

**DIVISION 23 52 33.13**

**FINNED WATER-TUBE WATER HEATERS**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section includes gas-fired, copper finned-tube water heaters for use with a storage tank.
- 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 Z21.10.3/CSA 4.3
- B. ASME, Section IV
- C. 2006 UMC, Section 1107.6
- D. National Fuel Gas Code, ANSI Z223.1/NFPA 54
- A. NEC, ANSI/NFPA 70
- B. 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 Z21.10.3/CSA 4.3
- B. Certifications
  - 1. CSA
  - 2. ASME HLW-Stamp and National Board registered

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

- A. Limited one-year parts warranty
- B. Limited five-year warranty for copper 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; Website: [www.raypak.com](http://www.raypak.com)
  - 2. Product: Raytherm<sup>®</sup> copper finned-tube water heater(s)
    - a. Model(s) \_\_\_\_\_

## 2.2 WATER HEATERS

### A. General

1. The water heater(s) shall be fired with \_\_\_\_\_ gas at a rated input of \_\_\_\_\_ BTU/hr.
2. The water heater(s) shall be CSA tested and certified with a minimum thermal efficiency of 82 percent at full fire.
3. The water heater(s) shall be ASME inspected and HLW-stamped and National Board registered for 160 PSIG working pressure, complete with a Manufacturer's Data Report.
4. The water heater(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 with 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 bronze or glass-lined cast iron headers with high temp silicone O-rings.
3. 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.
4. The heat exchanger shall incorporate "V" baffles, between the tubes, to ensure complete contact of the external tube surfaces with the products of combustion.
5. The water heater(s) shall be capable of operating at inlet water temperatures as low as 105°F without condensation.
6. The water heater(s) shall be designed to accommodate field changes of either left- or right-hand plumbing and electrical while leaving the tube bundle in place.
7. 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 water heater(s) shall be equipped with a 100 percent safety shutdown system. The standard pilot ignition shall be:
  - a. Models 182-1826 shall have an electronic intermittent ignition (IID) system with electronic flame supervision having a nominal 0.8-second flame response time.
  - b. Models 2100-4001 shall have an electronic ignition (IID) 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 indicate flame presence and/or system status.

### E. Gas Train

1. The water heater(s) shall have dual gas valve seats per ANSI Z21.10.3/CSA 4.3.
2. 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 Z21.10.3/CSA 4.3.

### F. Water Heater 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 water heater(s) shall be equipped with an energy-saving pump control relay (Economaster), mounted and wired, which automatically shuts off the water heater pump at a set period after water heater shut-down (adjustable from three to ten minutes) to avoid standby losses associated with constant pump operation.

G. Firing Mode

1. The water heater(s) shall be equipped to (a), (b), or (c):
  - a. Provide full modulation of gas input to any load condition as low as 10% of the full rating of the water heater (10:1 ratio) without flashback, burning at orifices or improper combustion.
  - b. Provide staged control of the gas input to the water heater.
  - c. Provide on/off control of the gas input to the water heater.

H. Water Heater Diagnostics

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

“M” Ignition Model (Continuous Retry)

- a. 2 flashes per second (“heartbeat”) – Normal operation
- b. 2 flashes – Five-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 – Five-minute retry delay (on every third retry on the same “Call For Heat”)
- h. 6+3 flashes – On every sixth flame failure during run on the same “Call For Heat”
- i. 6+4 flashes – Flame sensed out of sequence for more 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 – Five-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 five flame failures during run on the same “Call For Heat” resulting in lockout
- i. 6+4 flashes – Flame sensed out of sequence for more 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 water heater’s flue material and size shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA54 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 water heater(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 and Cold Water Run Systems cannot be used on the same water heater.*

L. Operating Controls

1. The water heater(s) shall feature an optional temperature controller.

M. Water Heater Pump - Refer to Equipment Schedule

#### N. Cold Water Start System

1. The water heater(s) shall be configured with a cold water start automatic proportional bypass system that ensures the water heater 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 water heater.
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.

#### O. Cold Water Run System

1. The water heater(s) shall be configured with a cold water run automatic proportional bypass system that ensures the water heater 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 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 water heater loop to maintain a minimum inlet temperature. The PID controller temperature sensor shall be located in the inlet header of the water heater.
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 alarm contacts.

### 2.3 SOURCE QUALITY CONTROL

- A. The water heater(s) shall be completely assembled, wired, and fire-tested prior to shipment from the factory.
- B. The water heater(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. Canada only: CAN/CSA B149 Installation Code and CSA C22.1 CEC Part I
  5. 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**