Armstrong Flo-H2O™ Water to Water Instantaneous Heater

AY-414

Installation and Maintenance & Operation

This bulletin should be used by experienced personnel as a guide to the installation and maintenance of the Flo-H_2O water to water Instantaneous Heater. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or its local representative if further information is required.

System Description

The Flo-H_2O is a packaged system designed to instantly heat domestic water on demand (no storage tank required).

The package consists of the following components:

- Single or double wall heat exchanger
- Primary pump (Boiler Water)
- Domestic hot water (DHW) recirculating pump
- Control panel
- 3-way control valve with electronic actuator
- High limit temperature switch (Aquastat)
- Six (6) temperature sensors
- Isolation and check valves, strainers, pressure gauges, fittings and interconnecting piping
- A common baseplate to which all components are attached

The system is compact and is available in three different package sizes ranging from 40 to 200 gpm of DHW supply.

Domestic Hot Water

Operating Temperatures:

Primary (boiler side): 180 - 200°F supply and 160°F return (140°F minimum)

Secondary (domestic side): 40 - 60°F city water and 110-140°F supply

Operating Pressures:

Primary and secondary: 125 psig maximum

Water Flows (gpm):

Model	Boiler Side at 180 - 200°F	Domestic Hot Water Side at 140°F	Recirculation at 110 - 140°F
40	100	40	6
70	175	70	11
100	250	100	15

Heat Exchanger:

The heat exchanger shall be:

- Plate and frame type.
- Heat exchangers are either single or double wall construction depending on the installation.
- The plate and frame is supplied with 316 Stainless Steel plates (0.5mm thick) and carbon steel frame. Unit is built to ASME Section VIII, Div. 1 and Code Stamped.

Primary Pump
The primary pump is an Armstrong Series 4380, bronze fitted and rated from 3 hp through 5 hp depending on the package size, 3 Phase, 60Hz. The primary pump has its own "H-O-A" switch (**H**and/manual – **O**ff – **A**utomatic). Under normal conditions, this pump runs continuously at constant speed.

Domestic Hot Water Circulating Pump
The circulating pump is an Armstrong Series H, all bronze construction with fractional 1/6 hp motor, single phase 60 Hz. A transformer in the control panel supplies the single-phase power. The circulating pump has its own ON/OFF switch and runs continuously.

Control Panel
The control panel includes both, the high and low voltage components.

- High voltage components include the motor starter and the transformers.
- The low voltage component is basically the temperature controller. Its function is to maintain a constant domestic hot water (DHW) temperature supply.

The "PID" (**P**roportional + **I**ntegral + **D**erivative) control of the temperature controller is optimized by using "**F**uzzy **A**daptive **T**uning" (FAT) to adjust for the constantly changing demands. This FAT technique repeatedly monitors the process and automatically fine-tunes the PID constants to meet varying load demands.

3-Way Control Valve/Electronic Actuator
The valve has a bronze body with female NPT connections up to 2 inch. Larger valves have cast iron body with flanged connections (2-1/2" and larger). The flow characteristics are "equal percentage" on the **N**ormally **C**losed (NC) port and "linear characteristic" on the **N**ormally **O**pen (NO) port. The electronic actuator requires a 24 volt AC power supply (supplied by a transformer in the control panel) and accepts either a 0 to 10 volt DC signal or 4 to 20 mA signal. The control signal is received from the temperature controller and facilitates the proportional modulation of the 3-way control valve. The actuator response time is 30 seconds on the opening and 15 seconds on the closing with a spring return.

High Limit Temperature Switch (Aquastat)
The Aquastat is installed on the domestic hot water supply piping and set at 20°F above temperature controller set point. When energized it shall cut off the source of heat by closing the boiler port of the 3-way mixing valve. A high temperature alarm light will be indicated on the temperature controller. The high limit Aquastat requires 115 volt AC power supplied by a transformer in the control panel.

Temperature Sensor Location
Temperature sensors shall be part of the temperature controller, wired and ready for installation on the pipe. They shall be of type "T" and have a minimum length of four (4) inches. The sensor locations on the package shall be as follows:

- Boiler supply
- Boiler return
- Domestic Hot Water supply (to the building loop)
- City water supply
- DHW Re-circulation (from building loop)
- Mixed city supply and re-circulation (from building loop)

Piping & Fittings:

Primary (Boiler side):	Black steel piping with malleable iron fittings
Secondary (Domestic side):	Red brass piping with bronze fittings

Operation:

The Flo-H_2O package will be operating under continuously changing demands. Loads may repeatedly vary from 0% to 100% of maximum rated flow throughout the day; however, the system will operate at low demand most of the time.

The temperature controller in the control panel operates on DHW (**D**omestic **H**ot **W**ater) supply temperature and DHW usage using feedback and feed forward compensation principles.

The PID constants are constantly changing to adapt to load changes in the process by using the state-of-the-art Adaptive Fuzzy Tuning control. The actual DHW supply temperature shall be maintained to within ± 4°F of the set point. The temperature controller shall 'clip' any overshoots or undershoots in DHW supply temperature that might exceed the above-mentioned band. Moreover, the temperature controller shall correct for the 'hunting' of the 3-way control valve should that happen at low demand.

At full load the 3-way control valve will have the boiler port fully open. At lower demand load the control valve starts modulating to mix boiler hot water with return warm water from heat exchanger; this will assist in meeting the demand and maintain DHW set point.
At all times the flow through the primary side of the heat exchanger is constant.

DHW supply shall be maintained at a present temperature ranging from 110°F to 140°F at the outlet of the heat exchanger. At low demand periods (nighttime), DHW set point temperature shall be automatically reset to lower temperatures to reduce heat loss from recirculating piping and thus conserving energy consumption. The minimum temperature setting shall be 110°F. Return boiler temperature shall be maintained above 140°F. Should the temperature drop below that limit, an alarm message will appear on the control panel's display.

A high limit temperature switch on the DHW side, set at 20°F above temperature controller set point, when activated shall cut off the source of heat by closing the boiler port of the 3-way control valve. This will prevent scalding water to reach the fixtures. Again, an alarm message will be indicated on the control panel's display should DHW supply attain scalding levels.

Note: This is an unusual condition and – should this happen – qualified personnel should check the system for a defective device.

Start Up

(a) Install the system in a location where the front of the control panel can be seen and accessed.

(b) Bring in power supply through the side or top of the control panel adjacent to the main terminals.

Note: This is the only electrical connection required at the control panel.

(c) Connect the three leads of the power supply to the top-side of the disconnect switch.

Note: Turn all switches on the panel to the OFF position before doing any electrical connection.

(d) Close all isolating valves on the package before piping water connections. The 3-way control valve is normally closed (NC) on the boiler supply port.

(e) Connect the primary side (boiler supply side) of the heat exchanger to the supply and return piping of the hot water boiler.

Caution: Piping on the primary side of the heat exchanger is extremely hot.

(f) Connect the secondary side of the heat exchanger to the domestic water piping. The circulator should be connected to the building recirculation loop.

Note: All piping should be independently and adequately supported so that no strain is imposed on the packaged unit when the pipes are connected. All connecting pipe work should be accurately located. Do not attempt to force both the primary and secondary piping of the packaged unit into position.

(g) Open the city main supply valve and all isolating valves after all water piping connections are done on the secondary side of the system.

Note: Secondary side is domestic water side.

(h) Fill up the building system with cold city water.

(i) Open several faucets in the building system to create a demand for start-up.

(j) Using the keypad on the front of the control panel set the temperature controller to the AUTO mode.

(k) The electronic control (3-way) valve should start to open (stem going down).

(l) Turn on the primary pump using its ON/OFF switch for a brief period of time and check the rotation of the motor. This should correspond to the directional arrow i.e. clockwise when looking down on top of the motor. If the motor is turning in the wrong direction, interchange any two power leads at the bottom side of the starter in the control panel.

(m) Isolation valves in the primary pump discharge pipe should be opened gradually after the pump is turned on.

Note: Opening this valve too fast may result in water hammer in the discharge pipe.

(n) Run the primary loop for a while to remove all the air from the system using an air vent installed at the highest point. Check also for noise, vibration and any leaks in the pipe work. When all the air has been successfully removed close the air vent valve.

(o) The electronic 3-way control valve will modulate, depending on DHW demand, to maintain the set point.

Electronic Control Valve Operation:
The electronic valve operates on 4-20 mA (mili-amp) or 0-10 Volt DC (Vdc) analog control signal. The valve is normally closed (NC); at the NC position the valve stem is UP.

1. When actual DHW (domestic hot water) supply temperature is above set point; the control signal then is 4 mA or 0 Vdc.
2. When actual DHW supply temperature drops below set point the valve starts to open the boiler hot water supply port; signal is then proportional to the valve stroke travel.
3. At maximum load the boiler hot water supply port is fully open, (stem down) the control signal then is 20 mA or 10 Vdc.

Notes:
- Boiler flow through the heat exchanger is constant at all times.
- The "0" and "1" marking on the valve actuator correspond to the "4 mA (0 Vdc)" or "20mA (10 Vdc)" respectively.
- For manual override, turn the top knob
  - clockwise to move the stem toward the "1" position.
  - counter-clockwise to move the stem toward the "0" position.

Primary Pump Pressure Measurement:
The primary pump is supplied with one – liquid filled – pressure gauge complete with petcocks and interconnecting copper tubing.

- To read the system pressure, open both petcocks
- To read the suction pressure, open the suction side petcock and close off the discharge petcock
- To read the pump discharge pressure, close off the suction side petcock and open the dis charge side petcock

Control Panel Operation:
The control panel is built to the NEMA 1 standard. It contains:
1. the starter for the primary pump
2. the digital temperature controller

The main function of the temperature controller is to maintain a constant DHW supply temperature. DHW set point will be displayed continuously.

Control panels are shipped – with a factory-adjusted set point – matching the requested set point on the purchase order.

Note: The set point can be modified on site to any temperature between 110°F and 140°F inclusive. When set points are changed, the volume of the DHW would change accordingly. During periods of low demands, the set point is reduced – automatically and gradually – to the minimum temperature as specified on the purchase order. The set point, however, will not drop below the "night-time setback" temperature.