Installation and Operating Service Manual

ELECTRIC WATER BOILERS

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INSTALLATIOIN INSTRUCTIONS ELECTRIC WATER BOILERS

Section 1

Note: Please read the entire instruction manual before attempting installation.

Insurance and local or state regulatory codes may contain additional or more stringent requirements than those contained in this manual. Installation must conform to these codes and any other authority having jurisdiction. Appropriate sections of NEC should be consulted and followed.

1.1 BOILER FOUNDATION

Before uncrating, the boiler location should be prepared. The boiler should set upon a good level concrete floor. If the boiler is not level or the floor is not in good condition, a concrete foundation should be built, the dimensions being larger than the outside dimensions of the boiler base.

1.2 CLEARANCES

The front of the boiler should not be any closer than 36" from any obstruction for servicing the electrical panels. The element end of the boiler should not have any obstruction to allow for the same length as the boiler supplied for removal and servicing of elements. The back of the boiler (as long as panels are not supplied in the rear) can be mounted next to an obstruction. Local codes must be applied to specific installations and the minimum clearances established accordingly. Provisions must also be made for service, accessibility, and clearance for piping and electrical connections.

NOTE

ADHERE TO ALL APPLICABLE LOCAL CODES REGARDING BOILER INSTALLATION AND CLEARANCES.

1.3 UNCRATING THE BOILER

Uncrate the boiler near its permanent location. Leave it on the bottom crating until ready to place it permanently. Leave the plastic shroud on the boiler until all piping work is complete, cutting holes in the plastic for access to connections.

Remove the bolts attaching the boiler to the crate at the underside of the bottom crating. Lift or slide the boiler off of the bottom crating into position. Be careful not to tip the boiler up on one corner or side, which could cause damage to jacket.

1.4 BOILER CONNECTIONS

1.4.1 GENERAL

Do not run any pipes along the element access and power panel side of the boiler. Maintain clearances as shown on the dimensional drawing for servicing and as referenced in NEC. All piping should be designed and installed to avoid any loadings on the boiler connections or piping.

1.4.2 FLOW CONNECTION

The system supply and return flow connections are shown on the boiler dimensional drawing in this manual. A gate valve and union should be on the boiler outlet and inlet lines. This allows the boiler to be isolated from the heating system for draining and servicing. Use a tee, nipple, and cap on the boiler inlet line to allow inspection and cleaning.

1.4.3 SAFETY RELIEF VALVE(S)

A connection is provided in the top of the boiler for the relief valve. The relief valve discharge piping must be the same size as the relief valve discharge opening. Avoid over-tightening as this can distort valve seats. All piping from relief valve must be independently supported with no weight carried by the valve.

1.4.4 EXPANSION TANK CONNECTIONS

A connection is provided in the top of the boiler for connecting piping to the expansion tank. This piping should be installed as to avoid air entrapment in the boilers.

1.4.5 DRAIN CONNECTION

A drain valve must be installed off of the boiler drain connection, the same pipe size as this connection, to allow draining of the boiler.

1.4.6 INDIRECT WATER HEATING BOILERS

When the boiler is to be used only for heating potable (domestic) water or swimming pool water, the heating system connections discussed above are capped. The relief valve connections are still required. Water connections are made only to the indirect heat exchanger(s), according to the piping drawing included in this manual. An automatic boiler fill valve is provided with the boiler. This valve must be connected to the fresh water system. With some units, this connection is made to the heat exchanger at the factory.

1.5 ELECTRICAL CONNECTION

IMPORTANT

All electrical connections must conform to the NEC and to all other applicable State and Local Codes.

The heating elements supplied with Bryan electric boilers are of the resistance type with an incoloy sheath and a watt density not exceeding 75 watts/square inch. These elements are typically delta wired unless otherwise specified. Power supply voltage must be as shown on the wiring diagram enclosed. A fused main disconnect switch must be supplied per NEC requirements. Wiring to the main power terminals in the power panel by the contractor must have current carrying capacity equal to at least 125% of the amperage rating of the boiler. The lugs supplied are at the top of the power panel and the entrance can be recognized on the dimensional.

EQUIPMENT GROUNDING: The boiler must be grounded in accordance with the NEC, ANSI/NFPA #70

CAUTION

ALL CONTROL PANELS AND CONTROLS ARE SUBJECT TO SOME INTERNAL HEAT. ADEQUATE BOILER ROOM VENTILATION MUST BE PROVIDED.

1.6 BOILER ACCESSORY EQUIPMENT

1.6.1 ELEMENTS

The immersion type electric resistance heating elements are mounted in a standard 150# flange (300# flange if required). These elements are held into this flange with brass fittings. Each element hairpin is rated at 5 KW or 10 KW at the rated volts. The incoloy sheath is a nickel, chrome and iron alloy, which provides good resistance to oxidation and has good strength characteristics at elevated temperatures. By virtue of its very high nickel content, the material does not have a tendency to become embrittled after prolonged exposure to temperatures. Corrosion resistance of the incoloy is attributed to the chrome and nickel content of the alloy. This type of material was chosen as a sheath material because of its resistance to corrosion oxidizing conditions and attacks from impurities in the various water conditions. Each element is easily replaced by using ordinary hand tools. This eliminates the necessity of having a complete element bundle as spare parts and also eliminates the necessity of returning the element bundle to the manufacturer for repair, although this service is available.

1.6.2 BOILER COMPONENTS - GENERAL

The boiler equipment list in this manual lists the components supplied with this boiler. A description of the major components follows, however, detailed information can be found in each manufacturer's literature data

1.6.3 POWER PANEL WIRING

These circuits are broken down into branch circuits of no more than 50 amps per circuit. A distribution lug in the BE Series and a copper bus bar in the BH Series is used to branch the power to individual fuses and contactors in each branch circuit. Each leg in each circuit is individually fused with fast acting fuses to interrupt power if required. The contactors are then wired using high temperature wire to each element circuit and bundle located in the element flange.

1.6.4 CONTROL CIRCUIT WIRING

The control circuit voltage is 120 V, single phase, and fed from a step down transformer (if provided). The transformer's primary side is connected to two fuses located in the power panel. One side of the secondary is grounded and the other side feeds the control circuit through the control circuit fuse. All of the safety controls are wired in series so that any one of the safety controls will shut down the boiler if the limit is reached. Also, located in the control circuit a recycle relay (in some cases the relay is built into the sequencer). In case of power failure, the function of this relay is to eliminate a sudden power load on the distribution system. If a power failure occurs, the recycle relay interrupts the control circuit power causing the magnetic contactors to drop out. Power is shut off to the elements until the modulating motor has driven the sequencer back to its original starting position. The relay is then activated, and the sequencer will bring the steps back on one at a time until the system is again balanced. There is also a limit supplied to be installed with the shunt trip on the main circuit breaker in order to completely shut down all power to the boiler. Refer to the electric wiring diagram supplied

1.6.5 SAFETY RELIEF VALVES

The safety relief valves are mounted on the top of the boiler. These are a final safety device in case the operator and other safety devices fail. Such a failure will cause the pressure to rise in the boiler to the set pressure of the relief valve. The relief valve will discharge, so that the boiler will not be able to generate pressure beyond the set pressure of the relief valve.

1.6.6 LOW WATER CUT-OFF

The function of the low water cut-off is to shut down the boiler if for any reason the water level should drop below the normal operating range

1.7 PROCEDURES TO BE FOLLOWED BEFORE PLACING BOILER IN OPERATION

1.7.1 HYDROSTATIC TEST OF BOILERS AND SYSTEM

After completing the boiler installation, the boiler connections, fittings, attachments and adjacent piping must be inspected for leaks by filling the unit with water. The pressure should be gradually increased to a pressure just below the setting of boiler safety relief valve(s).

Remove the boiler access panels (see dimensional drawing in this manual). Inspect all openings and fittings for any leaks. Although the boiler is hydrostatically tested at the factory, minor leaks in fittings and attachments can develop from shipping vibrations or from installation procedures. It is often necessary to re-tighten such fittings after installation and after the boiler has been in operation for some time. Replace panels before starting boiler.

Section

2

START-UP AND OPERATION ELECTRIC WATER BOILERS

WARNING:

SERVICING AND START-UP MUST BE DONE ONLY BY FULLY TRAINED AND QUALIFIED PERSONNEL.

CAUTION

BEFORE DISCONNECTING OR OPENING ANY BOILER ITEMS OR ACCESSORIES, BEFORE CLEANING OR REPLACING PARTS OF ANY KIND, TAKE THE FOLLOWING PRECAUTIONS:

1. TURN OFF AND LOCKOUT ALL ELECTRICAL DISCONNECTS TO THE BOILER AND ANY OTHER EQUIPMENT OR SYSTEMS ELECTRICALLY INTERLOCKED WITH THE BOILER.

2. ALL COVER PLATES, ENCLOSURES, AND GUARDS MUST BE IN PLACE AT ALL TIMES EXCEPT DURING MAINTENANCE AND SERVICING.

2.1 LIMIT CIRCUIT CUT-OUT TEST

2.1.1 PROTECTIVE DEVICES

All operating and limit controls, and low water cutoffs must be tested for proper operation.

2.1.2 WATER TEMPERATURE OPERATING CONTROL

The water temperature in the boiler is regulated by the Boiler Operator. This is a temperature control which senses the water temperature and turns the boiler on and off accordingly. This control must be operationally tested. Turn the temperature setting on the control to a temperature less than the boiler temperature (as shown on the boiler temperature gauge). The control should turn the boiler off. Restore the control setting to normal. The boiler should cycle on.

2.1.3 OUTDOOR RESET CONTROLS

Some boiler control systems also include an outdoor reset control. This control increases the boiler operating temperature with a decrease in outdoor air temperature, and decreases the boiler operating temperature with a rise in the outdoor temperature. Refer to the literature on the outdoor reset control for further information.

2.1.4 HIGH LIMIT CONTROL

At least two additional temperature controllers are provided as high limit controls. They are set at a temperature above the operator to act as a back-up should the operator fail. The high limit control must be operationally tested. With the boiler operating, decrease the temperature setting of the limit control below the current temperature of the boiler. The boiler should cycle off. Restore the high limit control setting to normal (pushing the reset button if it is a manual reset type). The boiler should now cycle on.

2.1.5 POOL TEMPERATURE CONTROL

On swimming pool heating boilers, an additional temperature control is installed with its sensing bulb in the pool circulation line (sensing the water temperature coming from the pool) to cycle the boiler, so as to control the pool water temperature. Test this control by reducing the temperature of the control below the temperature of the pool water. The boiler should cycle off. Restore the setting of the control and the boiler should cycle on

2.1.6 COIL LIMIT CONTROL

On indirect water heating boilers, an additional temperature limit control is installed to limit the temperature leaving the heat exchanger. It must be tested in the same manner as the boiler High Limit control.

2.1.7 LOW WATER CUT-OFF(S)

Most boilers are supplied with at least one float or electric probe type control, designed to sense the level of the water in the boiler. It operates to shut off the boiler if the water level drops below its sensing level. The low water cut-off controls must be operationally tested by manually lowering the boiler water level (by opening the drain valve). The boiler should cycle off when the water level drops below the control point of the low water cut-off. When the water level is restored, the boiler should cycle back on. Depress the manual reset button of devices which require manual reset in order to restore the boiler to operation. Carefully read the enclosed literature on the low water cut-off controls, particularly installing, operating and servicing.

2.1.8 COMBINATION LOW WATER CUT-OFF & FEEDER

The low water cut-off/feeder supplied with some boilers serves as a low water cut-off (see above) and also causes make-up water to be added to the boiler, should the water level drop below its control point. This type of control must be operationally tested as described in Section 2.1.1 and also to assure that the make-up water is introduced as needed. Carefully read the enclosed literature on the Low Water Cut-off controls, particularly installing, operating and servicing.

2.1.9 OTHER CONTROLS

Additional controls, as required for the particular installation, may also be provided. Refer to the literature on these devices included in the Boiler Manual. All such devices must be operationally tested to assure reliable operation of the boiler and system.

2.2 OPERATING CONTROLLER

2.2.1 PLC STEP CONTROL

As previously discussed, electric boilers are broken down into branch circuits. Each circuit is controlled by a step control (if two steps or less, then controlled by their own temperature control). Step control operates by having a signal sent from the operating control that typically sends a modulation signal depending on the temperature setting at the temperature operating control. The temperature operating controller will send a signal to the step control to cycle on more steps until the heat demand is satisfied.

Once the heat demand is satisfied, steps will begin to cycle off, therefore, turning off elements and reducing the heat output. Each step control is supplied with a dead band area. When the temperature is reached the step control will stay constant until a larger degree of drop is recognized. This will keep the step controller from oscillating between steps during operation. The operating control temperature needs to be set and maintained by the operator for the desired output.

2.3 OPERATING INSTRUCTIONS

2.3.1 FAMILIARIZATION WITH MANUAL(S)

The user of the boiler must familiarize himself with this manual to be sure he is prepared to operate and maintain the boiler properly. The operating instructions should be kept in a safe place and available to all who may be working or operating the boiler

CAUTION

CHECK ALL ELECTRICAL TERMINALS AND CONNECTIONS FOR TIGHTNESS BEFORE START-UP.

READ THE MANUAL BEFORE ATTEMPTING A START UP.

2.4 MAINTENANCE SCHEDULE

2.4.1 POSTING SCHEDULE

Post a maintenance schedule in accordance with the recommendations in this manual. A copy of a typical schedule is included in this manual.

Section

3

CARE AND MAINTENANCE ELECTRIC WATER BOILERS

CAUTION:

- The boiler area should be kept free of combustible materials, gasoline and other flammable liquids.
- The following procedures must be conducted as outlined to assure safe operation of the boiler.
- All cover plates, enclosures, and guards must be in place at all times, except during maintenance and servicing.

3.1 CLEANING THE BOILER AND SYSTEM – NEW SYSTEMS

3.1.1 PRE-BOIL OUT FLUSHING OF SYSTEM

Much of the dirt and contamination in a new hot water system can be flushed out before the boil out of the system. First, flush the system of waste with clear water. The boiler and circulating pumps must be isolated through the successive zones of the system to waste, carrying chips, dirt, pipe joint compound, etc. with it. Follow with a chemical flush. The removal of pipe chips and other debris from the system before opening the isolation valves to the boiler and pumps will help to protect this equipment from damage by such debris.

In combination with system contamination, bacteria from ground water boiler water may produce objectionable odors, sometimes resembling natural gas. It is important to keep these fumes from air intakes which would distribute them throughout the building.

3.1.2 BOIL OUT PROCEDURE

The boil out of the boiler and system is neither difficult nor expensive. The chemicals needed for cleaning are readily available. Tri-sodium phosphate or sodium hydroxide (lye) are the most commonly used chemicals. Use only one type of solution in the system. The amount of chemical required will vary according to conditions, but one pound per fifty gallons of water is suggested.

Fill the system with this solution, venting all air. Then, with the circulating pump running, bring the system to design or operating temperature. After circulating water for two to three hours, the system should be drained completely, and refilled with fresh, softened water. Usually enough of the cleaning solution will adhere to the piping to result in an alkaline solution satisfactory for operation. A pH reading between 7 and 8 is preferred. If necessary, to increase the pH, a small amount of cleaner may be added.

IMPORTANT

The boil out procedure outlined must be performed by, or under the direct supervision of, a qualified technician. The chemicals used present a hazard of burns and physical injury if mishandled. Always use suitable face mask, goggles, protective gloves and garments when handling caustic chemicals. Do not permit the chemical to come into contact with skin or clothing. Always follow the safety precautions on the container's label. Add chemicals slowly and in small amounts to prevent excessive heat and agitation.

3.1.3 DRAINING THE SYSTEM

A clean neutral hot water system should not be drained, except for an emergency or when unavoidable for servicing of equipment. See Section 3.3 for water treatment required when refilling.

3.2 REPLACEMENT BOILER INSTALLATIONS: PROTECTION AGAINST CORROSION & SEDIMENT

3.2.1 CLEAN OR REPLACE ALL SYSTEM PIPING AND HEATING UNITS

Arrange for chemical or mechanical cleaning of the entire system. A chemical treatment company should be consulted for the proper means of any chemical cleaning.

- Replace any piping considered to be deteriorated beyond safe or cleanable condition.
- Flush the system clean, being certain to isolate the boiler.
- Inspect, repair as necessary, or replace system air control devices.
- Install gauge glasses on air expansion tanks and install a tank fitting in the system connection to the tank.
- Install a strainer in boiler return piping.

DO NOT FLUSH THE SYSTEM THROUGH THE BOILER.

NOTE:

For some old systems, there is a reluctance to clean the piping because of possible leaks occurring in badly corroded lines. Should the customer refuse cleaning, it is necessary to install filtration equipment. Install either a fibrous filter or a centrifugal filter in the boiler return piping. This will collect and remove sediment from the system. A booster pump may be required to overcome the additional pressure drop introduced in the line by the filter. When filling the system, provide chemical treatment as outlined in Section 3.3.

CAUTION

Failure to properly clean the system or to install mechanical sediment removal equipment can result in tube blockage and severe corrosion plus damage to pumps, controls, and air removal devices.

3.3 BOILER WATER TREATMENT

3.3.1 PURPOSE OF WATER TREATMENT

Water treatment is required for satisfactory operation of the boiler. It must be devised to prevent depositing of scale and corrosion from acids, oxygen and other such harmful elements that may be in the water supply. A qualified water treatment chemist should be consulted and the water systematically treated.

3.3.2 OBJECTIVES

The basic objectives of water treatment are:

- Prevent the accumulation of scale and deposits in the boiler.
- Remove dissolved gases from the water.
- Protect the boiler against corrosion.
- Maintain the highest possible boiler fuel efficiency.
- Decrease the amount of boiler down time from cleaning.

3.3.3 WATER SOFTENER

It is highly recommended that a zeolite water softener be used for all make-up to the boiler. It is intended that this be used in addition to the chemical treatment of the boiler. Water softening removes calcium and magnesium, the primary causes of hard boiler scale.

3.3.4 CONTINUOUS MONITORING REQUIRED

Water treatment should be checked and maintained whenever the boiler is operating. The boiler operator should be sure that the boiler is not operating for long periods without proper water treatment.

It should be noted that water boilers may well need chemical treatment for the first filling plus additional periodic chemical treatment, depending on system water losses and the makeup requirements.

Water treatment may vary from season to season or over a period of time. Therefore, the water treatment procedure should be checked not less than four times a year, and possibly more frequently as the local water conditions may indicate. All water introduced into the boiler should be softened and should include an oxygen scavenger like sodium sulfite. This is required to remove dissolved oxygen from the water. Dissolved oxygen will cause severe boiler tube corrosion.

3.3.5 DRAINING & REFILLING THE BOILER SYSTEM

If the system is drained and then refilled, chemical treatment is essential to treat the raw water. Use only clean, softened water.

3.4 SUGGESTED MAINTENANCE SCHEDULE

3.4.1 DAILY

- Make visual inspection of gauges, monitors, and indicators and record readings in boiler log.
- Make visual check of instrument and equipment settings against factory recommended specifications.
- Check operation of float type low water cutoffs to ensure control is functioning. The lower piping connections of float type level controls should have a suitable blowdown valve piped into a proper drain. This valve should be opened periodically to allow any sludge accumulated in the control to be flushed out. On closed loop water heating systems this should not be often required. Consult manufacturer's instructions.

3.4.2 WEEKLY

- On units equipped with operating control, verify it is functioning correctly by adjusting control and observing if temperature changes accordingly.
- Make visual inspection of all fuses and electrical components making sure they are in good operating condition..
- Confirm boiler area is free of combustible materials and that there is nothing hindering proper operation of the boiler..
- Check all limit controls as specified in Section 2.1 of this manual.
- Check float low water cutoff as described above.

3.4.3 MONTHLY

- Make visual inspection of all wiring and components.
- Check float low water cutoff as described above.

3.4.4 ANNUALLY

- Check operating control, high limit and other electrical components for proper operating procedures as specified in manufacturer's instructions.
- The elements in the boiler should be removed at least yearly for proper visual inspection. If elements need to be replaced, they should be replaced or the element bundle sent to the factory for service at this time.
- The boiler pressure vessel and piping should be checked annually.