DIVISION 23 34 36.29

COMMERCIAL, WATER-TUBE, CONDENSING GAS DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes condensing, gas-fired copper finned-tube, gas domestic water heaters

Specifier Note: Use as needed

B. Related Sections
   1. Building Services Piping – Division 22 10 00
   2. Breeching, Chimneys, and Stacks (Venting) – Division 23 51 00
   3. Electrical – Division 23 09 33

1.2 REFERENCES

A. ANSI Z21.10.3/CSA 4.3
B. ASME Boiler and Pressure Vessel Code, Sections IV and VIII
C. UMC, Section 1107.6
D. ANSI/ASHRAE 15-1994, Section 8.13.6
E. National Fuel Gas Code, ANSI Z223.1/NFPA 54
F. National Electric Code, ANSI/NFPA 70
G. ASME CSD-1 (when 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 Z21.10.3/CSA 4.3
   2. Local and national air quality regulations for low NOx (0-30 PPM NOx emissions) water heaters
B. Certifications
   1. CSA – ANSI Z21.10.3 / CSA 4.3
   2. ASME HLW Stamp and National Board Listed – Primary Heat Exchanger
   3. ASME U Stamp and National Board Listed – Secondary Stainless Steel Condensing Heat Exchanger
   4. CSA Certified – < 0.25% Low Lead Compliant

1.5 WARRANTY

A. Limited one-year warranty from date of installation - parts
B. Limited twenty-five-year thermal shock warranty – heat exchangers
C. Limited five-year primary heat exchanger warranty (copper), ten-year (cupro-nickel)
D. Limited ten-year secondary stainless steel condensing 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: (800) 872-9725; Web site: www.raypak.com
2. Product: XTherm® condensing water-tube domestic 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 shall have a maximum adjustable setpoint of 150ºF.
3. The water heater(s) shall be CSA tested and certified with a minimum thermal efficiency of 97 percent at full fire (up to 99% at part load).
4. The water heater(s) shall be ASME inspected and stamped and National Board registered for 160 PSIG maximum allowable working pressure and 210ºF maximum allowable outlet temperature, complete with a Manufacturer's Data Report.
5. The water heater(s) shall have a floor loading of 70 lbs. /square foot or less.
6. The water heater(s) shall be capable of operating at inlet water temperatures as low as 50°F.

B. Primary Heat Exchanger

1. The primary heat exchanger shall be of a single-bank, vertical multi-pass design and shall completely enclose the combustion chamber for maximum efficiency. The tubes shall be set vertically and shall be rolled into a powder-coated, ASME water heater quality, carbon steel tube sheet.
2. The primary heat exchanger shall be sealed to 160 PSIG rated bronze headers with high-temperature silicone "O" rings.
3. The low water volume primary heat exchanger shall be explosion-proof on the water side and shall carry a twenty-five-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. A heavy gauge stainless steel slotted primary heat exchanger wrap shall ensure proper combustion gas flow across the copper-finned tubes.
5. The water heater(s) flue connection, combustion air opening, gas connection, water connections, condensate drain and electrical connections shall be located on the rear.
6. The primary heat exchanger shall have accessible water heater drain valves with hose bibs to drain the water section of the primary heat exchanger.

C. Condensing Secondary Heat Exchanger

1. The condensing secondary heat exchanger shall be a single-bank, multi-pass design constructed of stainless steel and shall bear the ASME U stamp.
2. The secondary heat exchanger shall have accessible boiler drain valves with hose bibs to drain the water section of the heat exchanger.

D. Condensate Drain

1. The water heater(s) will feature a condensate drain switch which will shut down the water heater(s) if the condensate drain is blocked.

E. Burner

1. The combustion chamber shall be of the sealed-combustion type employing the Raypak high-temperature radially-fired knitted burner, mounted in a vertical orientation.
2. The burner must be capable of firing at both a complete blue flame with maximum gas and air input as well as firing infrared when gas and air are reduced. The burner must be capable of firing at 100% of rated input when supplied with 4.0” WC of inlet gas pressure, so as to maintain service under heavy demand conditions; no exceptions.

3. The burner shall use a combustion air blower to precisely control the fuel/air mixture for maximum efficiency throughout the entire range of modulation. The combustion air blower shall operate for a pre-purge period before burner ignition and a post-purge period after burner operation to clear the combustion chamber.
4. The blower shall infinitely vary its output in response to a Pulse Width Modulation (PWM) signal supplied directly from the VERSA IC® modulating temperature controller, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion. Minimum fire shall be as low as 9.0 percent of rated input (natural gas or propane gas).

F. Ignition System
1. The water heater(s) shall be equipped with a 100 percent 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, to ensure consistent operation.
3. The igniter will be located to the side of the heat exchanger 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 display.
5. An external viewing port shall be provided, permitting visual observation of burner operation.

G. Gas Train
1. The water heater(s) shall have a firing/leak test valve and pressure test valve as required.
2. The water heater(s) shall have dual-seated main gas valve.
3. Gas control trains shall have a redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.10.3/CSA 4.3.

H. Water Heater Control
1. The following safety controls shall be provided:
   a. 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 (shipped loose)
2. The water heater(s) shall be equipped with the VERSA IC modulating temperature controller with 7-inch touch screen display that incorporates an adjustable energy-saving pump control relay and freeze protection, and is factory mounted and wired to improve system efficiency; three water sensors included (tank sensor is shipped loose)

I. Firing Mode: Provide electronic modulating control of the gas input to the water heater.

J. Water 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 7-inch Touch Screen display:
   a. System status
   b. Ignition failure
   c. Condensate blockage
   d. Blower speed error
   e. Low 24 VAC
   f. Manual reset high limit
   g. Auto reset high limit
   h. Blocked vent
   i. Controller alarm
   j. Flow switch
   k. Sensor failure
      1. Inlet sensor (open or short)
      2. Outlet sensor (open or short)

3. System sensor (open or short)

l. Factory option
m. Internal control fault
n. ID card fault
o. Cascade communications error

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

p. Auto reset high limit (optional)
q. Low water cut-off (optional)
r. High gas pressure switch (optional)
s. Low gas pressure switch (optional)

3. Provide ignition module indicating the following flash codes by LED signal and displayed on the 7-inch Touch Screen 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 – vent temperature
   g. 7 flashes – hi-limit
   h. 8 flashes – sensor fault
   i. 9 flashes – low gas pressure
   j. 10 flashes – water pressure
   k. 11 flashes – blower speed fault
   l. 12 flashes – low water cut-off
   m. 13 flashes – hi-temperature ΔT
   n. 14 flashes – FT-BUS communications
   o. 15 flashes – general safety limit

K. Combustion Chamber: The combustion chamber wrapper shall not require insulation to reduce standby radiation losses.

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 water heater(s), if located on a combustible floor, shall not require a separate combustible floor base.
   3. The water heater(s) shall connect both the combustion air and flue products through the back of the unit.
   4. The heater shall have as standard an internal, combustion air filter rated to MERV 8 (>95% arrestance).

M. Water Heater Pump – The water heater(s) shall be equipped with factory-packaged pump system.

N. Cold Water Protection System
   1. The water heater(s) shall be configured with an automatic cold water protection proportional bypass system that ensures the heater primary heat exchanger will experience inlet temperatures in excess of 120ºF in less than 7 minutes to avoid damaging condensation.
   2. The cold water protection system shall be configured with a variable-flow injection system that is controlled by the VERSA IC control system that diverts the correct amount of heated outlet water directly into the heater loop to maintain the required minimum inlet temperature. The VERSA IC control temperature sensor shall be located in the inlet header of the primary heat exchanger.

2.3 WATER HEATER OPERATING CONTROLS

A. The water heater(s) shall feature the VERSA IC modulating digital controller, mounted and wired.

B. The tank sensor shall be shipped loose for field-installation by installing contractor. Inlet/Outlet sensors are factory-installed.

C. The control shall have the ability to provide cascade control of up to 4 heaters as a single system via 2-wire communication.

D. Each heater shall have the ability to receive a 0 to 10 VDC signal from the Central Energy Management and Direct Digital Control System (EMCS) to vary the setpoint control or firing rate. Each heater shall have an alarm contact for connection to the central EMCS system.

E. Each heater shall be equipped with Modbus communications compatibility with up to 146 points of data available.

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

a. B-85 Gateway – BACnet MS/TP, BACnet IP, N2 Metasys or Modbus TCP (optional)
b. B-86 Gateway – LonWorks (optional)

2.4 DIRECT VENT

A. The water heater(s) shall meet safety standards for direct vent equipment as noted by the Uniform Mechanical Code, section 1107.6, and ASHRAE 15-1994, section 8.13.6.

2.5 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(s), 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. 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. Operating controls
3. Static and full load gas supply pressure
4. Gas manifold and blower air pressure
5. Amp draw of blower
6. Combustion analysis

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