

## DIVISION 23 52 33.13

### FINNED WATER-TUBE WATER HEATERS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. Section includes gas-fired, copper and cupronickel finned-tube water heaters for use with or without 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. ANSI/ASHRAE 15-1994, Section 8.13.6
- E. National Fuel Gas Code, NFPA 54/ANSI Z223.1
- 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 Z21.10.3/CSA 4.3
  2. Local and national air quality regulations for low NO<sub>x</sub> (0-20 PPM NO<sub>x</sub> emissions) water heaters
- B. Certifications
  1. CSA
  2. ASME, Section IV, HLW-Stamped and National Board registered
  3. S.C.A.Q.M.D. Rule 1146.2 Compliant
  4. CSA-Certified – Low-Lead Compliant

##### 1.5 WARRANTY

- A. Limited one-year warranty from date of installation
- B. Limited twenty-year thermal shock warranty from date of installation
- C. Limited ten-year warranty for cupronickel heat exchanger
- D. Limited five-year warranty for copper heat exchanger

#### 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 water heater(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 83.1% for copper (85% for cupronickel) finned tubes at full fire.
3. The heater(s) shall be ASME inspected and stamped and National Board registered for 160 PSIG maximum allowable working pressure and 210°F maximum allowable temperature, complete with a Manufacturer's Data Report.
4. The water heater(s) shall have a floor loading of 65 lbs. /square foot or less.
5. The heater water connections shall be 2 NPT connections.

### B. Heat Exchanger

1. The heat exchanger shall be of a single-bank, horizontal-grid design with eight integral copper or cupronickel (optional) finned-tubes, each end of which is rolled into an ASME water heater quality steel tube sheet.
2. The heat exchanger shall be sealed to 160 PSIG-rated bronze or glass-lined cast iron headers (optional) 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. 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 verified by a third-party certification agency.

### 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.
3. The burner must be capable of firing at 100% of rated input when supplied with 5.6" W.C. of inlet natural gas pressure, or 11.0" W.C. when supplied with propane gas, so as to maintain service under heavy demand conditions; no exceptions. When the low gas pressure option is utilized the minimum natural gas pressure becomes 4" W.C. and when supplied with propane the minimum gas pressure is 11.0" W.C.

### D. Ignition Control System

1. The water heater(s) shall be equipped with a 100% safety shutdown.
2. The ignition shall be a Hot Surface Ignition (HSI) type with full flame rectification by remote sensing separate from the ignition source. A three-try-for-ignition sequence is standard with a single-try ignition available as an option.
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 water heater(s) shall have a firing/leak test valve and pressure test valve as required by CSD-1.
  2. The water heater(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 Z21.10.3/CSA 4.3.
- F. Heater 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 heater(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. Freeze protection
    - d. Three (3) water sensors included (inlet and outlet factory-mounted and wired; system sensor is loose)
- G. Firing Mode
1. Two-stage firing control of the gas input to the water heater.
- H. Heater 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" 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 Run (optional)
  3. Factory-installed VERSA IC® ignition and control components for two-stage 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 water heater's flue material and size shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 latest edition (Category I).
  2. When routed horizontally, the water heater(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.
  3. The water heater(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 heater(s), if located on a combustible floor, shall not require a separate combustible floor base.
  3. The heater(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 water heater. The Low Gas Supply Pressure and FlexGas Manifolds also cannot be used on the same water heater.*

- L. Water Heater Pump - Refer to Equipment Schedule
- M. SureRack® Water Heater Stacking Kit
  1. The water heaters shall be stacked directly one on top of the other, without offset, to minimize footprint.
- N. Cold Water Run System
- O. Cold Water Protection – Variable-Speed Injection System
  1. The boilers shall be configured with a proportional variable-speed injection pumping system controlled by the onboard VERSA IC® that ensures the boiler will experience inlet temperatures in excess of 120°F in less than 7-minutes to avoid damaging condensation. The unit can be user-configured to automatically shut down or continue to operate if the inlet temperature is not achieved within the 7-minute time frame and provide alarm output.
  2. The cold water protection function is user-adjustable to allow for custom tuning for varying lengths of piping. The PID logic shall be capable of limiting system overshoot to a maximum of 10°F on initial start-up or call-for-heat.

3. The cold-water protection system shall be completely wired and mounted at the factory.
- P. Low Gas Supply Pressure Manifold
1. The water heater(s) shall be CSA-certified for full-input operation down to 4.0" WC dynamic inlet natural gas supply pressure.
- Q. FlexGas® Dual-Fuel Gas Manifold
1. The water heater(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 manifold shall be capable of accomplishing the fuel changeover in less than sixty seconds.
- R. TruSeal® Direct Vent
1. The water heater(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 Z21.10.3/CSA 4.3.

## 2.3 HEATER OPERATING CONTROLS

- A. Each water heater shall have the ability to receive a 0-10 VDC signal from the Central Energy Management and Direct Digital Control System (EMCS) to vary the setpoint control. Each water heater shall have an alarm contact for connection to the central EMCS system.
- B. Each water heater shall be equipped with Modbus communications compatibility with up to 165 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. Heater(s) shall feature an integrated VERSA IC® modulating digital controller, mounted and wired.
- D. The control shall have the ability to provide cascade control of up to 8 water heaters as a single system via 2-wire communication.
- E. System tank sensor shall be shipped loose for field installation by installing contractor. Inlet/Outlet sensors are factory-installed.
- F. VERSA IC® control system is capable of controlling up to two (2) connected pumps.
  1. Heater pump (fixed-speed)
  2. Recirculation pump

## 2.4 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, ANSI Z223.1 /NFPA 54 – 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**