

DIVISION 23 52 33.13

FINNED WATER-TUBE BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes gas-fired, copper or cupronickel finned-tube hydronic heating boilers
- B. Related Sections

Specifier Note: Use as needed

- 1. Building Services Piping – Division 23 21 00
- 2. Breeching, Chimneys, and Stacks (Venting) – Division 23 51 00
- 3. HVAC Instrumentation and Controls – Division 23 09 00
- 4. Electrical – Division 23 09 33

1.2 REFERENCES

- A. ANSI Z21.13/CSA 4.9
- B. ASME, Section IV
- C. 2006 UMC, Section 1107.6
- D. ANSI/ASHRAE 15-1994, Section 8.13.6
- E. National Fuel Gas Code, ANSI Z223.1/NFPA 54
- F. NEC, ANSI/NFPA 70
- G. ASME CSD-1-2018 (when required)
- H. ISO 9001: 2015

1.3 SUBMITTALS

- A. Product data sheet (including dimensions, rated capacities, shipping weights, accessories)
- B. Wiring diagram
- C. Warranty information
- D. Installation and operating instructions

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. ANSI Z21.13/CSA 4.9
 - 2. Local and national air quality regulations for low NO_x (< 20 PPM NO_x emissions) boilers
- B. Certifications
 - 1. CSA
 - 2. ASME H-Stamped and National Board registered

1.5 WARRANTY

- A. Limited one-year warranty from date of installation
- B. Limited twenty-year thermal shock warranty
- C. Limited ten-year closed-system heat exchanger warranty

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Raypak, Inc.
 - 1. Contact: 2151 Eastman Ave., Oxnard, CA 93030; Telephone: (805) 278-5300; Fax: (805) 278-5468; Website: www.raypak.com
 - 2. Product: Hi Delta® copper or cupronickel finned-tube hydronic boiler(s)

2.2 BOILERS

A. General

1. The boiler(s) shall be fired with _____ gas at a rated input of ___ BTU/hr.
2. The boiler(s) shall be CSA-tested and certified with a minimum thermal efficiency of 84% at full fire.
3. The boiler(s) shall be ASME inspected and stamped and National Board registered for 160 PSIG maximum working pressure, complete with a Manufacturer's Data Report.
4. The boiler(s) shall have a floor loading of 65 lbs. per square foot or less.

B. Heat Exchanger

1. The heat exchanger shall be of a single-bank, horizontal-grid design with twelve integral copper-finned tubes, each end of which is rolled into an ASME boiler-quality steel tube sheet.
2. The heat exchanger shall be sealed to 160 PSIG-rated cast-iron glass-lined or bronze headers with high-temperature silicone "O"-rings.
3. The low water volume heat exchanger shall be explosion-proof on the water side and shall carry a twenty-year warranty against thermal shock.
4. The headers shall be secured to the tube sheet by stud bolts with flange nuts to permit inspection and maintenance without removal of external piping connections.
5. The boiler(s) shall be capable of operating at inlet water temperatures as low as 105°F without condensation.
6. The boiler(s) shall be designed to accommodate field changes of either left or right hand plumbing and electrical while leaving the tube bundle in place.

C. Burners

1. The tubular burners shall have multiport radial gas orifices, punched ports and slots, be capable of quiet ignition and extinction without flashback at the orifice, and be manufactured from corrosion-resistant, titanium-stabilized stainless steel with low coefficient of expansion.
2. The burners will be supplied with a fan-assisted, clean-burning, and highly-efficient fuel-air mixture.

D. Ignition Control System

1. The boilers(s) shall be equipped with a 100% safety shutdown.
2. The ignition shall be Hot Surface Ignition (HSI) type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence (single-try optional), to ensure consistent operation.
3. The igniter will be located away from the water inlet to protect the device from condensation during start-up.
4. The ignition control module shall include an LED that indicates fifteen (15) individual diagnostic flash codes and transmits any fault codes to the 3-1/2" LCD display.
5. Two external viewing ports shall be provided, permitting visual observation of burner operation.

E. Gas Train

1. The boiler(s) shall have a firing/leak test valve and pressure test valve as required by CSD-1.
2. The boiler(s) shall have dual-seated main gas valve(s).
3. Gas control trains shall have a redundant safety shut-off feature, main gas regulator, shutoff cock and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.

F. Boiler Control

1. The following safety controls shall be provided:
 - a. Fixed High limit control with manual-reset.
 - b. Flow switch, mounted and wired.
 - c. ___ PSIG ASME pressure relief valve, piped by the installer to an approved drain.
 - d. Temperature and pressure gauge.
2. The boiler(s) shall be equipped with the following:
 - a. VERSA IC® modulating temperature controller with a 3-1/2" LCD display.
 - b. Three (3) adjustable energy-saving pump control relays (heater, system, indirect DHW).
 - c. Four (4) water sensors included (system sensor and indirect DHW tank sensor are shipped loose).

3. The heater(s) shall allow for 0-10 VDC input connection for remote building DDC system control of system temperature (single or multiple units) or firing rate (single units only).
4. The heater shall have built-in "Cascade" function for up to eight (8) units of same or different BTUH inputs without utilizing an external controller or sequencer.
 - a. System shall be capable of leader redundancy and lead rotation every forty-eight (48) hours.
 - b. Cascade function shall allow users to enable or disable alarm sharing across cascaded appliances when an alarm condition occurs.

G. Firing Mode

1. Model 992C provides three-stage firing control of the gas input to the boiler.
2. Models 1262C-2342C provide four-stage firing control of the gas input to the boiler.

H. Boiler Diagnostics

1. Provide external LED panel displaying the following water heater status/faults:
 - a. Power on – Green
 - b. Call for heat – Amber
 - c. Burner firing – Blue
 - d. Service – Red
2. Provide monitoring of all safeties, internal/external interlocks with fault display by a 3-1/2 in. LCD display:
 - a. System status
 - b. Ignition failure
 - c. False flame
 - d. Ignition proving current (HSI)
 - e. Field Interlock
 - f. Air pressure switch
 - g. Low 24 VAC
 - h. Manual-reset high limit
 - i. Blocked vent
 - j. Controller alarm
 - k. Flow switch fault
 - l. Sensor failure
 - I. Inlet sensor (open or short)
 - II. Outlet sensor (open or short)
 - III. System sensor (open or short)
 - IV. High limit sensor (open or short)
 - m. Internal control fault
 - n. ID card fault
 - o. Cascade communications error

Specifier Note: The following items are options. Delete if not being specified.

 - p. Low water cut-off (optional – please specify shipped loose or factory-installed)
 - q. Low gas pressure switch (optional – please specify shipped loose or factory-installed)
 - r. High gas pressure switch (optional – please specify shipped loose or factory-installed)
 - s. Controller alarm (optional – please specify shipped loose or factory-installed)
 - t. Cold Water Start/Cold Water Run (optional – please specify shipped loose or factory-installed)
3. Factory installed VERSA IC® ignition and control components for staging control of the boiler.
4. Provide ignition module indicating the following flash codes by LED signal and displayed on LCD display:
 - a. 1 flash – low air pressure
 - b. 2 flashes – flame in the combustion chamber w/o CFH
 - c. 3 flashes – ignition lock-out (flame failure)
 - d. 4 flashes – low hot surface igniter current
 - e. 5 flashes – low 24 VAC
 - f. 6 flashes – Vent temperature fault (not used)
 - g. 7 flashes – Hi-limit fault
 - h. 8 flashes – Sensor fault
 - i. 9 flashes – Low gas pressure fault

- j. 10 flashes – Water pressure fault (not used)
 - k. 11 flashes – Blower speed fault (not used)
 - l. 12 flashes – Low water cut-off
 - m. 13 flashes – Hi-temperature Delta-T
 - n. 14 flashes – Ft-bus communication fault
 - o. 15 flashes – General safety fault
- I. Combustion Chamber: The lightweight, high-temperature, multi-piece, interlocking ceramic fiber combustion chamber liner shall be sealed to reduce standby radiation losses, reducing jacket losses and increasing unit efficiency.
- J. Venting
- 1. When routed vertically, the boiler's flue material and size shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA54 latest edition (Category I).
 - (1) When routed horizontally, the boiler(s) flue material and size shall meet or exceed the requirements as specified for Category III in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 latest edition.
 - 2. The boiler(s) shall be ducted combustion air ready.
- K. Cabinet
- 1. The corrosion-resistant galvanized steel jackets shall be finished with a baked-on epoxy powder coat which is suitable for outdoor installation, applied prior to assembly for complete coverage, and shall incorporate louvers in the outer panels to divert air past heated surfaces.
 - 2. The boiler(s), if located on a combustible floor, shall not require a separate combustible floor base.
 - 3. The boiler(s) shall have the option of venting the flue products either through the top or the back of the unit.
 - 4. Combustion air intake shall be on the left side of the cabinet (standard), right side optional.

*Specifier Note: The remaining items in this section are options. Delete those that are not being specified. **IMPORTANT:** The Cold Water Start and Cold Water Run Systems cannot be used on the same boiler. The Low Gas Supply Pressure and FlexGas Manifolds also cannot be used on the same boiler.*

- L. Boiler Operating Controls
- A. Each boiler shall have the ability to receive a 0-10 VDC signal from a Central Energy Management and Direct Drive Control System (EMCS) to vary the setpoint control. Each heater shall have an alarm contact for connection to a central EMCS system.
 - B. Each boiler shall be equipped with Modbus communications compatibility with up to 146 points of data available.
 - a. B-85 Gateway – BACnet MS/TP, BACnet IP, N2 Metasys or Modbus TCP (*optional – please specify shipped loose or factory-installed*)
 - b. B-86 Gateway – LonWorks (*optional – please specify shipped loose or factory-installed*)
 - C. System and indirect DHW sensors shall be shipped loose for field installation by the installing contractor. The outdoor air sensor is optional.
- M. Boiler Pump - Refer to Equipment Schedule
- N. SureRack® Boiler Stacking Kit
- 1. The boilers shall be stacked directly one on top of the other, without offset, to minimize footprint.
- O. Cold Water Start System
- 1. The boiler(s) shall be configured with a cold water start automatic proportional by-pass system that ensures the boiler will experience inlet temperatures in excess of 105°F in less than 7-minutes to avoid damaging condensation. The unit can automatically shut down if the inlet temperature is not achieved within the 7-minute time frame.
 - 2. The cold-water start system shall be configured with a three-way diverting valve that is controlled by the VERSA IC® software that bypasses the correct amount of cold water directly into the system loop to maintain a minimum inlet temperature. The factory-installed boiler inlet temperature sensor shall be utilized for the cold water start system.

3. The control shall have a temperature setting adjustment located in the Setup menu of the VERSA IC® Control. The inlet temperature range shall be 105°F to 120°F. The PID Logic shall be capable of limiting system overshoot to a maximum of 10°F on initial start-up or call-for-heat.
4. The cold water start system shall be completely wired and mounted at the factory.
5. The control shall have alarm contacts.

P. Cold Water Run System

1. The boiler(s) shall be configured with a cold-water run automatic proportional by-pass system that ensures the boiler will experience inlet temperatures in excess of 105°F in less than 7-minutes to avoid damaging condensation. The unit can automatically shut down if the inlet temperature is not achieved within the 7-minute time frame.
2. The cold-water run system shall be configured with a variable-speed pump that is controlled by the VERSA IC® software that injects the correct amount of cold water directly into the system loop to maintain a minimum inlet temperature. The factory-installed boiler inlet temperature sensor shall be utilized for the cold water run system.
3. The control shall have a temperature setting adjustment located in the Setup menu of the VERSA IC® Control. The inlet temperature range shall be 105°F to 120°F. The PID Logic shall be capable of limiting system overshoot to a maximum of 10°F on initial start-up or call-for-heat.
4. The cold water run system shall be completely wired and mounted at the factory.
5. The control shall have alarm contacts.

Q. Low Gas Supply Pressure Manifold

1. The boiler(s) shall be CSA-certified for full-input operation down to 4.0" WC dynamic inlet natural gas supply pressure.

R. FlexGas® Dual-Fuel Gas Manifold (not offered on model 2002C)

1. The boiler(s) shall be configured with a patented, CSA-certified gas control system that is capable of operating with natural gas or propane gas in a configuration that does not require mechanical disassembly or adjustment of gas or air components.
 - a. The gas switching shall be accomplished by a three-position electrical switch with an "OFF" position between the Natural and Propane settings including a positive fuel shutdown in both directions to block back-pressure.
 - b. The FlexGas manifold shall as a minimum have two ON/OFF solenoid shutoff valves for natural gas, and a minimum of one ON/OFF solenoid shutoff valve and a lock-up regulator for propane gas, as a safety feature.
 - c. The FlexGas gas manifold shall be capable of accomplishing the fuel changeover in less than sixty seconds.

S. TruSeal® Direct Vent

1. The boiler(s) shall meet safety standards for direct vent equipment as noted by the 2006 UMC, section 1107.6, ASHRAE 15-1994, section 8.13.6, and ANSI Z21.13/CSA 4.9.

2.3 SOURCE QUALITY CONTROL

- A. The boiler(s) shall be completely assembled, wired, and fire-tested prior to shipment from the factory.
- B. The boiler(s) shall be furnished with the sales order, ASME Manufacturer's Data Report, inspection sheet, wiring diagram, rating plate and Installation and Operating Manual.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Must comply with

1. Local, state, provincial, and national codes, laws, regulations and ordinances
2. National Fuel Gas Code, NFPA 54/ANSI Z223.1 – latest edition
3. National Electrical Code, ANSI/NFPA 70 – latest edition
4. Standard for Controls and Safety Devices for Automatically-Fired Boilers, ANSI/ASME CSD-1, when required

5. Canada only: CAN/CSA B149 Installation Code and CSA C22.1 CEC Part I
 6. Manufacturer's installation instructions, including required service clearances and venting guidelines
- B. Manufacturer's representative to verify proper and complete installation.

3.2 START-UP

- A. Shall be performed by Raypak factory-trained personnel.
- B. Test during operation and adjust if necessary:
 1. Safeties (2.2 - F)
 2. Operating Controls (2.3)
 3. Static and full load gas supply pressure
 4. Gas manifold and blower air pressure
- C. Submit copy of start-up report to Architect and Engineer.

3.3 TRAINING

- A. Provide factory-authorized service representative to train maintenance personnel on procedures and schedules related to start-up, shut-down, trouble shooting, servicing, and preventive maintenance.
- B. Schedule training at least seven days in advance.

END OF SECTION