

**DIVISION 23 52 33.13**

**FINNED WATER-TUBE BOILERS**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section includes gas-fired, copper 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, NFPA 54/ANSI Z223.1
- F. I=B=R
- G. NEC
- H. ASME CSD-1, 2009 (if required)

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 NOx (0-20 PPM NOx emissions) boilers
- B. Certifications
  - 1. CSA
  - 2. ASME H Stamp and National Board Listed

1.5 HEAT EXCHANGER WARRANTY

- A. Limited twenty-year thermal shock warranty
- B. Limited ten-year closed-system warranty

**PART 2 - PRODUCTS**

2.1 MANUFACTURER

- A. Raypak, Inc.
  - 1. Contact: 2151 Eastman Ave., Oxnard, CA 93030; Telephone: (805) 278-5300; Fax: (800) 872-9725; Web site: [www.raypak.com](http://www.raypak.com)
  - 2. Product: Hi Delta® copper finned-tube hydronic boiler(s) with a separate condensing heat exchanger (CHX)

## 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
3. The CHX(s) shall be an externally-mounted, non-fired heat exchanger designed to capture waste heat from the flue products exiting the boiler, increasing the thermal efficiency of each system to up to 98 percent at full fire.
4. The boiler(s) shall be ASME inspected and H-stamped and National Board registered for 160 PSIG working pressure, complete with a Manufacturer's Data Report.
5. The boiler(s) shall have a floor loading of 90 lbs. /square foot or less.

### B. Heat Exchanger

1. The heat exchanger shall be of a single-bank, horizontal-grid design with integral copper fin tubes (models 402B-2002B), 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 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 into the primary heat exchanger 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 expansion coefficient.
2. The burners will be supplied with a fan-assisted, clean burning, and highly efficient fuel-air mixture.

### D. Ignition Control System

1. The boiler(s) shall be equipped with a 100 percent safety shutdown system.
2. The ignition shall be Hot Surface Ignition type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence, to ensure consistent operation.
3. The igniter will be located away from the water inlet to protect the device from condensation during startup.
4. The ignition control module shall include an LED that indicates six (6) individual diagnostic flash codes.
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, shut-off 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. High limit control
  - 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 an energy-saving pump control relay, mounted and wired, which automatically shuts off the boiler pump at a set period after boiler shut-down (adjustable for five or ten minutes) to avoid standby losses associated with constant pump operation.
- G. Firing Mode
1. For model 402B, provide on/off control of the gas input to the boiler (stage fire optional).
  2. For models 502B-2002B, provide staged firing control of the gas input to the boiler.
- H. Boiler Diagnostics
1. Provide external LED panel displaying the following boiler status/faults:
    - a. Power on – Blue
    - b. Call for heat – Amber
    - c. Flow – Green
    - d. Stages – Green (Stages 1-2 – Models 402B-902B; Stages 1-4 – Models 992B-2002B)
    - e. Fan(s) proven – Green (Fan 1 – Models 402B-902B; Fans 1-3 – Models 992B-2002B)
    - f. Ignition fault – Red
    - g. Safety fault – Red
  2. Provide internal circuit board indicating the following safety faults by a 2 line, 20 character, LCD display:
    - a. System status
    - b. Manual reset high limit
    - c. Blocked vent
    - d. Flow switch
    - e. Air pressure
    - f. Factory option
    - g. External interlock
    - h. Cold Water Start/Cold Water Run
    - i. Ignition lock-out

Specifier Note: The remaining items in this section are options. Delete those that are not being specified

- j. Controller alarm (optional)
    - k. Auto reset high limit (optional)
    - l. Low water cut-off (optional)
    - m. High gas pressure switch (optional)
    - n. Low gas pressure switch (optional on Models 402B-902B; standard on Models 992B-2002B)
  3. A Central Point Wiring board with diagnostic LED's indicating the status of each relay.
  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 24VAC
    - f. 6 flashes – internal fault (replace module)
- 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. Condensing Heat Exchanger (CHX)
  1. All surfaces of the CHX that are exposed to flue gases shall be constructed entirely of condensate-benign materials and shall be corrosion resistant under normal operating conditions. The CHX flue casing shall be constructed of AL29-4C stainless steel. The outer jacket shall be constructed of galvanized with a baked-on textured epoxy powder coating which passes a 1,000-hour salt spray test and is suitable for outdoor installation, applied prior to assembly for complete coverage. The CHX shall be designed so that it has no moving parts.
  2. A port shall be provided to drain condensate away from the unit. This port shall be no smaller

than 1/2".

3. The water-tube heat exchanger of the CHX shall be of the four-bank, counter-flow, tilted-grid design with 32 integral cupro-nickel fin tubes, each end of which is rolled into an ASME boiler-quality steel tube sheet and sealed to 160 PSIG-rated bronze headers with high temperature silicone "O" rings. The fins shall be epoxy-coated for additional corrosion resistance. The low-water-volume heat exchanger shall be explosion-proof on the water side and shall bear a 20-year warranty against thermal shock caused by momentary fluctuations in system inlet temperature to a maximum allowable Delta T within the heat exchanger of 150°F, with water outlet temperature not exceeding 230°F.
4. Access panels shall be provided on the CHX for easy cleaning.

#### K. Venting

1. Exhaust gases from the boiler shall be routed through the CHX to remove all possible waste heat. Past the CHX, flue gases shall be either:
  - a. Mixed with dilution air and drawn through an inline power vent fan, then discharged to atmosphere, OR
  - b. Discharged to atmosphere by means of a pressure-sensitive variable-speed extractor fan.
2. Vent material used between the fan and discharge shall be certified for the expected conditions as specified in Raypak's published description of the Hi Delta CHX system (ref. CHX Installation & Operating Manual, Cat. No. 1000.56)
3. The boiler(s) shall be ducted combustion air ready.

#### L. 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, 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.*

#### M. Operating Controls

1. The boiler(s) shall feature an optional two-stage digital controller with adjustable outdoor reset, mounted and wired.
2. Water and air temperature sensors shall be shipped loose for field installation by installing contractor.

#### N. Boiler Pump - Refer to Equipment Schedule

#### O. SureRack™ Boiler Stacking Kit

1. The boilers shall be stacked directly one on top of the other, without offset, to minimize footprint.

#### P. 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.

#### Q. Cold Water Start System

1. The boiler(s) shall be configured with a cold water start automatic proportional bypass system that ensures the boiler will experience inlet temperatures in excess of 105°F within 7 minutes to avoid damaging condensation. The unit will 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 modulating three-way valve that is controlled by a system-matched PID controller. The PID controller temperature sensor shall be located in the inlet header of the boiler.
3. The control shall have a temperature setting dial located on the face of the board. The temperature range of the dial 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 the following diagnostic LED's:
  - a. Call for heat
  - b. Start-up mode
  - c. Inlet temperature error
  - d. Sensor out of range
6. The controller shall have the capability to add optional alarm contacts.

R. Cold Water Run System

1. The boiler(s) shall be configured with a cold water run automatic proportional bypass 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 will 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 a system-matched PID control that injects the correct amount of cold water directly into the boiler loop to maintain a minimum inlet temperature. The PID controller temperature sensor shall be located in the inlet header of the boiler.
3. The control shall have a temperature setting dial located on the face of the board. The temperature range of the dial 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 the following diagnostic LED's:
  - a. Call for heat
  - b. Start-up mode
  - c. Inlet temperature error
  - d. Sensor out of range
6. The controller shall have the capability to add optional alarm contacts.

S. Low Gas Supply Pressure Manifold

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

T. FlexGas™ Dual-Fuel Gas Manifold

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.

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, troubleshooting, servicing, and preventive maintenance.
- B. Schedule training at least seven days in advance.

**END OF SECTION**