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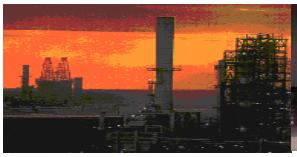
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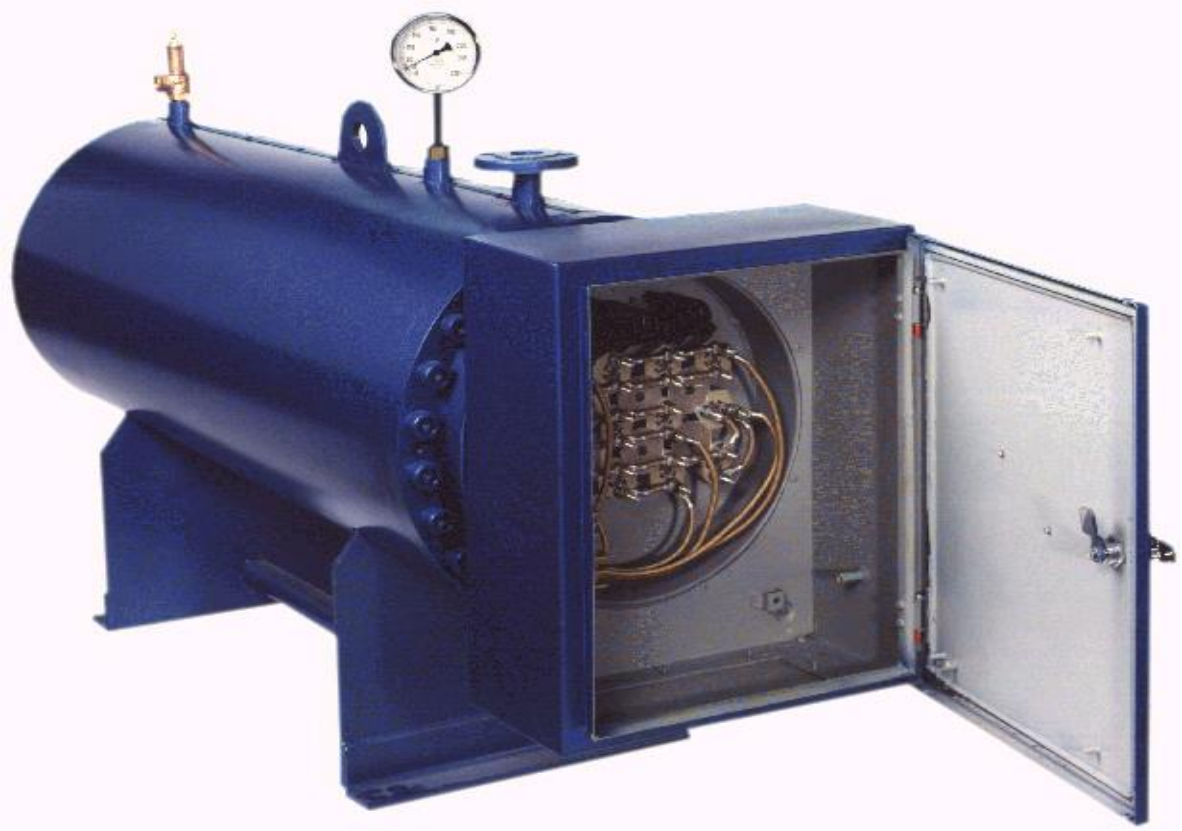

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Installation Instructions for Steam/Electric In-Line Heaters with Removable Core Type Elements

Contents

1.0 Introduction

AKW series CES and PB Line heaters are basically designed for oil preheating applications. The construction of the heater unit is mild steel throughout using materials conforming with British Standard Specifications. Where a fluid other than oil is to be heated then material specifications vary accordingly. The heater design follows conventional layout with separable Tube Plate and Heater Shell thus enabling the heating battery to be removed easily for repair, replacement or upgrading. The steam battery is, in the case of the CES type, integral with the electric heating elements on the same tube plate.
The steam and electric tube plates are separate on the PB type, being at opposing ends of the heater shell.
For the CES, optionally we will provide the oil outlet on a removable plate, see the relevant drawing.

The tube bundle is optimally designed for the use which is specified in the original Order, and may be baffled to optimise heat transfer rates without exceeding pressure drop limitations.

The basic heater unit solely comprises the tube bundle with a header assembly fitted to a fully insulated and clad pressure vessel. This allows for flexibility of design in that heaters for horizontal and vertical fixing or heaters with various types of oil temperature control systems all utilise the basic heater unit and all design alterations necessary for particular systems are confined to external fittings. In general therefore this Instruction Manual is confined to the basic heater unit and where applicable literature is appended dealing with the various accessories supplied.

2.0 Installation

CES and PB heaters are mounted either horizontally or vertically according to the clients wishes. Definite instruction must be given to supply vertical mounted types otherwise a horizontal unit will be supplied. Design changes are necessary for the vertical type, such as change over of the normal inlet and outlet connections and a modification to the control unit housing. Control housings are normally fitted with either left or right handed accessory fittings, e.g. thermometer etc., dependent upon instructions.

The following connections are provided as standard :

1) Oil Return / Inlet
2) Oil Flow / Outlet
3) Oil Drain
4) Thermometer
5) Relief Valve
6) Steam/Hot Water Flow
7) Steam/Hot Water Return

Care must be taken to ensure that sufficient free space is provided for the withdrawal of either the heating element(s) or the tube bundle. This withdrawal length is usually given on the heater drawing, or can be assumed to be the length of the heater shell. Entire heaters can be lifted by connecting suitable gear to the lifting lugs or to the flange and end plate holes.

It is recommended that horizontal heaters are mounted to give a tilt towards the header assembly or drain, wherever it is placed. This ensures that steam condensate and any sludge will collect and drain correctly.
A tilt of 1" in 5' (25mm in 1500mm) is considered satisfactory.

3.0 Electrical Connections

Conduit bosses or a detachable plate for drilling on site may be provided at the base of the terminal box, although in some cases adequate space can be found on the circumference of the enclosure for the Plant Engineer to add additional conduit connections if required.

Since all electromechanical thermostats are single phase devices and of 15 Amp (A.C.) maximum rating, direct connection to the electrical supply is limited to 3.0 kW single phase, 220 / 250 volts (A.C.) Current loads in excess of 15 Amps (A.C.) and all three phase and D.C. supplies necessitate the use of a separate contactor for each electrical heating stage.

The coil circuit of the contactor is normally wired in series with the master thermostat / control thermostat and, when specified, a hand operated switch. It is important that for multi-stage heaters, the control thermostats are connected to the coil of the corresponding contactor, as shown on the wiring diagram.

3.1 Steam or Hot Water Connections

Two connections are provided, one for supply and the other for condense or hot water return.

4.0 Standard Accessories

We supply a relief valve to suit the stated working pressure, which fits in the ½" or ¾" BSP connection provided. Normally we also supply a thermometer, which is provided with a 1/2" BSP mild steel (or other material as appropriate) pocket so that the instrument may be removed without draining the heater or interrupting the process.
A spare gasket / oil joint can be supplied on request. These items are supplied "loose" and will normally be found in a box attached to the newly delivered unit, or will be contained in the terminal box.

5.0 Method of Operation of the Electrical Heater Unit

This type of heater works by transferring electrically generated heat to a liquid, normally for boiler start-up purposes. Once the boiler is fired and steam produced, this steam will provide the energy to supply the heater for normal running purposes.

The performance of this type of heater has been evaluated and a distinct calculation is undertaken for each application.

Heat is transferred to the liquid by means of removable ceramic formed heating elements or cores, fitted into a sheath or tube. The rate of heat output is closely related to the type of fluid being heated.

Control and Safety thermostats are standard features. All thermostats are normally closed (ON) so that an increase in liquid temperature above the (adjustable) set temperature opens the thermostat contacts and therefore the heater circuit is switched OFF. All thermostats are of the changeover type, that is the thermostat switches from one contact to another. Please see the relevant documentation. The inclusion of this feature gives the option of warning or operation indication. This is especially relevant in the case of the Safety thermostat, which must be manually reset.

Control is achieved by a temperature measurement device or devices which may take the form of adjustable electromechanical thermostats as previously described, or electronic thermostats normally utilising a simple probe linked to a sophisticated control device.
In every case we provide fittings suitable for a variety of devices.

A Safety (master cut-out) thermostat is mandatory in compliance with British Standards.

5.1 Steam / Hot Water Coil

Where fitted, the Steam / Hot Water Coil is a continuous coiled tube of heavy gauge steel and is capable of extremely long service life under arduous conditions. It has the advantage of only requiring two holes to be drilled in the tube plate, and is easy to replace. Unfortunately it is made by hand and is therefore both expensive to produce, has a high cost both initially and as a replacement and is slightly less efficient than the following type.

5.2 "U" tube

The "U" tube arrangement comprises multiple hairpin bent steel pipes inserted into the tube plate, to which is attached a header plate effectively gathering steam input and output to their respective inlet and return. The "U" tubes may be finned for greater heat transfer area or plain for greater packing density. Due to the relative ease of manufacture this system is somewhat cheaper than the coil, although this is to some extent negated by the extra tube plate work and header required.

6.0 Setting of Thermostats

6.1 General Information

Thermostats fitted have adjustable scales covering the temperature control range required.
Each thermostat is fitted in a pocket which enables replacement without draining down the vessel contents. If more than one control thermostat is fitted, it will generally be sited above a heating element corresponding to the particular control group.

Note that in most cases the thermostat senses a higher temperature than the actual bulk liquid temperature since it is in the direct path of hot liquid rising from the element sheaths, hence there is a differential between the actual outlet temperature and that to which the thermostat should be set. So in the case of the heater we would see that the thermostat should be set at a higher temperature, say 100 degrees, so as to provide an outlet temperature of 90 degrees.
The differential is - in this example only - 10 degrees. In practice it would be much less than this value. As always, some trial and error is necessary to establish the correct setting to compensate for the measurement errors which abound in normal process plant.

6.2 Control Thermostats

A Control Thermostat is normally fitted to the heater, and this may control any chosen load. Practically however this is usually limited to around 40 kW per control group, with a heater of larger capacity being split into two or more heating sections

In multi -stage units the number of Control thermostats varies according to the number of stages. The minimum number of heating elements to each Control thermostat is three.

Where more than one Control thermostat is fitted, they should be set at different temperatures so that a base load is "ON" for longer than the makeup load which operates "ON/OFF". In every case, the control system should be set up in ascending load order.

6.3 Safety (Master) Thermostats

One Master Thermostat is supplied with each heater to protect the unit from excessive liquid temperature when a fault arises. The thermostat is usually set some 25 degrees C above the liquid outlet temperature or other recommended temperature. When this temperature is exceeded the master thermostat opens all the heater circuits thus closing down the system.

In some cases the master thermostat is wired in series with the liquid transfer pump electrical system. As a matter of good practice this should incorporate a means whereby the pump continues to operate for a short period of time (say, five minutes) to ensure that the liquid in the heater does not overheat due to residual heat build up.

If the thermostat trips, it will be necessary to manually reset it since it will not automatically close as the temperature falls.

NOTE : It is extremely important that the mains supply is isolated before attempting to reset the Master thermostat since the operator may be unaware of energising the heater elements as soon as the thermostat is reset.

6.4 Steam / Hot Water Control Systems

In most steam / hot water heater applications, some method of control of the liquid outlet temperature is required. Since there are many different types of thermostatic, pneumatic or electrical control system available, we do not provide such equipment as part of the heater package. This equipment is provided under our option scheme. A typical system is discussed below.

6.5 Steam / Hot Water Thermostatic Controls - Typical

A pocket is provided in the heater tube plate for the steam thermostat, either a Sarco type 121 or 128. The steam valve is fitted local to the steam supply connection. Working instruction cards are provided in the various containers supplied.

When ordered, the Steam Control Package consists of :

a) Steam Regulator
b) Steam Control Valve
c) Steam Trap
d) Sight Glass
e) Strainers as appropriate
f) Isolating Valves as required

6.5 Steam / Hot Water Thermostatic Controls - Typical (Cont'd)

Any or all components can be ordered directly from us, sized to suit the application.

The Steam Regulator is a two part unit comprising valve and thermostat. The valve is controlled via a capillary tube by the thermostat which is fitted to the heater tube plate. The steam control valve is a fully modulating, hydraulically operated type incorporating packless glands.

The valve should always be fitted in a horizontal pipeline with the valve closing element vertically below the line. It is important that line stresses such as can be caused by expansion or inadequate pipe supports are not imposed on the valve body. If the valve has been correctly sized for the duty it has to perform it will often be smaller than the pipeline to and from it. Reduction in pipeline dimensions can be made by eccentric reducers.

It is advisable to protect the valve by fitting a strainer on the upstream side.

The thermostat should be set on site to the required outlet temperature.

Please read the instructions attached to the valve, thermostat, and other equipment, when supplied.

7.0 Maintenance

The best way to enjoy a long and trouble free life from any piece of equipment is to keep it well maintained. With a heater, which appears to have no moving parts, this may seem a waste of time at first, but maintenance is required just as with any other equipment. We recommend that maintenance be carried out regularly and a close check kept on sludge removal etc., so that a schedule which is efficient and effective for your application may be established.

7.1 Periodic Maintenance

(a) Ensure all electrical connections are clean, dry and tight.
Check all steam / hot water pipe joints for leakage and tighten as necessary.
(b) Check for liquid leakage around the tube plate to heater ring flange joint.
(c) Ensure that the heater is isolated from the fluid transfer system, and that it is cool.
Loosen drain valve and check for sludge build up. If this is excessive then remove the air vent if it is a vertical unit or remove the relief valve if it is a horizontal unit - remember there may be pressure in the system despite being isolated.

NOTE : Never attempt to open a hot heater unit.

7.2 Routine Cleaning - 6 monthly if required.

(a) Isolate the heater and drain the contents
(b) Disconnect all accessories and check for damage or corrosion. Refer to separate manuals where applicable for maintenance details.
(c) Steam clean or chemically clean heater interior if possible and check for corrosion or other internal damage.

7.3 General Overhaul - 12 monthly at least.

(a) Carry out Routine Cleaning schedule and
(b) If fitted, remove steam cover plate or steam "hat", spacer plate and heater gaskets.
(c) Ease out tube plate.
(d) Remove heater battery from shell and inspect element tubes and steam tubes for scale and corrosion. Remove scale carefully by wire brushing.
(e) Inspect heater shell where visible and clean where necessary.
(f) Re-fit heater battery - using a new gasket - and re-fit other accessories, heating elements, thermostats etc. in reverse order to above.
(g) Re-fill system, ensuring all air has been expelled.
(h) If possible, pressure test to rated pressure on nameplate, or to available pressure on site.

NOTE : DO NOT ATTEMPT TO SWITCH HEATER ON UNTIL ALL AIR HAS BEEN VENTED AND FLUID FLOW HAS BEEN ACHIEVED (THUS CONFIRMING ALL VALVES ARE OPEN). FAILURE TO OBSERVE THIS CAUTION MAY RESULT IN EXPLOSION. DO NOT TAKE SHORT CUTS WITH SAFETY.

8.0 Spares

8.1 Thermostats

If a thermostat is faulty in any way it must be returned to our works for inspection. Thermostats can be easily removed by releasing the electrical connections and pinching screws.

Standard thermostats are available from stock but others may be several weeks delivery.
Since we do not manufacture these items ourselves, it is sometimes difficult to estimate delivery.

When a spare thermostat is required, ALWAYS give us the details on the nameplate of the heater.

8.2 Heating Elements

Replacement Heating Elements are available from our factory provided that full details are given, as shown on the last page. The Serial Number is vitally important.

Heating elements can be removed easily by loosening the retaining clip screws. If difficulty is experienced beyond that which you might consider normal, bearing in mind that these elements should be a sliding fit in their sheaths, then it is imperative that you telephone us directly for advice. If you fail to do so, we cannot be held responsible for any breakages.

Note that occasionally some small ceramic parts may be left within the element sheath. You should check the removed element for missing parts and ensure that the sheath is clear of obstruction to allow element replacement.

In general, heating elements are warranted in the same way as the heater unit i.e. A one year warranty exists. However as these items are the subject of differing operating regimes the application of any warranty is at our sole discretion.

8.2 Relief Valve

Oil pressure relief valves are provided for intermittent discharge only and are not sized for full discharge on the larger heaters. Spare valves can be had on early delivery. Please quote all the necessary details when ordering. It would be very helpful if you could determine the pressure, which is stamped on the "hex" of the valve, and the fitting size, since this information will normally confirm ours so that you receive the right item.

8.3 Steam / Hot Water Bundle

In the case of the steam / hot water coil, all the information we require is on the nameplate. The coil comes as one item and must be replaced by us at the factory, using either a new tube plate or the existing one.

If hairpin tubes "U" tubes are in use, it is not practical to repair individual tubes by cutting and refitting. Suitable replacement tube bundles complete with tube plate can, however, be supplied with in 2 - 3 weeks of an Order. Earlier delivery is possible if the old tube plate is returned for refurbishment. As with spare items described above, it is extremely important to quote all the details requested.

8.4 Steam / Hot Water Thermostat / Valve

The steam / hot water thermostat is a sealed unit. If it is damaged or a spare is required, please return it to our factory or order the required part by quoting the serial number of both the valve and the heater.

9.0 Fault Correction

9.1 Poor Control Characteristics

Reset the thermostats and if it is felt necessary check operation by immersion in a fluid of known temperature. A kettle full of boiling water is sufficient for testing. Where it is felt that the temperature indicated on the thermostat scale does not accord with that of the test, we recommend that you return the item for replacement.

9.2 Required Outlet Temperature Unobtainable

This can be due to the failure of one or more heating elements and a resistance test should be carried out on the suspect items. If a fault is found, then refer to Spares Ordering for details of how to order a new element.

If a fault cannot be readily found within the heater, then check other parts of the system BEFORE suspecting anything else. Once you are satisfied that the problem lies with the heater unit, begin a logical fault finding process as outlined on the appropriate page .

9.3 Constant Fuse Failure

Check earth insulation and phase/phase insulation of heater unit.

Resistance readings should be better than 1 Megohm. when cold. However if the heater has been in a damp environment for some time, it is possible that the ceramic heating cores are also damp, thus giving poor insulation values. Rectify by removing cores and drying in a warm oven or by carefully applying a low voltage supply to the elements.

9.4 Safety (Master) Thermostat Trips out

Before manually resetting the Safety thermostat, carefully check the cause of the trip. This could be any of the following :

a) Setting is too low - set at least 25 C above normal working temperature
b) The Control thermostat or thermostats have failed in the closed circuit mode (ON)
c) If the thermostat continually trips regardless of setting, suspect failure of the thermostat unit itself and you should replace the item. Note that thermostat failure is extremely rare however.
d) If this is accompanied by a difficulty in removing heating elements, you must contact this office immediately for further guidance.

9.5 SPARES ORDERING INFORMATION

It is essential when ordering spares to quote all the details given on the nameplate.
These comprise :

SERIAL NUMBER DATE KILOWATT RATING

(Optionally - Original purchaser)

The important detail is the Serial Number. Failing that we would need a name and date.
We maintain records spanning our entire existence - over 50 years - but we still need something to go on if we are to provide good service.