



**RAYTHERM®, TYPE H  
SUGGESTED SPECIFICATIONS**

Catalog No.: 2000.90I  
Effective: 04-01-20  
Replaces: 04-15-10

**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. National Fuel Gas Code, ANSI Z223.1/NFPA 54
- E. AHRI
- F. NEC, ANSI/NFPA 70
- G. ASME CSD-1, 2015 (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
- B. Certifications
  - 1. CSA
  - 2. ASME H Stamp and National Board Listed

1.5 HEAT EXCHANGER WARRANTY: BOILERS SHALL INCLUDE MANUFACTURER'S STANDARD FORM IN WHICH MANUFACTURER AGREES TO REPAIR OR REPLACE COMPONENTS OF BOILERS THAT FAIL IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD.

- A. Limited one-year parts warranty
- B. Limited ten-year closed-system warranty for copper and cupronickel heat exchangers
- C. Limited twenty-five-year thermal shock 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; Web site: www.raypak.com
2. Product: Raytherm® copper finned-tube hydronic boiler(s)
  - a. Model(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 82 percent at full fire.
3. 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.
4. The boiler(s) shall have a floor loading of 70 lbs. /square foot or less.

B. Heat Exchanger

1. The heat exchanger shall be of a single-bank, horizontal-grid design integral copper fin 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 \_\_\_\_\_ 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-five-year warranty against thermal shock caused by boiler operation with large temperature changes, not exceeding 150°F between the water temperature at the boiler inlet and the boiler outlet temperature up to 230°F maximum.
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 heat exchanger shall incorporate "V" baffles, between the tubes, to ensure complete contact of the external tube surfaces with the products of combustion.
6. The boiler(s) shall be capable of operating at inlet water temperatures as low as 105°F without condensation.
7. 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.
8. The heat exchanger shall be AB-1953 compliant in construction and verification by a third party certification agency.

C. Burners

1. The stainless steel alloy burners shall be of the raised port design with primary fixed air ports, capable of quiet extinction without flashback at the orifice at firing rates between 20% and 100%, and mounted in a slide out burner drawer for ease of inspection.

D. Pilot Control System

1. The boiler(s) shall be equipped with a 100 percent safety shutdown system. The pilot ignition shall be (a) or (b)
  - a. Models 182-1826 shall have an electronic intermittent ignition system with electronic flame supervision having a nominal 0.8-second flame response time.
  - b. Models 2100-4001 shall have an electronic ignition system with electronic flame supervision having a nominal 0.8-second flame response time, requiring a manual reset on flame failure.
2. The ignition shall be Spark Ignition type with full flame rectification 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 two LEDs that indicates flame presence and/or system status.

E. Gas Train

1. The boiler(s) shall have a firing/leak test valve and pressure test port as required by CSD-1.
2. The boiler(s) shall have dual gas valve seats per ANSI Z21.13/CSA 4.9.
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 (Economaster), mounted and wired, which automatically shuts off the boiler pump at a set period after boiler shut-down (adjustable from three to ten minutes) to avoid standby losses associated with constant pump operation.

G. Firing Mode

1. The boiler(s) shall be equipped to (a), (b), or (c):
  - a. Provide full modulation of gas input to any load condition as low as 20% of the full rating of the boiler (5:1 ratio) without flashback, burning at orifices or improper combustion.
  - b. Provide staged control of the gas input to the boiler.
  - c. Provide on/off control of the gas input to the boiler.

H. Boiler Diagnostics

1. Provide ignition module indicating the following flashes by LED signal:

“M” Ignition Model (Retry)

  - a. 2 flashes per second (“heartbeat”) – Normal operation
  - b. 2 flashes – 5 minute retry delay
  - c. 3 flashes – Recycle - flame failed during run
  - d. 4 flashes – Flame sensed out of sequence
  - e. 7 flashes – Flame sense leakage to ground
  - f. 8 flashes – low 24VAC (secondary voltage)
  - g. 6+2 flashes – 5 minute retry delay (on every third retry on the same “Call For Heat”)
  - h. 6+3 flashes – On every 6<sup>th</sup> flame failure during run on the same “Call For Heat”
  - i. 6+4 flashes – Flame sensed out of sequence – longer than 10 seconds
  - j. ON steady – Soft lockout due to error detected during self check sequences

“H” Ignition Model (Lockout)

- a. 2 flashes per second (“heartbeat”) – Normal operation
  - b. 2 flashes – 5 minute retry delay
  - c. 3 flashes – Recycle - flame failed during run
  - d. 4 flashes – Flame sensed out of sequence
  - e. 7 flashes – Flame sense leakage to ground
  - f. 8 flashes – low 24VAC (secondary voltage)
  - g. 6+2 flashes – Failed trial for ignition resulting in lockout
  - h. 6+3 flashes – More than 5 flame failures during run on the same “Call For Heat” resulting in lockout.
  - i. 6+4 flashes – Flame sensed out of sequence – longer than 10 seconds
  - j. ON steady – Soft lockout due to error detected during self check sequences
- I. Combustion Chamber: The lightweight, high-temperature, multi-piece, interlocking castable combustion chamber liner shall 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/NFPA 54 latest edition (Category I).

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 require an optional separate combustible floor base.

*Specifier Note: The remaining items in this section are options. Delete those that are not being specified.*  
**IMPORTANT:** The Cold Water Start System cannot be used on the same boiler.

- L. Operating Controls
  - 1. The boiler(s) shall feature an optional staged controller with adjustable outdoor reset, mounted and wired.
  - 2. Water and air temperature sensors for all digital controllers shall be shipped loose for field installation by installing contractor.
- M. Boiler Pump - Refer to Equipment Schedule
- N. 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 alarm contacts.

### 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

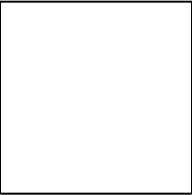
### 3.1 INSTALLATION

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

**END OF SECTION**