

DIVISION 23 52 33.13

STAINLESS STEEL HEATING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes condensing gas-fired, stainless steel hydronic heating boilers

Specifier Note: Use as needed

- B. Related Sections

- 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, ANSI Z223.1/NFPA 54
- F. AHRI
- G. NEC, ANSI/NFPA 70
- H. ASME CSD-1, 2018 (when required)
- I. 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
 - 2. Local and national air quality regulations for low NO_x (0 -20 PPM NO_x emissions) boilers. Units can be tuned onsite to 9 ppm NO_x where required.
- B. Certifications
 - 1. CSA
 - 2. CEC
 - 3. ASME, Section IV, H-Stamped and National Board registered
 - 4. S.C.A.Q.M.D. Rule 1146.2 Compliant

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 heat exchanger warranty
- C. Limited twenty-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; Website: www.raypak.com
2. Product: XFIIRE™ condensing stainless steel hydronic heating boiler(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 96.5% for 300B model at full fire and 96% for models 400B - 1000B.
3. The boiler(s) shall have a minimum turndown ratio of 7:1.
4. The boiler(s) shall have a floor loading of 95 lbs. per square foot or less.
5. The boiler(s) shall have a user setting for percentage of glycol to be used in the piping system and, using a patent-pending algorithm, will automatically and dynamically adjust maximum allowable firing rate, maximum temperature differential, minimum required fluid flow and burner response timing. This feature will provide maximum protection for the heat exchanger and provide for the maximum achievable life of the boiler under varying system conditions. The default setting for this feature is 50% glycol, to ensure the maximum protection level is provided as shipped.
6. The boiler shall have a user setting to select the vent material being installed with the boiler. This setting, along with a flue gas temperature sensor, will dynamically adjust firing rate to provide protection for the vent system selected by the user. The default setting is for PVC vent material, to ensure the maximum protection level is provided as shipped.

B. Heat Exchanger

1. The primary heat exchanger shall be of a helically-wound, multi-pass design and shall completely encircle the combustion chamber for maximum efficiency.
2. The heat exchanger is removable from the cabinet for replacement without removing the entire boiler assembly from the site. The stainless-steel combustion chamber shall be designed to have a trough located on the bottom front and back section leading to the middle to ensure that condensation does not collect in the boiler.
3. The heat exchanger 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 flue connection, combustion air opening, gas connection, electrical connections, water connections and condensate drain shall be located on the rear of the unit.
5. The boiler water connections shall be 2-inch grooved connector for models 300B-800B and 2.5-inch grooved connector for model 1000B.

C. Condensate Drain

1. The boiler(s) will feature a condensate drain with float switch, which will shut down the boiler(s) if the condensate drain is blocked.

D. Burner

1. The combustion chamber shall be of the sealed-combustion type employing the "Bluejet" burner, mounted in a horizontal orientation.
2. The burner shall be a premix design and constructed of high-grade Inconel and 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 natural gas pressure, or 8.0" for propane 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 control, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion.
- E. Ignition System
1. The boiler(s) shall be equipped with a 100% safety shutdown.
 2. The ignition shall be proven Direct Spark Ignition (DSI) type with full flame rectification by remote sensing separately from the ignition source. A three-try-for-ignition sequence is standard *with single-try available as an option*.
 3. The ignition control module shall include an LED display that indicates fifteen (15) individual diagnostic flash codes and transmits any faults to the touchscreen display.
 4. An external viewing port shall be provided, permitting visual observation of burner operation.
- F. 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 a dual-seated main gas valve.
 3. Gas control trains shall have a redundant safety shut-off feature, main gas regulation, and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.
- G. Boiler Control
1. The following safety controls shall be provided:
 - a. High limit control with manual-reset, mounted and wired
 - b. Blocked vent pressure switch, mounted and wired
 - c. Blocked condensate switch, mounted and wired
 - d. Temperature and pressure gauge (shipped loose)
 - e. Adjustable high limit control with manual-reset, mounted and wired (optional – please specify shipped loose or installed)
 - f. Adjustable high limit control with auto-reset, mounted and wired (optional – please specify shipped loose or installed)
 2. The boiler(s) shall be equipped with the following:
 - a. VERSA IC modulating temperature controller with 4.3" capacitive color touchscreen display
 - b. Three adjustable energy-saving pump control relays (boiler, system, indirect DHW)
 - c. Freeze protection
 - d. Five (5) water sensors included (inlet and outlet factory mounted and wired; indirect, temperature to indirect and cascade sensor shipped loose for field installation by others).
 - e. Outdoor air sensor (shipped loose for field installation by others)
 - f. *Water flow rate sensor, mounted on a vertical manifold for field installation and wiring. Accurate to +/- 1%. (displays flow in GPM and available via BMS data port) (OPTIONAL)*
 3. The boiler(s) shall allow for 0-10 VDC input connection for remote building DDC system control of system temperature or firing rate.
 4. The boiler(s) shall have built-in "Cascade" function for up to eight (8) units of same or different BTUH inputs without utilizing an external controller or sequencer.
 - a. The Cascade function shall include selectable modes for parallel modulation and sequential modulation with lead boiler rotation and lead-lag operation.
 - b. System shall be capable of leader redundancy and lead rotation every forty-eight (48) hours.
 - c. Cascade function shall allow users to enable or disable alarm sharing across cascaded appliances when an alarm condition occurs
 - d. Cascade functions shall include an interstage delay setting with auto-delay option.
- H. Firing Mode: Provide electronic modulating control of the gas input to the boiler.
- I. Boiler Diagnostics – The front panel Raypak logo shall be illuminated to provide external display of the following boiler status/faults:
- a. Power on – Solid white
 - b. Call for heat – Pulsing blue
 - c. Burner firing – Solid blue
 - d. Post-purge (gas purge) – Pulsing White
 - e. Service – Pulsing Red

1. Provide monitoring of all safeties, internal/external interlocks with fault display by a 4.3" capacitive color touchscreen display:
 - a. System status
 - b. Ignition failure
 - c. Condensate blockage
 - d. Low Water Cut Off (LWCO)
 - e. Blocked vent
 - f. Flow switch fault
 - g. Factory option
 - h. External interlock
 - i. Ignition lock-out
 - j. Blower speed error
 - k. Low 24VAC
 - l. High vent temperature
 - m. Internal control fault
 - n. ID card fault
 - o. Cascade communication error
 - p. Sensor failure
 1. Inlet sensor (open or short)
 2. Outlet sensor (open or short)
 3. System (cascade) sensor (open or short)
 4. Air sensor (open or short)
 5. Temperature to indirect sensor (open or short)
 6. Indirect DHW tank sensor (open or short)
 7. Water flow rate sensor
 - q. *High Delta-T (temperature differential between inlet and outlet (optional - if flow meter is installed, varies based on flow)*
 - r. *Adjustable manual-reset high limit (optional – please specify shipped loose or installed)*
 - s. *Adjustable auto-reset high limit (optional – please specify shipped loose or installed)*
 - t. *High/Low gas pressure switches (optional – please specify shipped loose or installed)*
 - u. *Controller alarm (optional)*

J. Combustion Chamber

1. The combustion chamber shall be constructed of 316L stainless steel and fully surround the burner for maximum efficiency.

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 the 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 connect both the combustion air and flue products through the back of the unit.
4. The boiler(s) shall have as standard an internal combustion air filter rated to MERV 8 (equal to or greater than 95% arrestance).
5. The formed structural steel base shall include properly-sized openings for forklift from either side or a pallet jack from the front or rear of the unit.

L. *Boiler Pump – The boiler(s) shall be equipped with an optional factory-packaged pump system. (OPTIONAL)*

M. *Motorized isolation valve (OPTIONAL)*

2.3 BOILER OPERATING CONTROLS

- A. Each boiler 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 or control firing rate. Each boiler shall have an alarm contact for connection to the central EMCS system.

- B. Each boiler shall be equipped with Modbus communications compatibility with up to 146 points of data available.
 - a. B-85 Gateway – BACnet MS/TP, BACnet IP, N2 Metasys or Modbus TCP (optional – please specify shipped loose or installed)
 - b. B-86 Gateway – LonWorks (optional – please specify shipped loose or installed)
- C. The boiler(s) shall feature the integrated VERSA IC® modulating digital controller, mounted and wired.
 - 1. Mode 1 = Hydronic, without indirect domestic hot water
 - 2. Mode 2 = Hydronic, with indirect domestic hot water plumbed into system loop piping
 - 3. Mode 3 = Hydronic, with indirect domestic hot water plumbed into boiler loop plumbing (Primary/Secondary Piping Only)
- D. System cascade sensor and optional air temperature sensor shall be shipped loose for field installation by installing contractor. Inlet, outlet, flue gas, and water flow rate sensors are factory-installed.
- E. VERSA IC® control system is capable of controlling up to three (3) connected pumps.
 - 1. Boiler pump (Fixed- or Variable-Speed)
 - 2. System pump
 - 3. Indirect DHW pump

Specifier Note: The remaining item(s) in this section are options. Delete those that are not being specified.

- F. *Raymote™ Connectivity (optional)*
 - 1. *The VERSA IC® shall include the Raymote connectivity feature to allow remote access to boiler data, and to provide maintenance reminders and error notifications on iOS and Android devices or by website access.*
 - 2. *The Raymote system allows for registering of multiple devices at various locations and multiple devices in a single cascade installation. The system also allows separate Groups to be established with various levels of access and control permission to be set by the equipment owner. The Groups feature will also allow for quick and efficient troubleshooting service by Raypak's Service Team.*
 - 3. *Raymote will provide reminders and alerts via iOS or Android notification, text, or email. All notification features are user set.*
 - 4. *The Raymote app and website will allow remote monitoring of the following:*
 - a. *Outlet and inlet temperature monitoring*
 - b. *Vent temperature*
 - c. *Flow (if equipped)*
 - d. *Blower speed*
 - e. *Modulation percentage*
 - f. *Flame current*
 - g. *Run time*
 - h. *Boiler Status*
 - i. *Cycles*
 - j. *Historical data*
 - 5. *The Raymote App and Website will allow remote control/adjustment of the following:*
 - a. *Temperature Setpoint*
 - b. *Temperature differential*
 - c. *Outdoor Reset settings*
 - d. *Indirect Setpoint*
 - e. *Indirect differential*
 - f. *Custom notification*
 - g. *Full historical data reports will be available for review on the Raymote website.*
 - 6. *One (1) year of Raymote service is included with boiler purchase*

2.4 ELECTRICAL POWER

- A. Controllers, electrical devices and wiring: Electrical devices and connections are specified in Division 26 sections.

- B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices shall provide single-point field power connection to the boiler.
- C. Electrical characteristics:

Model	120 VAC, 60 Hz 1Ø (Standard)	208 VAC, 60 Hz 1Ø (Optional)
300B	<7.5A	<5.0A
400B	<7.5A	<5.0A
500B	<5.0A	<5.0A
650B	<5.0A	<5.0A
800B	<7.5A	<7.5A
1000B	<7.5A	<7.5A
Current draw is for heater only. Supply breaker must have a delayed trip.		

2.5 VENTING

- A. The exhaust vent must be UL-listed for use with Category IV appliances and compatible with operating temperatures up to 230°F, condensing flue gas service. UL-listed vents of Centrotherm® Polypropylene and Category IV stainless steel must be used with boilers. PVC ANSI/ASTM D1785 schedule 40, ANSI/ASTM F441 schedule 40 CPVC solid-core pipe may also be used to vent the XFIIRE™ boiler when installed using the factory-supplied vent adapter.
- B. The minimum exhaust vent duct size for each boiler is four-inch (4") diameter for models 300B-500B, 6" diameter for models 650B-1000B.
- C. Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors.
- D. The minimum sealed combustion air duct size for each boiler shall be four-inch (4") diameter for models 300B-500B, six-inch (6") diameter for models 650B-1000B.
- E. Common vent and common combustion air must be an available option for boiler installation. Consult manufacturer for common vent and combustion air sizing. Follow guidelines specified in the manufacturers' venting guides.
- F. Standard vent connection shall be PVC/CPVC.
- G. *Vent adapter (OPTIONAL - select either item 1 or 2 below if utilizing)*
 1. *Stainless steel vent adaptor*
 2. *Centrotherm Innoflue® (sales option D-33) that allows for the use of polypropylene vent material.*
 3. The boiler-mounted VERSA IC® control shall include a feature allowing for the user to select the vent material during setup, which will automatically adjust unit operation to not exceed a maximum safe flue exhaust temperature.

2.6 DIRECT VENT

- A. The boiler(s) shall meet safety standards for direct vent equipment as noted by the 2006 Uniform Mechanical Code, section 1107.6, and ASHRAE 15-1994, section 8.13.6.
- B. The combustion air duct and vent length should not exceed 100 equivalent feet each.

2.7 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(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. 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. Operating controls
 - 3. Static and full load gas supply pressure
 - 4. Gas manifold and blower suction pressure
 - 5. 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, shutdown, troubleshooting, servicing, and preventive maintenance.
- B. Schedule training at least seven days in advance.

END OF SECTION