PRECISION BOILERS

Installation and Operating Instructions

‘ISH’

ELECTRIC STEAM

SUPERHEATER

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FOR YOUR SAFETY

This manual supplies information on the application, installation and operation of Precision Model 'ISH' Electric Steam Superheaters. Review all application and installation procedures completely before proceeding with the installation. Consult the Precision Boilers' Factory or local Representative with any problems or questions regarding this equipment. Experience has shown that improper installation causes most operation problems.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. **Read this manual thoroughly and follow the instructions herein.** The PRECISION 'ISH' Electric Steam Superheater shall be installed according to the procedures detailed in this manual, or the Precision Boilers Limited Warranty may be voided. The installation must conform to the requirements of the local jurisdiction having authority, and to the latest edition of the National Fuel Gas Code, ANSI Z223.1. Any modifications to the boiler or its gas / oil controls may void the warranty. If field installation requires modifications, consult either the local Precision Boilers' Representative or the Factory.

RETAIN THESE INSTRUCTIONS NEAR THE EQUIPMENT FOR READY REFERENCE

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1.0 INSTALLATION CLEARANCES

1.1 General

PRECISION has made a commitment to product improvement and follows a continuing quest for the highest standards of product performance. In pursuing this policy of continuous development of products, the manufacturer reserves the right to vary any details in this manual without notice.

Before installing the superheater, be sure the mounting location selected permits access to superheater trim and allows for element removal at the flanged ends as shown on the dimensional drawing.

CAUTION: Due to extreme temperatures possible with model ISH Superheaters, the vessels and piping must be well insulated and mounted away from combustible materials.

1.1.2 Because electrical power connections and thermocouple wires will need to be run from the control cabinet to the superheater, it is recommended that the superheater control cabinet be mounted in proximity to the superheater proper.

NOTE: Superheater expansion should be considered in installation of superheater and associated piping. Steel expands at a rate of 0.0000065 inches per °F and stainless steel at a rate of 0.0000096 inches per °F. The differential between superheater operating temperature and shut down temperature can be significant and good engineering practice may require that only one support point be fixed while the other is allowed to float during expansion.

EXAMPLE: A 60 inch long stainless steel unit operating at 900°F from a shutdown temperature of 70°F will expand by 60inches X (900-70)°F X 0.0000096" inches / in°F – 0.48 inches.

1.1.3 Since superheater performance is greatly dependant on steam quality (IE: the moisture content in steam), it is greatly recommended that as moisture content is expected to be greater than 1/2%.

2.0 MECHANICAL INSTALLATION

2.1 Steam Piping

2.1.1 Install steam piping connecting steam supply to superheater inlet. Pitch steam inlet piping to properly drain condensate formed in the steam line back to the boiler or to a trapped drip leg.

2.1.2 Install steam piping connecting superheater steam outlet to equipment to be supplied with superheated steam. The superheater outlet connection is the end at which thermocouple taps are located.

NOTE: Superheater pressure vessel connections are not designed to support pipe loads. Steam inlet and outlet piping must be adequately and independently supported by pipehangers.

NOTE: High outlet temperatures possible with model ISH superheaters require that the following be considered during the installation phase.

1) Pipe expansion as noted in Section 1.1

2) Derating of pipe and pipe fittings with increasing temperature. Refer to ANSI specifications for allowable pressure / temperature ratings.

3) Superheater and piping are sufficiently insulated to prevent loss of steam superheat and to protect personnel. Due to high temperature capability and correspondingly high heat transfer rates, insulation must be adequate.

4) It may be beneficial to locate the temperature control thermocouple remote from the superheater (IE: closer to the using equipment) for small superheaters with varying flow rates.

NOTE: It is recommended that the piping be checked for leaks before insulating.

2.2 Safety Valve

2.2.1 When required, a safety valve has been supplied with the superheater.

2.3 Hydro Test

2.3.1 It is good practice, as well as dictated in most local codes that a hydrostatic test, at a pressure equal to the safety valve setting, of the entire system be performed prior to superheater start-up. All leaks, both superheater and piping, should be stopped at this time. Additional leaks may develop under operating conditions due to the effect of temperature along with pressure. If severe, these leaks should be stopped as they occur by shutting unit down and tightening and / or reapplying sealant to threaded connections under safe, no pressure conditions. High temperature and pressure sealants such as X-PANDO are recommended.

NOTE: Small leaks between the bodies of the element compression fitting and the element flanges usually stop during the first few days of heater operation. Larger leaks, however, may necessitate tightening of compression fitting body.

CAUTION: Do not exceed 110 foot lbs. torque for a stainless steel compression fitting.

2.4 Responsibility

2.4.1 All piping, valves and fittings must meet the requirements of the local regulating codes. The responsibility for the installation of this superheater and compliance of installation with local codes rest with the owner or the installing contractor. PRECISION does not assume responsibility for connections made installing its equipment.

3.0 ELECTRICAL INSTALLATION

3.1 Electrical Power Supply

3.1.1 Check the superheater nameplate / wiring diagram for kw rating, voltage, phase and ampacity. When ampacity is not given, it can be calculated for three phase power by I = P divided by 1.732V where I is current per phase in amperes, P is power input in watts, and V is voltage applied in volts (1.732 equal the square root of 3).

3.1.2 Check the electrical supply to be sure it conforms to the superheater requirements.

3.1.3 Make electrical connections to the distribution block housed within the top portion of the superheater control cabinet. Minimum wire size is given on the wiring diagram.

3.2 Grounding

3.2.1 Connect an equipment ground to the grounding lug located within the control cabinet. Minimum copper wire size to be used is indicated on the wiring diagram.

3.3 Thermocouple Connection

3.3.1 Connect the wire provided with the thermocouples to the temperature control units in the superheater control cabinet as indicated on the wiring diagram. It is not necessary to shield these cable from other lines, however, it is necessary to maintain the correct polarity, positive or negative, at connection to controller. The red lead is positive and the black is negative.

3.4 Control Circuit Power Supply

3.4.1 Most PRECISION control cabinets are supplied with integral control power transformers and do not require separate 120VAC power supply.

3.4.1.1 On units requiring separate 120VAC power supply, a fused 120VAC power source must be connected to the two pole terminal block housed within the top control cabinet. Refer to the wiring diagram.

4.0 OPERATING INSTRUCTIONS

NOTE: Prior to start-up, any superheater and control cabinet which has been exposed to dusty, wet, and / or humid conditions must be thoroughly cleaned and dried out. The build-up of dust and rust may result in malfunction and / or damage unless the following precautions are undertaken:

1) All electrical components should be thoroughly cleaned, dried and checked for loose connections.

2) All element terminals should be thoroughly cleaned and dried, then meg ohm reading taken to assure there are no shorts to ground.

3) Heater and control cabinet should be inspected for stray objects, metal scraps, etc. which may have accumulated during installation. All such material must be removed from boiler before start up.

4) All power wiring connections should be checked to assure tight connections.

IMPORTANT: Precision Boilers, Inc., as manufacturer of these boilers, will not be responsible for damages incurred at the time heaters are started up, unless the above steps have been taken to assure the heaters are properly prepared for start up.

4.1 General

The following section of this manual should be read in its entirety prior to performing any operations.

4.2 Preliminary Checks and Adjustments

4.2.1 Temperature Control

(Superheaters supplied with SCR power control)

4.2.1.1 Temperature Setting

Most Model ISH Superheaters are equipped with proportioning type temperature controls. These units employ a thermocouple installed at the superheater outlet to sense steam temperature, a solid state temperature control to generate a 4-20 milliamp signal in proportion to temperature deviation from set point, and an SCR (silicon controlled rectifier) to modulate power input to heating elements to control superheater output temperature. The temperature control should be set at the desired superheater outlet temperature but shall not exceed 90% of the superheater maximum allowable temperature as stamped on its nameplate. This limit is necessary, at least initially, to prevent over temperature resulting from controlled overshoot of setpoint. Proper system operation can be checked via the temperature limit control or temperature gauge if installed.

NOTE: The superheater should not be operated without flow to equipment served or flow through a bleed valve installed downstream of the superheater. Flow is necessary for the thermocouples to properly sense steam temperature and avoid element burnout as a result of element overheating.

4.2.1.2 Response Adjustment

Temperature controlled response can be adjusted via proper programming of the controller. With these adjustments the controlled gain and reset can be increased or decreased to stabilize the superheater output temperature. Refer to vendor literature at the back of this manual.

4.2.2 Temperature Control

(Superheater supplied with non-proportioning control)

4.2.2.1 Temperature Setting

Some Model ISH Superheaters are equipped with one or more independent temperature controls which switch on or off elements in accordance with their temperature setting. The differential between these settings should be set in accordance with system requirements. Adjustment is made by changing setpoint indicated on control to bring heating element on or off at higher or lower temperature as required. For adjustment of the differential in which the element circuit remains energized, refer to the vendor literature at the back of this manual.

4.2.3 Temperature Limit Cutout

A second thermocouple and control or temperature limit switch is employed to act as a superheater high temperature cutout. This control setpoint should be set at the maximum allowable superheater temperature as stamped on the superheater nameplate. This control will turn off the superheater if its temperature limit is exceeded and will automatically reset, returning superheater to operation, once temperature falls. For adjustment of the temperature limit control differential (between off and on), refer to the vendor literature at the back of this manual.

NOTE: Refer to descriptive literature in the rear of this manual on the respective controls.

5.0 MAINTENANCE

5.1 Elements

5.1.1 Operational Check

If an ammeter is supplied with the superheater, it should be used each time the unit is started up to check proper operation of the heating elements. To do this, simply switch from phase to phase, if current reading is consistent on all phases, then elements are operating properly; if one or two phases read low, then at least one element has probably failed.
IMPORTANT: Failed elements should be replaced immediately upon determination of a failure (see Section 5.3.3).

5.2.1 Temperature Control

Check of the proportioning temperatures control system can be made by moving the set point of the controller up or down scale and noting the corresponding action of the step control. If the step control fails to follow in either direction, refer to the appropriate descriptive literature at the rear of this manual.

5.3 ELECTRICAL COMPONENTS

5.3.1 Contractors

Periodic inspection and cleaning of contacts should be made. Spot check for pitted, burned or welded contacts and inoperative coils.

5.3.2 Fuses

Check for loose fuse clips and wires. Inspect for discoloration of clips due to looseness or overheating.

5.3.3 Elements

The resistance type immersion elements are field-replaceable with standard tools. To replace defective elements, refer to the replacement procedure attached herewith.

5.4 Hairpin –Type Element Replacement Procedure

CAUTION: Before element replacement, make certain main power to boiler / heater is turned off and unit is fully drained and vented.

5.4.1 Make sketch or drawing of element bussing and tag wires to simply re-connection later.
5.4.2. Remove element flange assembly from vessel.

NOTE: Some flanges have 1/2 - 13 tapped hole to use for jacking screw to help in breaking free the gasket.

5.4.3 Remove jumper wires and ferrule nuts from defective element.
5.4.4 Slide element toward dry side (about 2") to expose ferrules on element. Cut off ferrules with hacksaw. Slide element out of steel toward wet side.
5.4.5 Inspect and clean thread and set of steel flange where new ferrule will seal. If seats are pitted or rusted, it may be impossible to seal new elements; therefore, a new flange may be required.
5.4.6 Inspect element to insure sheath area in which ferrule will seal is clean and smooth. Clean with steel wool is necessary.
5.4.7 Screw new ferrule nuts (furnished with replacement element) into cleaned or new flange plate (finger tight).
5.4.8 Slide element into position. Make sure element sheath – copper or Incoloy – protrudes beyond ferrule nut approximately 1/4", or to match original assembly. Some boiler models may require the element sheath to extend out further than ¼" so that there is sufficient clearance between the end of the element and the opposite tank wall (3/4" min.)
5.4.9 Hold element to prevent twisting while tightening ferrule nuts. Tighten nuts to approximately 30-35 ft. lbs. (brass) or 55-60 ft. lbs. (stainless steel). You will feel ferrule separate from nut while tightening. A properly tightened ferrule nut will have separated from its ferrule and the ferrule will be squeezed or compressed onto the element sheath, thus providing a tight seal.
5.4.10 Replace element assembly into boiler, using a new gasket and anti-seize compound on gaskets and bolts. Torque element flange bolts to 90 – 100 ft. lbs. (for standard ½ -13 high stress bolts).
5.4.11 When boiler is filled and pressurized, inspect for leaks around all element flange bolts and gaskets.
5.4.12 Reinstall bussing and flange wiring. Check for proper phase-to-phase resistance, and that phase to ground resistance is infinite.

5.5 *Figure 1 – Flange* Gasket Assembly