation Measures above

12. Controls
   a. Provide a minimum of two digital outputs that can be programmed for multiple purposes and also controlled through the BAS network interface device by the BAS independent of other VSD functions or status. Control sequence possibilities shall include:
      1) Contact to open fan discharge damper either with fan start or independent of fan operation, controlled via the BAS and wait for the damper end switch to make before starting the drive; this shall function in the normal drive mode, bypass mode (if bypass is provided), and life safety mode (if part of smoke control system).
   b. Provide built-in PID control loop, allowing connection of a pressure or flow signal to the VSD for closed loop control.
   c. Provide factory installed BACnet/MSTP network interface that allows all VSD control points to be communicated to BAS. At a minimum, the following points shall be provided:
      1) Read only: Speed feedback, output speed, current, % torque, kW power, kilowatt hours (resettable), operating hours (resettable), drive temperature, digital input status, analog input values, all diagnostic warning and fault information, keypad
“Hand” or “Auto” selected, bypass selected, deceleration rate, and acceleration rate

2) Read/write: On/off, output speed, digital output open/close, analog output values, remote fault reset, PID setpoint and gains, force the unit to bypass, maximum speed, and minimum speed.

D. Equipment Protection and Safeties

1. VFDs short-circuit interrupting rating shall equal or exceed the fault current available at the drive.

2. VFD shall protect itself against all normal transients and surges in incoming power line, any grounding or disconnecting of its output power, and any interruption or run away of incoming speed signal without time delay considerations. Protection is defined as normal shutdown with no component damage.

3. The VSD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VSD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

4. VFD must protect itself against all phase-to-phase or phase-to-ground faults.

5. VFD shall be able to start into a rotating load at all speeds (forward or reverse) without trip.

6. Anti-regeneration circuit shall match the deceleration rate of the drive to that of the motor to prevent high bus voltage shutdown common to high inertia loads, such as fans.

7. VFD shall ride through an input power dip of 3 cycles without trip.

8. VSD shall operate properly at a -35% to +30% voltage fluctuation from rated voltage.

9. VSD shall operate properly at a 10 percent frequency variation from rated frequency.

10. VFD shall employ three current limit circuits to provide trip-free operation: slow current regulation, rapid current regulation, and current limit switch-off limit. VFD shall be designed so that overcurrent trip shall be at least 315% of the drive’s current rating.

11. VSD shall have the ability to set a maximum current available to the motor.

12. VSD shall withstand unlimited switching of the output under full load, without damage to the VSD. Operation of a disconnect switch between the motor and VSD shall not have an adverse effect on the VSD, whether the motor is operating or not. Controls conductors between the disconnect and the VSD shall not be required for the safe and reliable operation of the VSD.

13. The VSD shall withstand switching of the input line power up to 20 times per hour without damage to the VSD.
14. The VSD shall be capable of operating continuously at full load in the following service conditions
   
   a. Ambient temp: 30 to 104 degrees Fahrenheit
   
   b. Relative humidity: 0 to 95 percent, non-condensing

E. Start-Up/Warranty

1. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each drive with a copy to the owner and a copy kept on file by the manufacturer.

2. Warranty shall be 24-months from date of start-up certification including all parts, labor, travel time, and expenses.

2.4 BUILDING AUTOMATION SYSTEM

A. Direct Digital Controls

1. Andover

2. The system shall be DDC-electric type without the use of pneumatic controls or actuators

B. Submittals and Shop Drawings

1. Submittals and Shop Drawings: See Paragraph 1.9 herein

2. The electronic version of the final documentation shall be loaded onto the control system front end computer with a link on the main graphics screen.

C. General Hardware Requirements

1. The BAS shall be composed of intelligent control panels connected via a peer-to-peer communications network that allows point information from any panel (including zone controllers) to be used in a control sequence in any other panel. The use of a front-end PC or gateway to serve as a communications server is not acceptable.

2. In general, a single stand-alone controller shall be provided for each system (e.g. each air handler and associated condensing unit) and each zone so that control can be maintained in case of communications failure. The controlled device and controlled point for all PID control loops shall be connected to the same stand-alone panel.

3. Each stand-alone unit shall contain the required software stored in non-volatile EEPROM memory, which is not dependent upon the presence of a battery to be retained. Controllers shall allow independent operation regardless of the status of the other units or front-end PC.

4. Temperature sensors
   
   a. Except as indicated below, room sensors shall be accurate to within 0.5°F at 77°F.
   
   b. Duct and immersion sensors shall be accurate to within 0.5°F at 77°F. All piping immersion sensors shall be in thermowells that allow removal from operating system.
c. Outdoor air sensors shall be accurate to within 0.36°F at 77°F and shall have solar shield.

d. Sensors shall drift no more than 0.3°F and shall not require calibration over a three-year period.

e. Other than in public areas, setpoints shall be adjustable at all wall mounted sensors with setpoint knobs with software limits. Include LCD to display setpoint and actual temperature.

f. Other than sensors in 24-hour spaces, provide off-hour override button on room sensors for off-hour override of HVAC with software limitations as to duration of operation.

5. Knowledge of modulating device positions is required, i.e. if a floating point actuator is used, feedback from the actuator is required as an analog input to determine damper position. (For VAV boxes only, timing of open-close contacts to estimate position is acceptable.)

6. Variable speed drives: Each VFD shall include a gateway/interface card in the VFD control panel so that BAS network may directly connect to VFD. See Paragraph 2.3C.12. Map across VFD start/stop, status, all alarm points, and motor power to the BAS. Speed control and start/stop shall be a hard-wire speed signal input to the drive from the BAS; all other points may be passed across the network.

D. General Software Requirements

1. Front-end software shall

   a. Include graphical displays of all systems and subsystems. Provide graphics also of all floor plans showing HVAC zones and lighting control zones along with relevant zone information (e.g. temperature, occupied mode, lighting status). Setpoints shall be adjustable by clicking on the point on the display. Data shall refresh automatically on a regular basis or by a keyboard command.

   b. Allow the user to create graphics

   c. Allow the user to modify and input control sequence software and to download (and compile if required) to panels. Software must include programming tools such as search and replace by variable name, test sequences, etc.

   d. Set up, graphically view, and export trend data to printer or disk. Data must be ASCII or otherwise compatible with Excel spreadsheet.

2. Include PC-Anywhere, Internet interface, or similar software for one off-site PC to allow it to fully communicate with the system through the front-end PC.

3. All custom programs shall be modifiable from front-end PCs without having to "burn chips”.

4. The system must be capable of supporting software ("virtual") points to be used in control sequences and monitored just as if they were real digital or analog points.
5. All setpoints shall be user adjustable (via virtual points if necessary) and not embedded in programming using constants. This includes PID gains.

6. All real and virtual points shall be accessible to all control panels via the communications network for use in any control sequences and for text and graphical display on the front-end computer. (Exception: internal timers and switches that the operator would have no need or desire to change.)

7. Every point, both real and virtual, shall be available for data trending. Trending software shall be capable of recording point values and time on both a user specified regular time step and on a change-of-state basis (data is recorded when point changes by a specified amount (analog) or changes state (binary)).

8. All binary output points controlling fans, pumps, chillers, etc. shall include automatic run-time accumulation with program controlled zeroing.

9. Alarm software shall allow a minimum of 3 levels of alarms to be assigned to different events at user's option. All analog input points shall have user adjustable high and low alarm limits. Binary output points to devices with status inputs shall automatically generate an alarm when the two points disagree after a user adjustable time delay from a change-of-state. The system shall be capable of assigning actions to each alarm level, including printing, displaying on front-end PC with continuous or momentary audible beep, or automatically dialing out alarms to at least two phone numbers, e.g. a remote PC and pager.

10. Temperature and temperature setpoints shall display and be capable of being set to an accuracy of 0.5°F. Static pressures and setpoints shall display and be capable of set to an accuracy of 0.05” W.C. Differential pressures and setpoints shall display and be capable of set to an accuracy of 0.5 psi.

11. The software must allow the user to manually override any real or virtual point at the front-end computer to fix the output value and override any control sequences. Point and graphical display screens must clearly show that the point is under operator control.

12. Control sequences shall be translated into appropriate programming language by the controls subcontractor then submitted to the Owner for review at least three weeks before installation and download at the site. During the warranty period, software bugs (both due to programming misinterpretations and sequence errors) shall be corrected and any reasonable control sequence changes shall be provided at no additional cost.

E. Points: Provide at a minimum the following points, in addition to any points required to meet specified control sequences:

1. Boiler Isolation Valve (boiler isolation valve control shall be by Aerco (E) software)
   a. Valve feedback

2. Heating Hot Water Plant
   a. Supply water temperature
   b. Return water temperature
F. Sequence of Controls

1. Boilers

   a. All boilers require a minimum flow rate for temperature control. This minimum flow rate must be maintained throughout the system at low turndown firing rates and after the call for heat has been satisfied for a period of time long enough to stabilize pressure vessel temperature to prevent the boiler water from flashing to steam causing nuisance high limit and or low water shutdown requiring manual reset per California Safety Orders.

   b. BMK2.0 boilers require 25 GPM minimum flow rate each

   c. Upon a call for heat the AERCO BMS will enable the boilers, as currently programmed.

   d. When Unit Type selected in the C More control configuration menu is BOILER loose capped wires 182 (hot), 184 (neutral) and 183 (ground) are available inside the control. These wires are closed when there is a call for heat and will open when the call for heat has been satisfied (when there is a low water fault these wires will open). Note these wires do not directly power the motorized isolation valves; a 120V electro mechanical relay (solid state relay not acceptable), suitable for the motorized isolation valve load, must be furnished by others to power the motorized isolation valves.

   e. C More configuration menu PUMP DELAY TIMER is 0-30 minutes programmable to keep the isolation valves open for system appropriate time delay.

   f. C More AUX START ON DELAY holds the start sequence of the boiler to give a proving switch (e.g. valve end switch that proves the motorized isolation valve is fully open) the time to make. This proving switch is wired to the Delayed Interlock in the I/O Box. Should the proving switch not make within the programmed time frame (adjustable 0-120 seconds) the boiler will shut down

   g. Upon a call for heat the EMS will start the boiler pumps and enable the AERCO BMS.

   h. Each boiler C More control will control dedicated motorized isolation valve.

   i. AERCO BMS will control each boiler firing rate. Should the AERCO BMS be disabled, each boiler will run on internal temperature set point

   j. HW supply pumps VFD controlled by EMS

   k. As the call for heat is satisfied and when each boiler shuts off there will be an adjustable 0-30 minute time delay before the motorized isolation valve closes

   l. Minimum 25 GPM each boiler flow rate will be maintained throughout the system after the call for heat has been satisfied for a suitable time period.

   m. AERCO BMS will rotate boilers for even wear
n. EMS must maintain at least one motorized isolation valve open at all times to prevent pump dead heading

2. Pumps
   a. Pumps shall be lead/lag alternated.
   b. When the lead system is enabled, first start the lead pump and simultaneously open the boiler isolation valve, then after 30 seconds, enable the boiler. When the lead system is disabled, first disable the boiler, then after 3 minutes turn off the lead pump and simultaneously close the boiler isolation valve.
   c. When any pump is proven on, pump speed will be controlled by a PID loop maintaining the flow signal at a flow setpoint.
      1) The design flow through each boiler is 180 GPM, for a total of 1080 GPM. The design flow through each pump is 650 GPM, for a total of 1300 GPM.
      2) The flow setpoint of the pumps shall vary as a function of the number of operating boilers.
         a) If one boiler is operating, the flow should be maintained at 180 GPM by varying the speed of the lead pump to 27\% (adjustable).
         b) If two boilers are operating, the flow should be maintained at 360 GPM, by varying the speed of the lead and the lag pump to 27\% (adjustable).
         c) If three boilers are operating, the flow should be maintained at 540 GPM, by varying the speed of the lead and the lag pump to 41\% (adjustable).
         d) If four boilers are operating, the flow should be maintained at 720 GPM, by varying the speed of the lead and the lag pump to 55\% (adjustable).
         e) If five boilers are operating, the flow should be maintained at 900 GPM, by varying the speed of the lead and the lag pump to 69\% (adjustable).
         f) If six boilers are operating, the flow should be maintained at 1080 GPM, by varying the speed of the lead and the lag pump to 83\% (adjustable).
      3) The minimum speed setpoint shall be set to provide 25 GPM, the minimum flow of the boiler.
   d. HW pumps shall be staged as a function of HW flow ratio (HWFR = actual flow divided by total plant design flow). When HWFR is above 47\% for 10 minutes, stage on the lag pump. When HWFR is below 47\% for 15 minutes, stage off the lag pump.

G. Electrical Work
   1. All electrical materials and installation provided under this division shall comply with all applicable codes.
2. Wiring in exposed areas (e.g. outdoors or in electrical and mechanical rooms) shall be in conduit. Plenum cable may be used for low voltage wiring above ceilings or in ductwork as allowed by code.

3. All control wiring shall be 120V and less. All wiring for voltages higher that 30 volts shall be installed by a licensed electrician.

2.5 Pipe Materials And Joining Systems

A. Piping materials shall be

1. HW: Schedule 40 Black steel or Type "L" Copper at contractor’s option.

B. Joint System

1. Steel: welded or grooved (Victaulic)

2.6 Pipe Fittings & Accessories

A. Piping system components shall be selected for maximum design operating pressure based on static head, shutoff pump head, and pressure relief valve setting.

B. Gauges

1. Fixed gauges
   a. Temperature gauges
      1) Self-powered via integral photovoltaic cells
      2) Weiss DVU or equal
   b. Pressure gauge: Weksler Model AA44 with valve
   c. Boilers to have factory mounted temperature and pressure gauge

2. Pressure/Temperature Test Plugs: "Pete’s Plug" fittings, solid brass with Nordel valve core (or neoprene valve core for chilled water or condenser water) fitted with a color coded and marked cap with gasket.

C. Check Valves

1. Nibco or equal

2. Silent

3. Combination higher pressure drop check & balance (triple-duty) valves are not acceptable as a substitution for individual check and shut-off valve (due to high pressure drop and poor ease of use).

D. Shut-off Valves

1. Nibco or equal
2. Ball or butterfly valves only

3. Ball valves to be Full Port 1/2 to 1 inch; Standard Port 1-1/4 and larger

4. Butterfly valves used for balancing shall have infinite position handles with memory stop

5. Butterfly valves shall have
   a. Removable seats
   b. Valve stem shall be fastened to the disc so that no liquid can reach the stem
   c. External fasteners such as roll pins, cotters, keys, or set screws will not be allowed
   d. Butterfly valves shall be lug type; no wafer type valves allowed
   e. Provide manual gear operator for butterfly valves 8" and larger

6. Extended neck model for all insulated lines

7. Provide chain operators on all valves located higher than 7 feet above access level

E. Pipe Supports

1. Kin-line, Superstrut, or equal

2. Where pipe is insulated, protect insulation at hangers by installing a 22 gauge shield and clamp sized to allow pipe insulation to pass continuously through the hanger. For piping 2" and larger, provide 360 degree high density calcium silicate insert within shield.

F. Escutcheons: Provide stainless steel escutcheons at piping penetrations of walls where exposed public view and required for proper appearance. Provide galvanized steel escutcheons at penetrations of masonry walls elsewhere. Escutcheons not generally required at drywall penetrations where not exposed to public view.

G. Sleeves

1. Provide sleeves where pipes pass through floors above grade, roofs, poured-in-place masonry walls, and exterior walls.

2. Sleeves shall be standard weight steel pipe, except sleeves for concealed piping through floors not in structural members may be 25-gauge galvanized sheet metal.

3. Floor sleeves for piping shall extend from the bottom of the slab to 2-inches above the finished floor.

4. Seal between piping and sleeve with fire-rated caulk at all penetrations of fire-rated partitions and floors.

5. Make sleeves through outside walls watertight. Caulk between uninsulated pipe and sleeve.

6. Size sleeves for insulated pipes to allow full thickness insulation.
2.7 Insulation

A. Certainteed, Owens Corning, Manville, Knauf or equal

B. Insulation shall:
   1. Meet minimum thickness requirements of Section 120.4 of Title 24 and CMC 604.1
   2. Meet mold, humidity, and erosion resistance requirements of CMC 605.0
   3. Have flame spread not more than 25 and smoke density of not more than 50 when tested as a composite installation per CMC 602.2

C. Piping
   1. Fiberglass molded pipe insulation with all service jacket.
   2. Thickness per Title 24 requirements.
   3. All devices through which water flows in normal operation shall be insulated.
   4. Fittings
      a. Hot water/steam/condensate: Fittings on pipe over 1/2” shall be insulated with fiberglass and finished with one piece PVC fitting cover (Zeston). Valves, flanges and irregular surfaces shall be insulated with over sized pipe covering with ASJ jacket. Exposed ends shall be finished with four ounce canvas jacket saturated in Arabol.
   5. Weatherproof jacket for outdoor piping
      a. Corrugated aluminum jacket
         1) 0.016 inch thick
         2) Moisture barrier adhered to inside face
         3) Longitudinal seams on bottom
       b. Secure to insulation with aluminum or stainless steel bands

D. Hot Equipment: Air separators, pumps, and other hot equipment shall be insulated with 1-1/2” thick fiberglass, and secured with wire or bands. Finish with insulating cement and a six ounce canvas jacket sized with Fosters 30-36 or Arabol as required for a neat job. Do not insulate expansion tank or chemical feeder.

PART 3 EXECUTION

3.1 Record Drawings

A. Keep an accurate dimensional record of installed systems and equipment. Maintain a set of record (“as-built”) drawings up-to-date as construction progresses. Drawings shall be
maintained at the jobsite and available for inspection by the general contractor, other subcontractors, the Engineer, and Owner’s representatives.

3.2 Protection of Work During Construction

A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.

B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage and deterioration during construction. Protect exposed coils with plywood or other suitable rigid covers to avoid damage to fins.

C. Cover motors and other moving machinery to protect from dirt and water during construction.

D. Cover with plastic open ends of lined ductwork where exposed to weather or construction debris.

E. Keep openings in piping closed to prevent entrance of foreign matter.

F. Material, Equipment or Apparatus

1. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.

2. Remove damaged material, equipment or apparatus from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.

3. Porous materials, such as insulation, shall be protected from weather. If such material becomes wet during construction, it shall be removed and replaced at no cost to Owner; drying is not sufficient due to possible microbial contamination.

3.3 Installation and Workmanship

A. All equipment and material shall be installed in a neat and workmanlike manner.

B. Repair all damaged or temporarily removed walls, roofs, roofing, equipment, etc.

C. Follow manufacturer’s installation instructions and recommendations.

D. All equipment must be anchored to the building. All hung equipment shall incorporate vibration isolation.

3.4 Piping

A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak resistant piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

B. Escutcheons: Provide stainless steel escutcheons at piping penetrations of walls where exposed to public view and required for proper appearance. Provide galvanized steel
escutcheons at penetrations of masonry walls elsewhere. Escutcheons not generally required at drywall penetrations where not exposed to public view.

3.5 Seismic Control

A. Install seismic restraints for pipes, ducts and equipment per CBC and SMACNA or Mason Industries Guidelines for pipe and duct bracing.

B. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning, or uplift

1. Calculations required for supports and bracing for situations not covered by referenced guidelines.

2. Include horizontal and vertical reaction loads at connections to building structures for all seismic restraints, including those covered by referenced guidelines. Coordinate reaction loads and attachment details with structural engineer for building.

3. Calculations made and signed by registered structural engineer knowledgeable in seismic design
   a. Hired under this Section of work
   b. Cost of calculations borne under this Section

C. Provide resilient restraining devices as required to prevent equipment motion in excess of 1/4 inch

D. Coordinate seismic bracing requirements with other sections to result in

   1. Vertical pipe and duct restraints to coincide with and take place of required hangers
   2. Longitudinal pipe bracing to coincide with required pipe anchors

E. Bracing shall not short circuit vibration isolation systems or transmit objectionable vibration or noise

3.6 Vibration Isolation

A. Vibration isolation requirements shall be as required to meet sound and vibration design constraints. See Section Error! Reference source not found.

B. Installation

   1. Install isolators and seismic restraints in accordance with manufacturer's written instructions
   2. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment
   3. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified
2. Interior of ductwork at air outlets as far back as visible from occupied spaces
   a. Flat black

3. Marred surfaces of factory painted equipment
   a. Spot coat to match adjacent coat

B. Execution

1. Protect flooring and equipment with drip cloths

2. Paint and materials stored in location where directed

3. Oily rags and waste removed from building every night

4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied

5. Workmanship
   a. No painting or finishing shall be done with:
      1) Dust laden air
      2) Unsuitable weather conditions
      3) Space temperature below 60 degrees F
   b. Pipes painted containing no heat and remain cold until paint is dried
   c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls or other defects
   d. Finished surfaces shall be uniform in sheen, color, and texture
   e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats
   f. Priming undercoat of slightly different color for inspection purposes

6. Piping continuously painted in all exposed areas

C. Paint

1. High gloss medium or long alkyd paint

2. Best grade for its purpose

3. Deliver in original sealed containers

4. Apply in accordance with manufacturers instructions

D. Colors
1. Color to meet existing equipment

2. Interior of ductwork as far back as visible from outside: flat black

3. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer

E. Factory finish

1. Steel air outlets in ceilings: baked white enamel

2. Bare aluminum air outlets: anodized

3. Exposed fan coil units: baked enamel

4. Unit ventilators and unit heaters: baked enamel

F. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat

3.10 Leakage Testing

A. Testing of hydronic systems: Pressure test piping at 1-1/2 times operating pressure, hold for one hour. No loss in pressure will be permitted. All leaks shall be repaired by tightening, rewelding or replacing pipe and fittings. Caulking of joints will not be permitted. Retest as required.

3.11 Testing, Adjusting, and Balancing

A. Test and adjust all items of heating, ventilating and air conditioning system to provide design conditions

1. Testing, adjusting, and balancing shall be performed in complete accordance with AABC or NEBB National Standards for Field Measurements and Instrumentation as applicable to air distribution and hydronic systems.

2. In general, systems shall be balanced so that one or more balancing valves/dampers remains wide open; if further flow reduction is required, pump speed shall be reduced.

3. Hydronic Systems

a. General

1) Equipment (boilers, chillers, etc.): Test and adjust flow through all equipment within 10% of the design requirements. For variable flow systems, no balance is required except for equipment in parallel, balance so that flows are proportionally balanced through each piece of equipment.

b. Under no circumstances shall valves at pumps be used for balance. All balance shall be done using valves at boilers, and other devices served by the pumps (VFDs).

c. Test and adjust entering and leaving flows at boilers. Test documentation shall include design, initial test and final adjusted GPM. Balancing valves shall be
permanently marked after balance is complete so that they can be restored to their correct positions if disturbed.

4. Provide upon completion of running tests, two (2) complete sets of data listed below for all items of equipment for incorporation in Owner's Operation and Maintenance Manual for the job

   a. Name and address of testing agency and name of individual responsible for the work
   b. Make, model and latest calibration date of testing equipment
   c. Sketch or written description sufficient to identify individual devices tested
   d. Entering and leaving water pressures, flow rates, and test temperatures at each piece of hydronic equipment
   e. Manufacturer, size, model, serial number, motor hp, rpm, voltage, full load amps, vee belt sheave sizes, grooves, belts, sizes, length, starter heater size, rating and fuse size of each fan and pump.

3.12 Commissioning

A. Commissioning (Cx) activities shall be coordinated by a representative of the General Contractor who shall serve as the Commissioning Coordinator (CxC) as directed by the Owner.

   1. Cx shall only encompass the BAS sequences/controls impacted by this project.

B. BAS Commissioning

   1. Calibration: Factory calibration is acceptable. Obviously inaccurate sensors must be replaced if calibration is not possible.

   2. Each control loop shall be tuned as required to maintain setpoint within specified accuracy requirements during normal operating conditions and to achieve this stability within 15 minutes after an abrupt system or setpoint change.

   3. Each digital output point shall be tested to ensure the controlled device starts and stops properly. Each digital input status point shall be tested to ensure the input device is properly adjusted (e.g. adjust current setpoint on current switches) and wired.

   4. Each control sequence shall be tested for proper operation. Trend logs shall be collected during the test period accordingly.

   5. Maintain a test log of all testing and calibration.

   6. Functional Tests

      a. Summary

         1) Functional testing is performed to verify proper operation of the mechanical systems, rather than just the verification of each component. The objective of the
functional performance testing is to demonstrate that each system is operating according to the documented design intent and contract documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

2) Each system shall be operated through all modes of operation where there is a specified system response. Verification of each sequence in the sequence of operation is required. Proper responses to such modes and conditions shall also be tested.

b. Prerequisites

1) All pre-functional testing must be successfully completed before beginning functional testing.

2) All HVAC equipment must be successfully started, and Testing, Adjusting, and Balancing work completed before beginning functional testing.

3) Calibration and Loop Tuning must be successfully completed before any functional testing can begin.

4) All systems should be running according to normal sequence of operations unless commanded otherwise as part of functional testing.

c. Procedure

1) Functional tests shall be conducted by the BAS Contractor with the assistance of the HVAC Contractor.

2) Functional test forms shall be submitted to the Owner for review and approval.

3) Demonstration tests: A subset of functional tests selected by the Owner shall be performed by the BAS Contractor and witnessed by the Owner or the Owner’s representatives. The test period shall not exceed 0.5 days.

7. Trend Reviews

a. BAS Contractor shall initiate trends of all real and relevant software points on a 5 minute basis (or COV for digital points).

b. Following successful completion of functional tests, a minimum of two weeks of trend data shall be collected and submitted to the Owner for review and approval. Data shall be in electronic format such as CSV, Excel, Access, or SQL.

c. If any but very minor glitches are indicated in the trends, the verification period will start over until there are two continuous weeks of error free operation. Contractor shall reimburse Owner’s representative at normal billing rates for all time spent reviewing trend reviews after the first set.

d. Final payment and system acceptance will only be made if the trend reviews indicate proper system operation.
C. Training

1. General Training: Upon completion of work, provide Owner's operating personnel two instruction periods in operation and maintenance of material and equipment. Each period shall be 3-hours continuous; first period to be immediately upon completion, and second period within 30 days of completion.

2. Control System Training: Upon completion of all commissioning work, provide Owner's operating personnel three instruction periods in operation of control system. Each period shall be 4-hours continuous; first period to be immediately upon completion, second period within 30 days of completion, and third period just prior to the end of the warranty period.

END OF SECTION
ADDENDUM #1

Boiler Isolation Valve Project Exhibit A

Scope of work

Furnish and install (6) motorized isolation valves (Belimo BELI F6100HD+DRCX24-3-T, or equal) with feedback signal, (1) at each of the six Aerco boilers.

Furnish and install (6) AERCO PN 69102-3 pump control relays.

Furnish and install new ultrasonic or insertion magnetic flow meter on main piping into boiler plant to report GPM to Andover system. Use existing hot water supply and return temperatures (if available, otherwise supply new) along with the flow rate to provide a BTU meter, using GPM and flow to provide calculated BTU on Andover graphics.

Furnish and install (2) new VFDs (ABB or equivalent), (1) on each of the 20hp hot water pump motors, controlled by the Andover controller.

Furnish and install all new wiring for a complete and operating system as described in an approved Sequence of Operations. All new wiring to be installed in conduit.

Develop and implement owner approved Sequence of Operations to control valves and hot water pumps according to boilers in use. Provide point to point checkout for all new points.

Update graphics and floor plans on existing Andover system to reflect new boiler points and all new equipment. Provide a new graphic showing the central plant piping diagram with pipes, pumps, boilers, automatic isolation valves, flow meter, HWS/R, BTU, boiler firing rate, boiler % load, plant % load in the Andover system.

All EMS programming to be performed by a contractor familiar with the Andover Product and the location EMS system. All bidders must be building automation contractors in the business of installing Direct Digital Controls (DDC) for a minimum of 3 years, have an office in the San Francisco Bay/Central Valley area., be a channel partner for “Andover Controls” and have a trained staff of application engineers, who have been certified by Andover in Administration, Networking, Configuration, Programming and service of the automation system. All installers must have a factory-trained technician on-site at all times during installation of the DDC controls).

Contractor shall be responsible for system start-up, commissioning, and testing upon project completion. Contractor shall provide up to 8 hours of on-site training for College and District employees, as is required and agreed upon by the District. Training program to include operation of new control systems, maintenance, and changes to Andover graphics and boiler control points. Contractor to demonstrate system is commissioned and operating as designed by demonstrating a functional performance test of the
ADDENDUM #1

system to the Owner and providing trend review reports. Functional performance test to be created by the contractor and approved by the owner prior to performing testing/demonstration testing.

Contractor will be responsible for complying with Proposition 39 requirements. Contractor is required to report all on-site full time employee and trainee/apprentice hours as well as the number of employees who worked on this project on a Form J after project completion. Contractor must complete and sign the form. See attached ‘LMC Boiler Isolation Project Close-Out Form J’ for reference. Contractor is required to provide detailed itemized invoices after project completion. If invoices are found to not be in enough detail, Contractor will be required to revise the invoices and submit new ones.

All work done on this project must comply with the California Building Standards Code, Title 24 2013, California Code of Regulations (CCR), Part 6, California Energy Code. Requirements include, but are not limited to, Section 110.2 (Mandatory Requirements for Space-Conditioning Equipment), Section 110.3 (Mandatory Requirements for Service Water-Heating Systems and Equipment), Section 120.2 (Required Controls for Space-Conditioning Systems), and Section 140.4 (Prescriptive Requirements for Space Conditioning Systems).
ORIGINAL BOILER DRAWING FOR REFERENCE

New Work Shown Below

LEGEND

- 1/2" STRAINER
- ISOLATION VALVE
- UNION
- BALANCING VALVE
- PRESSURE GAUGE
- TEMP GAUGE
- SFP BACKFLOW PREVENTER

NOTES

1. Remove exiting valve on 3/4" side of boiler. Install (8) 1/2" isolating valves on 3/4" side of boiler.
2. Install new intermediate valve:
3. Add 1/2" backflow Preventer to boiler system.
4. Adjust circuit balancing valves to be full open to prevent limitation to flow. The new SFPs on the pumps will modulate the flow.
Contra Costa Community College District

Minutes
PRE-BID MEETING & SITE WALK (MANDATORY)

=====================================================================================================================  
PROJECT NUMBER/NAME:  L-1093 HHW Boiler Isolation Valves
CAMPUS:  Los Medanos College at 2700 E Leland Rd, Pittsburg, CA 94565

DATE:  September 29, 2016
TIME:  10:00 AM
LOCATION:  Los Medanos College - PS2 20

Important Note:  An on-site job walk follows the meeting.  Attendance at the job walk for this project is mandatory.  At completion of the job walk, be sure to obtain a Certification of Site Visit (Section 00450), signed by the District.  This signed form must be submitted with your bid.

1. Opening Remarks – Rob Mohr, Construction Manager
   •  Introductions
   •  DIR Registration requirement

2. Project Team Members

   Rob Mohr  Construction Manager - Critical Solutions, Inc. (CSI)
   Russ Holt  Buildings and Grounds (B&G) Manager, LMC

3. Brief Project Description

   In general, the Work consists of providing and installing (6) motorized isolation valves, (1) valve controller, flow meter, (2) VFDs, associated wiring and graphics update for a complete functioning system.

   •  Timeline (calendar days):
     o  Bid Opening – Tuesday October 11, 2016
     o  Estimated NTP – Monday October 24, 2016

4. Project Work Restrictions

   •  Refer to Supplementary General Conditions Section 00800
   •  Shutdown to be coordinated and done at a time that does not interrupt usual operations of campus.
5. **Bid Phase Communications & Correspondence**
   - All questions related to this Project must be in writing and directed to:

   **Jovan Esprit, Contracts Manager**
   Contra Costa Community College District
   500 Court St., Martinez, CA 94553
   Email: jesprit@4cd.edu
   Facsimile: 925-370-6517

6. **Addenda Update**
   - Pending.

7. **Bid Phase Schedule Milestones**
   - Last day for RFI: October 4, 2016, 2:00 PM
   - Last Addendum Issued: October 7, 2016, 2:00 PM
   - Bid Opening: October 11, 2016, prior to 2:00 PM
   - Notice to Proceed: October 24, 2016

8. **Bid Opening**
   - All bids will be time stamped at the reception counter in the building lobby.
   - Any bid received after the bid opening time will be rejected.
   - An announcement will be made at the 2-minute mark prior to the bid opening deadline.

9. **Bid Package**
   - Review your bid package carefully before submitting it. **Be sure to include all required documentation.**

10. **Site Job Walk**
    - Review Construction Site
    - Distribute signed Certificate of Site Visit forms

   NOTE: Bid Opening date changed to October 13, 2016
### PRE-BID MEETING
#### SIGN-IN SHEET

**PROJECT TITLE:** L-1093 HHW Boiler Isolation Valves

**DATE / TIME:** Thursday September 29, 2016 at 10:00 AM

**LOCATION:** Los Medanos College

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<thead>
<tr>
<th>COMPANY NAME</th>
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<tbody>
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<td>GLEN NOLC</td>
<td>Account Manager</td>
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<td>Marken Mechanical</td>
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<tr>
<td>Mantle's Boiler</td>
<td>PAUL VONKLER</td>
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