

Instruction Manual

30B5M Vapour Booster Pumps

| Description | Item Number |
|--|-------------|
| Unconfigured 30B5M Vapour Booster Pumps: | |
| 200 V, 50/60 Hz, 3-phase | B064-07-200 |
| 220 V, 50/60 Hz, 3-phase | B064-07-220 |
| 380 V, 50/60 Hz, 3-phase | B064-07-380 |
| 400 V, 50/60 Hz, 3-phase | B064-07-400 |
| 415 V, 50/60 Hz, 3-phase | B064-07-415 |
| 440 V, 50/60 Hz, 3-phase | B064-07-440 |
| 460 V, 50/60 Hz, 3-phase | B064-07-460 |
| 480 V, 50/60 Hz, 3-phase | B064-07-480 |
| Control Configured 30B5M Vapour Booster Pumps: | |
| 200 V, 50/60 Hz, 3-phase | B064-08-200 |
| 220 V, 50/60 Hz, 3-phase | B064-08-220 |
| 380 V, 50/60 Hz, 3-phase | B064-08-380 |
| 400 V, 50/60 Hz, 3-phase | B064-08-400 |
| 415 V, 50/60 Hz, 3-phase | B064-08-415 |
| 440 V, 50/60 Hz, 3-phase | B064-08-440 |
| 460 V, 50/60 Hz, 3-phase | B064-08-460 |
| 480 V, 50/60 Hz, 3-phase | B064-08-480 |





Declaration of Conformity

We, Edwards,
Manor Royal,
Crawley,
West Sussex, RH10 9LW, UK

declare under our sole responsibility, as manufacturer and person within the EU authorised to assemble the technical file, that the product(s)

30B5M Vapour Booster:

| | | | |
|-------------|-------------|-------------|-------------|
| B064-07-200 | B064-07-220 | B064-07-380 | B064-07-400 |
| B064-07-415 | B064-07-440 | B064-07-460 | B064-07-480 |
| B064-08-200 | B064-08-220 | B064-07-380 | B064-08-400 |
| B064-08-415 | B064-08-440 | B064-08-460 | B064-08-480 |

to which this declaration relates is in conformity with the following standard(s) or other normative document(s)

EN60204-1: 2006
+ A1: 2009

Safety of Machinery. Electrical Equipment of Machines.
General Requirements

and fulfils all the relevant provisions of

2006/95/EC
2004/108/EC

Low Voltage Directive
Electromagnetic Compatibility (EMC) Directive

Note: This declaration covers all Product serial numbers from the date this Declaration was signed onwards.

Peter Meares, Technical Support Manager, Industrial and
Chemical pumps

9 December 2009

Date and Place

This product has been manufactured under a quality system registered to ISO9001

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1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards 30B5M Vapour Booster Pumps. You must use the pump as specified in this manual.

Read this manual before you install and operate your pump. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.



WARNING

Warnings are given where failure to observe the instruction could result in injury or death to people.

CAUTION

Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

In accordance with the recommendations of IEC 1010, the following warning symbols may appear on the pump or its accessories:



Warning - refer to accompanying documentation.



Warning - risk of electric shock.



Warning - hot surfaces.

The units used throughout this manual conform to the SI international system of units of measurement.

1.2 Description

Note: There are two versions of 30B5M pumps, control configured versions and unconfigured versions: refer to Section 3.7.1.

Refer to Figure 1. The 30B5M pump is a high throughput vapour booster pump. The 30B5M is designed for industrial processes in which large quantities of gas or water vapour are evolved or processes which may result in heavy contamination.

The pump has an interior jet assembly (3) inside the jet-stage cone (32) which is mounted vertically on the base of the pump. The jet assembly has three jet-stages; each jet-stage has a jet on the top of a vapour tube (26). The pump inlet-flange (1) is on the top of the first jet-stage.

The pump has two horizontal ejector-stages (29 and 30). The first ejector-stage (30) is below the jet-stages, the second ejector-stage (29) is at the opposite end of the pump base. Each ejector-stage has a vapour tube (26) and a conical ejector-jet (28 and 9).

The second ejector-stage (29) is connected to the backing-condenser (4), which is mounted vertically next to the jet-stage cone (32). The backing-condenser has a flange to connect the backing-pump.

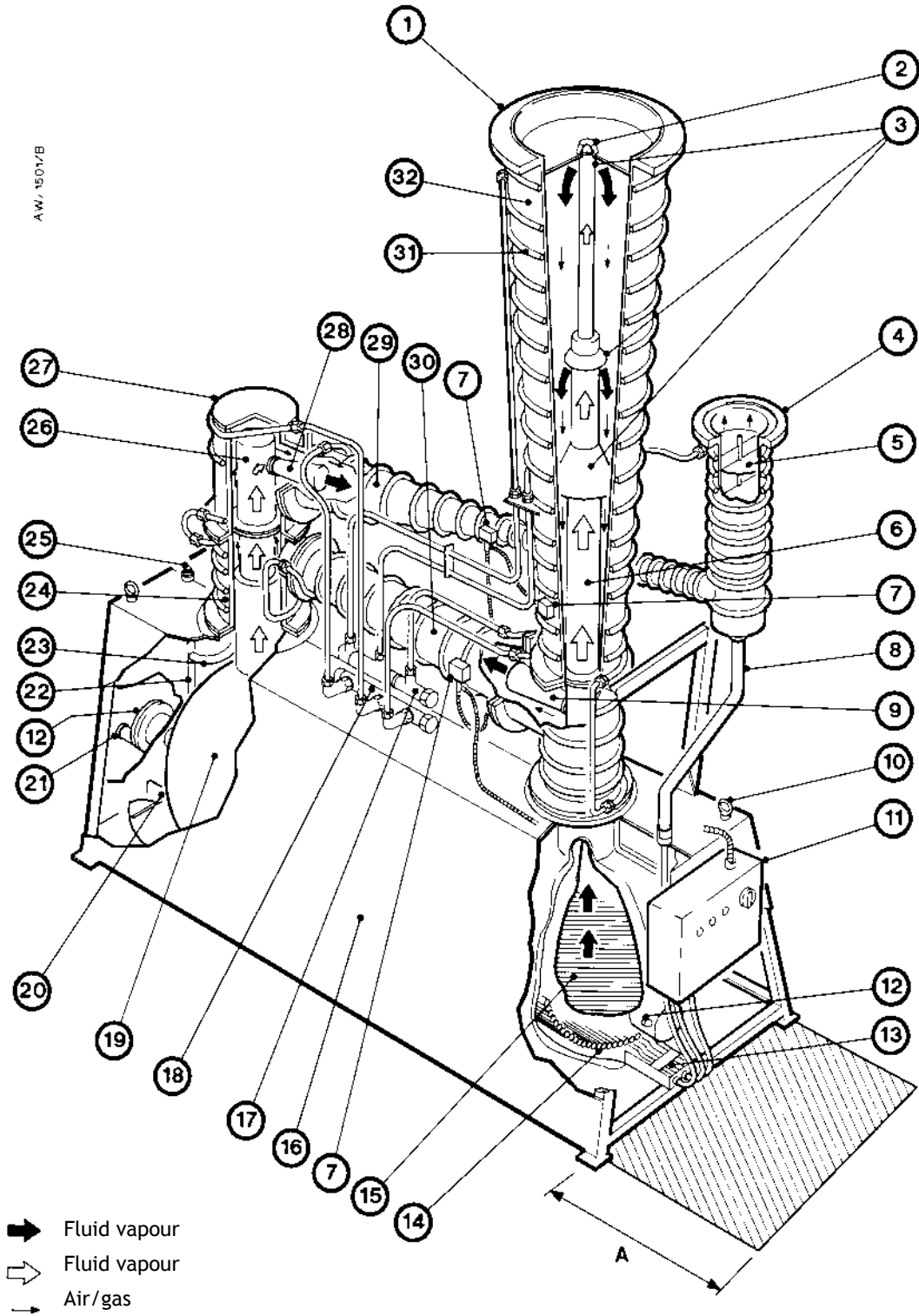
The pump is cooled by water which flows through copper cooling-coils (31) wound around the jet-stages, ejector-stages and the backing-condenser.

Heaters (14) around the boiler at the base of the pump heat the pump fluid (15) to generate the required vapour. There are 18 heaters in the pump, rated the same for all voltage variants (see Section 2.5). A radiation shield underneath the heaters reflects heat from the back of the heaters to the boiler and so increases the efficiency of the pump.

Figure 1 - Part sectional view of the 30B5M pump: Key

| | | |
|----|--|----------------------------------|
| A | Clearance required to remove/refit a heater: 1.6 m | |
| 1 | Inlet-flange | 17 Cooling-water inlet manifold |
| 2 | Guard-ring | 18 Cooling-water outlet manifold |
| 3 | Jet assembly | 19 Boiler |
| 4 | Backing-condenser | 20 Neutral connector |
| 5 | Baffle-plate | 21 Fluid drain-plug |
| 6 | Vapour tube | 22 Fluid-return pipe |
| 7 | Cooling-fail thermal snap-switch | 23 Cleaning union |
| 8 | Fluid-return tube | 24 'T' tube |
| 9 | First ejector-stage jet | 25 Dipstick |
| 10 | Lifting-bolt | 26 Vapour tube |
| 11 | Control-box | 27 Right-angle tube |
| 12 | Boiler protection thermal snap-switch | 28 Second ejector-stage jet |
| 13 | Heater terminals | 29 Second ejector-stage |
| 14 | Heaters | 30 First ejector-stage |
| 15 | Pump fluid (in the boiler) | 31 Cooling-coil |
| 16 | Side boiler cover | 32 Jet-stage cone |

Figure 1 - Part sectional view of the 30B5M pump



1.3 Principle of operation



WARNING

Ensure that the boiler protection thermal snap-switches are wired into the pump control system, and are correctly adjusted when the pump is fully charged with fluid and under vacuum.

The thermal trips are to protect the pump from overheating from low oil level, which may cause the boiler to implode.

Pump fluid is heated in the base of the pump to produce a vapour which passes up through the interior of the jet-stages and emerges from the jets as high-velocity vapour streams. The vapour streams condense on the cooled walls of the jet-stage cone and the ejector-stage cones and drain into the base of the pump for recirculation.

A portion of system gas which arrives at the pump-inlet is trapped in the vapour stream from the first jet-stage. The gases are compressed and transferred to the next stage. The gases then pass through the two ejector-stages and into the backing-condenser where they are removed by the backing-pump.

The cooled surface of the guard-ring above the first jet-stage traps and condenses pump fluid vapour and minimises any back-streaming of pump fluid vapour into the vacuum system.

1.4 Over-temperature protection

Note: The following sections describe the operation of the snap-switches on control configured pumps; you must ensure that unconfigured pumps will operate in the same way: refer to [Section 3.7](#).

1.4.1 Cooling-fail thermal snap-switches

Refer to [Figure 1](#). The pump has three cooling-fail thermal snap-switches (7) on the cooling-coils. These snap-switches are connected to the control-box (11). The snap-switches protect the pump against damage due to failure of the cooling-water supply. If the temperature of the pump increases above 46 °C, the snap-switches will operate to switch off the pump heaters. The snap-switches will reset automatically when the pump cools down.

The operating temperatures of the cooling-fail thermal snap-switches are preset for use with AP201 pump fluid. If you want to use other fluid types in the pump, contact your supplier or Edwards for advice.

1.4.2 Boiler protection thermal snap-switches

Refer to [Figure 1](#). The pump has two boiler protection thermal snap-switches (12). One snap-switch is fitted to the fluid return-tube (8) from the backing-condenser, and the other snap-switch is fitted next to the drain plug (21). These snap-switches are also connected to the control-box (11). The snap-switches protect the pump against damage due to a low level of pump fluid. As supplied, the snap-switches will operate at 250 °C to switch off the heaters. You can adjust the snap-switches to operate at different temperatures (refer to [Section 4.4](#)).

1.5 Full-heat and half-heat modes (control configured pumps only)

Control configured pumps have two operating modes: full-heat and half-heat. You can select these modes with the Heater Power switch on the control-box (see [Section 1.6](#)).

The full-heat mode is the normal operating mode. When this mode is selected, all the heaters are switched on.

When the half-heat mode is selected, the electrical supply to some of the heaters is switched off. If you have a cyclic process, you can select this facility when the 30B5M is not used to pump process gases; this will reduce the power consumption of the pump, but also maintain the pump close to its operating temperature.

1.6 Control-box controls and lamp (control configured pumps only)

Refer to [Figure 2](#). Control configured pumps have the following controls and lamp:

| | |
|--------------------------------|---|
| Power Enable switch (1) | Use this to reset the pump after it has been automatically shut down because of an over-temperature fault, or if it has been isolated from the electrical supply. |
| Power Enable lamp (2) | This lamp is on when the pump is available for operation. When this lamp is on, you can use the Heater Power switch to select full-heat or half-heat: see below. If the lamp is off, you must press the Power Enable switch to reset the pump before you can switch the heaters on. |
| Heater Power switch (3) | Use this to switch off all of the heaters, or to select half-heat or full-heat modes. |
| Electrical supply isolator (4) | Use this to isolate the pump from the electrical supply. |
| Emergency stop switch (5) | Use this in an emergency to isolate the pump from the electrical supply. |

1.7 Performance

The pumping speeds and throughputs given in [Section 2](#) were calculated from measurements made with total pressure gauges. If partial-pressure gauges are used, the calculated values for pumping speeds are approximately 10% higher. This is because partial-pressure gauges do not measure the pressure added to the system by condensable gases.

We do not give absolute values for the ultimate pressure of the pump. The ultimate vacuum depends on the fluid used in the pump, the leak tightness of the system, outgassing from surfaces and the use of cold traps.

1.8 Operation with high ambient humidity

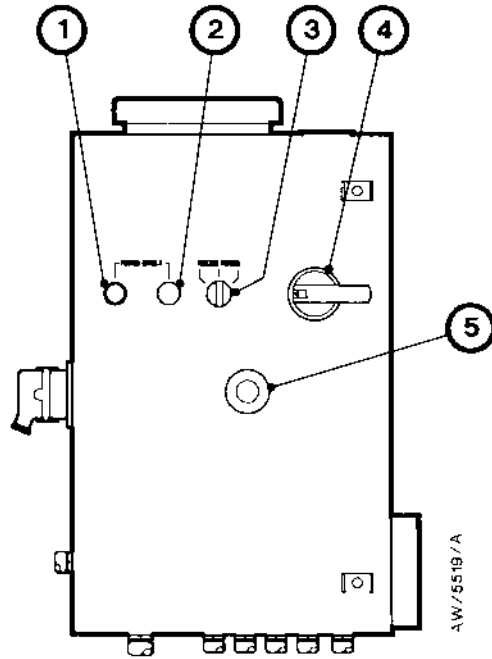
When the pump is switched off, the heaters in the pump will absorb moisture: this will cause a decrease in the insulation resistance of the heaters. If you operate the pump in an environment with high ambient humidity, this may cause the heaters to fail. The rate of moisture absorption (and therefore the time taken for the insulation resistance of the heaters to fall below the recommended value) depends on the ambient humidity and temperature and the length of time that the pump is switched off.

In addition to the recommendations made in later sections of this manual, you can overcome the effect of high ambient humidity if you:

- Configure the electrical installation of the pump for 'soft-start' operation, when the pump is operated with typically 20 to 25% of the nominal electrical supply voltage.
- Install anti-condensation heaters under the base of the pump. Switch on these heaters when you switch off the pump.

Detailed information about these recommendations is outside the scope of this manual. If you need more information about the operation of the pump with high ambient humidity, contact your supplier or Edwards for advice.

Figure 2 - Control-box controls and lamp



- 1. Power Enable switch
- 2. Power Enable lamp
- 3. Heater Power switch
- 4. Electrical supply isolator
- 5. Emergency stop switch

2 Technical data

2.1 Performance

| | |
|--|--|
| Pumping speed (ISO) | |
| Air | 12500 ls ⁻¹ |
| Hydrogen | 15000 ls ⁻¹ |
| Ultimate vacuum | less than 1 x 10 ⁻⁴ mbar, 1 x 10 ⁻² Pa |
| Throughput at 1 x 10 ⁻¹ mbar (10 Pa) | 2.4 x 10 ² mbar.ls ⁻¹ (2.4 x 10 ⁵ Pa.ls ⁻¹) |
| Fluid loss at 1 x 10 ⁻¹ mbar (10 Pa) | 12 g.h ⁻¹ |
| Critical backing pressure | 5.3 to 6 mbar (5.3 x 10 ² to 6 x 10 ² Pa) |
| Maximum system pressure | 1.3 bar absolute (1.3 x 10 ⁵ Pa) |
| Warm-up time to maximum performance at full-heat input | 60 min |
| Minimum backing-pump displacement for maximum throughput | 290 m ³ h ⁻¹ |
| Recommended backing-pump | Edwards E1M275 |

2.2 Mechanical data

| | |
|---------------|---|
| Dimensions | See Figure 3 |
| Mass | 620 kg |
| Inlet-flange | 737 mm diameter with 12 equally spaced 20.6 mm fixing-holes on a 686 mm PCD (pitch circle diameter) |
| Outlet-flange | 279 mm diameter with 4 equally spaced 16.7 mm fixing-holes on a 235 mm PCD |

2.3 Pump fluid data

Note: An Edwards Material Safety Data Sheet for AP201 fluid is available on request.

| | | | |
|------------------------|-----------------------|-------------------------------|-------------------------|
| Recommended fluid type | Apiezon AP201 | | |
| Fluid charge | 55 litres | | |
| Fluid type | Flash point °C | Auto-ignition point °C | Molecular weight |
| Apiezon AP201 | 196 | 305 | 310 |

2.4 Cooling-water

| | |
|--|--------------------------------------|
| Minimum cooling-water flow | 1950 lh ⁻¹ at 25 °C |
| Maximum allowed water-outlet temperature | 35 °C |
| Pressure differential across supply and return | 1 bar gauge (2 x 10 ⁵ Pa) |
| Cooling-water connections | 1 inch BSP |

2.5 Electrical data

| | |
|--|--|
| Heater rating | 1.25 kW |
| Nominal heater power (18 heaters) | 22.5 kW |
| Electrical supply | 200, 220, 380, 400, 415, 440, 460 or 480 V |
| Over-current protection settings on full heat | |
| 200 V, 50/60 Hz | 73 A |
| 220 V, 50/60 Hz | 66 A |
| 380 V, 50/60 Hz | 38 A |
| 400 V, 50/60 Hz | 36 A |
| 415 V, 50/60 Hz | 35 A |
| 440 V, 50/60 Hz | 33 A |
| 460 V, 50/60 Hz | 32 A |
| 480 V, 50/60 Hz | 30 A |
| Maximum cooling-fail thermal snap-switch voltage | 24 V a.c., 60 V d.c. |
| Maximum interlock control voltage | 24 V a.c. |

2.6 Performance curves

As specified in [Section 1.7](#), pump performance depends on a number of factors; [Figure 4](#) shows typical performance curves.

2.7 Construction materials

| | |
|----------------------------|---------------------------------------|
| Pump-body | Painted mild steel |
| Cooling-coils | High conductivity copper |
| Guard ring | Copper |
| Inlet and outlet 'O' rings | Nitrile |
| Pump 'O' rings | Fluoroelastomer |
| Panels/frame | Mild steel |
| Jet assembly gasket | Aramid fibre in nitrile rubber binder |

Figure 3 - Dimensions (mm)

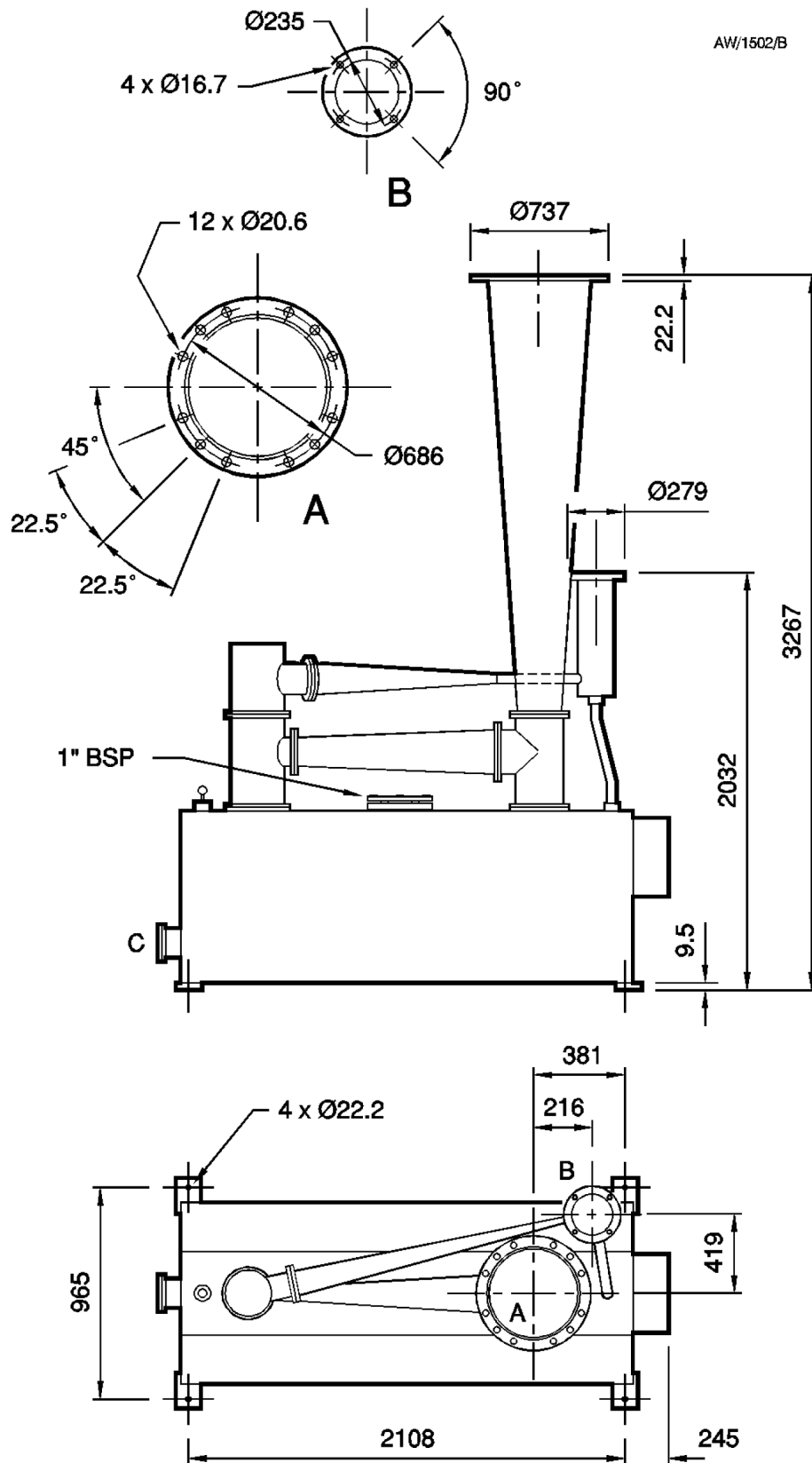
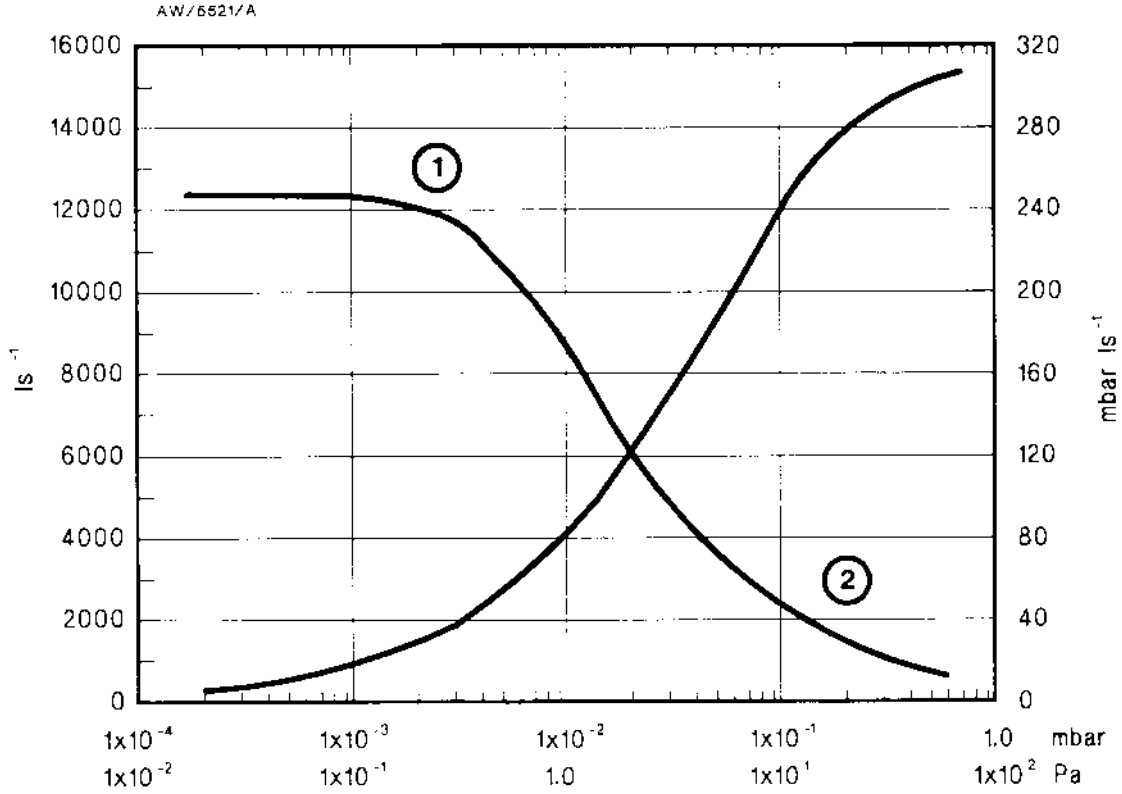


Figure 4 - Typical performance curves



- 1. Pumping speed (l.s⁻¹) against inlet pressure (mbar/Pa) for nitrogen
- 2. Throughput (mbar.l.s⁻¹) against inlet pressure (mbar/Pa) for nitrogen

3 Installation

3.1 Safety



WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

- A suitably trained and supervised technician must install the pump.
- Ensure that the installation technician is familiar with the safety procedures which relate to the pump fluid and to the products pumped. Wear the appropriate safety-clothing when you come into contact with contaminated components. Dismantle and clean contaminated components inside a fume-cupboard.
- Disconnect the other components of the vacuum system from the electrical supply so that they cannot be operated accidentally.
- Vent and purge the vacuum system with nitrogen for 15 minutes before you start installation work.

3.2 Unpack and inspect

The 30B5M Vapour Booster Pump is supplied either fully assembled in a single package, or unassembled in two packages. On receipt, remove all packing materials and protective covers and check the equipment.

If the equipment is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the pump together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the pump if it is damaged.

If you have received two packages, check that you have received the items listed in [Table 1](#). If either item is missing, notify your supplier in writing within three days.

If the 30B5M pump is not to be used immediately, replace the protective covers. Store the pump in suitable conditions, as described in [Section 6](#).

Table 1 - Checklist of components

| Qty | Description | Check (✓) |
|-----|---|--------------------------|
| 1 | Pump base, with ejector stages and backing-condense | <input type="checkbox"/> |
| 1 | Jet-stage cone | <input type="checkbox"/> |

3.3 Locate and assemble the pump

**WARNING**

Locate the pump on a flat, secure foundation. If you do not, it may become unstable and fall over.

**WARNING**

Use suitable lifting equipment to move the base of the 30B5M pump. The mass of the base of the pump is 620 kg.

**WARNING**

If you mount the pump off of the floor, you must fit a suitable mesh shield (with hole size less than 10 mm) under the pump, to prevent accidental contact with unprotected electrical conductors in the pump.

Note: Surfaces of the pump are very hot during operation. If necessary, fit guard rails around the pump after you have installed it, to prevent accidental contact with hot surfaces of the pump.

The base of the 30B5M pump has lifting-bolts (see [Figure 1](#)). Locate the base of the pump within practical working distance from your electrical supply and your cooling-water supply. We recommend that you leave a gap of at least 1.6 m from the control-box end of the pump to allow you to easily replace the heaters.

After you have located the base of the pump, if your pump was supplied unassembled in two packages, assemble the other components as described below.

1. Refer to [Figure 1](#). Lift the jet-stage cone (32) over the pump, then lower the vapour tube (6) and jet assembly (3) through the inlet-flange (1).
2. Connect the vapour tube (6) to the top of the T-tube.
3. Lower the jet-stage cone (32) onto the pump, then connect the bottom flange of the jet-stage cone (32) to the T-tube.
4. Fit the braces which support the jet-stage cone (32).
5. Fit the guard-ring (2) and the 'O' ring to the pump inlet-flange (1).
6. Inspect all 'O' ring joints and ensure that they are tight; tighten any loose joints.

3.4 Vacuum connections

3.4.1 System design



WARNING

You must fit a backing pressure-interlock if you intend to pump dangerous substances.

Consider the following points when you design your system:

- On all applications, we recommend that you fit a backing pressure-interlock to the outlet pipeline to switch off the electrical supply to the heaters if the pressure in the pipeline rises to the critical backing pressure. You **must** fit a backing pressure-interlock when you pump dangerous substances. If you do not fit a backing pressure-interlock and the pressure in the backing pipeline rises to the critical backing pressure, fluid will backstream into the vacuum system and thermal breakdown of the pump fluid may occur. On control configured pumps, use plug PL1 (Figure 6, item 13) to connect the backing pressure-interlock; on unconfigured pumps, connect the backing pressure-interlock as described in Section 3.7.3.
- Ensure that the pipeline which connects the 30B5M to your vacuum system is as short as possible and has the maximum possible internal diameter.
- Separately support the pipeline which connects the 30B5M to your vacuum system.
- Ensure that the pipeline which connects the 30B5M to the backing-pump is as short as possible and has the maximum possible internal diameter.
- Incorporate flexible pipelines in the backing pipeline to reduce the transmission of vibration and to prevent loading of coupling joints. If you use flexible pipelines, you must ensure that you use pipelines which have a maximum pressure rating which is greater than the highest pressure that can be generated in your system. We recommend that you use Edwards flexible pipelines.
- You must be able to isolate the 30B5M pump-inlet and outlet from the atmosphere and from your vacuum system.
- You must be able to vent the 30B5M to atmosphere.

3.4.2 Connect the pump-inlet to the vacuum system

Before you connect the pump to your vacuum system: inspect the inlet-flange sealing face and ensure that it is free of scratches; if necessary, refinish the sealing face; clean the inlet-flange with a suitable cleaning solution.

Use the correct number and size of bolts to connect the pump to your vacuum system.

Use an 'O' ring to seal the connection; clean the 'O' ring and apply a light wipe of pump fluid or vacuum grease to the 'O' ring before you connect the inlet-flange. Ensure that the 'O' ring is not twisted.

3.4.3 Connect the pump-outlet to the backing pipeline



WARNING

Conduct the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.

Connect the backing-pipeline to the outlet-flange of the 30B5M with a flanged pipe which has an internal diameter of 100 mm.

Use an 'O' ring to seal the connection; clean the 'O' ring and apply a light wipe of pump fluid or vacuum grease to the 'O' ring before you connect the outlet-flange. Ensure that the 'O' ring is not twisted.

3.5 Leak-test the system

The 30B5M pump is stringently leak-tested before despatch. After you have installed the 30B5M pump, leak-test the system before you fill the pump with fluid; outgassing from the fluid may give false test results. The pump fluid is viscous at ambient temperature and may block small leaks.

The level of leak-tightness required will depend on the application of your vacuum system. You must leak-test the system to ensure the integrity of the system and its vacuum seals.

3.6 Connect the cooling-water supply

CAUTION

Maintain the temperature of your cooling-water supply below 35 °C. If you do not, you will not be able to achieve the specified performance of the pump.

Connect the cooling-water supply and return pipes to the 1 inch BSP cooling-water inlet and outlet connectors on the cooling-water inlet and outlet manifolds (Figure 1, items 17 and 18). If you have to connect more than one pump to the cooling-water supply, connect the pumps in parallel and not in series.

Your cooling-water supply must meet the specification in Section 2.

We recommend that the cooling-water supply is filtered and that you incorporate a flow indicator into the supply system.

3.7 Electrical installation

WARNING



Ensure that the electrical installation of the 30B5M conforms with your local and national safety requirements. The pump must be connected to a suitable rated and protected electrical supply and a suitable earth (ground) point.

3.7.1 Introduction

WARNING



Ensure that the boiler protection thermal snap-switches are wired into the pump control system, and are correctly adjusted when the pump is fully charged with fluid and under vacuum.

The thermal trips are to protect the pump from overheating from low oil level, which may cause the boiler to implode.

Note: Where necessary, refer to the circuit diagrams for the pumps shown in Figure 9 and 10.

Two versions of the 30B5M pump are available:

- On the control configured pump, the control-box is fully configured; the cooling-fail and boiler protection thermal snap-switches will automatically shut-down the pump when an over-temperature fault occurs.
- On the unconfigured pump, the outputs of the thermal snap-switches are connected to terminals in the control-box. You must configure the control-box or connect the outputs to your control equipment to shut-down the pump when an over-temperature fault occurs: refer to Section 3.7.4.

3.7.2 Connect the electrical supply to the pump

As described in [Section 1.8](#), when the pump is switched off, the heaters in the pump will absorb moisture: this will cause a decrease in the insulation resistance of the heaters. We recommend that you connect the electrical supply to the pump through an RCCB (residual current circuit breaker): the RCCB will operate to disconnect the electrical supply if the insulation resistance of the heaters is too low, or if an earth (ground) fault condition arises.

For additional electrical safety:

- If you do not use conduit for the electrical installation, use cable which is heat resistant (up to 150 °C) in case of accidental contact with the pump.
- On an unconfigured 30B5M, fit an emergency stop switch, an electrical supply isolator and an over-current trip. Set the over-current trip in accordance with the recommendations given in [Section 2](#).
- Check the earth (ground) continuity of the pump electrical supply before you switch on the pump.

Use the following procedure to connect the electrical supply to the pump:

1. Check that your electrical supply voltage and rating correspond with the information shown on the pump rating plate.
2. Unlock and open the front door of the control-box.
3. Refer to [Figure 5](#) or [6](#). Remove the gland plate (1) from the top of the control box, then drill a hole suitable for your cable or conduit gland in the gland plate.
4. Fit your gland to the gland plate (1), then refit the gland plate to the control box.
5. Loosen the gland, then pass your electrical supply cable through the gland and into the control box.
6. Refer to [Figure 5](#). On an unconfigured 30B5M, connect the phase wires in the electrical supply cable to terminals 1 to 3 and terminals 4 to 6 (to allow for half-heat operation) on terminal block TS02 (4).
7. Refer to [Figure 6](#). On a control configured 30B5M, connect the phase wires in the electrical supply cable to the terminals marked 'L1', 'L2' and 'L3' on the electrical supply isolator/circuit breaker (4).
8. Refer to [Figure 5](#) or [6](#). Connect the earth (ground) wire in the electrical supply cable to the main earth (ground) block (2) in the control-box.
9. Use a suitable earth (ground) lug and a short length of green/yellow earth (ground) cable to connect the armour of the cable or conduit to the control-box earth (ground) stud.
10. If you have an unconfigured pump, continue at [Section 3.7.3](#). Otherwise, close and lock the front door of the control-box.

3.7.3 Connect the backing-pressure interlock

Refer to [Figure 5](#). On an unconfigured pump, wire the backing-pressure interlock switch in series with the thermal snap-switches: refer to [Section 3.7.4](#).

Refer to [Figure 6](#). On a control configured pump, connect plug PL1 (13) to the backing-pressure interlock switch through the screw terminals. Alternatively, if you use another form of interlock (for example, an inlet valve actuation interlock) connected directly to your control equipment, link pins 1 and 4 in the plug to ensure that the interlock is permanently on.

3.7.4 Thermal snap-switch connections (unconfigured pumps only)



WARNING

You must connect the outputs of the thermal snap-switches to switch off the electrical supply to the pump if any of the thermal snap-switches open. If you do not, the pump may overheat and be damaged and the pump fluid may undergo thermal breakdown.

Refer to [Figure 5](#). As supplied:

- The two normally closed boiler protection thermal snap-switches are wired in series and are connected to terminals 1 and 2 on terminal block TS01 (10).
- The three cooling-fail thermal snap-switches are wired in series and are connected to terminals 3 and 4 on terminal block TS01 (10).

You must connect these two circuits in series to your control equipment, in order to shut down the pump if any of the thermal snap-switches open.

If you use a backing-pressure interlock switch, you must wire the switch in series with the thermal snap-switches.

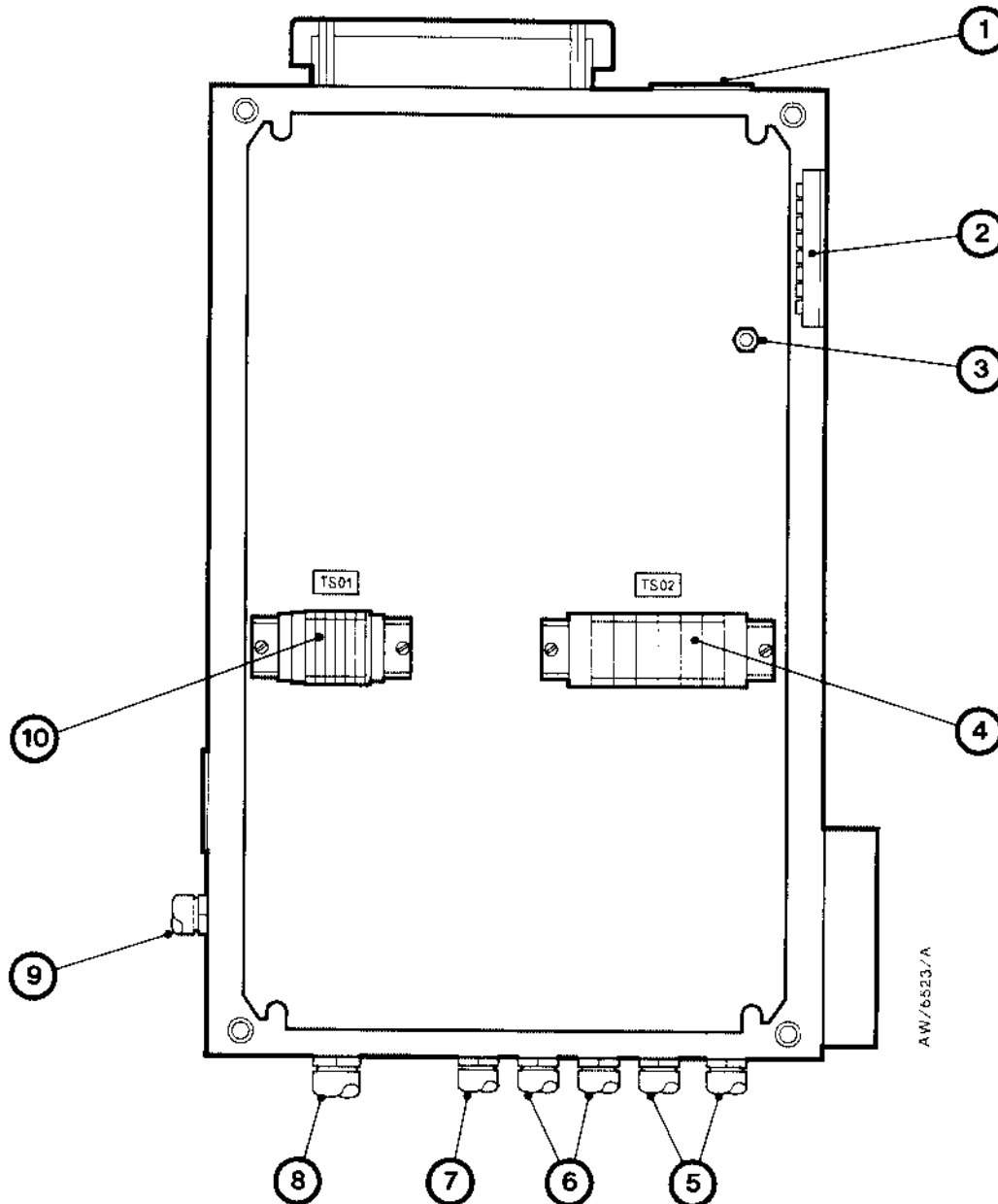
After you have connected the thermal snap-switches (and the backing-pressure interlock, if used), close and lock the front door of the control-box.

3.8 Fill the pump with fluid

3.8.1 Safety of vapour pump fluids

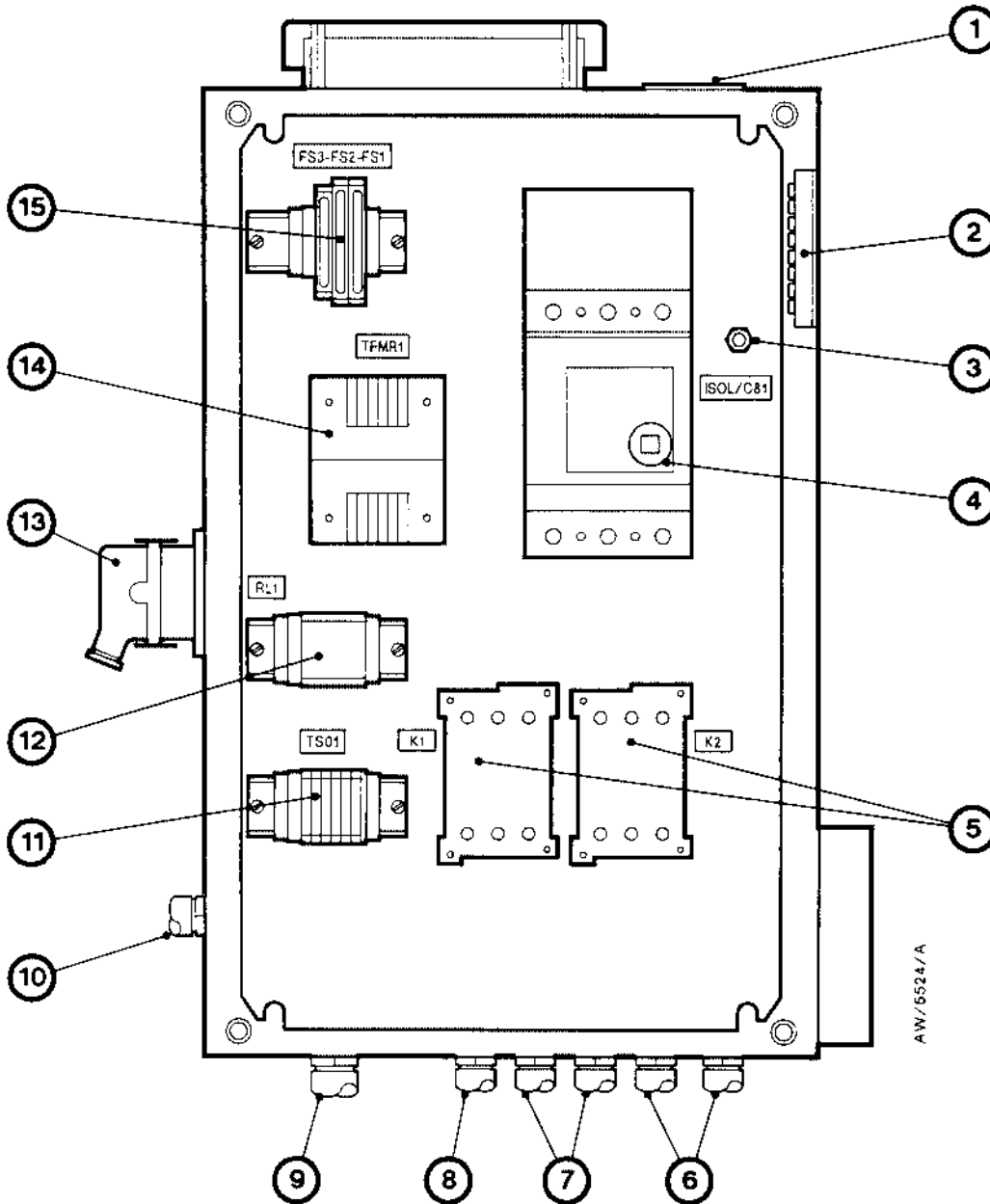
Vapour pump fluids are not dangerous when used in a pump that is operated correctly. But if the pump is operated incorrectly and is allowed to get to very high-temperatures, the pump fluid can go through a process of thermal breakdown. The breakdown products which result can be dangerous. [Table 2](#) gives more information about the thermal breakdown of the different vapour pump fluids. Thermal breakdown is more likely to occur if the breakdown temperature is close to the operating temperature of your pump.

Figure 5 - Interior of the control-box: unconfigured pumps



- | | |
|----------------------------------|---|
| 1. Electrical supply gland plate | 7. Conduit (to frame earth (ground) stud) |
| 2. Earth (ground) block | 8. Conduit (to boiler protection thermal snap-switches) |
| 3. Chassis earth (ground) stud | 9. Conduit (to cooling-fail thermal snap-switches) |
| 4. Terminal block TS02 | 10. Terminal block TS01 |
| 5. Conduits (to terminal box) | |
| 6. Conduits (to terminal box) | |

Figure 6 - Interior of the control-box: control configured pumps



- | | |
|---|---|
| 1. Electrical supply gland plate | 9. Conduit (to boiler protection thermal snap-switches) |
| 2. Earth (ground) block | 10. Conduit (to cooling-fail thermal snap-switches) |
| 3. Chassis earth (ground) stud | 11. Terminal block TS01 |
| 4. Electrical supply isolator/circuit breaker | 12. Relay RL1 |
| 5. Contactors K1 and K2 | 13. Plug PL1 |
| 6. Conduits (to terminal box) | 14. Transformer TFMR1 |
| 7. Conduits (to terminal box) | 15. Fuses F1 to F3 |
| 8. Conduit (to frame earth (ground) stud) | |

Table 2 - Vapour pump fluid thermal breakdown

| Vapour pump fluid | Edwards product | Auto-ignition temp. °C | Break-down temp. °C | Thermal breakdown products | Type of danger | Possible injury |
|---|----------------------------------|------------------------|---------------------|--|--|--|
| Silicone fluids (methyl phenyl siloxanes) | DC 702, DC704 EU, DC 705 | ≈ 500 | 400 | Decomposed hydrocarbons and silicon based species | Negligible | Negligible |
| Alkyl naphthalene fluid | Edwards L9 | 370 | ≈ 300 | Naphthalene and decomposed hydrocarbons | Naphthalene is poisonous in large quantities by ingestion and skin contact | Minor (first aid may be required) |
| Polyphenyl ether (5-ring) | Santovac 5 | 590 | ≈ 460 (in helium) | Phenol, benzene & phenolic materials | Phenolic materials are poisonous and caustic by ingestion and skin contact | Major (a lost time accident can occur) |
| Paraffinic fluids & ester fluids | Apiezon A, B, C, AP201 and AP301 | ≥ 305 | < 300 (in air) | Decomposed hydrocarbons | Fire (Note: AP201 has a low auto-ignition temperature) | Major (a lost time accident can occur) |
| Perfluoro-polyether | None | None | > 260 | Decomposed fluorocarbons including hydrofluoric acid | Highly aggressive materials. Poisonous and caustic by inhalation and skin contact. | Potentially fatal |

3.8.2 Recommended pump fluid



WARNING

Do not use perfluoropolyether (PFPE) pump fluid in the 30B5M pump. The thermal breakdown temperature of PFPE fluids is near the operating temperature of the 30B5M. The thermal breakdown products of PFPE fluid are very dangerous.

We recommend that you use Apiezon AP201 fluid in the 30B5M pump. The thermal breakdown products of this fluid can be dangerous; details of the breakdown products are given in [Table 2](#). The pump has a protection system which prevents the pump from reaching temperatures at which this thermal breakdown takes place.

3.8.3 Filling procedure



WARNING

Do not admit air into the pump through the dipstick assembly or any other port until the pump has cooled to room temperature. AP201 fluid has a low auto-ignition temperature and could catch fire if air is admitted. Also, if the pump is hot, expansion of the admitted air may cause hot pump fluid to be ejected through the dipstick assembly or other open ports.

Use the best fluid for your application. If the 30B5M pump already contains traces of pump fluid, you must refill it with the same type of fluid. If it is necessary to use a different fluid, you must clean the 30B5M pump thoroughly before you fill it with a different fluid.

Fill the pump with fluid as described below.

1. If necessary, isolate the pump from the electrical supply, allow it to cool for at least five hours, then open it to atmospheric pressure.
2. Refer to [Figure 1](#). Remove the dipstick (25) from the fluid-return pipe (22).
3. Use a funnel to pour the correct quantity of fluid into the pump through the fluid-return pipe; the correct quantity of fluid is given in [Section 2](#).
4. Allow the fluid to drain into the pump for five minutes.
5. Use the dipstick to check the level of fluid. When you remove the dipstick, residual fluid from the sides of the fluid-return tube will be on the dipstick. Make sure that you do not confuse the actual fluid-level in the boiler with the level indicated by this residual fluid.
6. If the fluid-level is low, pour more fluid into the pump. If the fluid-level is too high, remove the drain-plug (21), drain the excess fluid from the pump, then refit the drain-plug.
7. When the fluid-level is correct, replace the dipstick.

3.9 EMC commissioning

After installation of the 30B5M, you must test the complete installation to ensure that it complies with your relevant EMC standards.

4 Operation

4.1 Introduction



WARNING

Do not touch any part of the 30B5M pump when it is switched on. Avoid contact between the pump and combustible materials, plastic materials and electrical cables. Surfaces of the pump are very hot and can cause injury to people and damage to equipment.



WARNING

If the cooling-water supply fails during operation, steam or water may be ejected from the couplings if they are disconnected.



WARNING

The pump must be run with the side panels fitted. The panels are an essential part of the safe thermal management of the pump. Removal of the panels could cause the thermal trips to function incorrectly and the pump boiler to overheat and implode.

In the following sections we assume that the 30B5M pump will be used in conjunction with a pumping system as shown in [Figure 7](#). Unless otherwise stated, item numbers in brackets in the following sections refer to the components of the pumping system in [Figure 7](#).

The pumping system shown in [Figure 7](#) has a holding pump (item 11). If your vacuum system is not large, and rough pumping does not take a long time, you may not need a holding pump.

Always obey the following rules when you operate the pump:

- Always turn on the cooling-water supply before you switch on the pump; if you do not, the pump may overheat.
- Always allow the pump boiler to cool to 100 °C before you turn off the cooling-water supply.
- Never allow the pressure at the inlet of the pump to rise above 1300 mbar (1.3×10^5 Pa) when the pump is at operating temperature.
- When the pump is at operating temperature, never allow the backing pressure to rise above the critical backing pressure for the fluid used.
- Always allow the pump to cool before the pump-inlet and backing pressures are allowed to rise above their critical values.

4.2 Check the insulation resistance of the heaters

If the pump heaters have absorbed moisture while the pump was switched off, the insulation resistance of the heaters may be too low. Use the following procedure to measure the insulation resistance of the heaters before you switch the pump on.

If you have an RCCB in your electrical supply circuit, you do not need to measure the insulation resistance of the heaters, because the RCCB will operate to disconnect the electrical supply from the the pump if the insulation resistance is too low.

If your RCCB has operated, use the following procedure to check the insulation resistance of the heaters before you reset the RCCB.

1. Measure the insulation resistance (at 500 V d.c.) between any of the heater terminals (Figure 1, items 13) and earth (ground). Then:
 - If the insulation resistance per heater is greater than 1 M Ω , you can switch on the pump.
 - If the insulation resistance per heater is less than 1 M Ω , continue at Step 2 below.
2. Remove the heaters from the pump (refer to Section 5.7). Bake the heaters in an oven at a temperature of 120 °C for 12 hours or more.
3. Remove the heaters from the oven. Measure the insulation resistance of each heater:
 - If a heater has an insulation resistance greater than 1 M Ω , you can refit the heater to the pump.
 - If a heater has an insulation resistance less than 1 M Ω , repeat Steps 2 and 3 of this procedure. If the insulation resistance of a heater is less than 1 M Ω after the heater has been baked for 24 hours, then the heater is faulty and you must replace it with a new heater.

4.3 Pump start-up

Note: *If you do not have an RCCB in your electrical supply circuit, you must check the insulation resistance of the heaters as described in Section 4.2 before you switch on the pump.*

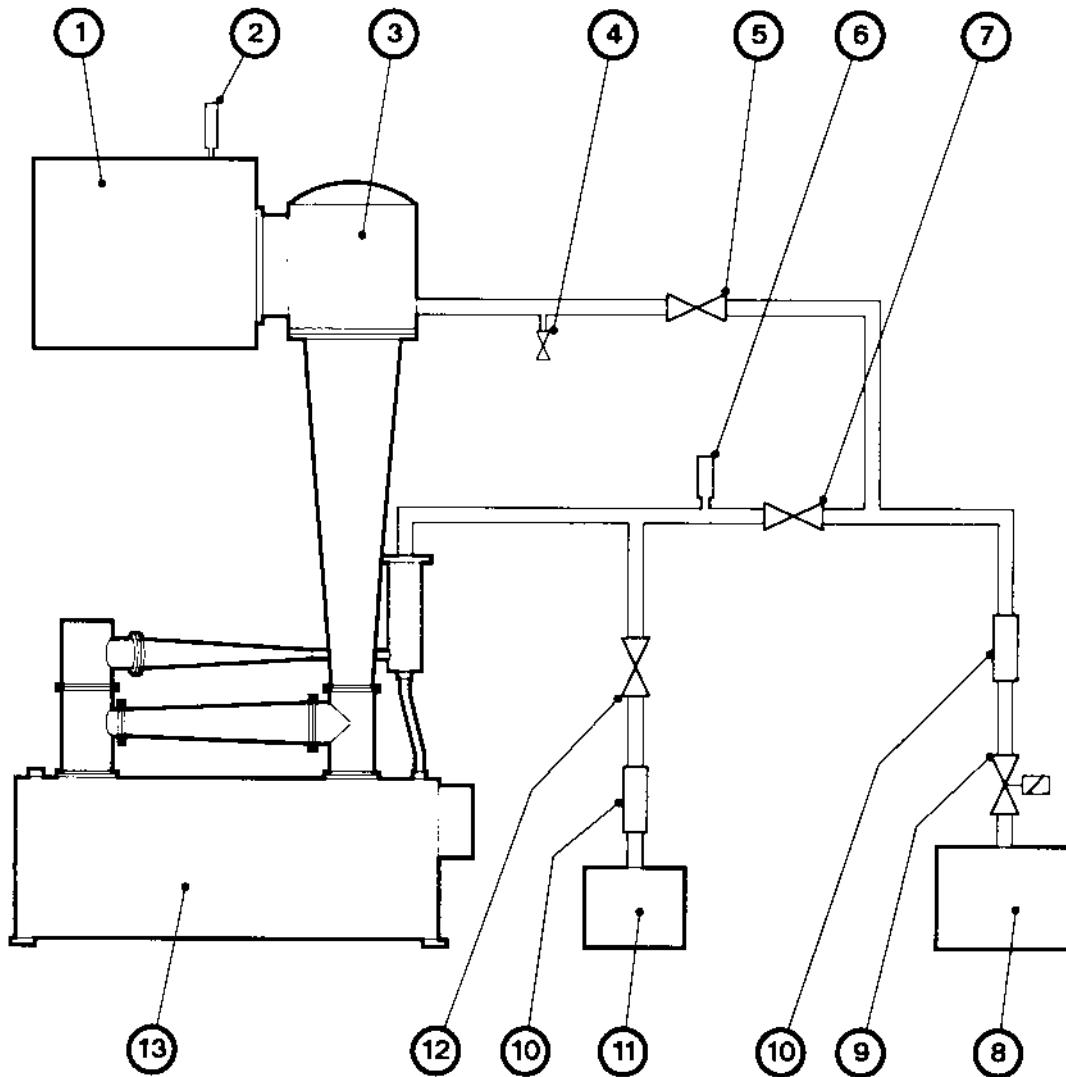
The following procedure is recommended when the pump and your vacuum system are at atmospheric pressure.

1. Refer to Figure 7. Close the vacuum system isolation-valve (3) and the vacuum system air-admittance valve (4). Close any other openings to atmospheric pressure.
2. Switch on the cooling-water supply to the 30B5M pump.
3. Switch on the holding pump (11, if fitted), then switch on the backing pump (8).
4. Open the holding valve (12, if fitted), then open the backing valve (7).
5. On unconfigured pumps, when the backing pressure reaches 10 mbar (1×10^3 Pa) or lower, switch on the electrical supply to the pump heaters. Initially, the backing pressure will increase due to the outgassing of the pump fluid. Continue at Step 8.

On control configured pumps, continue at Step 6.

6. Refer to Figure 2. Ensure that the Heater Power switch on the control-box (3) is in the off position and then use the isolator (4) to switch on the electrical supply to the pump.
7. When the backing pressure reaches 10 mbar (1×10^3 Pa) or lower, press the Power Enable switch (Figure 2, item 1) and make sure that the Power Enable lamp (Figure 2, item 2) goes on. Then, move the Heater Power switch (Figure 2, item 3) to the Full position. Initially, the backing pressure will increase due to the outgassing of the pump fluid.
8. Allow the pump to warm-up for about 1 hour so that it reaches its operating temperature.
9. Check that the backing pressure is below the critical value for the pump fluid being used, then close the backing valve (7) and open the roughing valve (5).
10. When a system pressure of less than 2 mbar (2×10^2 Pa) is reached, close the roughing valve (5) and the holding valve (12, if fitted), open the backing valve (7) and open the vacuum system isolation valve (3) to start fine pumping using the 30B5M.

Figure 7 - Typical pumping system



AW/5620/A

- | | |
|---------------------------------|---------------------------------|
| 1. Vacuum system | 8. Backing pump |
| 2. Vacuum system pressure gauge | 9. Backing pump isolation valve |
| 3. Isolation valve | 10. Flexible pipeline |
| 4. Air-admittance valve | 11. Holding pump |
| 5. Roughing valve | 12. Holding valve |
| 6. Backing pressure gauge | 13. 30B5M pump |
| 7. Backing valve | |

4.4 Adjust the boiler protection thermal snap-switches

CAUTION

Ensure that the boiler protection thermal snap-switches are correctly adjusted when the pump is fully charged with fluid and under vacuum. If they are not, the pump may overheat and the boiler may implode.

As supplied, the boiler protection thermal snap-switches (Figure 1, item 12) are set to operate to shut down the pump when the boiler temperature reaches 250 °C. If you need to adjust the snap-switches to operate at a different temperature, use the following procedure. You must adjust the thermal snap-switches when the pump is fully charged with fluid, is at operating temperature and is under vacuum; if you do not, the snap-switches may not operate at the correct temperature, and the pump may overheat.

1. Remove the boiler end-cover at the control-box end of the pump.
2. Refer to Figure 8. Loosen the locking screw (3) on the snap-switch.
3. Slowly turn the temperature set-screw (2) clockwise until the snap-switch just trips open; the pump will then automatically shut down.
4. Turn the set-screw anticlockwise again by $\frac{3}{4}$ of turn (270°); one complete anticlockwise revolution of the screw (in the direction of the arrow, 4) is equivalent to an increase in the operating temperature of approximately 40 °C.
5. When you have set the snap-switch, tighten the locking screw (3).
6. Refit the boiler end-cover.
7. Restart the pump: refer to Section 4.5.
8. Remove the boiler end-cover at the drain-plug end of the pump.
9. Adjust the other thermal snap-switch: use the method in Steps 2 to 7.

4.5 Pump start-up after over-temperature shut-down

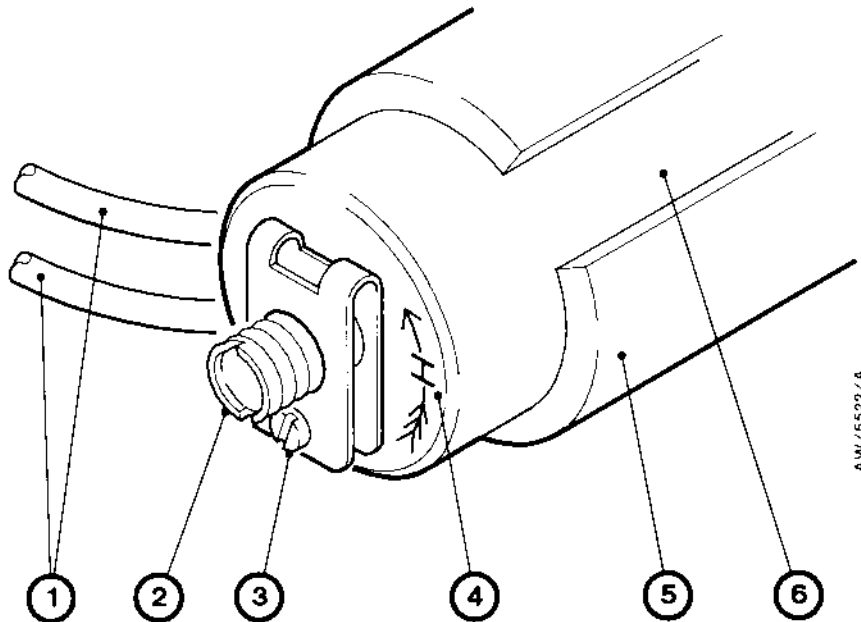
If the pump has been shut-down automatically because of an over-temperature fault (that is, the thermal snap-switches have operated to switch off the electrical supply to the heaters), you must manually restart the pump. Use the following procedure:

1. Allow the pump to cool down to its normal operating temperature.
2. On unconfigured pumps, switch on the electrical supply to the pump.

On control configured pumps:

- Press the Power Enable switch on the control-box (Figure 2, item 1) and make sure that the Power Enable lamp (Figure 2, item 2) goes on.
- Set the Heater Power switch (Figure 2, item 3) to the required operating mode (half-heat or full-heat)

Figure 8 - Adjust the boiler protection thermal snap-switches



1. Electrical wires
2. Temperature set-screw
3. Locking screw
4. Arrow
5. Mounting sleeve
6. Snap-switch body

4.6 Selection of half-heat and full-heat modes (control configured pumps only)

To select the half-heat or the full-heat facility at any time, move the Heater Power switch (Figure 2, item 3) to the required position.

4.7 Readmission of air to your vacuum system

WARNING



Do not admit air into the pump through the dipstick assembly or any other port until the pump has cooled to room temperature. AP201 fluid has a low auto-ignition temperature and could catch fire if air is admitted. Also, if the pump is hot, expansion of the admitted air may cause hot pump fluid to be ejected through the dipstick assembly or other open ports.

1. Close the vacuum system isolation valve (3), close the roughing valve (5) and open the backing valve (7) and the holding valve (12, if fitted).
2. Open the vacuum system air-admittance valve (4).

4.8 Re-evacuation of your vacuum system

1. Close the vacuum system air-admittance valve (4) and any other openings to atmospheric pressure.
2. Close the backing valve (7) and open the roughing valve (5) and holding valve (12, if fitted).
3. When a system pressure of less than 2 mbar (2×10^2 Pa) is reached, close the roughing valve (5) and the holding valve (12, if fitted) and open the backing valve (7).
4. Open the vacuum system isolation valve (3).

4.9 Pump shut-down

As described in [Section 1.8](#), when the pump is switched off, the heaters in the pump will absorb moisture: this will cause a decrease in the insulation resistance of the heaters. To avoid the absorption of moisture when the pump is in an environment of high ambient humidity, we recommend that you maintain the pump boiler temperature at a temperature between 20 and 30 °C above ambient temperature. Ensure that the boiler does not get too hot; if it does, the pump fluid may vaporise and contaminate the vacuum system.

The following method of shut-down ensures that the 30B5M pump is left evacuated and prevents absorption of air by the pump fluid.

When you subsequently start-up, evacuate the system to a pressure of about 10 mbar (1×10^3 Pa) through the backing valve before you switch on the 30B5M heaters.

1. Refer to [Figure 7](#). Close the vacuum system isolation valve (3).
2. On an unconfigured pump, switch off the electrical supply to the pump. On a control configured pump, move the Heater Power switch ([Figure 2](#), item 3) to the off position.
3. Leave the pump to cool down for at least four hours; the backing pump must be left switched on throughout this time.
4. After the cool-down period, close the backing valve (7).
5. Open the backing pump air-admittance valve and switch off the backing pump (8). If you do not admit air to the backing pump, backing pump oil may be drawn into the backing pipeline.
6. Turn off the cooling-water supply when the boiler temperature falls to 100 °C.
7. If required, open the vacuum system air-admittance valve (4) to admit air into the system.

5 Maintenance

5.1 Safety



WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

- A suitably trained and supervised technician must maintain the pump.
- Isolate the pump from the electrical supply and your vacuum system before you start maintenance.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the pump fluid and the products pumped. Wear the appropriate safety-clothing when you come into contact with contaminated components. Dismantle and clean contaminated components inside a fume-cupboard.
- Allow the pump to cool for at least three hours before you touch any part of the pump.
- Allow the pump boiler to cool to 100 °C before you turn off the cooling-water supply.
- Do not remove the dipstick or open the drain-plug to vent the pump while the pump is operating or under vacuum.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present if the pump has been overheated to 315 °C and above. These breakdown products are very dangerous. Fluorinated materials in the pump include seals and 'O' rings. The pump may have overheated if it was misused, if it malfunctioned, or if it was in a fire. Edwards Material Safety Data Sheets for fluorinated materials used in the pump are available on request: contact your supplier or Edwards.
- Do not use abrasive or reactive chemical substances to clean the pump.
- Do not use solvents to clean 'O' rings.

5.2 Maintenance plan



WARNING

Regular oil level checks should be carried out Low oil level could cause the pump to overheat and the boiler to implode. Ensure the thermal trips are connected correctly.

The plan shown in [Table 3](#) lists the maintenance operations necessary to maintain the 30B5M pump in normal use. Instructions for each operation are given in the section shown.

More frequent maintenance may be required if the pump has been used to process corrosive or abrasive gases and vapours. If necessary, adjust the maintenance plan according to your experience.

Table 3 - Maintenance plan

| Operation | Frequency | Refer to Section |
|---|-------------|------------------|
| Check the pump fluid-level | Weekly | 5.3 |
| Clean the fluid-return pipes and boiler | As required | 5.4 |
| Inspect the pump fluid (drain if necessary) | As required | 5.5 |
| Inspect and clean the pump | Monthly | 5.6 |
| Replace a heater | As required | 5.7 |

5.3 Check the pump fluid-level

If the pump boiler operates at a higher than normal temperature, check the level of fluid in the pump as described below.

1. Isolate the pump from the electrical supply, allow it to cool for at least four hours, then open it to atmosphere.
2. Refer to [Figure 1](#). Use the dipstick (25) to check the level of fluid. When you remove the dipstick, residual fluid from the sides of the fluid-return pipe will be on the dipstick. Make sure that you do not confuse the fluid-level in the boiler with the level indicated by this residual fluid.
3. If there is a high level of residual fluid on the dipstick, this indicates that there may be a blockage in the fluid-return pipes and you must clean the fluid-return pipes and boiler as described in [Section 5.4](#). If there is not a high level of residual fluid, continue at Step 4 below.
4. If the fluid-level in the boiler is low, pour more fluid into the pump. If the fluid-level is too high, remove the drain-plug (21) and drain the excess fluid.
5. When the fluid-level is correct, check the dipstick 'O' ring. If the 'O' ring is damaged or thermal set has taken place, replace the 'O' ring. Refit the dipstick.
6. Reconnect the pump to the electrical supply as described in [Section 3](#).

5.4 Clean the fluid-return pipes and boiler

5.4.1 Introduction

When you clean the pump, choose the cleaning solution to suit the type of pump fluid that has been used.

After you have cleaned the pump or any components, wash the components again with acetone to remove all traces of the cleaning solution. Bake to 77 °C to remove the acetone; alternatively, pass warm air over the pump or components.

5.4.2 Clean the fluid-return pipes

Refer to [Figure 1](#) and use the following procedure to clean the fluid-return pipes.

1. Make sure that the pump is isolated from the electrical supply, is cool and is open to atmospheric pressure.
2. Remove the dipstick (25).
3. Place a suitable container under the fluid drain-plug (21) or connect a pipe (leading to a suitable container) to the drain connection.
4. Open the drain-plug and allow the fluid to drain out of the pump. Dispose of the fluid safely (see [Section 6](#)).
5. Remove the boiler end-covers and the isolator mounting-plate.
6. Remove the fluid-return pipe union blanks (23).
7. Clean the upper fluid-return pipes with a flexible drain cleaner.
8. Undo the knurled securing-ring at each end of the upper fluid-return pipe (8) connected between the backing-condenser (4) and the boiler (19). Remove the fluid-return pipe.
9. Use a suitable tool to clean the fluid-return pipe removed in Step 8 (8) and the fluid-return pipe which is still on the pump.
10. Replace all of the 'O' rings and seals on the items removed in Steps 2 to 9.
11. Use the knurled securing-rings removed in Step 8 to refit the upper fluid-return pipe (8).

12. Refit the fluid-return pipe union blanks (23).
13. Clean the boiler as described in [Section 5.4.3](#).

5.4.3 Clean the boiler

Note: This procedure ensures that you will only need to clean the complete pump at long intervals. The procedure assumes that you have just cleaned the fluid-return pipes as described in [Section 5.4.2](#).

1. Flush a suitable solvent (refer to [Section 5.4.1](#)) through the fluid-return pipes to loosen any deposits in the pump boiler, then use suitable tools to remove the loosened deposits from the boiler. Dispose of the deposits and solvent safely (see [Section 6](#)).
2. Repeat Step 1 as necessary until the boiler is clean.
3. Refit the isolator mounting-plate and the boiler end-covers.
4. Refit the fluid drain-plug (21) and refill the pump with fluid as described in [Section 3.8](#). Refit the dipstick (25).
5. Make sure that all traces of the cleaning solution used have been removed (see [Section 5.4.1](#)), then reconnect the pump to the electrical supply.

5.5 Inspect and drain the pump fluid

If the pump fails to give satisfactory performance on a leak-tight system, inspect the condition of the pump fluid. Use the following procedure.

1. Switch off the pump, allow the pump to cool for at least four hours, then open it to atmosphere.
2. If the pump is cold, switch on the pump heaters for a maximum of two minutes to warm the pump fluid. Do not vaporise the pump fluid.
3. Isolate the pump from the electrical supply and disconnect it from your vacuum system.
4. Open the drain-plug ([Figure 1](#), item 25) and drain a quantity of fluid into a suitable container.
5. If the pump fluid is badly discoloured, the fluid has deteriorated and you must change it; continue at Step 6 below. If the fluid is in a satisfactory condition, refill the pump as detailed in [Section 3.8](#).
6. Inspect and clean the pump as detailed in [Section 5.6](#).

5.6 Inspect and clean the pump

5.6.1 Dismantle the pump

Refer to [Figure 1](#) and dismantle the pump as described below.

1. Drain the fluid from the pump as described in [Section 5.5](#).
2. Disconnect the pump from the vacuum system isolation-valve.
3. Remove the 'O' ring and the guard-ring (2) from the pump inlet-flange (1).
4. Disconnect the braces which support the jet-stage cone (32) and the backing-condenser (4).
5. Disconnect the bottom flange of the jet-stage cone (32) from the pump.
6. Lift the jet-stage cone (32) and disconnect the vapour tube (6) from the T-tube.
7. Remove the vapour tube (6) and jet assembly (3) through the inlet-flange (1), then remove the jet-stage cone (32).

8. Undo the knurled securing-ring at each end of the upper fluid-return pipe (8) connected between the backing-condenser and the boiler. Remove the fluid-return pipe.
9. Remove the second ejector-stage (29) and backing-condenser (5) from the ejector-stage T-tube (24).
10. Remove the second ejector-stage jet (28). Unscrew and remove the elbow from the ejector-stage T-tube (24).
11. Remove the upper ejector-stage vapour tube (26).
12. Remove the first ejector-stage cone (30) from the T-tube at each end.
13. Remove the T-tube (24) from the dipstick end of the pump.
14. Unscrew and remove the first ejector-stage jet (9).
15. Remove the remaining T-tube on the pump.

5.6.2 Clean the pump

1. Clean the fluid-return pipes and the boiler as described in [Section 5.4](#).
2. Wash the other components of the pump (that is, the body of the pump and the components removed in [Section 5.6.1](#)) with the selected cleaning solution (refer to [Section 5.4.1](#)).
3. Wash again with acetone to remove all traces of the cleaning solution. Bake to 77 °C to remove the acetone. Alternatively, pass warm air over the components and the pump interior.

5.6.3 Reassemble the pump

Refer to [Figure 1](#) and reassemble the pump as described below. When you reassemble the pump:

- Inspect all 'O' rings and seals for damage or deterioration and replace them if they are defective.
 - Check that all sealing-faces are free from scratches and other damage. Refinish surfaces that are scratched.
1. Refit the two T-tubes to the pump. Do not fully tighten the bolts which secure the T-tubes.
 2. Refit the first ejector-stage jet (9).
 3. Refit the first ejector-stage cone (30) to the two T-tubes. Tighten the bolts which secure the two T-tubes.
 4. Refit the second ejector-stage upper vapour tube (26).
 5. Refit the elbow on the second ejector-stage T-tube (26) and refit the second ejector-stage jet (28).
 6. Refit the second ejector-stage cone (29) and backing-condenser (4) to the ejector-stage T-tube (24).
 7. Use the knurled rings at each end to refit the fluid-return pipe (8) to the boiler and the backing-condenser (4).
 8. Place the jet-stage cone (32) in position over the T-tube.
 9. Lift the jet-stage cone (32), then lower the vapour tube and jet-stage assembly (3) through the inlet-flange (1). Connect the vapour tube (6) to the T-tube.
 10. Connect the bottom flange of the jet-stage cone (32) to the T-tube.
 11. Refit the braces which support the jet-stage cone (32) and the backing-condenser (4).
 12. Refit the guard-ring (2) and the 'O' ring to the pump inlet-flange (1).
 13. Connect the inlet-flange to the high vacuum isolation-valve.
 14. Refill the pump with fluid as described in [Section 3.8](#).
 15. Reconnect the pump to the electrical supply.

5.7 Replace a heater



WARNING

Do not allow anti-seize compound to come into contact with electrical cables. If you do, the cables may be damaged and there may be a risk of electric shock.

Use the following procedure to replace a heater.

1. Switch off the 30B5M pump, allow it to cool, then open it to atmosphere.
2. Isolate the pump from the electrical supply and disconnect the pump electrical supply cable from the electrical supply.
3. Remove the lower boiler end-cover at the control-box end of the pump. Remove one of the boiler side-covers (Figure 1, item 16).
4. Remove the thermal insulation at each end of the boiler.
5. Remove the heater terminals and the faulty heater(s).
6. Fit the new heater(s).
7. Lightly coat the threads of the heater terminals with a high-temperature anti-seize compound, then refit the heater terminals.
8. Refit the thermal insulation to each end of the boiler.
9. Refit the boiler side-cover and the lower boiler end-cover.
10. Reconnect the electrical supply cable to the electrical supply.

5.8 Fault finding

Table 4 - Fault finding

| Symptom | Check | Action |
|----------------------------------|---|---|
| Ultimate pressure is poor. | <p>Is there a leak in the vacuum system (real or virtual)?</p> <p>Is the vacuum system dirty?</p> <p>Is the pump fluid contaminated?</p> <p>Is the heat input high or low?</p> <p>Is the cooling inadequate?</p> <p>Is the backing pressure too high?</p> <p>Is the backing pump performance poor?</p> <p>Has the pump fluid undergone thermal breakdown?</p> | <p>Locate and seal the leak.</p> <p>Clean the vacuum system.</p> <p>Inspect the pump fluid. If necessary, clean the pump and refill the pump with fluid.</p> <p>Check that the electrical supply voltage is correct. Check the heaters for the correct power rating, electrical continuity and poor thermal contact. If necessary, replace heaters.</p> <p>Check that the cooling-water supply temperature and flow are correct.</p> <p>Check for a leak in the backing pipeline and seal any leak found.</p> <p>Check that the backing pump is suitable to back the 30B5M. Check that the pump operates correctly; if necessary, rectify any defect found.</p> <p>Inspect the pump fluid. If necessary, clean the pump and refill the pump with fluid.</p> |
| There are inlet pressure surges. | <p>Is the heater input correct?</p> <p>Is the fluid outgassing?</p> <p>Is there a leak in the vacuum system ahead of the 30B5M pump inlet?</p> <p>Is there a trapped volume in the vacuum system?</p> <p>Have 'O' rings or other seals been excessively lubricated?</p> <p>Is there too much fluid in the pump?</p> | <p>Check that the electrical supply voltage is correct. Check the heaters for the correct power rating, electrical continuity and poor thermal contact. If necessary, replace heaters.</p> <p>Inspect the pump fluid. If necessary, clean the pump and refill the pump with fluid.</p> <p>Check for a leak and seal any leak found.</p> <p>Eliminate the trapped volume.</p> <p>Inspect the 'O' rings and other seals. Clean off excessive lubrication, or replace the seals.</p> <p>Drain the excess fluid from the pump</p> |

6 Storage and disposal

6.1 Storage

Use the procedure below to store the pump:

1. Shut down the pump as described in [Section 4](#).
2. Isolate the pump from the electrical supply, disconnect it from the vacuum system and drain the pump fluid as described in [Section 5](#).
3. Dismantle, clean and reassemble the pump as described in [Section 5](#). Do not refill the pump with fluid.
4. Place protective covers over the inlet and outlet-flanges and the cooling-water connection points.
5. Where possible, store the pump in cool dry conditions until it is required for use. When required, prepare and install the pump as described in [Section 3](#).

6.2 Disposal

Dispose of the 30B5M pump and any components removed from it safely in accordance with all local and national safety and environmental requirements.

Take particular care with the following:

- Components which have come into contact with pump fluid.
- Fluoroelastomers which may have been subjected to temperatures above 260 °C (see [Section 5](#)).
- Components which have been contaminated with dangerous process substances.

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7 Service and spares

7.1 Introduction

Edwards products, spares and accessories are available from Edwards companies in Belgium, Brazil, Canada, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, Switzerland, United Kingdom, U.S.A, and a world-wide network of distributors. The majority of these centres employ Service Engineers who have undergone comprehensive Edwards training courses.

Order spare parts and accessories from your nearest Edwards company or distributor. When you order, please state for each part required:

- Model and Item Number of your equipment
- Serial number (if any)
- Item Number and description of part.

7.2 Service

Edwards products are supported by a world-wide network of Edwards Service Centres. Each Service Centre offers a wide range of options including: equipment decontamination; service exchange; repair; rebuild and testing to factory specifications. Equipment which has been serviced, repaired or rebuilt is returned with a full warranty.

Your local Service Centre can also provide Edwards engineers to support on-site maintenance, service or repair of your equipment.

For more information about service options, contact your nearest Service Centre or other Edwards company.

7.3 Spares

| Spare | Item Number |
|---------------------------------------|-------------|
| Inlet 'O' ring, VIT0135 | H021-06-259 |
| Outlet 'O' ring, VIT0441 | H021-06-083 |
| Apiezon AP201 fluid (20 litres) | H026-01-052 |
| Spares kit | B064-04-800 |
| Heater (1.25 kW) | |
| 115 V (for B064-07/8-200) | H017-02-021 |
| 127 V (for B064-07/8-220) | H017-02-022 |
| 220 V (for B064-07/8-380) | H017-02-023 |
| 230 V (for B064-07/8-400) | H017-02-024 |
| 240 V (for B064-07/8-415) | H017-02-025 |
| 254 V (for B064-07/8-440) | H017-02-026 |
| 265 V (for B064-07/8-460) | H017-02-027 |
| 277 V (for B064-07/8-480) | H017-02-028 |
| Cooling-fail thermal snap-switch | B023-02-000 |
| Boiler protection thermal snap-switch | B064-01-113 |

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8 Engineering diagrams

The circuit diagrams for the control configured and unconfigured 30B5M pumps are shown in Figure 9 and 10.

Figure 9 - Circuit diagram for control configured pumps

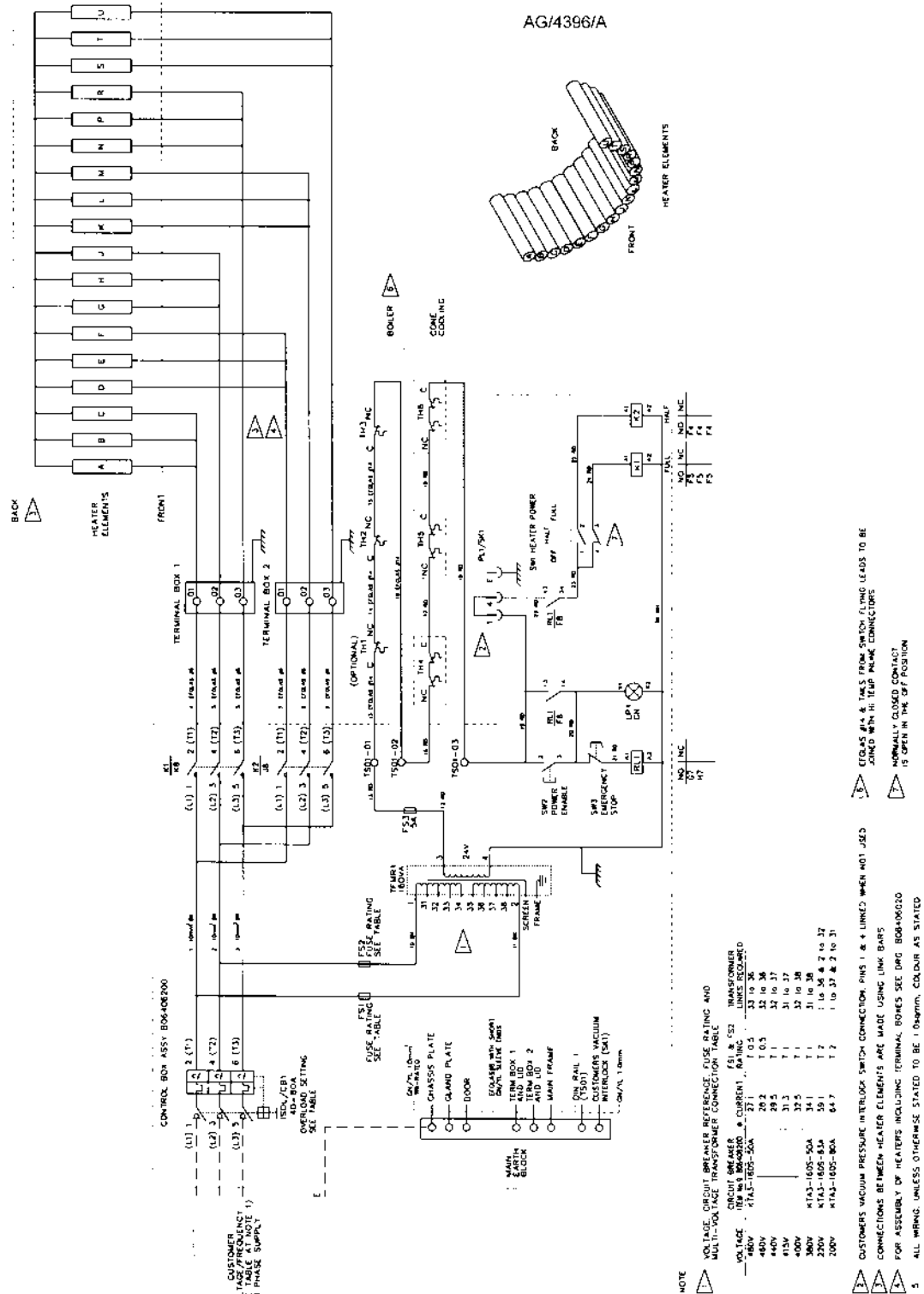
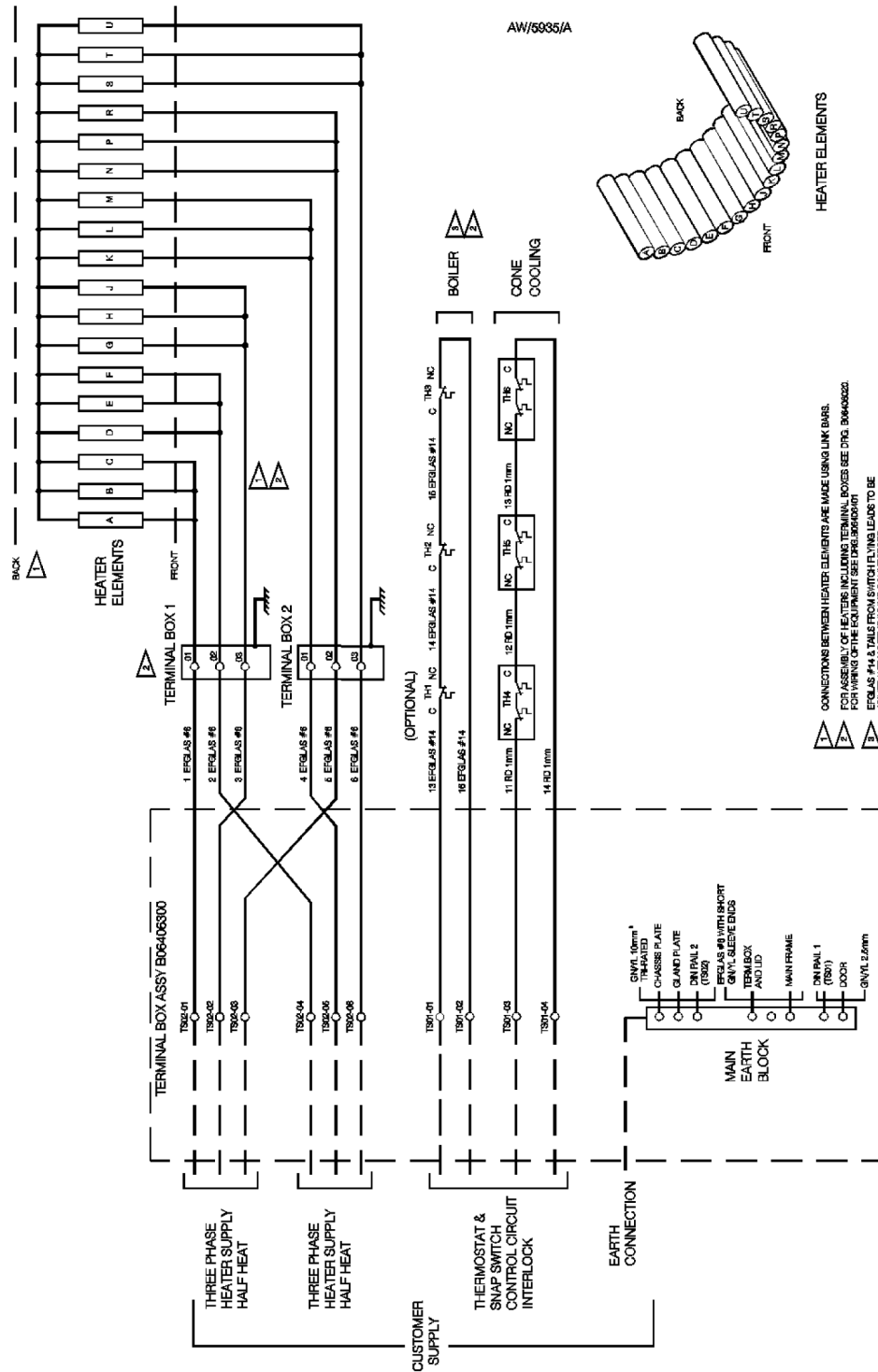


Figure 10 - Circuit diagram for unconfigured pumps



Appendix A1 Annual Overhaul

A1.1 Introduction

This Appendix describes in detail the procedure for an annual overhaul of the 30B5 vapour booster pump.

It is recommended that the 30B5 be overhauled annually, however if the pump is used in harsh/dirty conditions, then reduce this time interval.

A1.2 Pump Cleaning

A1.2.1 Boiler cleaning

Through normal use, dust and process by-products will move through the pump body and settle at the base of the pump boiler. Over a period of time, they will combine with the pump fluid to form a sludge. This sludge prevents the effective heat transfer in to the fluid and must be removed at regular intervals.

1. Refer to [Figure A1](#). Loosen union nut and remove the dipstick (1).
2. Loosen union nut on the drain assembly (2 and Picture A), drain the pump fluid into a suitable container (Nominal fill of pump is 55 l). If there is a significant amount of sludge in the pump boiler, the drain port may become blocked. To unblock the drain port, carefully prod it with a suitable length of rod.
3. When the oil has drained from the boiler, remove the pump drain flange (3 and Picture A) by undoing the 6 x M8 screws.
4. Use a spade (14), that incorporates two radii which match both the boiler and the tube diameter, to clean the base of the boiler. Starting from the drain port, the spade should be used to drag out progressive sections of the boiler sludge until the boiler base is clear.

A1.2.2 Jet stack and baffle clean

Chemical pumping processes can cause the build up of a residue on the hot running jet stack. The jet gaps of the vertical jet stack are all under 1 mm and may become partially blocked by this residue. This will significantly affect the performance of the pump, therefore the assembly should be cleaned at an interval depending on the degree of contamination of the process being run.

1. Refer to [Figure A1](#). Disconnect both the inlet and the outlet flanges of the pump from the vacuum system.
2. Disconnect the supply and return lines from the water couplings of the pump.
3. Either remove the right angle vacuum isolation valve from above the pump, or move the pump away from the vacuum system to give adequate clearance for an overhead crane/hoist.
4. Disconnect the support braces mounted on the main cone (Picture B).
5. Disconnect the 16 mm compression coupling that links the main cone cooling coils to the remainder of the water circuit (Picture B and D).
6. Undo the 4 x M10 fixing bolts of the guard ring, and remove (6 and Picture E).
7. Attach two shackles to the inlet flange holes of the main cone (5) and support the cone by means of an overhead crane/hoist.
8. Remove the 8 x M10 screws that secure the main cone (5) to the pump body (4 and Picture B), and raise the main cone a short distance.
9. Undo the 6 x M6 screws that secure the bottom vapour tube (8) of the jet stack, and from the pump inlet lift out the jet stack as a complete assembly.

10. Dismantle the interior jet stack by unscrewing the top jet cap (10), followed by unscrewing the tie rod (7) from the securing plate.
11. Either clean the components in a degreasing tank, or wipe down the components with a suitable paraffin-based solvent. Pay particular attention to the jet formation areas. If there are solid deposits on the components, remove with an abrasive.
12. Undo the single M6 fixing screw (Picture C) and remove the backing baffle assembly (9) from the backing body of the pump, and follow the same cleaning procedure as above.

A1.2.3 Fluid-return pipework flush out

Whilst the pump is disassembled, it is recommended that the accessible oil return pipework be flushed.

1. Refer to [Figure A1](#). Either pour or spray under pressure a suitable paraffin-based solvent into the backing body (11), and verify that the solvent drains into the boiler without obstruction.
2. Either pour or spray under pressure a suitable paraffin-based solvent into the top of the main tee (12).
3. If the flow of the solvent appears obstructed use a flexible rod to clear the obstruction.

A1.3 Gasket and O-ring renewal

Refer to [Figure A1](#). Where pump or vacuum system joints have been broken, new O-rings must be fitted. These are:

Table A1 - 30B5 O-rings

| O-ring | Product Code |
|--------------------------------|--------------|
| 1" drain port (2) | H021 26 026 |
| Drain flange | H021 26 062 |
| Pump inlet flange (Picture E) | H021 06 259 |
| Pump outlet flange (Picture C) | H021 26 083 |
| Main cone (4) | H021 06 091 |
| Interior gasket (13) | B064 06 146 |

A1.4 Interior re-assembly

1. Before re-assembly, clean the boiler to ensure that no flush through residue remains.
2. Refer to [Figure A1](#). Screw the tie rod (7) into the lower vapour tube (8) of the interior jet stack.
3. Insert the above components into the main cone (5), and hold them in as you slide the main cone over the flange of the main tee (12).
4. Tighten the 6 x M6 screws that fix the lower vapour tube (8).
5. Lower the remaining interior components through the pump inlet.
6. Screw in the top jet cap (10). If there is sufficient overhead clearance, it is recommended that the third jet gap is checked by feeler gauge for uniformity (0.89/1.0 mm).
7. Once the interior jet stack is secure, attach the main cone (5) to the main tee (12).
8. Bolt the guard ring into the pump inlet. When cold, the position of the guard ring should be set so that the bottom edges of the top jet cap and guard ring cones are level (Picture E).

9. Re-assembly of the remainder of the jet stack and baffle is the reverse procedure detailed in section [Section A1.2.2](#).

10. Re-assembly of the boiler is the reverse procedure detailed in section [Section A1.2.1](#).

When recharging the pump, check the condition of the pump fluid. If the fluid is badly discoloured and / or shows evidence of significant oxidisation, it must be renewed.

A1.5 Electrical circuit inspection



WARNING

Ensure that the pump is isolated from its electrical supply before attempting any inspection of the electrical circuit.

The neutral end of the 3-phase electrical Star circuit carries full line current. Prolonged exposure to full line current and high temperature can cause deterioration. It is recommended that the heater links be inspected on regular intervals. If any sign of deterioration or damage is found, the links must be replaced.

Access to the neutral end is gained by removing the radiation shields at the drain port of the boiler, and the end boiler lagging.

Notes: 1. Heater connection strip (short) B064 06 147

2. Heater connection strip (long) B064 06 148

A1.6 Cooling coils de-scale

If your water supply is affected by hardness, the interior surface of the cooling coils will scale over a period of time. It is recommended that the coils be flushed out with a caustic solution of calcium hydroxide, or similar de-scaling agent.

Ensure that the coils are well flushed out with water after carrying out this procedure.

Figure A1 - Sectional view of 30B5

