

VGH MasterSpec

SECTION 235216.13 – WATER TUBE STAINLESS-STEEL CONDENSING BOILERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes factory packaged, gas-fired, water-tube boilers, trim, and accessories for closed heating water systems.

1.3 SUMMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boiler(s), boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

- 1. Design Calculations signed and sealed by a professional engineer

- 2. Wiring Diagrams: Power, signal, and control wiring.

- c. Warranty: 1 year full boiler and 10 year heat exchanger manufacturer's warranty.

1.4 INFORMATIONAL SUBMITTALS

- A. Operation and Maintenance: To include in operation and maintenance manuals.

- B. Other Informational Submittal:

- 1. ASME Report: Submit ASME documentation as required by authorities having jurisdiction.

- 2. Startup report

1.5 CLOSEOUT SUBMITTALS

- A. Operational and Maintenance Data: to include in boiler emergency, operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70. Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. ASME Compliance: Fabricate and Label Boiler to comply with ASME Boiler and Pressure and Vessel Code.

- C. ASHRAE/IESNA 90.1 Compliance: Boiler(s) shall have minimum efficiency according to “Gas and Oil Fired Boilers – Minimum Efficiency Requirements.
- D. DOE Compliance: Minimum Efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, “Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers.”
- E. AHRI Compliance: Boiler(s) shall be tested and rated according to AHRI’s “Rating Procedure for Heating Boilers” and “Testing Standard for Commercial Boilers”, with the AHRI Emblem on a rating plate affixed to the boiler.
- F. LC Compliance: Boiler(s) to be compliant with LC certification.

## 1.7 COORDINATION

- A. Coordinate boiler(s) mounting and location on wall or floor stands.

## 1.8 WARRANTY

- A. Standard Warranty: Manufacturer’s standard warranty in which manufacturer agrees to repair or replace components and heat exchangers that fail due to failure in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Heat Exchangers: 10 years from installation.
  - 2. Warranty Period for Other Factory Supplied Parts: 1 year from installation.

## PART 2 – PRODUCTS

### 2.1 WATER-TUBE BOILER(S)

- A. Basis of Design: Slant/Fin VGH boiler(s) as specified on drawings. All others must be submitted as equal alternate.
- B. Furnish and install \_\_\_\_ (Quantity) Slant/Fin Model \_\_\_\_\_ (Choose VGH-299; VGH-399; VGH-500) high efficiency modulating input condensing boiler(s), (Choose Natural Gas-Fired or LP Gas-Fired). Install in accordance with code requirements and manufacturer’s installation and start –up manual. Installation code requirements include ASME CSD-1. Installer to include start up and set-up of boiler system in scope of work.

### 2.2 CONSTRUCTION

- A. Description: Factory fabricated and assembled and tested wall hung (or optional floor mount with stand) modulating input condensing gas-fired boiler(s) with stainless steel water tube heat exchanger; sealed combustion; combustion air intake connection; exhaust vent outlet connection; stainless steel internal heating water piping with supply and return connections: condensate drain connection with factory supplied trap to prevent exhaust gas from entering boiler room.
- B. Electrical: The electrical service to the boiler(s) is 120 VAC 1 Phase 60 HZ. Boilers’ main power is polarized. All electrical wiring must be installed according to all applicable codes, standards and regulations. In USA electrical installation must comply with NFPA 70, National Electric Code – latest edition.
- C. Heat Exchanger: Shall be a two pass, stainless steel, water tube design manufactured in accordance with ASME Section IV code. The heat exchanger shall be National Board listed and

have the ASME "H" stamp present. Water tubes to be manifolded together to optimize heat exchange and boiler efficiency. Water Tubes shall be a minimum of ¾ inches in diameter prior to forming. The heat exchanger's maximum working pressure shall be 160 PSI at 210F water temperature and pass a factory hydrostatic test at 240 PSI. Cast Iron, copper and aluminum heat exchangers are not acceptable. Upon request manufacturer shall provide matching "ASME Form H-3 Manufacturers Data Report For Watertube Boilers with a National Board number listed.

- D. Burner: Shall be stainless steel, premix, forced draft and for use with Natural Gas and LP Gas. The burner shall be capable of modulating input within published turndown within boilers' turndown ratio without loss of combustion efficiency.
- E. Boiler Controller: The boilers' controller and display shall be manufactured by EBM Pabst. The Control default setting shall enable the commissioning agent to start the boiler and complete the boiler commissioning process. The display shall be backlit with on/off service switch, reset button, menu button, escape button and right, left, up, down and confirm arrows. Icons showing on display shall include central heating demand, domestic hot water demand, burner on, cascade emergency mode active and error notification. Display shall also include central heating state and thermostat input status. All sensors shall be 10K @ 25C B3977k. There shall be 6 boiler modes including Central Heat Demand (CH) with thermostat control, CH with outdoor reset and thermostat control, CH with full outdoor temperature reset, CH with permanent heat demand, CH with analog input control setpoint and CH with analog input control of power output. Control shall be able to heat Domestic Hot Water (DHW) through either thermostat or sensor control. Boiler control shall be factory mounted and wired. Boiler control feature shall include features listed under section 2.4 of this specification.
- F. Boiler(s) Venting: Approved vent materials for boiler(s) shall be PVC, CPVC, Polypropylene and Stainless Steel. Maximum length of air intake and vent for VGH-299 is 228 equivalent feet; VGH399 is 121 equivalent feet; VGH-500 is 481 equivalent feet. Up to 5 cascading boilers of the same model may be common vented using approved polypropylene system. Boilers' air intake and vent must be installed following boiler manufacturer's instructions. Condensate drain connection must use boilers' condensate traps supplied with the boiler(s) and the connection to the sanitary sewer pipes must be open.
- G. Gas Piping: Fuel gas piping must comply with all local codes and National Fuel Gas Code, ANSI Z223.1/NFPA 54. Gas supply pipes must be sized to provide sufficient gas to have less than a 1 inch water column gas pressure drop when boiler(s) starts with all appliances firing that are connected to the same fuel source as the boiler(s).
- H. Water Piping: Boiler(s) water piping must be installed following boiler manufacturer's instructions. Water quality must meet or exceed boiler manufacturer's instructions. Installing contractor shall follow manufacturer's instructions for cleaning heating system and boiler(s) piping. Use of Glycol must follow boiler manufacturer's instructions and will be checked and maintained at least once per year. The boiler(s) piping must include a primary loop to ensure adequate water flow through the boilers' heat exchanger. Installer must follow all code requirements. Boiler(s) water quality must be maintained, especially if glycol is used in the system.
- I. General: Boiler(s) installation must comply with applicable code requirements. Installer must follow manufacturer's instructions. Installer to commission the boiler(s) following manufacturer's instructions and complete the "Installation/start-up checklist" contained in the

boilers' IOM. There is a "Maintenance Checklist" in the boilers' IOM that must be kept up to date.

- J: Boiler Jacket: Boiler jacket to be stainless steel with removable sturdy front cover. Boiler maintenance and programming may be performed from the front of the boiler(s). Boilers' wall mounting brackets are provided with the boiler(s) and are designed to lock the boiler to the wall.

## 2.3 TRIM

### A. Safety Relief Valve

1. Size and Capacity: 50 PSI (75 PSI) Factory set and sealed, installer to mount on the boiler(s) with full size drain pipe connected with discharge pipe ended approximately 6 inches from the floor. The end of the drain pipe shall not be threaded, to prohibit someone plugging the end of the discharge pipe.

2. Pressure Gauge: Factory supplied and shall have a range that exceeds system normal operating pressure by 50%.

3. Boiler Drain Valve: Supplied by boiler manufacturer with end that accepts standard hose-end connection.

4. Condensate Trap: Supplied with the boiler(s). Installer to install on the boilers' condensate drain outlet of the boiler(s). Installer to add condensate neutralizer with appropriate capacity for boiler system.

## 2.4 CONTROLS

- A. Refer to Division 230900 "Instrumentation and Control for HVAC".

- B. Boiler(s) controls shall have features including.

1. Large backlit LCD screen with full text information, programming and error messages.

2. Circulator Controls

- A. PWM control for variable speed circulator

- B. Boiler circulator relay

- C. System circulator relay

- D. DHW circulator relay

- E. Circulator exercise function

- F. Additional alternate functionality for air dampers and 3-way valves

3. Outdoor reset – Boiler(s) shall have factory supplied outdoor sensor to enable boiler control to automatically change boiler water target temperature based on changes in outdoor air temperature. This shall be an adjustable feature.

4. Warm weather Shutdown – Boiler(s) shall have automatic shutdown feature activated by measured outdoor temperature.

5. Night setback – night setback feature shall lower target water temperature during unoccupied periods. Boost function shall increase target water temperature during change period from unoccupied to occupied. Boost function shall override outdoor reset.

6. Boost Function – Boost function shall increase target water temperature during change period from unoccupied to occupy. Boost function shall override outdoor reset.

7. External control and BMS options

- A. Modbus connection standard
- B. 0-10 VDC remote water temperature control
- C. 0-10 VDC remote boiler input control
- D. Boiler(s) shall have a PC port connection
- E. Phone or tablet app to monitor boiler operation
- F. Gateway to Lon, BacNet, Metasys

8. Integrated cascade control

- A. up to 16 boilers (up to 5 boilers for common vent)
- B. Remote operation and heat demand indication from each boiler
- C. Cascade control for both heating and DHW
- D. Boiler sequencing and rotational control

9. Two level frost protection

10. Short cycle protection

11. DHW options

- A. DHW, CH and parallel priority
- B. DHW control option with anti-legionella option

12. Security Password – Boiler(s) shall have password security for installer to access some adjustable parameters.

13. Data Logging

- A. Real time and clock
- B. Days of operation
- C. Heating burner run time
- D. DHW burner runtime hours
- E. Successful ignition attempts
- F. Failed ignition attempts
- G. Last 15 lockout errors

- H. Hours since last service
- I. Hours until next service
- J. Total days of boiler operation
- C. Factory mounted and wired automatic reset Low Water Cut-Off shall be included with each boiler.
- D. ASME CSD-1 Kit including flow switch to be installed when required.
- E. Installer to supply and installed all required safety controls, including manual reset high temperature limit, to meet or exceed code requirements.
- F. Installer to supply and install a flow sensing device that will prevent burner operation if boilers' water flow is not adequate.

## 2.5 CAPCITIES AND CHARACTERISTICS

- A. Heating Medium – Water or Glycol Mix
- B. Maximum Pressure – 87 Pounds Per Square Inch (PSI) (75 PSI relief valve)
- C. Maximum Temperature – 194<sup>0</sup> Fahrenheit (F)
- D. Safety Relief Valve Setting – 50 or 75 Pounds Per Square Inch (Choose One)
- E. Heat Exchanger Design Pressure Rating – 160 PSI
- F. Minimum Efficiency – AHRI Listed
  - 1. 95% Thermal Efficiency for 300K input and over
  - 2. 95% AFUE for under 300K input
- G. Number of Passes in Heat Exchanger- 2 Passes
- H. Fuel (Pick one – Natural Gas or LP Gas)

## 2.6 SOURCE QUALITY CONTROL

- A. Factory assembled and tested in accordance with ASME Boiler and Pressure Vessel Code
- B. LC Tested and Listed in accordance with ANSI Z21.13 CSA 4.9 Latest Edition

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Before boiler(s) installation, examine rough-in for hanging, location, water piping, fuel piping, electrical, air intake and exhaust venting.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BOILER INSTALLATION

- A. Install boiler(s) in accordance with manufacturer's instruction

- B. Install boiler(s) in accordance with code requirements including NFPA54.
- C. Install electrical and water moving and safety devices not factory mounted and wired.
- D. Install control wiring

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler(s) to allow service and maintenance.
- C. Connect fuel gas piping to boiler with a union. Gas piping to boiler(s) to be sized for total gas demand requirements with piping at least full size of gas connection to boiler(s). Provide and install reducer if required.
- D. Install condensate drain in accordance with boiler manufacturer's instructions. Supply and install condensate neutralizer properly sized to treat condensate from boiler system.
- E. Boiler Air Intake and Exhaust Vent
  - 1. Install in accordance to boiler manufacturer's instructions
  - 2. Install in accordance to code requirements
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems"
- G. Connect wiring according to Section 260519 "Low Voltage Electrical Power Conductors and Cables"

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports
  - 1. Perform installation and startup checks according to boiler manufacturer's instructions.
  - 2. Leak test: Test water and fuel piping in accordance to code requirements. Repair as required.
  - 3. Test and adjust controls and safety controls. Replace and repair controls as required.
  - 4. Boiler Test: Startup and adjust boiler(s) to conform to manufacturer's instructions. Repair boiler if required. Adjust air-fuel ratio and combustion following manufacturer's specifications. Combustion testing must be done with calibrated combustion analyzer.
  - 4. Operational test – Start boiler(s) to confirm proper rotation and operation.
  - 5. Complete "Installation/startup checklist" contained within boiler manufacturer's installation instructions.
  - 6. Provide completed field quality documentation to building commissioning agent.

### 3.5 DEMONSTRATION

- A. Engage a factory authorized agent to train building maintenance personnel to operate boiler(s). Refer to Section 017900 "Demonstration and Training".

**END OF SECTION 235216**

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