

SECTION 15556 - BOILERS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of boiler work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division 3 for concrete pads; not work of this section.
- C. Refer to other Division 15 sections for piping, specialties, water treatment, pumps, breechings, temperature controls, etc., required external to boilers for installation; not work of this section.
- D. Electrical Work: Refer to Division-15 section "Electrical Provisions of Mechanical Work" for requirements.
- E. Electrical Work: Provide the following wiring as work of this section, in accordance with requirements of Division 16:
 - 1. Furnish to Electrical Installer, burner emergency shutoff switch.
 - 2. Provide control wiring between boiler control panel and thermostats, aquastats, pressurestats, or any other control device.
 - 3. Provide factory-mounted and wired controls and electrical devices as specified in this section.
- F. Refer to Division-16 sections for other electrical work including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.2 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of boilers, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Manufacturer's Test: All boilers shall be factory assembled and tested. Submit test results to Architect/Engineer prior to shipping.
- C. Codes and Standards:
 - 1. Cast Iron Boilers:
 - a. I=B=R Compliance: Provide cast-iron boilers that have been tested and rated in accordance with Institute of Boiler and Radiator Manufacturers (I=B=R) "Testing and Rating Standard for Cast-Iron and Steel Heating Boilers", and bear I=B=R emblem on nameplate affixed to boiler.
 - b. NFPA Compliance: Install oil-fired cast-iron boilers in accordance with NFPA Standard 31 "Standard for the Installation of Oil Burning Equipment".
 - c. NFPA Compliance: Install gas-fired cast-iron boilers in accordance with NFPA Code 54 "National Fuel Gas Code".

- d. ASME Compliance: Construct cast-iron boilers in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers". Controls shall be per ASME.
- e. UL and NEMA Compliance: Provide cast-iron boiler ancillary electrical components, which have been "listed" and "labeled" by UL, and comply with NEMA standards. "Listed" and "labeled" shall be defined by NEC, Article 100.

Retain below for projects insured by companies that require FM compliance.
- f. FM Compliance: Provide control devices and control sequences in accordance with requirements of Factory Mutual System (FM).
- g. IRI Compliance: Provide control devices and control sequences in accordance with requirements of Industrial Risk Insurers (IRI).

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), furnished specialties, flue sizing recommendations and accessories; and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, loadings, required clearances, and method of field assembly, components and location and size of each field connection.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to cast-iron boilers. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of cast-iron boilers and controls. Clearly differentiate between portions of wiring that are factory installed and portions to be field-installed.
- D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 15.
- E. Maintenance Data: Submit maintenance data and parts list for each cast-iron boiler, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 15.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Handle boiler sections and equipment carefully to prevent damage, breaking, and scoring. Do not install damaged sections or components; replace with new.
- B. Store boiler sections and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's rigging and moving instructions for unloading boilers, and moving them to final location.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

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

1. Cast Iron Boilers:

- a. Weil-McLain; A Division of the Marley Co.

2.2 CAST IRON PACKAGED GAS-FIRED BOILERS:

- A. General: Provide as indicated, factory-assembled and fire- tested packaged fully modulating gas-fired boilers, of capacity as scheduled. Provide design certified by AGA, net ratings approved by I=B=R, heating capacities based on standard test procedures prescribed by DOE, and constructed in accordance with requirements of the ASME Boiler and Pressure Vessel Code.
- B. Boiler: Construct of cast-iron sections, set on insulated steel base, with sections sealed with high-temperature sealant, and held together with tie rods.
- C. Equipment: Provide insulated extended jacket, vertical draft hood, aluminized steel burners, stainless steel radiation plates, combination gas control valve for 24- volts, 100percent shutoff, thermocouple, built-in air eliminator, non-linting pilot burner, ASME [safety/pressure relief valve](#), [automatic air vent](#), combination pressure-temperature gauge, combination relay receptacle and 40 VA transformer, plug-in circulator relay, automatic low water fuel cutoff, operating controls per ASME, high-limit control, electrical junction box, wiring harness and safety control wiring, [circulator](#), [compression tank with](#) backflow preventor shut-off valve, boiler drain valve and blowdown valve.
- D. Accessories: In addition to above, provide intermittent electronic ignition system, and automatic vent damper.
- E. [\[Edit\]](#) Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of boilers.

2.3 CAST IRON MODULAR GAS-FIRED BOILERS:

- A. General: Provide as indicated, factory-assembled and tested cast-iron, gas-fired fully modulating, modular hot water boilers, designed to be operated in battery of boiler modules, of capacity as scheduled. Provide design certified by AGA, net ratings approved by I=B=R, and constructed in accordance with requirements of the ASME Boiler and Pressure Vessel Code.
- B. Boiler: Construct of horizontal cast-iron sections, connected with push nipples, and provided with cast-iron flue collector.
- C. Equipment: Provide for each module, steel burner base with lanced steel atmospheric type gas burners, thermocouple type safety pilot, automatic gas valve, pressure regulator, high limit control, automatic low water fuel cutoff, operating controls per ASME and AGA, certified draft hood. Provide for each battery of boiler modules, ASME [safety/pressure relief valve](#), and insulated steel jacket.

- D. Controls: Provide gas controls designed to fire each module in battery in step sequence. Arrange controls so any module can be made inoperative without interfering with normal operation of other modules.
1. Each boiler shall be protected from over temperature by two temperature operated controls per ASME.
 2. Each boiler shall be protected by automatic low water fuel cutoff.
 3. Each boiler shall have a flow sensor device installed in the outlet pipe to automatically cut off fuel supply when the flow is interrupted.
- E. Accessories: In addition to above, provide the following accessories:
1. Prefabricated header set.
 2. Domestic hot water heat exchanger.
- F. [Edit] Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of boilers.

2.4 CAST IRON COMMERCIAL GAS-FIRED BOILERS:

- A. General: Provide as indicated, factory-assembled and tested gas-fired fully modulating cast-iron boilers, of capacity as scheduled. Provide design certified by AGA, net ratings approved by I=B=R, and constructed in accordance with requirements of the ASME Boiler and Pressure Vessel Code.
- B. Boilers: Construct of cast-iron sections, sealed with asbestos rope, and assembled with tie rods.
- C. Equipment: Provide insulated jacket, horizontal to vertical draft hoods, built-in air eliminator, factory-assembled base and burners, prepiped gas control assemblies, aluminized steel burners, manual main shutoff gas valves, pilot shutoff valves, high pressure gas switches, 40 VA transformer, electrical junction box, and flue brush.
1. Provide intermittent electronic ignition system consisting of electronic control, electronic supervised pilot, combination automatic gas valves and pressure regulators, redundant gas valves, pilot filters, and automatic 100 percent shutoff.
 2. Provide for water boilers high-limit control, operating control, per ASME combination pressure-temperature- altitude gauge, automatic low water fuel cut off and ASME safety relief valve (15 psig).
 3. Provide for steam boilers automatic low water fuel cutoff, pressure high limit control, operating pressure control, per ASME, steam pressure gauge (0-30 psig), gauge glass set with gauge cocks, siphon, and ASME safety relief valve (15 psig).
- D. Accessories: In addition to above, provide the following accessories:
1. Tankless water heater.
 2. Low water cutoff and feeder combination.
 3. 1-1/2inch inspection opening with brass plug for each section.
 4. Pilot pressure regulator.
 5. Multi-stage firing.
 6. Electronic flame safeguard control system with panel.
 7. High-Low-Off firing.
 8. Full modulation firing.
 9. Flow switch.

- E. [Edit] Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of boilers.

2.5 CAST IRON FORCED DRAFT BOILERS:

- A. General: Provide as indicated, factory assembled and tested package, forced draft cast-iron, fully modulating boilers of capacity as scheduled. Provide net ratings approved by I=B=R, and construct in accordance with requirements of ASME Boiler and Pressure Vessel Code.
- B. Boiler: Construct of cast-iron sections with integral base, sealed with asbestos rope for gas-tight construction, factory-assembled and tested.
- C. Equipment: Provide insulated flush jacket, burner mounting plate with refractory. Provide water-backed combustion area with water circulating around firebox, access to flow passages for cleaning and flame observation ports. flue collar with built-in breeching damper, front cleanout doors and plates, back access door, flue brushes and handles, close nipples and caps for washout tappings on front and back sections, and supply elbows or top outlets.
1. Provide intermittent electronic ignition system consisting of electronic control, electronic supervised pilot, combination automatic gas valves and pressure regulators, redundant gas valves, pilot filters, and automatic 100 percent shutoff.
 2. Provide for hot-water boilers ASME relief valve (15 psig), combination high-limit control, automatic low water fuel cutoff, operating pressure controls per ASME, and combination pressure-temperature-altitude gauge.
 3. Provide for steam boilers ASME safety relief valve (15 psig), automatic low water fuel cutoff, low-limit and high-limit pressure controls, operating controls per ASME, steam pressure gauge (0-30 psig), siphon, gauge glass set with gauge cocks.
- D. Accessories: In addition to above, provide the following accessories:
1. Water level controls.
 2. Auxiliary Low water cutoff and feeder combination.
 3. Barometric damper.
 4. 1-1/2inch side inspection openings with plugs.
 5. Tankless water heater.
 6. Flow switch.
 7. Pilot pressure regulator.
 8. Multi-stage firing.
 9. High-Low-Off firing.
 10. 10.Full modulation firing.
- E. Burner: Provide flame retention power burner for oil, gas, or gas-oil as scheduled. Provide burner mounted, factory- wired control panel for operation as scheduled.

Edit the following control to be provided with Boiler; Provide auxiliary contracts if connected to B.A.S. for monitoring.

- F. Operating Temperature Control: Electric indoor/outdoor controller maintains boiler water temperature with outdoor temperature reset.

OR

Operating Temperature Control: Electronic operating temperature controller maintains boiler water temperature with electronic primary and outdoor sensors. Reset ratio of outside air temperature change to discharge control point changes adjustable from 1:2 to 100:1, with adjustable initial set point from 80 to 230 degrees (27 to 110 degrees C.) Mounted in NEMA 250, type 1 wall mounted enclosure with full cover.

- G. [\[Edit\]](#) Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of boilers.
- H. Combination Burner Controls: Pre-wired factory assembled electronic controls in control cabinet with flame scanner or detector, programming control, relays and switches. Performs pre-purge and post-purge for ignition, and shuts down burner in event of ignition pilot and main flame failure, with manual reset.
- I. Hot Water Boiler Trim:
 - 1. Hot water connections: Supply and return connection locations shall provide internal thermal circulation which will mix return water with hot water in boiler.
 - 2. Drain Valves: Provide at low points.
 - 3. Dip tube: An integral part of the hot water outlet, and air vent tapping in boiler shell for removal of entrained air.
 - 4. Low water cutoff: Mounted on the side of boiler; factory-wired into burner control circuit to prevent burner operation if boiler water falls below safe level.
 - 5. Pressure and temperature gauges: Mounted on boiler, with temperature sensing element located adjacent to the hot water outlet.
 - a. Water pressure relief valves: Of type and size to comply with ASME Code requirements.
 - b. Temperature controls: To regulate burner operation; mounted temperature sensing elements adjacent to hot water outlet.
 - c. Operating controls per ASME.
 - d. Safety pressure controls: High-pressure-limit control.
- J. Gas Burner: High radiant multiport type burner, integral with front head of boiler, approved for operation with natural, manufactured, or mixed gas.
 - 1. Operation:

Select one of the Following.

- a. Burner Operation and Combustion Air Control: On-off principle with manually operated combustion air damper for proper air-fuel ratios. *Use for 15-20 BHP.

OR

Burner Operation and Combustion Air Control: High-low-off with motor-operated combustion air damper, linked with auxiliary switch; controls high or low fire gas supply. Return burner to low fire position for ignition. *Use for 30-40 BHP.

OR

Burner Operation and Combustion Air Control: Full modulation principle, 4-to-1 turndown ratio. Motor-operated combustion air damper and cam-operated, butterfly gas-metering valve, operated by a single damper-control motor. Regulate fire according to load demand. Damper motor operated by potentiometer type positioning controls. Burner returned to low fir position for ignition. *Use for 50-800 BHP.

- b. Return burner to low fire position for ignition.
- 2. Gas pilot: premix type with automatic electric ignition, complete with electronic detector to monitor pilot so primary fuel valve cannot open until pilot flame has been established.
- 3. Forced draft blower: for combustion air, mounted on front of boiler, with steel blower wheel and radial blades, directly connected to flanged type motor.
- 4. Combustion Air Control:

Select one of the Following.

- a. Manually operated damper for proper air-fuel ratios. *Use for 15-20 BHP.

OR

Motor-operated combustion air damper, linked with auxiliary switch to control high or low fire gas supply. *Use for 30-40 BHP.

OR

Motor-operated combustion air damper and cam-operated butterfly gas metering valve, operated by single damper control motor to regulate fire according to load demand. Operation of damper control motor shall be regulated by potentiometer type positioning controls. *Use for 50-800 BHP.

- 5. Gas burner piping: integrally mounted, including primary gas shutoff valve, motor operated with spring return, designed to start and stop gas burner, and to close automatically in event of power failure, flame failure, or low water condition. Gas train shall include lubricated plug cock located upstream of primary valve for manual shutoff, plugged leakage test cock and second lubricated plug cock; additional devices required, include:
 - a. A proof of closure switch on primary valve, and high and low gas pressure switches. *Use for 60-800 BHP.

OR

A second motorized safety shutoff valve and additional plugged leakage test cock, with proof-of-closure switch and manual reset. *Use for 125-800 BHP.

OR

A vent valve located between safety shutoff valves. *Use for 300-800 BHP.

6. Control panel: NEMA 1A control panel mounted on front of boiler, complete with an electronic programming relay, blower motor starter, and control switches. Panels shall include:
 - a. Plug-in fuel modules, and indicating lights for low water level, flame failure, fuel valve open, and load demand; Delete for units less than 50 BHP.
 - b. Programming relay, to control ignition timing and starting and stopping burner through pre-combustion purge and post-combustion purge, plus a flame scanner to shut down burner in event of ignition, pilot, or main flame failure.
 - c. Manual-automatic selector switch and damper motor positioning switch to permit automatic firing in accordance with load demand, or manual control of firing rate at any desired point between low fire and maximum rating; (Delete for units less than 30 BHP).
 - d. Factory-wired UL-labeled electrical equipment. Use oil, heat, and moisture resistant wire throughout.

PART 3 EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which boilers are to be installed, and substrate which will support boilers. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF CAST-IRON BOILERS:

- A. General: Install boilers in accordance with manufacturer's installation instructions, in accordance with State and local code requirements, and in accordance with requirements of local Utility Company. Install units plumb and level, to tolerance of 1/8inch in 10-0 inches in both directions. Maintain manufacturer's recommended clearances around and over boilers.
- B. Support: Install boilers on 4inches thick concrete pad, 6inches larger on each side than base of unit.
- C. Erection: Assemble boiler sections in proper sequence and with sealing between each section. Assemble boiler trim shipped loose, or unassembled for shipment purposes. Follow manufacturer's installation instructions.
- D. Electrical Work: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 1. Verify that electrical work installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment Installer.
- E. Gas Piping: Refer to Division-15 section "Natural Gas Systems". Connect gas piping to boiler, full size of boiler gas train inlet, provide union with sufficient clearance for burner removal and service.

- F. Oil Piping: Refer to Division-15 section "Fuel Oil Systems". Connect oil piping to boiler, full size of inlet to burner, provide shutoff valve and union with sufficient clearance for burner removal and service.
- G. Hot Water Piping: Refer to Division-15 section "Hydronic Piping". Connect supply and return boiler tappings as indicated, with shutoff valve and union or flange at each connection.
- H. Steam and Condensate Piping: Refer to Division-15 section "Steam and Condensate Piping". Connect supply, return, and blowdown boiler tappings as indicated, with shutoff valve and union or flange at each connection.
- I. Breeching: Refer to Division-15 section "Breechings, Chimneys, and Stacks". Connect breeching to boiler outlet, full size of outlet. Route as indicated.

3.3 FIELD QUALITY CONTROL:

- A. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.
- B. Hydrostatically test assembled boiler and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.
- C. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boiler piping, observation of hydrostatic testing, and for certification of completed boiler units.
- D. Start-up boilers, in accordance with manufacturer's start-up instructions, and in presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.

3.4 CLOSEOUT PROCEDURES:

- A. [Edit] Owner's Instructions: Provide services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of boilers.

3.5 ADJUSTING AND CLEANING:

- A. Clean and flush hydronic piping systems. Remove, clean, and 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.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.6 DEMONSTRATION:

- A. Services: After testing and inspection is complete, provide the services of an authorized factory service representative to perform start-up and operation demonstration service.
- B. Start-up: Perform services in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

- C. Maintenance and Operation Training: As a part of the maintenance and operating instructions, review data in operating and maintenance manual, including preventative maintenance schedule and procedures, and procedures for obtaining repair parts and technical assistance. Demonstrate all phases of operation including start-up and shut-down.
 - 1. Schedule training with Owner, provide at least 7-day notice to Architect/Engineer.
- D. Provide Combustion Test Record for each Boiler which shall include a minimum of the following information submitted following the test.

TIME:
DATE:

FUEL:	NATURAL GAS:	BTU/LB	Mid Range Manifold Pressure: WCI
COMBUSTION EFFICIENCY:		%	Steam Pressure: PSI
AMBIENT TEMPERATURE:		°F.	
STACK TEMPERATURE:		°F	
OXYGEN:		%	
CARBON MONOXIDE:		PPM	
CARBON DIOXIDE:		%	
COMBUSTIBLE GASES:		%	
STACK DRAFT (INCHES H ₂ O):			
EXCESS AIR:		%	
OXIDES OF NITROGEN:		PPM	
SULFUR DIOXIDE		PPM	
CARBON MONOXIDE ALARM:		PPM	

TEST PERFORMED BY:

END OF SECTION 15556