



**SUGGESTED SPECIFICATION LANGUAGE  
GREENSTAR 9800® SERIES WATER HEATERS**

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## 1.0 General

### 1.1 Scope

- a) The work to be performed includes all new equipment, labor and materials required to furnish and install high-efficiency condensing GreenStar 9800 Series water heaters as described in this specification

### 1.2 References

- a) ASME Section IV.
- b) ASME CSD1 - Controls and Safety Devices.
- c) ANSI Z21.13.
- d) CSA - CGA/AGA
- e) GE GAP
- f) NEC - National Electrical Code
- g) ETL, ETL-C
- h) NFC - National Fuel Code

### 1.3 Submittals

- a) Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, weights (shipping, installed, and operating), installation and start-up instructions, along with furnished accessory information.
- b) Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- c) Wiring Diagrams: Submit manufacturer's electrical requirements for water heaters including ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

### 1.4 Quality Assurance

- a) Manufacturer's Qualifications: Firms regularly engaged in the manufacturing of premix combustion, high efficiency, condensing water heaters, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.
- b) The water heater design working pressure will be 160 psig. Water heater will bear ASME Section IV symbol "H" stamp and shall be National Board listed.
- c) Water Heater Safeguard Control will be of an accepted quality manufacturer bearing UL Certification.
- d) The entire hot water system and its installation shall conform to the manufacturer's instructions, applicable codes and associated National Board requirements.
- e) The equipment shall, as a minimum, be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.
- f) The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.
- g) The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
- h) The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
- i) All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and space parts wherever possible.

- j) In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the water heater manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

### **1.5 Warranty**

- a) The water heater manufacturer shall guarantee in writing equipment to be free of defects for one year after start-up date or 18 months from factory shipment, and to repair or replace at manufacturer's expense any defective parts. Unit shall receive such factory tests as are deemed advisable by the manufacturer to check construction and operation.
- b) The pressure vessel shall be guaranteed against thermal shock for 20 years. The water heater pressure vessel shall be guaranteed accordingly without a minimum flow rate or inlet water temperature requirement. The water heater shall not require the use of flow switches or other devices to ensure minimum flow.
- c) The pressure vessel shall carry a 10-year warranty against material and workmanship defects.
- d) The heat exchanger shall be guaranteed against flue gas corrosion for a period of 10 years.
- e) All parts not covered by the above warranties shall carry a one-year warranty. This shall include all electrical and burner components.

## **2.0 Products**

### **2.1 Acceptable Manufacturers**

- a) This Specification is based on products as manufactured by Sellers Engineering Division of Green Boiler Technologies, Inc., GreenStar 9800 condensing water heaters. Equivalent units and manufacturers will be considered with written prior approval when units meet or exceed all the requirement of the specification.
- b) Basis of Design: GreenStar 9800 Series 650H, 1000H, 1500H or 2000H water heaters.

### **2.2 Water Heater Construction**

- a) The burner shall be constructed of stainless steel.
- b) The pressure vessel shell shall be constructed of 1-1/4 OD, type "L" Copper tubing with copper fins in a double wrapped coil configuration.
- c) Water heaters using small diameter tubing with cast iron or bronze manifolds are not acceptable.
- d) The premix burner assembly shall be mounted vertically to fire downward into a copper coil heat exchanger.
- e) The water heater's pressure vessel shall have a polymer-based coating to inhibit the corrosion caused by condensation.
- f) Water heaters utilizing stainless steel or aluminum heat exchanger construction are not acceptable.

### **2.3 Water Heater Design**

- a) The water heater shall be water-tube design, utilizing the principles of premix combustion. The water heater shall be forced draft using a variable speed blower and a stainless steel mesh combustion element. Water heaters using natural draft combustion or induced draft combustion are not acceptable.
- b) The water heater shall be capable of normal operation with turndown ratios of 7.5 to 1.
- c) The water heaters shall have a noise level of less than 65 dbA when measured within five feet of the respective water heater's front, back, left and right sides and within three feet of the intake and exhaust connections. Sound levels are based on assumed environmental noise conditions.
- d) Water heaters requiring using gas mufflers for sound attenuation are not acceptable.

- e) External convection and radiation heat losses to the boiler room from the water heater shall be less than 0.5% of the rated water heater input. The water heater shall not contain any refractory, refractory lining or ceramic.
- f) The water heater shall be designed for operation in a condensing mode, in order to extract the latent heat from the combustion products. The water heater shall have a minimum acceptable fuel-to-water efficiency of 94% at a return water temperature of 80 °F and at the full rated input capacity of the water heater. Overall efficiency at the low fire rated input capacity will be 98%.
- g) The water heater shall have no minimum inlet water temperature requirements.
- h) The water heater shall not require isolation dampers or mounting springs.

#### 2.4 Controls

The flame safeguard system shall be Honeywell Sola 7810A with a Honeywell S7999B local operator touch screen interface. The control shall provide a 35-second pre-purge and post-purge. The control shall maintain a running history of operating hours, number of cycles, and the most recent six faults. The control shall have the capability to be connected to a keyboard display module that will retrieve this information. The controller shall be compatible with LonWorks and BACnet building management systems.

- a) Combustion controls shall include the following:
  - i. Operating Temperature Controller for automatic start/stop of the pulse combustion process. Controller will have auto-tune PID capabilities for simplified loop configuration and fast response to water temperature fluctuations. A Type J temperature sensor shall be located in the water heater pressure vessel.
  - ii. High limit temperature aquastat with manual reset.
  - iii. One low water cutoff probe in the water heater shell with manual reset and push-to-test capability.
  - iv. Air safety switch to prevent operation unless sufficient pre-purge air is assured.
  - v. High condensate cut-off probe located in the condensate collector.
  - vi. A Proof of Flame switch and Flame Rod operating in parallel, to prove combustion.
- b) A combustion control system shall be furnished which provides a turndown ratio of 7.5:1 per ANSI Z21.13 (3:1 for LPG Fired Water Heaters) over the input range from high to low fire. The supply temperature and set point temperature shall be displayed at all times by the operating temperature control. Firing rate shall be controlled by a continuous 4-20mA analog signal to a modulation motor.
- c) All controls to be panel mounted and so located at table top level on the water heater as to provide ease of servicing the water heater without disturbing the controls and also located to prevent possible damage by water according to ETL, ETL-C requirements.
- d) When up to 8 multiple water heaters are to be installed in a common loop, a Honeywell S7999B Multi-unit touch screen display Water Heater Sequencing System shall be utilized. Please consult Sellers Engineering or Honeywell for complete details on the capabilities and functions of this control.
- e) The water heater control system shall include an electronic power conditioner/filter to prevent the possibility of system malfunctions caused by dirty electricity.

#### 2.5 Main Gas Train Components

The water heaters shall have an integral gas train, factory assembled and installed. The main gas train will include:

- a) One manual shut-off valve at gas inlet.
- b) Gas inlet trap.
- c) Gas regulator rated for a minimum of 4"WC and a maximum 14"WC supply pressure.
- d) Two safety shut-off valves. One to be solenoid and one motorized valve.

- e) Independent low and high gas pressure switches shall be supplied.

## **2.6 Water Heater Fittings**

- a) The water heater shall be supplied with an ASME Section IV approved, side outlet type safety valve. The safety relief valve size shall be in accordance with ASME code requirements.
- b) Temperature and pressure gauges shall be mounted on the rear of the water heater.
- c) A condensate drain connection shall be provided with a condensate drain and conditioner system as manufactured by Sellers Engineering.

## **2.7 Installation**

- a) The water heater shall be ETL, ETL-C approved as a direct vent water heater. A conventional chimney or stack shall not be required. Direct venting shall be accomplished with AL-29-4C stainless steel, single (or double) wall. Vent piping shall be installed in accordance with applicable national and local codes and per the water heater manufacturers' recommendations.
- b) The water heater shall have the outside combustion air intake supply ducted with PVC pipe and insulated ducting.

## **2.8 Emissions**

- a) The water heater shall operate with CO emissions less than 50 PPM corrected to 3% Oxygen and shall with NO<sub>x</sub> emissions less than 20 PPM corrected to 3% oxygen over the entire turndown range

## **2.9 Operating Manual**

- a) Instructions for installation, operation and maintenance of the water heater shall be contained in a manual provided with each unit.
- b) A wiring diagram corresponding to the water heater configuration shall be permanently affixed to the water heater near the electrical panel.

## **3.0 Execution**

### **3.1 Installation**

- a) Equipment and materials shall be installed in an approved manner and in accordance with the water heater manufacturers' installation requirements.
- b) The installer shall construct a level continuous concrete pad (min. 3 1/2 inches high) for the entire water heater system according to the water heater manufacturer's erecting instructions.
- c) Assemble unit sections and parts shipped loose or unassembled for shipment purposes. Follow manufacturer's installation recommendations and instructions.
- d) Install electrical control items furnished by manufacturer per wiring diagram provided by manufacturer.
- e) Complete water piping installation as required by manufacturer for operation of system.
- f) Provide air intake and exhaust piping, size and type as recommended by the manufacturer

### **3.2 Field Quality Control**

- a) After the water heater installation is completed, the manufacturer shall provide the services of a field representative for starting the unit and training the operator.
- b) Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of water heaters and piping. Obtain certification for completed water heater units, deliver to Owner, and obtain receipt.