

Bfit Model BFITW Condensing Hot Water Heater Specification

Note to Specifier: Select desired project specific product features & equipment options [\[in blue\]](#)

PART 1 GENERAL

1.11 SUMMARY

- A. This section includes condensing hot water heater(s) for indoor space-heating application.

1.12 REFERENCES

- A. Intertek (ETL)
 - 1. ETL certified to ANSI Z21.13 / CSA4.9 Gas Fired Hot Water Supply Boilers.
- B. American Society of Mechanical Engineers:
 - 1. ASME Section IV - Heater and Pressure Vessel Code
 - 2. ASME CSD-1 – Controls and Safety
- C. American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 1. ASHRAE: Standard 90.1 Energy Standard for Buildings
- D. Hydronics Institute, Division of Air Conditioning, Heating & Refrigeration Institute (AHRI):
- E. National Fire Protection Association:
 - 1. NFPA 54 - National Fuel Gas Code (ANSI Z223.1)
- F. [\[Relevant local and/or project specific Codes and Standards\]](#)

1.13 SUBMITTALS

- A. In accordance with Contract Documents. Minimum product data to include:
 - 1. Capacities, accessories and options included with water heater.
 - 2. General layout, dimensions, size and location of all required connections.
 - 3. Electrical characteristics
 - 4. Weight and mounting loads.
 - 5. Manufacturer's installation and start-up instructions.
 - 6. Equipment Operation and Maintenance Manuals.

1.14 QUALITY ASSURANCE

- A. Use an adequate number of skilled workers, trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements, pertinent contract documents, and methods needed for proper performance of the work described therein.
- B. Provide the services of a manufacturer's factory-authorized representative to inspect and verify proper installation of this equipment, and to provide equipment start-up and operator training.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. In accordance with Contract Documents.

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- B. Accept equipment and accessories in Factory shipping packaging. Inspect for damage. Keep water heater in a horizontal position from time of delivery to final installation.
- C. While stored, all equipment must be protected from external elements such as inclement weather, job site construction activity, etc. Protect equipment from damage by leaving packaging in place until installation.

1.16 WARRANTY

- A. The water heater shall come with the warranties stated below from date of original installation.
 - Pressure Vessel: Ten-year warranty
 - Heat Exchanger: Ten-year warranty.
 - All other parts: 1-year limited warranty.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bryan Bfit Condensing Water Heater, Model BFITW [2500, 3000, 3500, 4000]. Refer to the Equipment Schedule in the Contract Drawings for the specific design and performance criteria.
- B. It shall be the responsibility of the Contractor to insure that any substituted equipment is equivalent in fit, form and function to the specified equipment. The cost of any additional work caused by the substitution of equipment shall be borne by the Contractor.
- C. Or approved equal.

2.2 GENERAL REQUIREMENTS

- A. Water heater
 1. The water heater shall be assembled, firetested and shipped as a factory-packaged unit, complete with jacket, gas manifold, burner and controls mounted & wired, with water heater connections specified in this Section.
 2. The water heater shall be constructed in conformance to ASME Section IV, ASME CSD-1 and UL 795. The water heater shall bear the ASME "H" stamp with a maximum allowable working pressure (MAWP) of 160 PSI. Pressure vessel shall be subjected to a hydrostatic pressure test of 240 PSIG at the factory.
 3. The water heater shall be an ultra-high efficiency condensing water heater with a pressure vessel, constructed of 316L stainless steel and of water tube design, which shall not require a refractory combustion chamber.
 4. The water heater shall be equipped with an integral pre-mix, stainless steel forced draft burner for [natural gas, propane or dual fuel (natural gas or propane)] firing incorporating full modulation with 5:1 turndown. The burner shall be of high flame retention design and have a static swirl device to get uniform flame stability all around the combustion surface. Burner shall be equipped with a sliding guide rail

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- with hinged door to gain full access and inspection of the burner and combustion chamber.
5. The water heater gas valve will be designed with zero pressure regulation and equipped with a variable speed blower system to precisely control the fuel/air mixture, providing fully modulating firing rates for maximum efficiency.
 6. Water connections shall be located at the top of the water heater; flue gas exhaust, combustion air intake and condensate drain connections shall be located in the rear of the water heater and incoming gas connection shall be located on the top side of the water heater. A factory supplied oversized ASME temperature & pressure relief valve shall be provided with the water heater(s).
 7. The flue passages and combustion chamber shall be accessible from the front of the water heater for cleaning.
 8. The water heater shall be provided with a heavy duty 16 gauge steel jacket with a rust resistant powder coat finish. Jackets made of plastic or resin material shall not be acceptable. The water heater jacket shall contain an internal electrical cabinet for power and limit circuit wiring, providing a clean finished look when the jacket is installed. Electrical connections shall be accessible from top and/or left-side of the water heater on five (5) printed circuited boards (120VAC high and 24VAC/5VDC low voltage) with fused connections for protection and clear labeling for simple and accurate wiring.
 - a. The electrical components shall be separated from incoming combustion air gas, which may contain excess humidity, dust and other contaminants brought through ducted combustion air.
 9. A polypropylene condensate trap with a float-actuated shut-off switch shall be supplied with the water heater.
 10. Electrical input to the water heater shall be (Model 2500 – [120v/1ph/60hz, 208v/1or3ph/60hz, 230v/1or3ph/60hz or 460v/3ph/60hz], Models 3000 - 208v/1or3ph/60hz, 230v/1or3ph/60hz or 460v/3ph/60hz], Models 3500 & 4000 – [208v/3ph/60hz, 230v/3ph/60hz or 460v/3ph/60hz]).
 11. The water heater shall be of compact design with no more than [2500 – 99.1, 3000 – 99.1, 3500 – 127.8, 4000 – 127.8] cubic/ft and a footprint no larger than [2500 – 24.3, 3000 – 24.3, 3500 – 31.3, 4000 – 31.3] sq/ft.
 12. The water heater shall come on a base with forklift opening all sides and lifting lugs for ease of moving and rigging.
- B. Water heater Control System
1. Scope of Supply
Water heater Control System shall provide safety interlocks and water temperature control. The control system shall be fully integrated into the water heater control cabinet and incorporate single and multiple water heater control logic, inputs, outputs and communication interfaces. The control system shall coordinate the

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operation of up to eight (8) fully modulating hot water heaters and circulation pumps. The control system shall simply control water heater modulation and on/off outputs based on the water heater water supply temperature and an operator-adjusted setpoint. However, using parameter menu selections, the control system shall allow the water heater to respond to remote system water temperature or energy management system (EMS) firing rate demand, remote setpoint or remote start/stop commands. In order to support large domestic demands it shall be parameter selectable to start two water heaters simultaneously in response to a DHWP demand.

2. Water heater Control

Using PID (proportional-integral-derivative) based control, the remote system water temperature shall be compared with a setpoint to establish a target water heater firing rate. If the secondary loop flow speed is greater than the primary loop flow speed, firing rate is increased in response to the decrease in secondary loop temperature. When the remote system temperature is near the water heater high limit temperature, the water heater supply sensor shall limit the maximum water heater supply temperature to prevent water heater high limit events. Alternately, using parameter menu selections, the control system shall allow the water heater to respond directly to water heater supply temperature and setpoint to establish a target water heater firing rate while remote system water temperature is used for display purposes only. Each water heater's fuel flow control valve shall be mechanically linked to the air flow control device to assure an air rich fuel/air ratio. All the automated logic required to ensure that pre-purge, post-purge, light-off, and burner modulation shall be provided.

3. Hot Water Temperature Setpoint

When the controller is in the local control mode, the control system shall establish the setpoint based on the remote temperature sensor or manually adjusted by the operator. When enabled, the setpoint shall be adjusted above a preset minimum setpoint upon sensing a domestic hot water demand contact input. When in remote mode, the control system shall accept a 4-20ma or Modbus [*OPTION: 0-10Vdc] remote setpoint or firing rate demand signal from an external EMS.

4. Multiple Water heater Sequence

The controller shall incorporate its peer-to-peer communications on each connected water heater (up to eight [8] units) by using standard RJ45 ethernet cables. The control system shall allow the connected water heaters to exchange signals as required to provide coordinated fully modulating lead/lag functions. It shall not be required to wire individual control signals between water heaters. Multiple water heaters shall be modulated in "Unison" (all at the same firing rate). To increase operational efficiency, the control system shall utilize both water temperature and firing rate based water heater sequencing algorithms to start and stop the water heaters and shall minimize the total number of water heaters in operation. The control system shall start and stop water heaters when the water temperature is outside the adjustable temperature limit for longer than the adjustable time delay. In order to minimize temperature deviations, the control system shall start and stop the next water heater when the "lead" water heater is at an adjustable firing rate limit for longer than the adjustable time delay. The control system shall monitor both water heater lockout and limit circuits to automatically

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skip over those water heaters that are powered down for maintenance, tripped or otherwise will not start. The water heater shall be run at low fire for warm-up for a preset low fire hold time. When enabled, warm weather shut down control logic shall prevent water heater operation. The controller shall also be capable of auto-rotation of the water heaters based on user-selected run time hours.

5. User Interface

A touch screen message display shall be provided to display real time BTU/hr, numeric data, startup and shutdown sequence status, alarm, system diagnostic, first-out messages and water heater historical information. In the event of a fault condition, the display shall provide help screens to determine the cause of the problem and corrective actions. Historical information shall include graphical trends, lockout history, water heater & circulator cycle counts and run time hours.

6. Circulator Control

The controller shall be capable of sequencing the domestic hot water or system circulators. Simple parameter selections shall allow all three pumps to respond properly to various hydronic piping arrangements including either a water heater or primary piped indirect water heater. The controller shall perform circulator exercise to help prevent pump rotor seizing.

7. EMS Communication

Control and monitor the water heater via communication RS485 Modbus or direct wiring. The control shall allow for simultaneous communication for water heater peer-to-peer communication and EMS communication interfaces. Loss of EMS communication shall automatically transfer the water heater control to local operation. Water heater operation shall not be lost due to corrupt or loss of EMS communication. The water heater control system shall allow individual water heater limits, lockout, water heater and system temperatures and firing rate status to be readable and water setpoint, water heater firing rate, and start/stop command to be readable and writable. The control shall provide easy parameter selection and options for the following: Modulation Source (4-20ma or Modbus [*OPTION: 0-10Vdc]); Setpoint Source (4-20ma or Modbus [*OPTION: 0-10Vdc]); and Enable/Disable (contact wired or Modbus). The control shall allow a real time, live & convenient list of all interface signals to allow for quick interface verification. [OPTION: The water heater control system shall network with a communication gateway to connect with BACnet [LonWorks] [Johnson Controls Metasys N2] communication protocol.]

*Note to Spec Writer: 0-10Vdc option available with EMS Signal Converter

8. External Data Transfer

The control system shall include the ability to transfer parameters from water heater to water heater. Upon completion of commissioning the first water heater, a USB flash drive shall allow settings to be “downloaded” from one water heater and “uploaded” into the next. Additionally, these files shall be able to be sent via email and “uploaded” to a remote technical support system. Additionally, it shall be possible to restore parameters to the “as shipped state” by selecting a “Factory Default” Button.

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9. Archive History
All hard lockouts, soft lockouts (holds), sensor faults, Energy Management System (EMS) signal faults, sequencer faults and limit string faults shall be recorded with a time and date stamp. The time and date log shall stores up to 3000 alarm & events even after power cycle.” The alarm & event log must be downloadable to a USB thumb drive. The control shall include collect and store supply & return temperature, flame intensity and firing rate for at least 4 months. It shall be a simple matter to page through the water heater’s operation using the water heater mounted display or download the historical data to a USB thumb drive for off-site analysis. All data must be stored in standardly compatible CRV files.
10. Quality Assurance
The water heater control system shall be supplied as part of a factory-assembled and tested burner control cabinet.

B. Water heater Trim

1. Combination pressure-temperature gauge, 3 inch diameter.
2. Water temperature sensors shall be mounted on the inlet and outlet connections outside of the water heater jacket. Each sensor shall be accessible from the top of the water heater. The water heater control shall measure hot water and cold water temperatures and notify the operator if the direction of flow is reversed.
 - a. The water heater control shall adjust to impending temperature changes in such a way to minimize fuel consumption and maximize efficiency. The control shall measure temperatures and the rate of change in those temperatures and respond early, rather than waiting for temperatures to exceed limit control settings.
3. Flue gas temperature sensor shall be mounted in the flue vent connector to monitor flue gas temperatures and reduce the blower speed when flue gas temperatures exceed 180°F. If the flue temperatures exceed 205°F, a forced water heater recycle results.
4. ASME Section IV safety relief valve sized to exceed the gross output of the water heater which shall be factory set to relieve pressure at 150 psig water working pressure.
5. Water flow switch to prevent the burner operation during low water flow conditions.
6. High Temperature Limit, automatic and manual reset, to prevent burner operation if water temperature conditions rise above maximum water heater design temperature, wired to put the water heater into a hard lockout, requiring manual reset of the water heater primary control.
7. High and low gas pressure switches with manual reset and a range of 4 - 14 in W.C., wired to put the water heater into a hard lockout, requiring manual reset of the water heater primary control.
8. Low water cutoff (LWCO) device with manual reset. Water heater shall be fitted with a probe type LWCO located above the lowest safe permissible water level

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established by the water heater manufacturer. LWCO shall be UL listed and suitable for commercial hydronic heating service.

E. Vent & Intake Air Connections

1. The exhaust vent must be UL 1738 listed for use with Category II and IV appliances and compatible with operating temperatures up to 210°F, positive pressure, condensing flue gas service. UL certified vent material shall be CPVC, Polypropylene or Stainless Steel.
2. The exhaust vent system shall be in accordance with National Fuel Code, NFPA 54/ANSI Z221.3 or CAN/CSA B149.1 Installation Code for Canada, or, applicable provisions of local building codes.
3. Combustion air intake shall be capable of drawing air from inside the room or ducted from outdoors. Ducted piping shall be PVC or galvanized smoke pipe that is sealed and pressure tight. Pipe must be at least the same size as the inlet air connection on the water heater.
4. Combustion air intake shall be connected into the water heater vestibule NOT directly into the water heater blower assembly. Combustion air shall be preheated by passing around the exterior of the water heater furnace section before entering the pre-mix gas/air assembly.
5. Water heater shall be capable of common venting with an engineered vent system.
6. Venting shall have an equivalent length of up to 300 feet maximum when drawing air from inside the room or Venting shall have an equivalent length of up to 150 feet maximum and ducted combustion intake air shall have an equivalent length of up to 150 feet maximum.

2.3 PERFORMANCE

- A. Water heater thermal efficiency shall be no less than 98.0%.
- B. The burner shall emit low NO_x (corrected to 3% O₂) emissions at all firing rates.
- C. Provide services of a manufacturer's authorized representative to perform combustion test including water heater firing rate, gas flow rate, heat input, burner manifold gas pressure, percent carbon monoxide, percent oxygen, percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output. Perform test at minimum, mid-range, and high fire.

PART 3 EXECUTION

3.1 INSTALLATION

- A. In accordance with Contract Documents and water heater manufacturer's printed instructions.
- B. Flush and clean the water heater upon completion of installation in accordance with manufacturer's start-up instructions. The water heater must be isolated when any cleaning or testing of system piping is being performed.

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- C. Install skid plumb and level, to plus or minus 1/16 inch over base.
- D. Maintain manufacturer's recommended clearances around and over equipment, and as required by local Code.
- E. Arrange all electrical conduit, piping, exhaust vent, and air intake with clearances for burner removal and service of all equipment.
- F. Connect exhaust vent to water heater vent connection.
- G. If shown in Contract Drawings, connect full sized air inlet vent to flanged connector on water heater.
- H. Connect fuel piping in accordance with NFPA 54. Pipe size to be the same, or greater, than the gas train inlet connection.
- I. Use full size (minimum) pipe/tubing on all gas vent connections.
- J. Connect water piping, full size, to supply and return connections.
- K. Install all piping accessories per the details on the contract drawings.
- L. Install discharge piping from relief valves (open termination for viewing) and all drains to nearest floor drain.
- M. Provide necessary water treatment to satisfy manufacturer's specified water quality limits.

END OF SECTION