SECTION 235223 - CAST-IRON BOILERS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes cast-iron boilers, trim, and accessories for generating [**hot water**] [**and**] [**steam**].
			2. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer's installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.

Include rated capacities, operating characteristics, and furnished specialties and accessories.

* + - * 1. Shop Drawings: For boilers, boiler trim, and accessories.

Include plans, elevations, sections, and [**mounting**] [**attachment**] details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for boiler, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

* + - * 1. Source quality-control reports.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For special warranty.
				3. Product Test Reports:

Retain first subparagraph below for project in Canada.

CSA B51 pressure vessel Canadian Registration Number (CRN).

Startup service reports.

Startup service reports.

* + - 1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.
			2. WARRANTY

When warranties are required, verify with Director’s Representative's counsel that warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws. Coordinate with Section 016000 "Product Requirements." See discussion about warranties in "Warranties" Article in the Evaluations.

* + - * 1. Manufacturer's Warranty: Manufacturer agrees to repair or replace controls and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components.

Warranty Period for Controls: [**Two**] <**Insert number**> years from date of Substantial Completion.

Warranty Period for Heat Exchangers: [**Five**] [**10**] [**20**] <**Insert number**> years from date of Substantial Completion.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

* + - 1. PERFORMANCE REQUIREMENTS
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				2. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.

"ASHRAE/IES 90.1 Compliance" Paragraph below may be required to comply with Project requirements or authorities having jurisdiction and is required for sustainable design systems.

* + - * 1. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

Delete "DOE Compliance" Paragraph below if boiler rating exceeds 300,000 Btu/h.

* + - * 1. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.
				2. I=B=R Compliance: Boilers shall be tested and rated according to AHRI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.

Retain second option in "UL Compliance" Paragraph below for combination burners

* + - * 1. UL Compliance: Test boilers for compliance with [**UL 726**] [**UL 726 and UL 795**] [**UL 795**]. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

Retain "CSA Compliance" Paragraph below for projects in Canada.

* + - * 1. CSA Compliance: Test boilers for compliance with CSA B51.
				2. Mounting Frame: Steel rails used to mount assembled boiler package on concrete base.

Retain "Seismic Fabrication Requirements" Subparagraph below for projects in seismic areas. If retaining, also retain "Seismic Qualification Data" Paragraph in "Informational Submittals" Article.

Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when mounting base is anchored to building structure.

* + - 1. MANUFACTURERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6257) Subject to compliance with requirements, provide products by one of the following:

Smith Cast Iron Boileres

Burnham Cast Iron Boilers

Well-McLain Cast Iron Boilers

[Hydrotherm, Inc./Mestek, Inc](http://www.specagent.com/Lookup?uid=123457137872).

[Lennox Industries, Inc.; Lennox International](http://www.specagent.com/Lookup?uid=123457137873).

[Viessmann Manufacturing Co. (US) Inc](http://www.specagent.com/Lookup?uid=123457137877).

Approved equivalent.

* + - 1. MANUFACTURED UNITS
				1. Description: Factory fabricated and [**field**]assembled.

Retain one of two subparagraphs below. Retain first for factory-assembled boilers and second for field-assembled boilers.

Cast-iron sections shall be sealed pressure tight and held together with tie rods[**set on an insulated steel base**], including insulated jacket and flue-gas vent connection.

Ship cast-iron sections disassembled with all materials and equipment, including seals, tie rods, and insulated jacket and flue-gas vent connection for field assembly.

* + - * 1. Cast-Iron Section Design:

Configuration: Wet [**base**] [**back**] [**leg**].

Number of Passes: [**Single**] [**Multiple**].

Sectional Joints: High-temperature sealant to seal flue-gas passages not in contact with heating medium, [**tapered cast-iron push nipples,**] [**O-ring gaskets,**] [**fiber roping,**] and held together with tie rods.

Drain and blowdown tappings.

Return injection tube to equalize water flow to all sections.

Crown inspection tappings with brass plugs.

Separator in subparagraph below is available only in small residential-size boilers. Verify availability with manufacturer.

Built-in air separator.

* + - * 1. Combustion Chamber: Equipped with [**ceramic-fiber target wall**] [**refractory**] [**insulation**] [**and**] flame observation ports, front and back.
				2. Casing:

Jacket: [**Galvanized sheet**] [**Sheet**] metal, with snap-in or interlocking closures and [**baked-enamel**] [**powder-coated**] protective finish.

Insulation: Minimum [**1-inch-**] [**2-inch-**] thick, mineral-fiber insulation surrounding the heat exchanger.

Feature in "Combustion Chamber Access" Subparagraph below is unique for some boiler manufacturers.

Combustion Chamber Access: Refractory lined, hinged, front.

Access: For cleaning between cast-iron sections.

Draft Hood: Flue canopy and [**top**] [**rear**] flue connection shall be constructed of [**aluminized**] [**stainless**] steel containing adjustable outlet damper assembly.

Delete first subparagraph below if boiler design permits.

Insulated base constructed of aluminized steel to permit boiler to be installed on combustible floor.

Cabinet in subparagraph below is available only in residential natural-draft boilers.

Control Cabinet: Sheet metal casing shall cover all controls, gas train, and burner.

Delete "Draft Diverter" Paragraph below if boiler has forced-draft burner. If retaining, verify draft-diverter configuration with manufacturer.

* + - * 1. Draft Diverter: [**Steel assembly integral with boiler casing**] [**Separate galvanized-steel assembly**].

Retain "Atmospheric-Gas Burner," "Sealed-Combustion Burner," "Forced-Draft Burner," "Oil Burner," or "Combination Gas and Oil Burner" Article below.

* + - 1. ATMOSPHERIC-GAS BURNER
				1. Burner Tubes and Orifices: [**Stainless steel**] [**Cast iron**], for [**natural**] [**propane**] gas.

Retain one of two "Gas Train" paragraphs below. First applies to commercial boilers; second applies to residential boilers. Retain any of first three options with any of last four options.

* + - * 1. Gas Train: Control devices and [**full-modulation**] [**on-off**] [**low-high-low**] control sequence shall comply with requirements in [**ASME CSD-1**] [**FM Global**] [**IRI**] [**UL**].
				2. Gas Train: Combination-gas valve with manual shutoff, pressure regulator, and pilot adjustment.
				3. Pilot: [**Standing**] [**Intermittent-electric-spark**] pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

Retain "Sealed Combustion Burner" Article for residential-sized boilers that require this type of burner.

* + - 1. SEALED-COMBUSTION BURNER
				1. Burner Tubes and Orifices: [**Stainless steel**] [**Cast iron**], for [**natural**] [**propane**] gas.
				2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor, with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

* + - * 1. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
				2. Pilot: [**Standing**] [**Intermittent-electric-spark**] pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
			1. FORCED-DRAFT BURNER
				1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for [**natural**] [**propane**] gas.
				2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor, with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Retain any of first three options in "Gas Train" Paragraph below with any of last four options. Availability of three control sequences listed depends on boiler capacity. Consult boiler manufacturer.

* + - * 1. Gas Train: Control devices and [**modulating**] [**on-off**] [**low-high-low**] control sequence shall comply with requirements in [**ASME CSD-1**] [**FM Global**] [**IRI**] [**UL**].
				2. Pilot: [**Intermittent**] [**Interrupted**]-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

Retain "Flue-Gas Recirculation" Paragraph below to decrease oxides of nitrogen emissions. Not all manufacturers can comply with options listed below.

* + - * 1. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.

Maximum Oxides of Nitrogen Emissions: [**20**] [**30**] <**Insert number**> ppm.

* + - 1. OIL BURNER
				1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil.
				2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor, with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Retain any of first three options in "Oil Supply" Paragraph below with any of last four options. Availability of three control sequences listed depends on boiler capacity. Consult boiler manufacturer.

* + - * 1. Oil Supply: Control devices and [**modulating**] [**on-off**] [**low-high-low**] control sequence shall comply with requirements in [**ASME CSD-1**] [**FM Global**] [**IRI**] [**UL**].

Oil pump may be remotely mounted and shipped separately. Revise performance parameters in "Oil Pump" Subparagraph below to suit Project.

Oil Pump: Two-stage, gear-type oil pump[**integral to and directly driven by blower**] shall be capable of producing 300-psig discharge pressure and 15-inch Hg vacuum.

Oil Piping Specialties:

Suction-line, manual gate valve.

Removable-mesh oil strainer.

0- to 30-inch Hg vacuum; 0- to 30-psig vacuum-pressure gage.

0- to 300-psig oil-nozzle pressure gage.

Nozzle-line, solenoid-safety-shutoff oil valve.

* + - * 1. Pilot: [**Intermittent**] [**Interrupted**]-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid using [**cadmium sulfide**] [**UV scanner**] flame-safety control.

Retain "Flue-Gas Recirculation" Paragraph below to decrease oxides of nitrogen emissions. Not all manufacturers can comply with options listed below.

* + - * 1. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.

Maximum Oxides of Nitrogen Emissions: [**20**] [**30**] <**Insert number**> ppm.

* + - 1. COMBINATION GAS AND OIL BURNER
				1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and [**natural**] [**propane**] gas.
				2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor, with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

Retain any of first three options in "Oil Supply" Paragraph below with any of last four options. Availability of three control sequences listed depends on boiler capacity. Consult boiler manufacturer.

* + - * 1. Oil Supply: Control devices and [**modulating**] [**on-off**] [**low-high-low**] control sequence shall comply with requirements in [**ASME CSD-1**] [**FM Global**] [**IRI**] [**UL**].

Oil pump may be remotely mounted and shipped separately. Revise performance parameters in "Oil Pump" Subparagraph below to suit Project.

Oil Pump: Two-stage, gear-type oil pump [**integral to and directly driven by blower**] shall be capable of producing 300-psig discharge pressure and 15-inch Hg vacuum.

Oil Piping Specialties:

Suction-line, manual, gate valve.

Removable-mesh oil strainer.

0- to 30-inch Hg vacuum; 0- to 30-psig vacuum-pressure gage.

0- to 300-psig oil-nozzle pressure gage.

Nozzle-line, solenoid-safety-shutoff oil valve.

Retain any of first three options in "Gas Train" Paragraph below with any of last four options. Availability of three control sequences listed depends on boiler capacity. Consult boiler manufacturer.

* + - * 1. Gas Train: Control devices and [**modulating**] [**on-off**] [**low-high-low**] control sequence shall comply with requirements in [**ASME CSD-1**] [**FM Global**] [**IRI**] [**UL**].
				2. Gas Pilot: [**Intermittent**] [**Interrupted**]-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
				3. Oil Pilot: [**Intermittent**] [**Interrupted**]-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with [**cadmium sulfide**] [**UV scanner**] flame-safety control.

Retain "Flue-Gas Recirculation" Paragraph below to decrease oxides of nitrogen emissions. Not all manufacturers can comply with options listed below.

* + - * 1. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.

Maximum Oxides of Nitrogen Emissions: [**20**] [**30**] <**Insert number**> ppm.

Retain "Trim for Hot -Water Boilers" or "Trim for Steam Boilers" Article below.

* + - 1. TRIM FOR HOT-WATER BOILERS
				1. Include devices sized to comply with ASME B31.9.

Retain "Aquastat Controllers" Paragraph below if using modulating or low-high-low firing sequence.

* + - * 1. Aquastat Controllers: Operating [**, firing rate,**] and high limit.
				2. Safety Relief Valve: ASME rated.
				3. Pressure and Temperature Gage: Minimum 3-1/2-inch- diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.
				4. Boiler Air Vent: [**Automatic**] [**Manual**].
				5. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
				6. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.

Tappings NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

Tappings NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

* + - 1. TRIM FOR STEAM BOILERS
				1. Include devices sized to comply with ASME B31.9.

Retain option in "Pressure Controllers" Paragraph below if using modulating or low-high-low firing sequence.

* + - * 1. Pressure Controllers: Operating [**, firing rate,**] and high limit.

Retain "Safety Relief Valve" Paragraph below if safety valve is a component of boiler. Coordinate with Section 232216 "Steam and Condensate Heating Piping Specialties."

* + - * 1. Safety Relief Valve:

Size and Capacity: As required for equipment according to 2010 ASME Boiler and Pressure Vessel Code.

Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

* + - * 1. Pressure Gage: Minimum 3-1/2-inch diameter. Gage shall have normal operating pressure about 50 percent of full range.
				2. Water Column: Minimum 12-inch glass gage with shutoff cocks.
				3. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.
				4. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle.
				5. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size as or larger than nozzle. Valves larger than NPS 2 shall have rising stem.

Retain "Stop-Check Valves" Paragraph below for boilers equipped with manhole openings that operate at more than 15 psig and supply steam to a common steam header with other boilers.

* + - * 1. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.

Coordinate "Tankless Heater" Paragraph below with other Sections for domestic water heaters. A tankless heater is not available from all manufacturers listed.

* + - * 1. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.

Tappings NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

Tappings NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

* + - 1. CONTROLS

Retain first paragraph below if controls are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

* + - * 1. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

Delete paragraph above and retain first two paragraphs below if controls are components of boilers. Coordinate with Section 230993.11 "Sequence of Operations for HVAC DDC."

* + - * 1. Boiler operating controls shall include the following devices and features:

Control transformer.

Set-Point Adjust: Set points shall be adjustable.

Retain "Operating Pressure Control" and "Low-Water Cutoff and Pump Control" subparagraphs below for steam boilers.

Operating Pressure Control: Factory wired and mounted to cycle burner.

Low-Water Cutoff and Pump Control: Cycle feedwater pump(s) for makeup water control.

Retain one of first two "Sequence of Operation" subparagraphs below for hot-water boilers.

Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.

Include automatic, alternating-firing sequence for multiple boilers to provide equal runtime for boilers.

Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At [**0 deg F**] <**Insert temperature**> outside-air temperature, set supply-water temperature at [**200 deg F**] <**Insert temperature**>; at [**60 deg F**] <**Insert temperature**> outside-air temperature, set supply-water temperature at [**140 deg F**] <**Insert temperature**>.

Include automatic, alternating-firing sequence for multiple boilers to provide equal runtime for boilers.

Retain "Sequence of Operation" Subparagraph below for steam boilers

Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.

Include automatic, alternating-firing sequence for multiple boilers to provide equal runtime for boilers.

* + - * 1. Safety Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

In "High Cutoff" Subparagraph below, retain third option for hot-water boiler and fourth option for steam boiler.

High Cutoff: [**Manual**] [**Automatic**] reset stops burner if operating conditions rise above maximum boiler design [**temperature**] [**pressure**].

In "Low-Water Cutoff Switch" Subparagraph below, retain first option for hot-water boilers and second option for steam boilers.

Low-Water Cutoff Switch: [**Electronic**] [**Float and electronic**] probe shall prevent burner operation on low water. Cutoff switch shall be [**manual**] [**automatic**]-reset type.

"Blocked Vent Safety Switch" and "Rollout Safety Switch" subparagraphs below apply to atmospheric burners. Some boilers may be equipped with only one of these two switches. Verify availability with boiler manufacturer.

Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.

Rollout Safety Switch: Factory mounted on boiler combustion chamber.

Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

Retain "Building Management System Interface" Paragraph below if boiler controls interface with building management system.

* + - * 1. Building Management System Interface: Factory install hardware and software to enable building management system to monitor, control, and display boiler status and alarms.

Retain "Hardwired Points" Subparagraph below if interface with building management system is through hardwired points and minimal interface is required.

Hardwired Points:

Monitoring: On/off status, [**common trouble alarm**] [**low-water-level alarm**] <**Insert monitoring**>.

Control: On/off operation, [**hot-water-supply temperature set-point adjustment**] [**steam pressure adjustment**] <**Insert control**>.

Retain subparagraph below if extensive interface with building management system is required and is beyond that which can be provided by hardwired points. Requirement may exclude some manufacturers listed.

A communication interface with building management system shall enable building management system operator to remotely control and monitor the boiler from an operator workstation. Control features available and monitoring points displayed, locally at boiler control panel shall be available through building management system.

* + - 1. ELECTRICAL POWER

Retain "Controllers, Electrical Devices, and Wiring" Paragraph below if single-point field power connection is inapplicable.

* + - * 1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

Retain "Single-Point Field Power Connection" Paragraph below if single-point field power connection is applicable.

* + - * 1. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

House in NEMA 250, Type [**1**] <**Insert type**> enclosure.

Wiring shall be numbered and color coded to match wiring diagram.

Install factory wiring outside of an enclosure in a [**metal**]raceway.

Field power interface shall be to [**wire lugs**] [**fused disconnect switch**] [**nonfused disconnect switch**] [**circuit breaker**].

Provide branch power circuit to each motor and to controls[**with disconnect switch or circuit breaker**].

Provide each motor with overcurrent protection.

* + - 1. CAPACITIES AND CHARACTERISTICS

If Project has more than one type or configuration of boiler, delete this article and schedule boilers on Drawings.

Retain "Hot-Water Heating" or "Steam Heating" Paragraph below.

* + - * 1. Hot-Water Heating:

Design Water-Pressure Rating: [**30 psig**] [**50 psig**] [**80 psig**] <**Insert pressure rating**>.

Safety Relief Valve Setting: <**Insert psig**>.

Entering-Water Temperature: <**Insert deg F**>.

Leaving-Water Temperature: <**Insert deg F**>.

Design Water Flow Rate: <**Insert gpm**>.

Design Pressure Drop: <**Insert psig**>.

* + - * 1. Steam Heating:

For steam boilers, limit steam pressure to 15 psig or less.

Design Steam-Pressure Rating: [**Steam, 15 psig**] <**Insert pressure rating**>.

Safety Relief Valve Setting: <**Insert psig**>.

Steam Operating Pressure: <**Insert psig**>.

Steam Flow Rate: <**Insert lb/h**>.

Retain "Minimum Efficiency AFUE," "Minimum Thermal Efficiency," or "Minimum Combustion Efficiency" Paragraph below. Specify standing or intermittent pilot with minimum AFUE. Sustainable design systems require compliance with ASHRAE/IES 90.1 and may require efficiency in excess of minimum efficiency required by ASHRAE/IES 90.1.

* + - * 1. Minimum Efficiency AFUE: <**Insert number**> percent.
				2. Minimum Thermal Efficiency: <**Insert number**> percent.
				3. Minimum Combustion Efficiency: <**Insert number**> percent.
				4. Number of Passes: [**One**] [**Two**] <**Insert number**>.
				5. Input Rating Method:

Retain "AGA Input," "I=B=R Input," or "Gas Input" Subparagraph below for gas.

AGA Input: <**Insert MBh**>.

I=B=R Input: <**Insert MBh**>.

Consider actual Btu content of fuel source if retaining "Gas Input" Subparagraph below. Contact fuel supplier and boiler manufacturers to determine impact. Add text indicating Btu content of fuel if applicable.

Gas Input: <**Insert cfh**>.

Retain "Oil Input" subparagraph for oil. Consider actual Btu content of fuel source if retaining paragraph. Contact fuel supplier and boiler manufacturers to determine impact. Add text indicating Btu content of fuel if applicable.

Oil Input: <**Insert gph**>.

* + - * 1. Output Capacity

Retain "AGA Output Capacity," "DOE Output Capacity," "Net I=B=R Output Capacity," "Gross I=B=R Output Capacity," or "Equivalent Direct Radiation" Subparagraph below for rating methods.

AGA Output Capacity: <**Insert MBh**>.

DOE Output Capacity: <**Insert MBh**>.

Net I=B=R Output Capacity: <**Insert MBh**>.

Gross I=B=R Output Capacity: <**Insert MBh**>.

Equivalent Direct Radiation: <**Insert EDR**>.

Retain "Tankless Water Heater" Paragraph below if boiler is equipped with tankless water heater.

* + - * 1. Tankless Water Heater:

Design Water Flow: <**Insert gpm**>.

Design Pressure Drop: <**Insert psig**>.

Entering-Water Temperature: <**Insert deg F**>.

Leaving-Water Temperature: <**Insert deg F**>.

Consider impact of site altitude on fan and motor.

* + - * 1. Blower:

Motor Horsepower: <**Insert number**> hp.

RPM: <**Insert number**>.

* + - * 1. Electrical Characteristics:

Volts: [**115**] [**208**] [**230**] [**460**] <**Insert number**> V.

Phase: [**Single**] [**Three**].

Hertz: [**50**] [**60**] <**Insert number**> Hz.

Full-Load Amperes: <**Insert number**> A.

Minimum Circuit Ampacity: <**Insert number**> A.

Maximum Overcurrent Protection: <**Insert number**> A.

Retain this article for factory-assembled boilers. Factory tests are an additional cost item.

* + - 1. SOURCE QUALITY CONTROL

Retain first option in first paragraph below for projects in the United States. Specify CSA B51 for projects in Canada.

* + - * 1. Test and inspect factory-assembled boilers, before shipping, according to [**2010 ASME Boiler and Pressure Vessel Code**] [**CSA B51**].
				2. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

Retain paragraph below if Director’s Representative wants to witness source quality-control testing.

* + - * 1. Allow Director’s Representative access to source quality-control testing of boilers. Notify Director’s Representative 14 days in advance of testing.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

* + - * 1. Examine mechanical spaces for suitable conditions where boilers will be installed.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. BOILER INSTALLATION
				1. Equipment Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-restraint device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

Retain first paragraph below for gas-fired boilers and combination gas- and oil-fired boilers.

* + - * 1. Install gas-fired boilers according to NFPA 54.

Retain first paragraph below for oil-fired boilers and combination gas- and oil-fired boilers.

* + - * 1. Install oil-fired boilers according to NFPA 31.

Retain paragraph below if boiler is field assembled.

* + - * 1. Assemble boiler sections in sequence and seal between each section.
				2. Assemble and install boiler trim.
				3. Install electrical devices furnished with boiler but not specified to be factory mounted.
				4. Install control wiring to field-mounted electrical devices.
			1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Piping installation requirements are specified in [**Section 232113 "Hydronic Piping"**] [**and**] [**Section 232213 "Steam and Condensate Heating Piping."**] Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Install piping adjacent to boiler to allow service and maintenance.
				3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.

Retain last paragraph above for gas-fired boilers and first paragraph below for oil-fired boilers, or both for combination gas- and oil-fired boilers.

* + - * 1. Connect oil piping full size to burner inlet with shutoff valve and union.

Retain first paragraph below for hot-water boilers.

* + - * 1. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

Retain first paragraph below for steam boilers.

* + - * 1. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.

Retain one of first two paragraphs below. Retain first for hot-water boilers and second for steam boilers. Delete both if safety valves are specified in Section 232116 "Hydronic Piping Specialties" or Section 232216 "Steam and Condensate Heating Piping Specialties."

* + - * 1. Install piping from safety relief valves to nearest floor drain.
				2. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
				3. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
				4. Connect breeching full size to boiler outlet. Comply with requirements in Section 235116 "Fabricated Breechings and Accessories" for venting materials.
				5. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Section 235123 "Gas Vents" for recirculation duct materials.
			1. FIELD QUALITY CONTROL

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" Paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" Paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

* + - * 1. Department of Labor Inspection: Arrange with NYS Department of Labor for Inspection of Boiler upon completion of installation.

Do not operate boilers until NYS Department of Labor inspection is made and a Certificate of Inspection is received.

Pay application and inspection fees required by NYS Department of Labor.

Preparation of boiler for inspection: Prepare boiler for internal inspection or hydrostatic pressure test on the date specified by the Department of Labor inspector.

Remove manhole and handhole plates, and washout plugs in the water column connection.

Remove grates of internally fire boilers.

Remove as directed by the NYS Department of Labor inspector, brick work and insulation.

Remove steam gage for testing if required by NYS Department of labor inspector.

Stop leaks of steam of hot water into the boiler being inspected from the other components.

Provide to the NYS Department of Labor inspector a competent person to be placed under the inspector’s supervision to disassemble, reassemble, test adjust, operate or forcible handling any part of the boiler.

* + - * 1. Provide framed glass holder for NYS Department of Labor Certificate of Inspection, and post near the boiler prior to operation of the boiler.
				2. Fasten two inch high metal identification numbers corresponding to number assigned by NYS Department of Labor Commissioner to a metal mounting plate and securely attach to the front of the boiler or front of boiler settings.

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Service Advisor to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections[**with the assistance of a Company Field Advisor per OGS Spec Section 014216**]:

Perform installation and startup checks according to manufacturer's written instructions.

Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.

Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and [**water temperature**] [**steam pressure**].

Set field-adjustable switches and circuit-breaker trip ranges as indicated.

* + - * 1. Remove and replace malfunctioning units and retest as specified above.

Retain "Performance Tests" Paragraph below if performance tests are required. Performance verification based on field tests is not typically required due to associated cost. Consult Director’s Representative.

* + - * 1. Performance Tests:

Engage a Company Service Advisor to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.

Perform field performance tests to determine capacity and efficiency of boilers.

For dual-fuel boilers, perform tests for each fuel.

Test for full capacity.

Test for boiler efficiency at [**low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20**] <**Insert range**> percent of full capacity. Determine efficiency at each test point.

Repeat tests until results comply with requirements indicated.

Provide analysis equipment required to determine performance.

Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are inadequate.

Notify Director’s Representative in advance of test dates.

Document test results in a report and submit to Architect.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Boiler will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. ADJUSTING
				1. Occupancy Adjustments: When requested within [**12 months**] <**Insert time period**> of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [**two**] <**Insert number**> visits to Project during other-than-normal occupancy hours for this purpose.
			2. DEMONSTRATION
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Director’s Representative's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 235223