

# Lee's Summit West High School Boiler #3 Replacement

## SECTION 235216 - CONDENSING BOILERS

### PART 1 - GENERAL REQUIREMENTS

#### 1.1 SCOPE

- A. The work to be performed includes all new equipment, labor and materials required to furnish and install a replacement boiler for Boiler #3 at Lee's Summit West High School.

#### 1.2 SUMMARY

- A. This Section includes packaged, factory-fabricated and assembled, gas-fired, condensing boilers, trim, and accessories for heating hot water.
- B. The following Section contains requirements that relate to this Section:
  - 1. Division 22 Section 22700, "Natural Gas Systems" for natural gas equipment connection requirements.

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with the Conditions of the Contract
  - 1. Product data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories; and installation and startup instructions. For boilers with factory-mounted starters, provide short circuit current rating.
  - 2. Shop drawings detailing fabrication and installation of equipment assemblies. Indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.
  - 4. AGA design certificates, for information.
  - 5. Maintenance data for each boiler, control, and accessory to include in the operation and maintenance Manual. Include parts list, maintenance guide, and wiring diagrams.
  - 6. Manufacturer's field reports, indicating work supervised and performed and related observations, for information.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in manufacturing condensing boilers similar to those indicated for this Project and that have a record of successful in-service performance.
- B. Comply with NFPA 70 "National Electrical Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

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1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
  2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. AGA Compliance: Design certified by AGA, tests and ratings according to AGA requirements.
- E. ASME Compliance: Fabricate and stamp boilers according to ASME Boiler and Pressure Vessel Code, Section IV, "Heating Boilers." Provide control and safety devices in compliance with locally adopted edition of ASME CSD-1.
- F. Coordination: Coordinate layout and installation of boilers.
1. Furnish copy of manufacturer's wiring diagram submittal to owner.
  2. Verify size and location of concrete housekeeping pads.
- G. All equipment in this specification shall have parts that are available in the contiguous U.S. for next day shipping. Disclose any foreign made parts that do not meet this requirement.

## PART 2 - PRODUCTS AND MATERIALS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide condensing boilers by one of the following:
- B. Condensing Hydronic Boilers:
1. Fulton "Vantage"
  2. Lochinvar "Crest"

### 2.2 DESCRIPTION

- A. Type: Sealed combustion, gas fired, condensing type hot water boiler with capacities and accessories as scheduled
- B. Factory-assembled and -tested modules include combustion air inlet chamber, pre-purge post-purge blower assembly, air-gas fuel control valve, combustion chamber, cast aluminum or stainless steel heat exchanger, and exhaust; insulated jacket around module and unit-mounted electrical control panel with operation sequence indicator lights.

### 2.3 CONTROLS

- A. Controller: Provide a master firing control processor. Processor will be capable of all boiler operation and efficient staging. The master firing control will also be equipped with open protocol communication for future integration to owners Building Automation System.

2.4 PIPE, FITTINGS, AND JOINING MATERIALS FOR HYDRONIC PIPING

- A. Pipe Threads: ASME B1 .20. I for factory-threaded pipe and pipe fittings.
- B. Welding Materials: AWS DIO. 12; Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- C. Brazing Materials: AWS A5.8; Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.
- D. Soldering Materials: ASTM B32; Refer to individual piping system specifications for solder appropriate for each respective system.
- E. Gaskets for Flanged Joints: ASME B16.21; Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B 16.20, or B1 6.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.
- F. Carbon Steel Grooved Piping System
  - 1. Carbon Steel, A-53B/A-106B roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with manufacturer's current listed standards conforming to ANSVAWWA C-606.
  - 2. Pipe ends to be grooved in accordance with manufacturer's current listed standards conforming to ANSI/AWWA C-606.
- G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grooved Mechanical-Joint Fittings and Couplings:
    - a. Victaulic Company of America.
    - b. Anvil International
    - c. Grinnell Mechanical Products
  - 2. Copper Grooved Piping System
    - a. Victaulic
    - b. Anvil International
    - c. Tyco Grinnell Mechanical Products.
  - 3. Copper Press-Fit Piping System:
    - a. NIBCO, Inc., Press System.
    - b. Viega, ProPress.
    - c. Apollo "Xpress"
    - d. Tyco GRINNELL Mechanical Products "G-Press"
  - 4. Copper Push-to-Connect Piping System
    - a. Victaulic Company of America (PermaLynx).
- H. Pipe and Tubing
  - 1. Drawn Temper Copper Tubing: ASTM B 88, Type L.
  - 2. Annealed Temper Copper Tubing: ASTM B 88, Type K

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### 3. Steel Pipe:

- a. NPS 2 and Smaller: ASTM A 53, Type S (seamless), Grade B, Schedule 40, black steel, plain ends.
- b. NPS 2-1/2 through NPS 10 ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 40, black steel, plain ends.
- c. NPS 12 through NPS 24 ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule STD, black steel, plain ends.
  1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.

### I. Fittings

1. Cast-Iron Threaded Fittings: ANSI B 16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1 .20. 1 .
2. Malleable-Iron Threaded Fittings: ANSI B 16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1 .20.1.
3. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.
4. Wrought-Copper Fittings: ANSI B 16.22, streamlined pattern.
5. Cast-Iron Threaded Flanges: ANSI B1 6.1, Class 125; raised ground face, bolt holes spot faced.
6. Cast Bronze Flanges: ANSI B16.24, Class 150; raised ground face, bolt holes spot faced.
7. Steel Flanges and Flanged Fittings: ANSI B 16.5, including bolts, nuts, and gaskets of the following material group, end connection and facing:
  - a. Material Group: I . 1 .
  - b. End Connections: Butt Welding.
  - c. Facings: Raised face.
8. Unions: ANSI B 16.39 malleable-iron, Class 150 for low pressure service and class 300 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1 .20. 1 .
9. Dielectric Waterway Fittings: Provide electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining, with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged) to effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
10. Dielectric Flanges and Flange Kits:
  - a. Full faced gasket with same outside diameter and bolt holes as the flange. Pressure rating of 175 psi at a temperature rating of 180F.

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- b. Steel washers, thermoplastic washers and bolt isolation sleeves or thermoplastic combination washers and bolt sleeves.

### J. Joining Materials

1. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony, for joining copper piping.
2. Brazing Filler Metals: AWS A5.8, Classification BAg 1 (Silver).
  - a. **WARNING:** Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
3. Welding Materials: Comply, with Section 11, Part C. ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
4. Gasket Material: thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.

## 2.5 PIPE INSULATION MATERIALS

A. Fiberglass Piping Insulation: ASTM C 547-00, Class 1 unless otherwise indicated.

B. Flexible Elastomeric Piping Insulation: ASTM C 534-01a, Type I.

C. Jackets for Piping Insulation: ASTM C 1136, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. PVC fitting covers shall be John Manville Zeston 2000 PVC or approved equal.

D. Coatings for Flexible Elastomeric Pipe Insulation Exposed to Weather: Apply two coats of weather-resistant vinyl lacquer finish over all insulation surfaces.

E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

1. Vapor Barrier Coating: Comply with MIL-PRF-19565C, Type II and be QPD listed. Permeance shall be 0.013 perms or less at 43 mils dry per ASTM E 96, Procedure B.

2. Lagging Adhesive: Comply with MIL-A-3316C, Class 1, Grade A

G. Insulation Diameters: Comply with ASTM C 585 for inner and outer diameters of rigid thermal insulation.

H. Pipe, Valve and Fitting Covers: Comply with ASTM C 450 for fabrication of fitting covers for pipe, valves and fittings.

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### I. High Density Insulation:

1. Calcium Silicate and Fiberglass: ASTM C 795 and MIL-I-24244.
2. Styrofoam Billets: ASTM C 518.

### J. Pre-Engineered Thermal Hanger-Shield Inserts:

1. Calcium silicate insulation meeting ASTM C 795 and encased in steel insulation shield.
2. Flexible elastomeric piping insulation meeting ASTM C 534-01a, Type I with integral high density pipe supports and encased in steel insulation shield.
  - a. Manufacturer: Cooper B-Line / Armacell or approved equal

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install boilers level and plumb, according to manufacturer's written instructions, rough-in drawings, and referenced standards.

B. Install according to NFPA 54.

C. Support boilers on concrete pad – verify existing housekeeping pad size to accommodate new boiler(s)

D. Assemble units and parts shipped loose or disassembled.

E. Install electrical devices furnished with boiler but not specified to be factory mounted.

F. Install piping adjacent to boiler to allow service and maintenance.

G. Connect air intake and exhaust piping to boiler, size as recommended by manufacturer. Provide intake and exhaust piping material per manufacturer's recommendations for the boiler operating conditions.

H. Connect gas piping to boiler according to requirements of Division 22 Section "Natural Gas Systems."

Provide union with sufficient clearance for burner removal and service.

1. Install pressure relief lines from the gas train devices to discharge outside of the building. Relief lines shall be black steel pipe with malleable iron fittings one pipe size larger than the relief outlet of the device. Provide turn down with 40 mesh insect screen at discharge. Provide individual relief lines for each gas train device.

I. Connect hot water piping to supply and return boiler taps, Provide shutoff valve and union or flange at each connection point to existing hot water system.

J. Connect condensate piping to boiler according to manufacturer's requirements. Use manufactures recommended pipe and fittings from boiler to nearest floor drain or as indicated with PH neutralizer. Provide clear plastic tubing between boiler module connection and manifold connection.

K. Verify existing boilers electrical service, breaker size, and conductor size is sufficient to provide power to new boiler. Install new conduit and conductors from an existing junction box to new boiler. All wiring to be installed per the NFPA 70, National Electric Code.

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### L. Controls:

1. Existing boiler has five (5) hardwired control points:
  - a. Boiler #3 Enable
  - b. Boiler #3 Status
  - c. Boiler #3 High Alarm Limit
  - d. Boiler #3 Flame Fail Alarm
  - e. Boiler #3 Low Water Alarm.
2. Owner is to unhook these hardwired points from existing boiler and terminate to new boiler controls. Coordinate with owner before boiler purchase to confirm requirements.
3. Coordinate with owner quantity and locations of weld-o-lets required for BAS temperature sensor wells.

### 3.2 HYDRONIC PIPING APPLICATIONS

- A. Install Type L, drawn copper tubing with wrought copper fittings and solder joints for 2 inch and smaller, above ground, within building. Install Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground or within slabs.
- B. Install steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints for 2-1/2 inch and larger.
- C. At Contractor's option, install mechanically joined piping with mechanical couplings and fittings for chilled and heating water piping systems. Refer to Section "Mechanically Joined Hydronic Piping Systems" for requirements.

### 3.3 HYDRONIC PIPING INSTALLATIONS

- A. Use fittings for all changes in direction and all branch connections. Provide long radius elbows with a minimum centerline radius of  $1\frac{1}{2}$  times the pipe diameter. Short radius elbows with a minimum centerline radius of 1 times the pipe diameter may be used only where space does not permit the long radius elbows.
- B. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- C. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

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- D. Install horizontal piping as high as possible allowing for specified slope and coordination with other components. Install vertical piping tight to columns or walls. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- E. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- F. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
- H. Install piping at a uniform grade of 1 inch in 40 feet upward in the direction of flow.
- I. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.
- J. Install branch connections to mains using Tee fittings in main with take-off out the top of the main unless otherwise shown on the drawings. Up-feed risers shall have take-off out the top of the main line.
- K. Install unions in pipes 2 inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- L. Install dielectric waterways for piping 2" and smaller for copper pipe connections to cast iron, carbon steel or stainless steel equipment connections, valves or fittings.
- M. Install dielectric flanges for piping 2-1/2" and larger for copper pipe connections to cast iron, carbon steel or stainless steel equipment connections, valves or fittings.
- N. Provide brass nipples between the equipment connection and dielectric flange for screwed connections. Provide an iron flange for the equipment side and a bronze flange for the copper piping side of the joint.
- O. Provide a bronze flange for the copper piping connection to a cast iron, ductile iron or steel flange.
- P. Provide full face gasket.
- Q. Provide at each bolt, steel washers, thermoplastic washers and bolt isolation sleeves or thermoplastic combination washers and bolt sleeves.
- R. Install flanges on valves, apparatus, and equipment having 2-1/2 inch and larger connections.
- S. Install flexible connectors at inlet and discharge connections to pumps (unless otherwise indicated) and other vibration producing equipment. Omit flexible connectors if replaced by series of three grooved couplings on projects where grooved pipe is used.
- T. Install strainers on the supply side of each pressure reducing valve, pressure regulating valve, pump, and elsewhere as indicated. install nipple and ball valve in blow down connection of strainers 2 inch and larger.
- U. Anchor piping to ensure proper direction of expansion and contraction

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### 3.4 HANGERS AND SUPPORTS

A. Pipe attachments shall be copper-plated or have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
2. Adjustable roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe roller complete - MSS Type 44 for multiple horizontal runs, 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide insulation saddles and protection shields

C. Install hangers with the following minimum rod sizes and maximum spacing:

| <u>Nom. Pipe Size - In.</u> | <u>Steel Pipe Max. Span - Ft.</u> | <u>Copper Tube Max. Span - Ft.</u> | <u>Min. Rod Dia. - In.</u> |
|-----------------------------|-----------------------------------|------------------------------------|----------------------------|
| Up to 3/4                   | 7                                 | 5                                  | 3/8                        |
| 1                           | 7                                 | 6                                  | 3/8                        |
| 1-1/4                       | 7                                 | 7                                  | 3/8                        |
| 1-1/2                       | 9                                 | 8                                  | 3/8                        |
| 2                           | 10                                | 8                                  | 1/2                        |
| 2-1/2                       | 11                                | 9                                  | 1/2                        |
| 3                           | 12                                | 10                                 | 1/2                        |
| 4                           | 14                                | 12                                 | 5/8 (1/2 for copper)       |
| 5                           | 16                                | 13                                 | 5/8 (1/2 for copper)       |
| 6                           | 17                                | 14                                 | 3/4 (5/8 for copper)       |
| 8                           | 19                                | 16                                 | 7/8 (3/4 for copper)       |
| 10                          | 20                                | 18                                 | 7/8 (3/4 for copper)       |
| 12                          | 23                                | 19                                 | 7/8 (3/4 for copper)       |

D. Support vertical runs at roof, at each floor, and at maximum 15-foot intervals between floors.

E. Install a support within one foot of each change of direction.

F. Space supports not more than five feet apart at valves, strainers or piping accessories in piping larger than 2".

### 3.5 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual. "
- B. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual. "
  - 1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts at piping specialties before brazing.
  - 2. Fill the pipe and fittings during brazing, with an inert gas (ie., nitrogen or carbon dioxide) to prevent formation of scale.
  - 3. Heat joints using oxy-acetylene torch. Heat to proper and uniform temperature.
- C. Threaded Joints: Conform to ANSI B1 .20. 1 , tapered pipe threads for field cut threads. Join pipe fittings and valves as follows:
  - 1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
  - 2. Align threads at point of assembly.
  - 3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
  - 4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
    - a. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- D. Welded Joints: Comply with the requirement in ASME Code B31.9-"Building Services Piping."
- E. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- F. Joints Containing Dissimilar Metals: Provide dielectric nipples for 2" and smaller and dielectric flanges for piping 2-1/2" and larger. Provide dielectric waterway fittings for 2" and smaller in concealed locations.

### 3.6 VALVE APPLICATIONS

- A. General Duty Valve Applications: Unless specifically indicated on construction documents otherwise, the following requirements apply:
  - 1. Shut-off duty: use gate, ball, and butterfly valves.
  - 2. Throttling duty: use globe, ball, and butterfly valves.
  - 3. Install shut-off duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.
- B. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
- C. Install safety relief valves on hot water boilers/generators, and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code Section V III, Division I for installation requirements.

### 3.7 FIELD QUALITY CONTROL

- A. Preparation for testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
  - 1. Leave joints including welds uninsulated and exposed for examination during the test.
  - 2. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
  - 3. Flush system with clean water. Clean strainers.
  - 4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
  - 5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
- B. Pressure Testing: Test hydronic piping as follows:
  - 1. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
  - 2. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the liquid.
  - 3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.

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4. Subject piping systems to a hydrostatic test pressure which at every point in the system is 1.5 times the maximum system design pressure but not less than 100 psi. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength, or 1.7 times the stress value in Appendix A of ASME B31.9, Code For Pressure Piping, Building Services Piping.
5. After the hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
6. Provide test reports summarizing the test procedures and results of the tests.

### 3.8 ADJUSTING AND CLEANING

- A. Clean and flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.
- B. Mark calibrated name plates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

### 3.9 STARTUP

- A. Submit to the State of Missouri Boiler and Pressure Division for inspection of the boiler(s) to obtain a Vessel ID Number.
- B. Provide services of a factory-authorized service representative to provide startup service.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and NFPA 70.
- D. Start boilers according to manufacturer's instructions.
- E. Adjust burner for maximum burning efficiency.
- F. Operate and adjust controls and safeties.
- G. Test and inspect boilers according to ASME Boiler and Pressure Vessel Code, Section IV for low-pressure boilers and Section I for high-pressure boilers.
- H. Retouch any marred or scratched surfaces of factory-finished surfaces, using finish materials furnished by manufacturer.

### 3.10 CLEANING AND TOUCH-UP PAINTING

- A. Flush and clean boilers upon completion of installation, in accordance with manufacturer's startup instructions.
- B. Just prior to substantial completion clean unit's exposed surfaces.
- C. Retouch any marred or scratched surfaces of factory-finished surfaces, using finish materials furnished by manufacturer.

3.11 DEMONSTRATION

- A. Coordinate with Owner to provide services of a factory-authorized service representative to demonstrate the operation of the boiler, burner and controls.
- B. Operate boiler, including accessories and controls, to demonstrate compliance with requirements.

END OF SECTION 235216