SECTION 235233.14 - FLEXIBLE WATER-TUBE BOILERS

This Section specifies flexible water-tube boilers with burners, controls, and accessories, suitable for use in steam or hot water systems fired by natural gas, propane, or fuel oil.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting requirements of this Specification.

This Section includes performance, proprietary, and descriptive specifications. Edit to avoid conflicting requirements.

This Section may include term "Architect/Engineer." "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See Drawing Coordination Checklist and Evaluations for information needed to coordinate this Specification Section with Drawings.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Flexible water-tube boilers.

Boiler controls.

[**Hot water**] [**Steam**] boiler trim.

[**Natural gas**] [**Propane**] [**Fuel oil**]-fired burner.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 033000 - Cast-in-Place Concrete: Concrete housekeeping pads.

Section 221100 - Facility Water Distribution: Cold-water piping connections to boilers.

Section 230513 - Common Motor Requirements for HVAC Equipment: Electric motors.

Section 230548 - Vibration and Seismic Controls for HVAC: Vibration isolators.

Section 230593 - Testing, Adjusting, and Balancing for HVAC: Adjusting and balancing hot water boiler flow rates.

Section 231113 - Facility Fuel-Oil Piping: Fuel oil piping connections to boilers.

Section 231123 - Facility Natural-Gas Piping: Natural gas piping connections to boilers.

Section 231126 - Facility Liquefied-Petroleum Gas Piping: LPG piping connections to boilers.

Section 232113 - Hydronic Piping: Hot water piping for connections to boilers.

Section 232213 - Steam and Condensate Heating Piping: Steam piping for connections to boilers.

Section 232500 - HVAC Water Treatment: Requirements for system cleaner, closed loop treatment, and steam treatment.

Section 235100 - Breechings, Chimneys, and Stacks: Breeching, chimney, and stack connections to boilers.

Section 260583 - Wiring Connections: Electric connections to boilers.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

* + - * 1. Air-Conditioning, Heating, and Refrigeration Institute - Hydronics Institute Section:

AHRI 1500 - Performance Rating of Commercial Space Heating Boilers.

* + - * 1. American National Standards Institute:

ANSI Z21.13 - Gas-Fired Low Pressure Steam and Hot Water Boilers.

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE/IES 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

* + - * 1. American Society of Mechanical Engineers:

ASME Boiler and Pressure Vessel Code (BPVC) Section I - Rules for Construction of Power Boilers.

ASME BPVC Section IV - Heating Boilers.

ASME CSD-1 - Controls and Safety Devices for Automatically Fired Boilers.

* + - * 1. Department of Energy:

10 CFR 430, Subpart B, Appendix N - Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers.

* + - * 1. National Electrical Manufacturers Association:

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

* + - * 1. NFPA:

NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

NFPA 54 - National Fuel Gas Code.

NFPA 58 - Liquefied Petroleum Gas Code.

* + - * 1. UL:

UL 726 - Oil-Fired Boiler Assemblies.

UL 795 - Commercial-Industrial Gas Heating Equipment.

* + - 1. PREINSTALLATION MEETINGS
         1. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
         2. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
      2. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 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. Section 013300 - Submittal Procedures: Requirements for submittals.
        5. Product Data:

Submit capacities and accessories included with boiler.

Submit general layout, dimensions, electrical characteristics, weight and mounting loads, and size and location of water, fuel, electric, and vent connections.

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

* + - * 1. Test and Evaluation Reports:

Indicate that boilers meet or exceed specified performance and efficiency.

Submit results of testing.

* + - * 1. Manufacturer Instructions:

Submit assembly, support details, connection requirements, and startup instructions.

Submit detailed instructions on installation requirements, including storage and handling procedures.

* + - * 1. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
        2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
        3. Manufacturer Reports:

Certify that equipment has been installed according to manufacturer instructions.

Certify control settings after startup.

Furnish performance chart of control system.

* + - * 1. Qualifications Statements:

Coordinate following Subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer and installer.

Submit manufacturer's approval of installer.

* + - * 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).
      1. MAINTENANCE MATERIAL SUBMITTALS
         1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Requirements for maintenance materials.
         2. Spare Parts: Furnish [**one set**] [**<\_\_\_\_\_\_\_\_> sets**] of feed pump seals.
      2. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

Select appropriate ASME reference; consider using BPVC IV for hot water not exceeding 160 psig (1 100 kPa) or 250 deg. F (121 deg. C), or for steam not exceeding 15 psig (104 kPa). Use BPVC I if hot water or steam exceeds those limits.

* + - * 1. Boiler Construction:

Comply with ASME [**BPVC I**] [**BPVC IV**] [**and**] [**ANSI Z21.13**] [**UL 726**].

Furnish boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

* + - * 1. Boiler Performance Requirements:

Minimum Efficiency: Comply with ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings”.

Testing: Comply with AHRI 1500 “Performance Rating of Commercial Space Heating Boilers”.

Delete Subparagraph below if boiler rating exceeds 300,000 Btu/h (87.9 kW).

Minimum Efficiency: Comply with 10 CFR 430, Subpart B, Appendix N “Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers”.

Confirm applicable safety controls based on Owner's insurance requirements.

* + - * 1. Gas Train and Safety Controls: Comply with requirements of [**ASME CSD-1**]. [**Factory Mutual**] [**Industrial Risk Insurers**] [**Improved Risk Mutual (IRM Insurance)**] <**\_\_\_\_\_\_\_\_**>.
        2. Unit Certification: [**American Gas Association**] [**Intertek ETL**] [**UL 795**].
        3. Internal Wiring of Factory-Wired Equipment: Comply with [**applicable**] code.
        4. Products Requiring Electrical Connection: Listed and classified by [**UL**] [**testing firm acceptable to authority having jurisdiction**] as suitable for purpose specified and as indicated.

In following Paragraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
      1. QUALIFICATIONS

Coordinate following Paragraphs with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
        2. Installer: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
      1. DELIVERY, STORAGE, AND HANDLING
         1. Section 016500 – Materials and Equipment000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
         2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
         3. Store materials according to manufacturer instructions.
         4. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Requirements for warranties.
        2. Furnish [**five**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for boilers.

1. PRODUCTS
   * + 1. FLEXIBLE WATER-TUBE BOILERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=11466) Subject to compliance with requirements, provide products by one of the following:

[Ajax Boiler Inc](http://www.specagent.com/Lookup?uid=123457138878).

[Raypak; a Rheem brand](http://www.specagent.com/Lookup?uid=123457196877).

[York-Shipley Global; Division of Power Mechanical, Inc](http://www.specagent.com/Lookup?uid=123457138881).

Approved equivalent.

[Manufacturers](http://www.specagent.com/LookUp/?ulid=8305&mf=04&src=wd):

Substitutions: [As specified in Section 016000 - Product Requirements] [Not permitted].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Subparagraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Description:

Factory assembled, wired, and tested packaged-type boiler.

Factory mounted on steel base frame, complete with integral [**forced**] [**atmospheric**] draft burner, burner controls, boiler trim, and refractory.

* + - * 1. Performance and Design Criteria:

If specifying units of different sizes, consider using schedule following END OF SECTION.

Furnish 5 sq. ft. (0.5 sq. m) of heating surface per rated boiler horsepower.

Maximum Working Pressure:

ASME rated.

Water Boiler: [**60**] [**125**] psig at 250 deg. F ([**400**] [**830**] kPa at 120 deg. C).

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Steam Boiler: [**15**] [**150**] <**\_\_\_\_\_\_\_\_**> psig ([**100**] [**1 000**] <**\_\_\_\_\_\_\_\_**> kPa).

Department of Energy (DOE) heating capacities and Annual Fuel Utilization Efficiency (AFUE) apply only to systems using boilers with inputs up to 300,000 Btu/h (88 kW). Use gross or net AHRI 1500 output ratings for boilers with larger capacities.

Capacity:

Input at Sea Level: [**<\_\_\_\_\_\_\_\_> Btu/h (<\_\_\_\_\_\_\_\_> kW)**] [**<\_\_\_\_\_\_\_\_> gph (<\_\_\_\_\_\_\_\_> L/h)**].

Department of Energy (DOE) Heating Capacity: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> kW).

Net Rating: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> kW).

Annual Fuel Utilization Efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Capacity:

Oil Burner Capacity: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/h).

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Gas Burner Capacity: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> kW).

Gross Output: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> kW).

Net Steam Rating: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> kW).

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Net Water Rating: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> kW).

Boiler Horsepower: <**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW).

* + - * 1. Fabrication:

Shell: Welded-steel boiler plate with steel drums, water legs, and tube headers.

Water Tubes:

Material: [**1**] [**1-1/2**]-inch ([**25**] [**38**]-mm) steel of serpentine bend design not subject to thermal shock.

Individual tubes removable and replaceable without welding or rolling.

Tube Access: From exterior of boiler.

Furnish tappings and inspection openings to allow for internal boiler inspection and cleaning.

Retain following Subparagraph for steam boilers.

Steam Drum:

Minimum Size: 24 inches (600 mm) in diameter.

Designed to produce steam quality in excess of 99 percent.

Jacket:

Description: Factory-painted steel jacket mounted over structural steel frame.

Jacket Panels and Access Doors: Individually removable.

Insulation: [**Sides and top covered with glass-fiber insulation**] [**Interior walls lined with high-temperature insulation, and floor beneath tubes lined with insulating refractory and mineral-fiber backup insulation**].

Following Paragraph applies only to forced-draft boilers.

* + - * 1. Combustion Chamber:

Description:

Refractory type, constructed of high-temperature insulating firebrick.

Furnish front and rear observation ports for flame observation.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Description: Waterwall type, with one side consisting of refractory-lined removable panels to allow full access to chamber and tubes from exterior of boiler.

Flue-Gas Section Joints: Welded except for gasketed panels on access side.

Maximum Operating Overfire Pressure: 2 inches wc (500 Pa).

Access Door:

Mounting: Hinged.

Location: Near burner end of chamber.

Size: Accommodate full access to combustion chamber and burner head.

Furnish full gaskets [**for pressurized firing**].

Retain following Paragraph if fuel is natural gas. Consider using first optional Paragraph for forced-draft burners, and second following Paragraph for atmospheric burners.

* + - * 1. Gas Burner:

Description: Natural gas firing, forced-draft flame-retention type, with integral motor and combustion air blower.

Mounting: Integral part of boiler.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Gas Burner:

Material: Tubular alloy steel.

Type: Atmospheric, for operation with atmospheric draft requiring no motor or blower.

Mounting: Integral part of boiler.

Furnish electric-ignition gas pilots.

Retain following Paragraph only for dual fuel, oil-natural gas boilers. Dual fuel boilers are available only as forced-draft type.

* + - * 1. Dual Fuel Gas-Oil Burner:

Description: Forced-draft, flame-retention, pressure-atomizing type, with integral motor, combustion air blower, and oil pump.

Fuel: Number [**2**] <**\_\_\_\_\_\_\_\_**> fuel oil and natural gas.

Retain following Paragraph only if oil is used as fuel. Oil-fired boilers are available only as forced-draft type.

* + - * 1. Oil Burner:

Description: Forced-draft, flame-retention, pressure-atomizing type, with integral motor and combustion air blower.

Fuel Number [**2**] <**\_\_\_\_\_\_\_\_**> fuel oil.

* + - * 1. Burner Controls:

Capacity Control: [**ON-OFF operation**] [**Two-stage, low-fire START and high-fire RUN**] [**Modulating**].

Automatic gas valve operator.

Auxiliary safety shutoff valve.

Pilot solenoid valve.

Pilot ignition assembly.

Pilot ignition transformer.

Pilot gas shutoff valves.

Main gas shutoff valves.

Pilot gas pressure regulators.

Main gas pressure regulators.

Main manual gas shutoff valve.

Air flow (air safety) switch.

Electronic combustion safety control with UV sensor.

Auxiliary safety gas shutoff valves.

Air-atomizing burners.

Items specified in following three Subparagraphs are typically used with atmospheric draft boilers.

Electronic pilot safety control.

100 percent gas pilot safety shutoff.

Draft diverter or barometric draft control.

Items specified in following five Subparagraphs are typically used with dual fuel boilers.

Manual fuel selector switch.

Oil Valves: Primary and auxiliary.

Oil ignition and nozzle assembly.

Direct spark ignition transformer.

Gas pilot.

Items specified in following six Subparagraphs are typically used with oil-fired boilers.

Combustion safety control [**with UV sensor**].

Oil Valves: Primary and secondary.

Direct spark ignition transformer.

Oil ignition and nozzle assembly.

Gas pilot.

Remote fuel oil pump.

* + - * 1. Hot Water Boiler Trim:

Description: Factory piped and wired according to ASME code and UL requirements.

Pressure Relief Valve:

ASME rated.

Pressure Setting: <**\_\_\_\_\_\_\_\_**> psig (<**\_\_\_\_\_\_\_\_**> kPa).

Combination thermometer and pressure gage.

Water Temperature Control Operator: Furnish high-limit safety control with manual reset.

Low-water cutoff with manual reset.

Auxiliary low-water cutoff.

Alarm [**bell**] [**or**] [**horn**].

LEAD-LAG alternation control if two or more boilers are required.

Indicator Lights: <**\_\_\_\_\_\_\_\_**>.

Control Transformer:

120 V.

Mounting: In control panel.

Motor starter.

Tankless water heater.

* + - * 1. Steam Boiler Trim:

Description: Factory piped and wired according to ASME code and UL requirements.

Pressure Relief Valve:

ASME rated.

Pressure Setting: <**\_\_\_\_\_\_\_\_**> psig (<**\_\_\_\_\_\_\_\_**> kPa).

Steam Pressure Control Operator: Furnish high-limit safety control with manual reset.

Steam pressure gage.

Water gage glass.

Gage cocks.

Low-Water Cutoff and Feed Pump Control: Furnish manual resets.

Auxiliary Low-Water Cutoff: Probe type.

Alarm [**bell**] [**or**] [**horn**].

Automatic boiler blowdown controls.

Manual blowdown valves.

Indicator Lights: <**\_\_\_\_\_\_\_\_**>.

Control Transformer:

120 V.

Mounting: In control panel.

Motor starter.

Tankless water heater.

* + - 1. OPERATION
         1. Electrical Characteristics:

As specified in Section 260583 - Wiring Connections.

[**<\_\_\_\_\_\_\_\_> hp (<\_\_\_\_\_\_\_\_> W)**] [**<\_\_\_\_\_\_\_\_> RLA**].

Voltage: <**\_\_\_\_\_\_\_\_**> V, [**single**] [**three**] phase, 60 Hz.

Maximum [**Fuse Size**] [**Circuit Breaker Size**] [**Overcurrent Protection**]: <**\_\_\_\_\_\_\_\_**> A.

Minimum Circuit Ampacity: <**\_\_\_\_\_\_\_\_**>.

Minimum Power Factor: <**\_\_\_\_\_\_\_\_**> percent at rated load.

* + - * 1. Motors: As specified in Section 230513 - Common Motor Requirements for HVAC Equipment.
        2. Control Panel:

NEMA 250 “Enclosures for Electrical Equipment (1000 Volts Maximum)” Type [**1**] <**\_\_\_\_\_\_\_\_**>.

Door: Metal; hinged.

Single-point power connection and grounding lug.

Mounting: On boiler.

* + - * 1. Disconnect Switch: Factory mounted [**in control panel**] [**on equipment**].
      1. SOURCE QUALITY CONTROL
         1. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
         2. Provide shop inspection and testing of completed assembly.

Include one or both of following Paragraphs to require Owner's inspection or witnessing of test at factory.

* + - * 1. Director’s Representative Inspection:

Make completed boilers available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Representative Witnessing:

Allow witnessing of factory inspections and tests at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on manufacturer's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved manufacturer.

1. EXECUTION
   * + 1. INSTALLATION
          1. According to manufacturer instructions.

Consider including following Paragraph if knockdown boiler is used in Project and is to be assembled on Site.

* + - * 1. Assemble boiler from knockdown configuration after transporting into boiler room.
        2. Install boilers plumb and level, to plus or minus 1/16 inch (2 mm) over boiler base.
        3. Maintain manufacturer's recommended clearances around and over boilers.
        4. Concrete Housekeeping Pad:

As specified in Section 033000 - Cast-in-Place Concrete.

Minimum Size: 3-1/2 inches (87 mm) high and 6 inches (150 mm) larger than boiler base on each side.

* + - * 1. Vibration Isolators: As specified in Section 230548 - Vibration and Seismic Controls for HVAC.
        2. Connect hot water piping to supply and return boiler connections.
        3. Fuel Piping Connections:

Connect to boiler, full size of boiler gas train inlet.

Arrange piping with clearances for burner removal and service.

Select from among following three Subparagraphs based on boiler fuel source.

Natural Gas Piping:

As specified in Section 231123 - Facility Natural-Gas Piping.

Comply with NFPA 54 “National Fuel Gas Code”.

Accessories:

Strainer.

Pressure gage.

Shutoff valve.

Check valve.

Pressure-reducing valve.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Propane Piping:

As specified in Section 231126 - Facility Liquefied-Petroleum Gas Piping.

Comply with NFPA 58 “Liquefied Petroleum Gas Code”.

Accessories:

Strainer.

Pressure gage.

Shutoff valve.

Check valve.

Pressure-reducing valve.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Fuel Oil Piping:

As specified in Section 231113 - Facility Fuel-Oil Piping.

Comply with NFPA 31 “Standard for the Installation of Oil-Burning Equipment”.

Accessories:

Strainer.

Shutoff valve.

Check valve.

* + - * 1. Piping Accessories:

As specified in Section [**232113 - Hydronic Piping**] [**232213 - Steam and Condensate Heating Piping**].

On Supply:

Thermometer well for temperature controller.

Thermometer well and thermometer.

Well for [**control system**] temperature sensor.

Strainer.

Nipple and flow switch.

Pressure gage.

Shutoff valve.

On Return:

Thermometer well and thermometer.

Well for [**control system**] temperature sensor.

Pressure gage.

Shutoff valve.

Balancing valve.

* + - * 1. Install discharge piping from relief valves and drain valves to nearest floor drain.
        2. Install boiler trim, electrical devices, and accessories furnished loose for field mounting.
        3. Install control wiring between boiler control panel and field-mounted control devices.
        4. Connect flue to boiler outlet, full size of outlet.
        5. Install thermometer in boiler breeching within 12 inches (300 mm) of flue nozzle for flexible water-tube boilers as specified in Section 235100 - Breechings, Chimneys, and Stacks.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Installation Standards: Install Work according to <**\_\_\_\_\_\_\_\_**> standards.
        2. Install boilers plumb and level to plus or minus 1/16 inch (2 mm) over boiler base.
        3. Maintain manufacturer's recommended clearances around and over boilers.
        4. Install boiler on concrete housekeeping pad, minimum 3-1/2 inches (87 mm) high and 6 inches (150 mm) larger than boiler base on each side, and refer to Section 033000 - Cast-in-Place Concrete.
        5. Install boiler on vibration isolators according to Section 230548 - Vibration and Seismic Controls for HVAC.
      1. FIELD QUALITY CONTROL
         1. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
        2. 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.
        3. Inspection:

Arrange with local authorities having jurisdiction for inspection of boilers and piping.

Obtain certificate of operation.

* + - * 1. Testing:

Perform tests at minimum- [**, midrange-,**] and high-fire rates.

Tests:

Boiler firing rate.

Over-fire draft.

[**Gas**] [**Oil**] flow rate.

Heat input.

Burner manifold gas pressure.

Percent carbon monoxide.

Percent oxygen.

Percent excess air.

Flue-gas temperature at outlet.

Ambient temperature.

Net stack temperature.

Percent stack loss.

Percent efficiency.

Heat output.

Consider including following Paragraph if knockdown boiler is used in Project and is to be assembled on Site.

* + - * 1. Knockdown Boilers Pressure Test:

Pressure test before connecting [**natural gas**] [**propane gas**] [**fuel oil**] piping, electrical connections, and controls.

Install boiler drain and pressure gage.

Plug remaining openings.

Fill boiler with water and vent air.

Test Pressure:

Steam Boilers: 45 to 55 psig (300 to 370 kPa).

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Water Boilers: 1-1/2 times working pressure.

Maintain test pressure for 10 minutes with no leaks.

Repair leaks and retest.

After successful test, drain and remove plugs from openings to be used for piping connections and controls.

* + - * 1. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> [**days**] [**hours**] on Site for installation, inspection, startup, field testing, and instructing Director’s Representative's personnel in operation and maintenance of equipment.
        2. Equipment Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

Make final adjustments to equipment under direction of manufacturer's representative.

* + - * 1. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.
      1. ADJUSTING
         1. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.
         2. Section 230593 - Testing, Adjusting, and Balancing for HVAC: Adjust and balance hot water boiler flow rates.
         3. Start up boilers according to manufacturer instructions and in presence of [**boiler manufacturer's representative**] <**\_\_\_\_\_\_\_\_**>.
         4. Test controls and demonstrate compliance with requirements.
         5. Adjust burner for maximum burning efficiency.
         6. Replace damaged or malfunctioning controls and equipment.
      2. CLEANING
         1. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.
         2. Section 232500 - HVAC Water Treatment: Requirements for system cleaner and closed loop treatment.
      3. DEMONSTRATION
         1. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.
         2. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Director’s Representative's personnel.
      4. MAINTENANCE
         1. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance service.
         2. Provide service and maintenance of boilers for [**one year**] [**<\_\_\_\_\_\_\_\_> years**] [**from date of Substantial Completion**] [**during warranty period**].
         3. Provide emergency callback service [**at all hours**] [**during working hours**] for specified maintenance period.
         4. Perform maintenance Work using qualified personnel under supervision [**and in direct employ**] of [**boiler manufacturer**] [**, boiler manufacturer's representative**] [**, or**] [**original installer**].
      5. ATTACHMENTSSCHEDULES

When relying on separate schedules, tables, illustrations, or forms to specify product requirements, include list of each attachment. Include identical list of attachments in Project Manual table of contents.

Consider including schedule if several boilers of different sizes are to be specified. Coordinate equipment tags and abbreviations with project specific requirements.

Insert attachments following END OF SECTION. Consider following examples when developing Project schedule.

* + - * 1. Flexible Water-Tube Boilers Schedule:

Equipment Tag: <B-1>:

Location: <**\_\_\_\_\_\_\_\_**>.

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Fuel Type: <**\_\_\_\_\_\_\_\_**>.

Input: <**\_\_\_\_\_\_\_\_**>.

Output: <**\_\_\_\_\_\_\_\_**>.

AFUE: <**\_\_\_\_\_\_\_\_**>.

Working Pressure: <**\_\_\_\_\_\_\_\_**>.

[**Blower Power: <\_\_\_\_\_\_\_\_>.**]

[**Blower Voltage: <\_\_\_\_\_\_\_\_>.**]

[**Oil Pump Power: <\_\_\_\_\_\_\_\_>.**]

[**Oil Pump Voltage: <\_\_\_\_\_\_\_\_>.**]

[**Indirect Water Heating Coil (Tankless Water Heater):**]

[**Water Flow Rate: <\_\_\_\_\_\_\_\_>.**]

[**Inlet Temperature: <\_\_\_\_\_\_\_\_>.**]

[**Outlet Temperature: <\_\_\_\_\_\_\_\_>.**]

Equipment Tag: <B-2>:

Location: <**\_\_\_\_\_\_\_\_**>.

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Fuel Type: <**\_\_\_\_\_\_\_\_**>.

Input: <**\_\_\_\_\_\_\_\_**>.

Output: <**\_\_\_\_\_\_\_\_**>.

AFUE: <**\_\_\_\_\_\_\_\_**>.

Working Pressure: <**\_\_\_\_\_\_\_\_**>.

[**Blower Power: <\_\_\_\_\_\_\_\_>.**]

[**Blower Voltage: <\_\_\_\_\_\_\_\_>.**]

[**Oil Pump Power: <\_\_\_\_\_\_\_\_>.**]

[**Oil Pump Voltage: <\_\_\_\_\_\_\_\_>.**]

[**Indirect Water Heating Coil (Tankless Water Heater):**]

[**Water Flow Rate: <\_\_\_\_\_\_\_\_>.**]

[**Inlet Temperature: <\_\_\_\_\_\_\_\_>.**]

[**Outlet Temperature: <\_\_\_\_\_\_\_\_>.**]

END OF SECTION 235233.14