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Instruction Manual

E-LAB 2 Pumps



Description	Item Number	Description	Item Number
E-LAB 2 Pump, 110-120/220-240 V, 50/60 Hz, single-phase	A652-07-903	E-LAB 2 Pump, 100/200 V, 50/60 Hz, single-phase	A652-07-904
E-LAB 2 Pump, 110-120 V, 50/60 Hz, single-phase	A652-07-906		

Declaration of Conformity

We, BOC Edwards,
Manor Royal,
Crawley,
West Sussex RH10 2LW, UK

declare under our sole responsibility that the product(s)

E-LAB 2 Rotary Vacuum Pumps:

A652-07-903 A652-07-904 A652-07-906

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

EN ISO 12100-2: 2003	Safety of Machinery – Basic Concepts, General Principles for Design.
EN 61010-1: 2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.*
IEC 34 Parts 1, 5, 11: 1991	Central Requirements for Rotating Electrical Machines.
C22.2 No 77: 1998 #	Motors with Inherent Overheating Protection.
C22.2 No 100: 1992 #	Motors and Generators.
C22.2 No 1010.1: 1992 #	Safety Requirements for Electrical Equipment for Measurement Control and Laboratory Use, Part 1: General Requirements.
UL 61010A: 2002 #	Electrical Equipment for Laboratory Use, Part 1: General Requirements.
UL 1004: 1994 #	Electric Motors.
* 1-phase pumps only.	The pumps comply with EN 61010-1 when installed in accordance with the instruction manual supplied with the pumps.
# 1-phase pumps only.	Canadian Standards Authority and Underwriters Laboratory.

following the provisions of

73/023/EEC	Low Voltage Directive.
89/336/EEC	Electromagnetic Compatibility Directive.
98/37/EC	Machinery Safety Directive.

J D Watson

Dr. J. D. Watson, Director of Technology,
Vacuum Equipment and Exhaust Management Product Divisions

6 DECEMBER 2004 Shoreham

Date and Place

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

P200-00-680 ISSUE A

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Associated publications

Publication title — Publication number

Publication title	Publication number
Vacuum pump and vacuum system safety	P300-20-000

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1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards E-LAB 2 Pumps (abbreviated to E-LAB 2 in the remainder of this manual). You must use your E-LAB 2 as specified in this manual. Read this manual before you install and operate your E-LAB 2.

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.

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

In accordance with the recommendations of IEC1010, the following warning symbols are on the pump:



Warning - refer to accompanying documents.



Warning - risk of electric shock.



Warning - hot surface.

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1.2 Description

Refer to Figure 1. The E-LAB 2 is a complete laboratory pumping system, which has a two-stage, rotary vane vacuum pump. An oil mist filter (6) is fitted to the outlet of the pump, to prevent the discharge of oil mist. An inlet catchpot (4) is fitted to the pump inlet to minimise the ingress of condensable vapours into the pump.

The E-LAB 2 has a gas ballast oil return assembly (16) which continuously returns oil trapped in the mist filter to the pump.

The vacuum pumping mechanism is oil sealed. You can inspect the level and condition of the oil in the oil-box through the sight-glass (8). Diagrams on the side panels and on the oil change tag (Figure 2, item 4) give guidance on when you should change the oil. Two oil filler-plugs (7) and an oil drain-plug (9) are provided on the oil-box.

The pump mechanism is driven directly by a single-phase electric motor through a flexible motor-coupling. The motor is totally enclosed and is cooled by the motor cooling-fan which directs air along the motor fins. The pumps are cooled by an additional fan attached to the motor-coupling.

The motor has an on/off switch (12) and a thermal overload device. When the motor is too hot, the thermal overload device switches off the pump. The thermal overload device has an automatic reset; when the motor cools down, the device resets and (unless you have incorporated suitable control equipment which must be manually reset: see Section 3.10.2), the motor will restart.

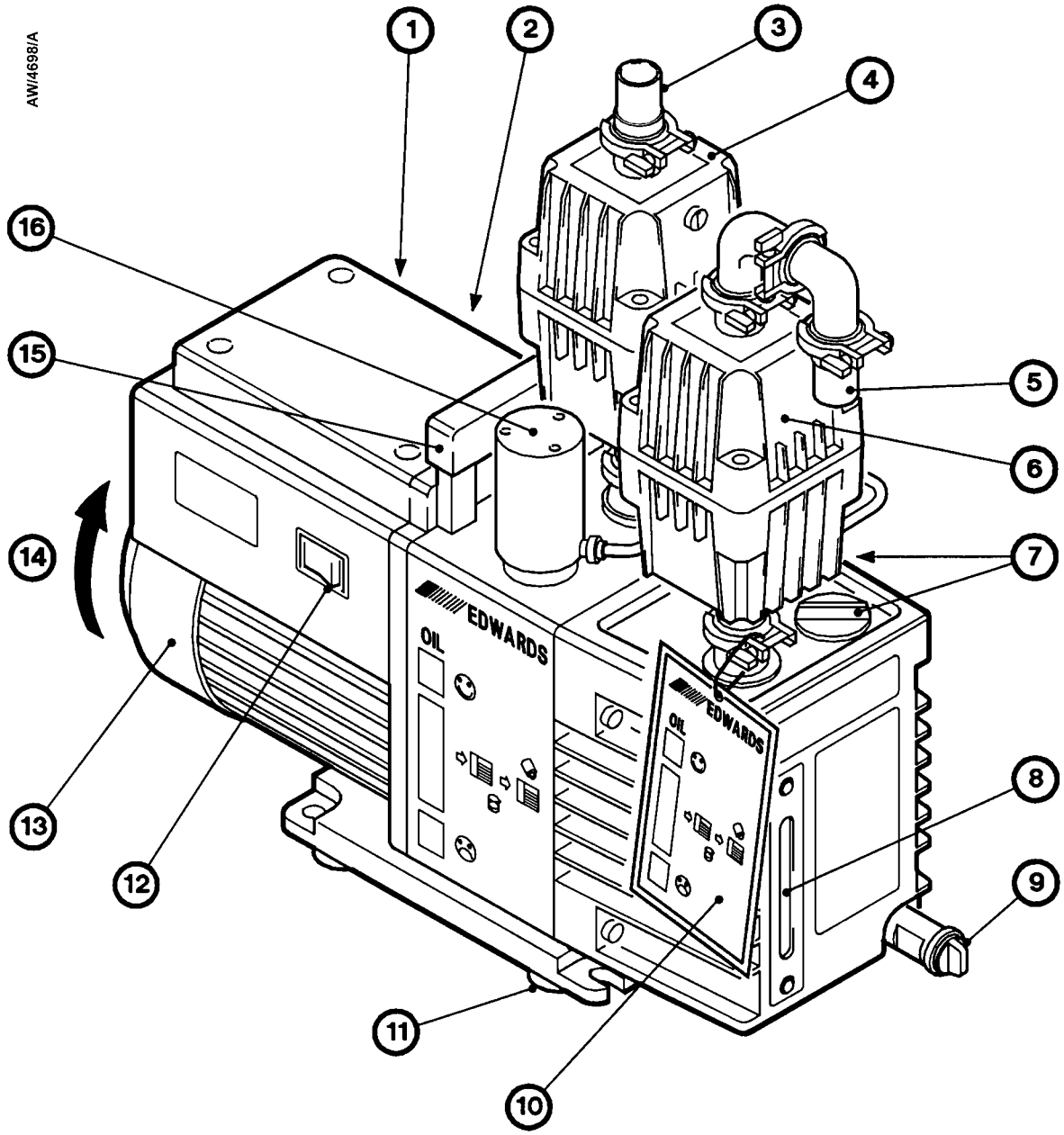
The E-LAB 2 has a gas ballast oil return assembly, which is supplied configured to automatically deliver high gas ballast flow rate into the pump; this prevents the condensation of vapours in the pumped gases and allows you to use the E-LAB 2 to pump high vapour loads. If required, you can reduce the gas ballast flow rate into the pump, or switch off the gas ballast flow.

When the E-LAB 2 is switched off, an inlet-valve seals the inlet and prevents the suck-back of air and oil into the vacuum system.

The E-LAB 2 has a retractable lifting handle (15) and is mounted on a base plate on rubber feet (11).

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Figure 1 - The E-LAB 2 Pump



1. Electrical supply connector
2. Voltage indicator
3. Inlet
4. Inlet catchpot
5. Outlet
6. Outlet oil mist filter
7. Oil filler-plugs
8. Oil-level sight-glass
9. Oil drain-plug
10. Oil change tag
11. Rubber feet (4 off)
12. On/off switch
13. Motor fan-cover
14. Correct direction of rotation
15. Lifting handle
16. Gas ballast oil return assembly

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2 Technical data

2.1 Operating and storage conditions

Ambient temperature range (operation)	12 to 40 °C
Normal surface temperature of the pump-body at ultimate vacuum (operation), ambient temperature of 20 °C	50 to 70 °C
Maximum humidity (operation)	90% RH
Ambient temperature range (storage)	-30 to 70 °C

2.2 Performance

Note: *The pumping speed curves for the E-LAB 2 are shown in Figure 3.*

Suckback protection	1 x 10^{-5} mbar.ls^{-1}, 1 x 10^{-3} Pa.ls^{-1}
Maximum displacement	
50 Hz electrical supply	3.7 m^3h^{-1}
60 Hz electrical supply	4.5 m^3h^{-1}
Maximum pumping speed, Pneurop 6602 (1979)	
50 Hz electrical supply	3.3 m^3h^{-1}
60 Hz electrical supply	3.9 m^3h^{-1}
Maximum permitted inlet pressure and gas-ballast inlet pressure	1 bar gauge, 2 x 10^5 Pa
Maximum permitted outlet pressure	1 bar gauge, 2 x 10^5 Pa
Ultimate total pressure	1 x 10^{-1} mbar, 10 Pa
Maximum gas ballast flow	14 l.min^{-1}
Maximum water vapour pumping rate	
50 Hz electrical supply	0.095 kg.h^{-1}
60 Hz electrical supply	0.11 kg.h^{-1}
Maximum water vapour inlet pressure	40 mbar, 4 x 10^3 Pa

2.3 Mechanical data

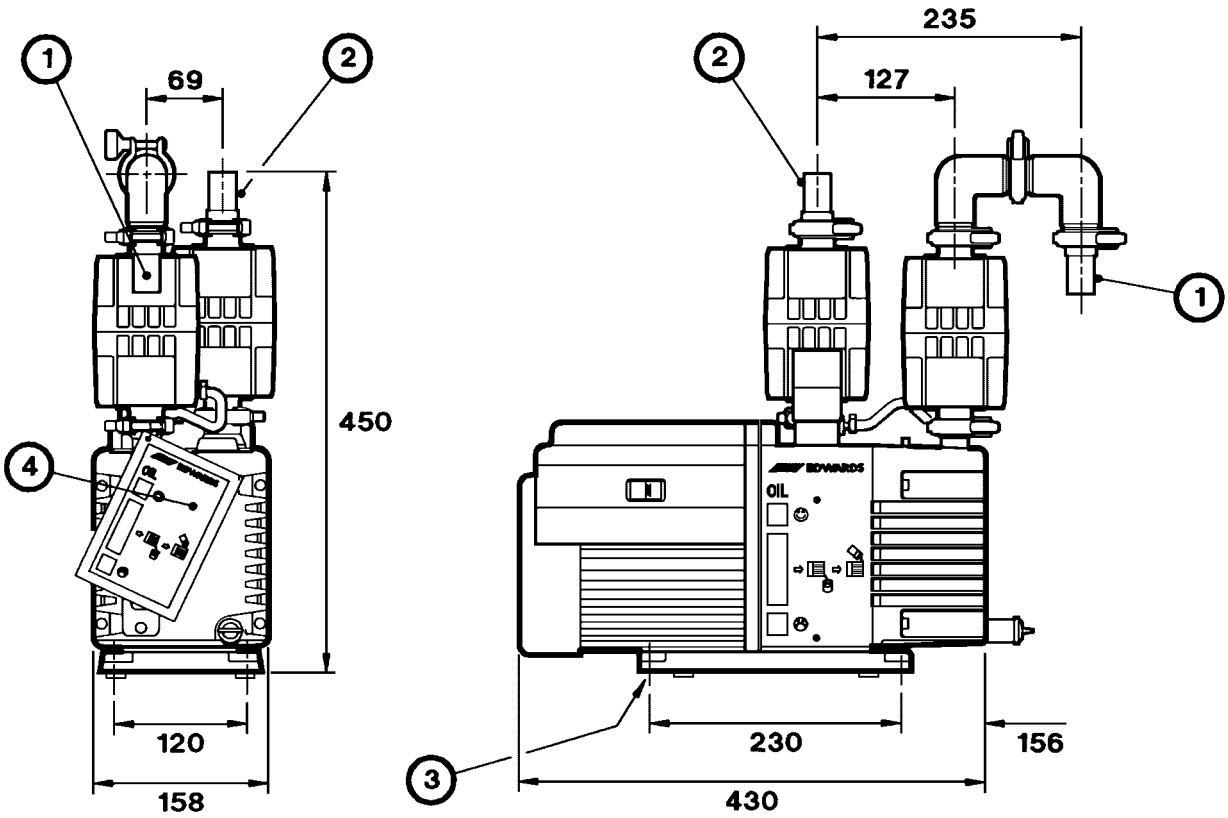
2.3.1 General

Overall dimensions	See Figure 2
Degree of protection (IEC 34-5: 1981)	IP44
Maximum tilt angle	10°
Pump-motor rotational speed	
50 Hz electrical supply	1470 r.min^{-1}
60 Hz electrical supply	1760 r.min^{-1}
Maximum mass of pump *	21.6 kg

* Without pump oil, inlet catchpot, outlet mist filter, and gas ballast oil return kit.

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Figure 2 - Dimensions: mm



1. Outlet
2. Inlet
3. Baseplate mounting holes: 4 x M8
4. Oil change tag

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2.3.2 Noise and vibration data

Sound pressure, measured at ultimate vacuum 1 metre from the end of the pump to ISO 11201, 50 Hz electrical supply	50 dB(A)
Vibration severity: measured at the inlet port to ISO 2372 (1974)	Class 1C

2.4 Electrical data

Note: *We recommend that you use fuses of the maximum ratings specified in Tables 1 and 2. You must not use fuses of a higher rating.*

The dual-voltage, dual-frequency motor is designed for a single-phase electrical supply and is suitable for 50 Hz or 60 Hz operation. The motor can be manually switched between nominal supply voltages of 110-120 V and 220-240 V (refer to Section 3.10.1).

When you start a cold pump, the motor will draw the start-up current shown in Tables 1 and 2 for up to several seconds, so you must use a slow-blow fuse to prevent unnecessary fuse failure during pump start-up. Within five minutes, as the oil in the pump warms up, the current drawn will slowly reduce to the full load current specified in Tables 1 and 2.

Table 1 - Electrical data (pumps with Item Numbers -903 or -906)

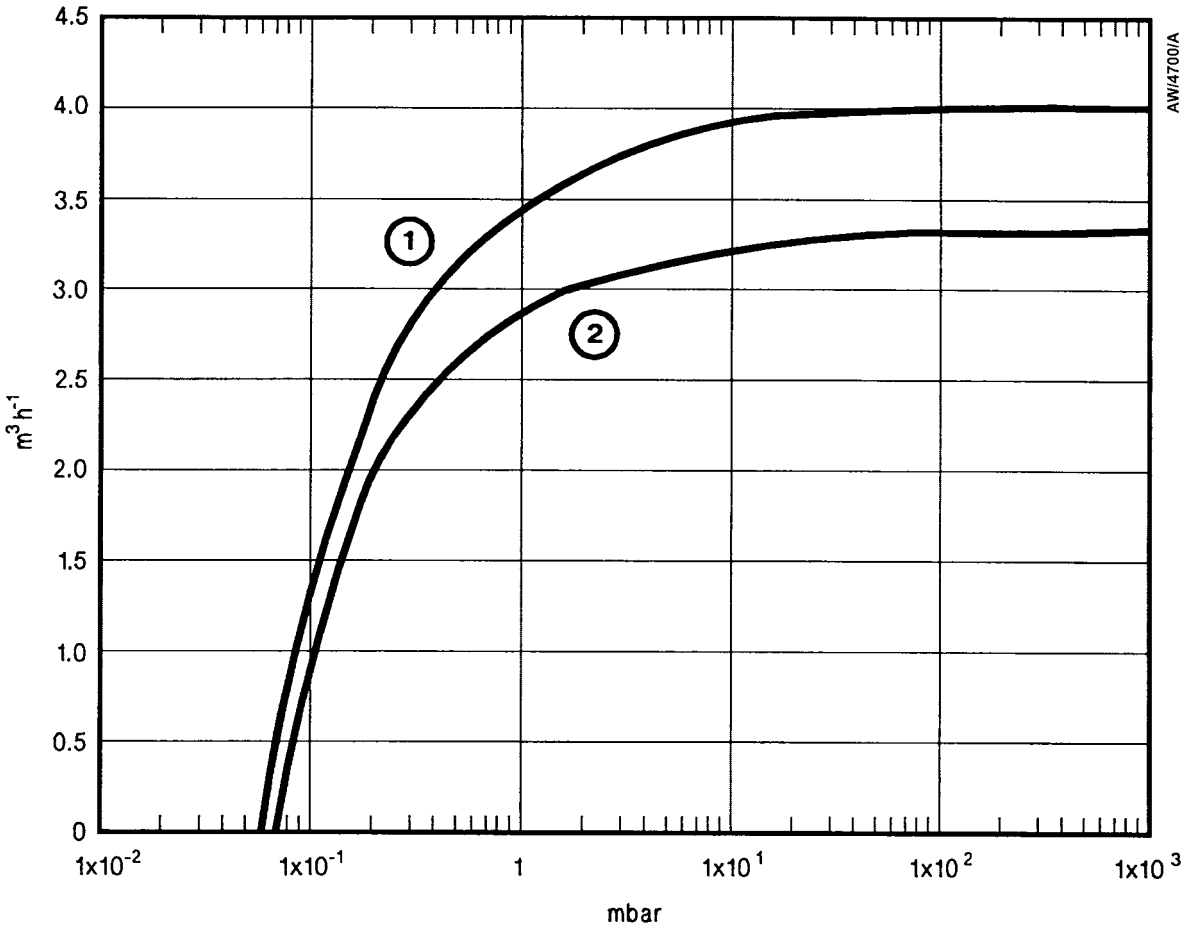
Nominal supply (V)	Frequency (Hz)	Power (W)	Full load current (A)	Start-up current	Maximum fuse rating (A)
220-240	50	250	2.4	15.6	13
230-240	60	300	2.2	15.2	13
110	50	250	4.6	29.4	20
115-120	60	300	4.4	31.5	20

Table 2 - Electrical data (pumps with Item Numbers -904)

Nominal supply (V)	Frequency (Hz)	Power (W)	Full load current (A)	Start-up current	Maximum fuse rating (A)
200	50	250	2.8	19.4	13
200-210	60	300	2.4	19.5	13
100	50	250	5.4	37.0	20
100-105	60	300	4.6	39.0	20

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Figure 3 - Pumping speed curves: speed plotted against inlet pressure



1. 60 Hz
2. 50 Hz

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2.5 Lubrication data

Note: *Edwards Health and Safety Data sheets for rotary pump oils are available on request.*

Recommended oil*	Edwards Ultragrade 19 (hydrocarbon oil)
Oil capacity	
Maximum	0.70 l
Minimum	0.42 l

* To operate the E-LAB 2 when the ambient temperature is outside the limits specified in Section 2.1, you may need to use a different oil.

2.6 Materials of construction

The surfaces of the pump that are exposed to the process vapours pumped are free from copper, zinc and cadmium.

Other materials of construction include cast iron, aluminium, fluoroelastomer, nitrile, chemically resistant polymers, nickel and stainless steel.

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3 Installation

3.1 Safety

WARNING



The E-LAB 2 is not recommended for pumping hazardous substances.

You must ensure that the E-LAB 2 is suitable for your application. If you have any doubt as to the suitability of the E-LAB 2 for your application, refer to the Edwards guidelines on vacuum pump and vacuum system safety (see the Associated publications at the end of the Contents list at the front of this manual).

The installation of your E-LAB 2 must be performed by a suitably trained and supervised technician. Obey the safety instructions listed below when you install the E-LAB 2, especially when you connect it into an existing system. Details of specific safety precautions are given at the appropriate point in the instructions.

- Wear the appropriate safety-clothing when you come into contact with contaminated components.
- Vent and purge your vacuum system before you start installation work.
- Ensure that the installation technician is familiar with the safety procedures which relate to the pump-oil and the products handled by the E-LAB 2. Take suitable precautions to avoid the inhalation of oil mist and excessive skin contact with pump-oil, as prolonged exposure can be harmful.
- Disconnect the other components in the pumping system from the electrical supply so that they cannot be operated accidentally.
- Ensure that you correctly fit the inlet catchpot, outlet oil mist filter and the gas ballast oil return kit, as described in the following sections.

3.2 System design considerations

Consider the following points when you design your pumping system:

- Use a suitable valve to isolate the E-LAB 2 from your vacuum system if you need to allow the E-LAB 2 to warm up before you pump condensable vapours, or to provide additional system protection when the E-LAB 2 is switched off.
- Avoid high levels of heat input to the E-LAB 2 from the process gases, otherwise the E-LAB 2 may overheat and seize, and cause the motor thermal overload device to open.
- If you use the E-LAB 2 in a high ambient temperature and have a high gas throughput, the temperature of the pump-body may exceed 70 °C and you must fit suitable guards to prevent contact with hot surfaces.
- Make sure that the exhaust pipeline cannot become blocked. If you have an exhaust- isolation valve, make sure that you cannot operate the E-LAB2 with the valve closed.

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3.3 Unpack and inspect

Remove all packing materials and protective covers and inspect the equipment. If any of the equipment is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the E-LAB 2 together with your order number and your supplier's invoice number. Retain all the packing materials for inspection. Do not use the E-LAB 2 if it is damaged.

Check that you have received the items listed in Table 3. If any item is missing, notify your supplier in writing within three days.

If the E-LAB 2 is not to be used immediately, replace the protective covers. Store the E-LAB 2 in suitable conditions, as described in Section 6.1.

Table 3 - Checklist of components

Qty	Description	Check (✓)
1	E-LAB 2 Pump (with oil change tag fitted)	❑
1	Oil mist filter	❑
1	Inlet catchpot	❑
6	Clamping rings	❑
4	Co-Seals	❑
1	Centring-ring and 'O' ring	❑
2	Elbows	❑
2	Hose adaptors	❑
1	Electrical supply cable *	❑
Gas ballast oil return kit, which contains:		
1	Oil return assembly	❑
1	Drain adaptor	❑
1	Restrictor	❑
1	Flexible oil-return tube	❑
2	Hose clips	❑

* Not supplied with pumps with Item Number A652-07-903: see Section 3.10.2.

3.4 Locate the pump

The E-LAB 2 has a lifting handle which you can use to move the pump by hand. If you wish to use mechanical lifting equipment, do not attach the equipment to the handle; for stability, use slings around the motor and the pump-body.

Provide a firm, level platform for the E-LAB 2. Refer to Figure 1. Locate the E-LAB 2 so that the oil-level sight-glass (8) and the oil change tag (10) are visible, and so that the oil filler-plug (7) and oil drain-plug are (9) accessible.

If your E-LAB 2 will be located inside an enclosure, make sure that there is adequate ventilation at both ends of the pump, so that the ambient temperature around the pump does not exceed 40 °C. There must be a minimum space of 25 mm between the pump and the enclosure walls.

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3.5 Fill the pump with oil

Fill the pump with oil as described below. Refer to Section 2 for the recommended oil.

1. Refer to Figure 1. Remove one of the oil filler-plugs (7).
2. Pour oil into the pump until the oil-level just reaches the MAX mark on the bezel at the top of the sight-glass (8). If the oil-level goes above the MAX mark, remove the drain-plug (9) and drain the excess oil from the pump.
3. After a few minutes, recheck the oil-level. If the oil-level is now below the MAX mark, pour more oil into the pump.
4. Refit the oil filler-plug. Tighten the plug firmly by hand. Do not overtighten.

3.6 Fit the outlet oil mist filter

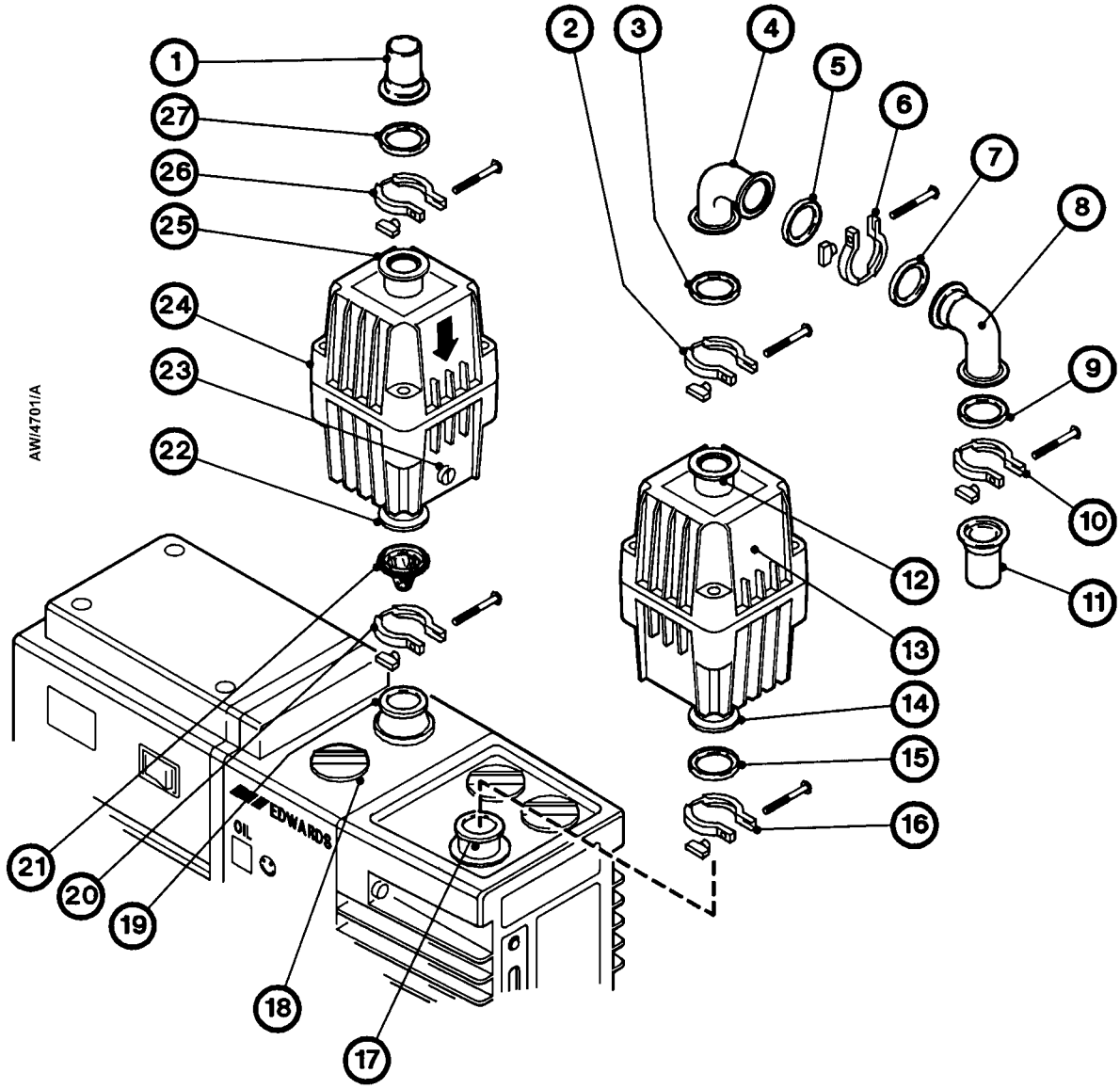
1. Refer to Figure 4. Ensure that the pump outlet (17) is clean, then place one of the Co-Seals (15) on the outlet.
2. Place the oil mist filter inlet (14) on the pump outlet, so that the arrow on the lower half of the body (see Figure 8) point upwards away from the pump outlet, and so that the drain plug points towards the oil filler-plugs (as shown in Figure 5).
3. Use one of the clamping rings (16) to secure the oil mist filter to the pump.
4. Use another Co-Seal (3) and clamping ring (2) to secure one of the elbows (4) to the mist filter outlet (12); ensure that the horizontal part of the elbow points towards the front of the pump (as shown in Figure 2).
5. Use another Co-Seal (5) and clamping ring (6) to secure the other elbow (8) to the elbow already fitted; ensure that the free end of the elbow point vertically downwards, as shown on Figure 4.
6. Use another Co-Seal (9) and clamping ring (10) to secure one of the hose adaptors (11) to the elbow.

3.7 Fit the gas ballast oil return assembly

1. Remove the drain-plug (Figure 8, item 4) from the drain port on the oil-mist filter.
2. Refer to Figure 5. Fit the drain adaptor (8) to the drain port on the oil mist filter.
3. Turn the gas ballast control on the pump (Figure 4, item 18) to position 'II'. Push the control down (against the spring), turn the control anticlockwise to release it, then remove the control from the pump. Leave the spring in position in the gas ballast port in the pump.
4. Lift the pump handle (Figure 1, item 15). Fit the oil return assembly (5) to the gas ballast port on the pump, push the assembly down (against the spring) and turn the assembly clockwise to secure it to the pump. When the assembly is correctly secured to the pump, the nozzle (4) should be over position '0' marked on the top of the pump (see detail B).
5. Cut a suitable length from the flexible oil-return tube. The routing of the tube (3) must be approximately as shown in Figure 5. When fitted, the tube must not be taut and there must be no tight bends in the tube. Ensure that the ends of the oil-return tube are free of burrs and that they are squarely cut (that is, the cut faces are at a right angle to the length of the tube).
6. Fit the restrictor (7) into the end of the tube, then fit the same end of the tube to the drain adaptor on the oil mist filter.
7. Fit the other end of the tube to the nozzle (4) on the oil return assembly (5).
8. Use the hose clips (2) to secure the ends of the flexible oil-return tube (3).

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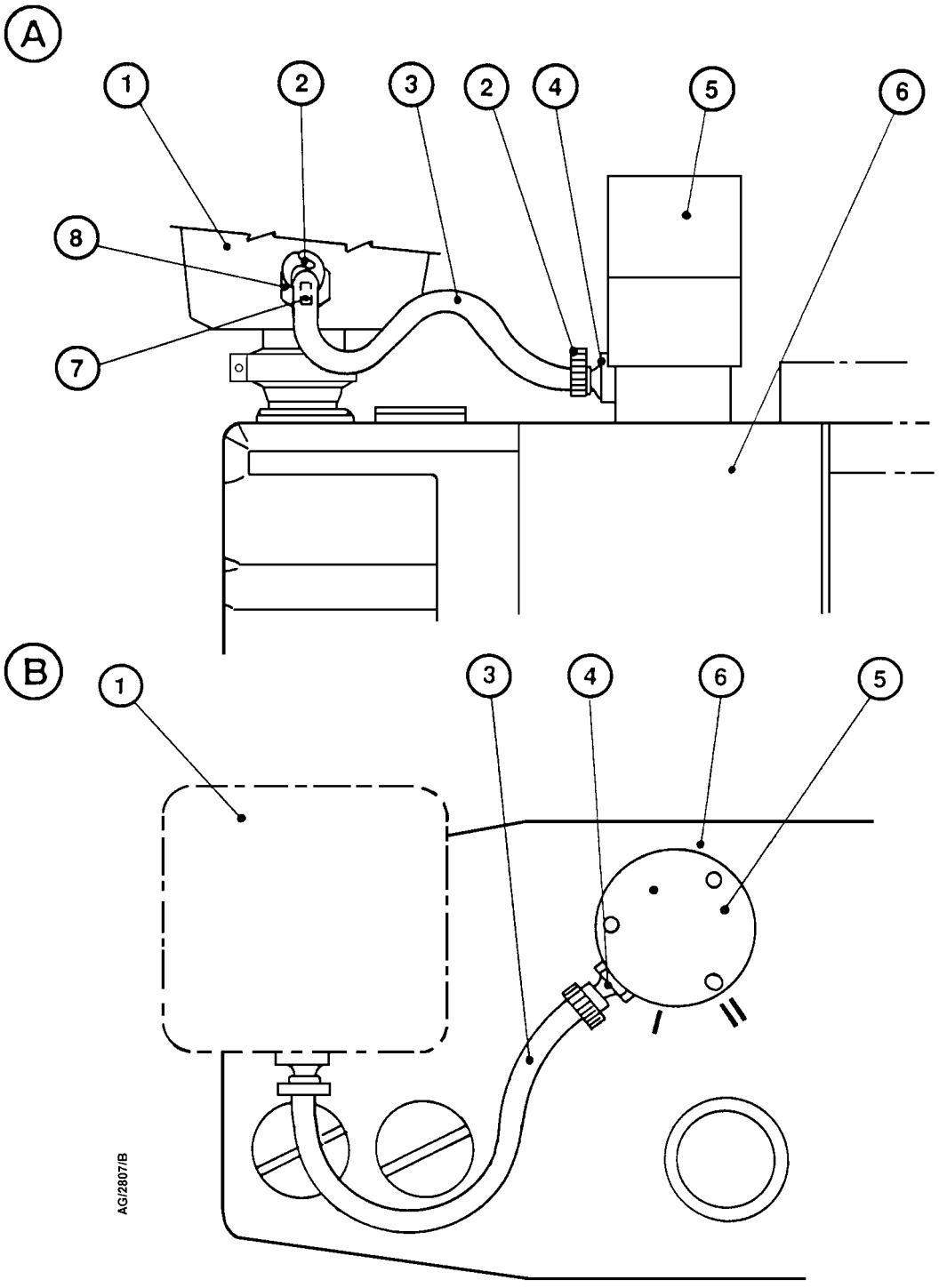
Figure 4 - Fit the inlet trap and oil mist filter



1. Hose adaptor
2. Clamping ring
3. Co-Seal
4. Elbow
5. Co-Seal
6. Clamping ring
7. Co-Seal
8. Elbow
9. Co-Seal
10. Clamping ring
11. Hose adaptor
12. Oil mist filter outlet
13. Outlet oil mist filter
14. Oil mist filter inlet
15. Co-Seal
16. Clamping ring
17. Pump outlet
18. Gas ballast control
19. Pump inlet
20. Clamping ring
21. 'O' ring, centring-ring and filter
22. Inlet catchpot outlet
23. Inlet catchpot drain plug
24. Inlet catchpot
25. Inlet catchpot inlet
26. Clamping ring
27. 'O' ring and centring-ring

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Figure 5 - Fit the gas ballast oil return assembly



A. Side view (pump inlet and inlet catchpot omitted for clarity)
B. Top view

1. Oil mist filter
2. Hose clip
3. Flexible oil-return tube
4. Nozzle
5. Oil return assembly
6. E-LAB 2 pump
7. Restrictor
8. Drain adaptor

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3.8 Select the gas ballast flow rate (optional)

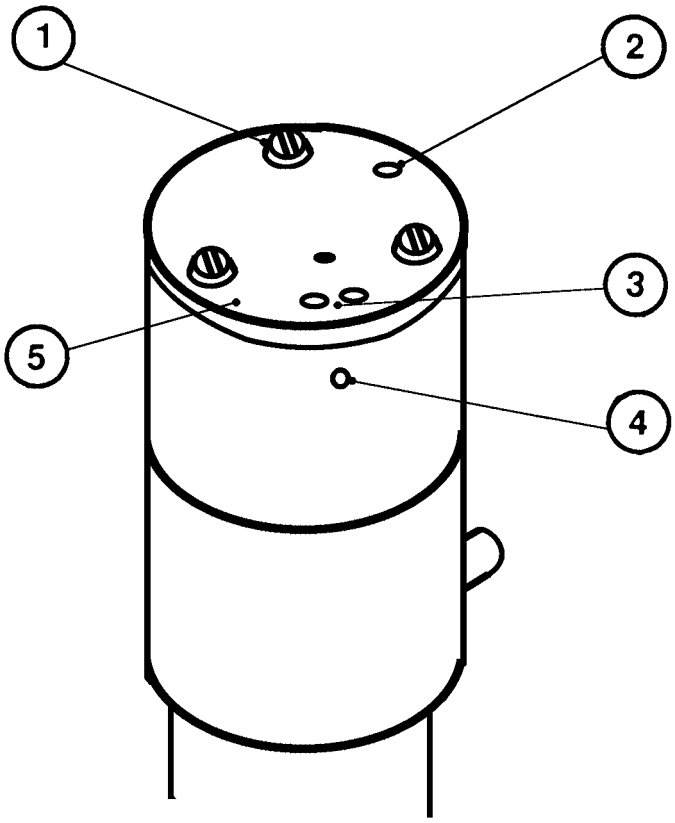
Note: *If required, use the procedure below to change the gas ballast flow rate after you have used the E-LAB 2; you must switch off the pump, allow it to cool and isolate it from the electrical supply before you use the following procedure.*

The oil return assembly is supplied configured for high gas ballast flow rate. If required, you can adjust the gas ballast flow rate; use the following procedure:

1. Refer to Figure 6. Undo and remove the three screws (1) which secure the restrictor plate (5); do **not** dismantle the assembly.
2. The restrictor plate (5) has circular indentations (2 and 3); the position of these indentations with respect to the indentation (4) on the oil return assembly identifies the gas ballast flow setting. Turn the restrictor plate to the required position:
   - To select no gas ballast flow, turn the restrictor plate so that none of the indentations (2 and 3) are aligned with the indentation (4) on the oil return assembly.
   - To select low gas ballast flow, turn the restrictor plate so that the single indentation (2) is aligned with the indentation (4) on the oil return assembly.
   - To select high gas ballast flow, turn the restrictor plate so that the two indentations (3) are aligned with the indentation (4) on the oil return assembly.
3. Refit and tighten the three screws (1).

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Figure 6 - Select the gas ballast flow rate



1. Screws (3 off)
2. Indentation (low gas ballast flow position)
3. Indentations (high gas ballast flow position)
4. Indentation
5. Restrictor plate

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3.9 Fit the inlet catchpot

1. Refer to Figure 4. Ensure that the pump inlet (19) is clean and that the centring-ring and filter assembly (supplied with the pump) is in place on the inlet.
2. Place the inlet catchpot (24) on the pump inlet, so that the drain plug (23) points towards the front of the pump, and so that the arrow on the upper half of the body points towards the pump inlet, as shown on Figure 4.
3. Use one of the clamping rings (20) to secure the inlet catchpot to the pump.
4. Use the 'O' ring and centring-ring (27) and clamping ring (26) to secure the hose adaptor (1) to the inlet (25) of the inlet catchpot.

3.10 Electrical installation

3.10.1 Check and configure the motor

CAUTION

Ensure that the motor is correctly configured for your electrical supply. If the motor is configured for 110 V operation and you operate the pump with a 240 V electrical supply, you will damage the motor.

Refer to Figure 7 for the item numbers in brackets.

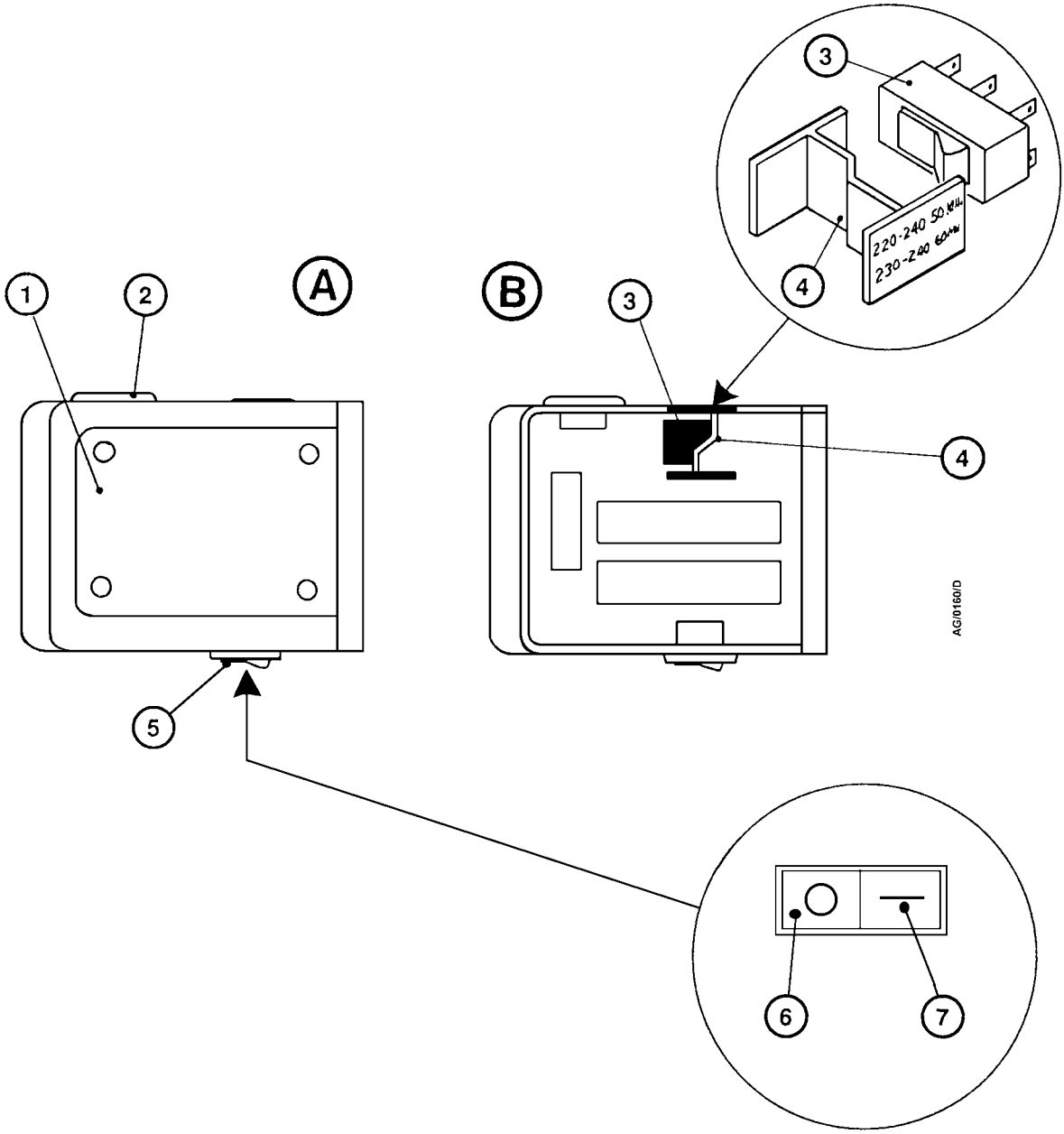
Ensure that the voltage shown on the voltage indicator (4) in the motor-cover corresponds with your electrical supply voltage. If it does not, you must change the configuration of the pump-motor to match your electrical supply voltage.

Use the following procedure to change the configuration of the pump-motor:

1. Undo the four screws, remove the cover-plate (1) and lift out the voltage indicator moulding (4).
2. Press the voltage selector switch (3) to select the alternative position.
3. Turn the voltage indicator moulding over so that the outer panel shows the required voltage. Refit the moulding.
4. Refit the cover-plate and secure it with the four screws.

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Figure 7 - Motor voltage configuration



A. Top view of motor
B. Internal view of top of motor

1. Cover-plate
2. Electrical inlet-connector
3. Voltage selector switch
4. Voltage indicator
5. On/off switch
6. Position 'O' (off)
7. Position '|' (on)

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3.10.2 Connect the pump to your electrical supply

WARNING



Ensure that the electrical installation of the E-LAB 2 conforms with your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth (ground) point.

Notes: 1. *In the UK, if you use a 13 A plug, it must comply with BS1363A and be fitted with a 13 A fuse which complies with BS1362.*

2. *To prevent automatic restart of the pump-motor if the electrical supply is restored after an electrical supply failure, connect the pump to the electrical supply through suitable control equipment which must be reset manually after an electrical supply failure.*

3. *Make the electrical connections to the pump-motor with an IEC 320 cable socket (cold condition type) that satisfies your local electrical standards.*

E-LAB 2 pumps with Item Numbers A652-07-904 and A652-07-906 are supplied with an electrical supply cable with a moulded IEC connector at one end, and with the other end of the cable fitted with a plug suitable for your local electrical supply. E-LAB 2 pumps with Item Number A652-07-903 are not supplied with an electrical supply cable; you must separately order a suitable electrical supply cable. Use the following procedure to connect the electrical supply to the pump:

1. Ensure that the on/off switch on the motor (Figure 7, item 5) is in the ‘off’ position.
2. Insert the moulded IEC connector at the end of the cable into the electrical inlet-connector on the motor (Figure 7, item 2).
3. Connect the plug on the other end of the cable to your electrical supply. If required, you can remove plug and connect the wires in the cable to the correct terminals of your electrical supply; connect the wires as follows:
   - Connect the green and yellow wire to earth (ground).
   - Connect the blue wire to neutral.
   - Connect the brown wire to live.

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3.10.3 Check the direction of rotation

CAUTION

Ensure that the pump-motor rotates in the correct direction. If it does not, the pump and your vacuum system can become pressurised.

Refer to Figure 1 for the item numbers in brackets.

1. Watch the motor cooling-fan through the motor fan-cover (13).
2. Use the on/off switch (12) to switch-on the electrical supply to the motor for a few seconds.
3. Check that the motor cooling-fan rotates in the correct direction (14) shown by the arrow on the motor fan-cover. If the direction of rotation is incorrect, switch off the electrical supply immediately and contact your supplier or Edwards for advice.

3.11 Inlet and outlet connections

WARNING



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

CAUTION

Ensure that the outlet hose is routed below the level of the pump outlet. If you do not, condensates may drain back into the pump and damage it.

Refer to Figure 1. Use suitable $^{1}/_{2}$ inch inside diameter hose to connect your vacuum system to the inlet (3) on the inlet catchpot, and to connect the outlet (5) on the oil mist filter to your exhaust-extraction system.

3.12 Leak-test the system

Leak-test the system and seal any leaks found after you have installed the E-LAB 2, to prevent leakage of substances out of the system and leakage of air into the system.

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4 Operation

Note: *At high inlet pressures (above 200 mbar, 2 x 10^4 Pa), the gas ballast oil return assembly will not work correctly. If you want to return oil to the pump when the pump is operated at continuous high inlet pressures, contact your supplier or Edwards for advice.*

4.1 Start-up procedure



WARNING

Ensure that your system design does not allow the exhaust pipeline to be blocked.

If the oil is contaminated, or if the pump temperature is below 12 °C, or if the electrical supply voltage is more than 10% below the lowest voltage specified on the voltage indicator (Figure 7, item 4), the pump may operate at a reduced speed for a few minutes. If the pump continues to operate at reduced speed, the motor thermal overload device will open and stop the pump. When the motor has cooled, the thermal overload device will reset automatically and the pump will restart.

1. Check that the pump oil-level is between the MAX and MIN marks on the bezel of the oil-level sight-glass; if it is not, refer to Section 5.4.

2. Use the on/off switch (Figure 1, item 12) to switch on the electrical supply to the pump.

4.2 To achieve ultimate vacuum/pump condensable vapours

If the E-LAB 2 does not achieve the performance specified in Section 2, make sure that this is not due to your system design before you contact your supplier or Edwards for advice. In particular, the vapour pressure of all materials used in your vacuum system (including pump oil, see below) must be much lower than the specified ultimate vacuum of the pump. Refer to Section 5.14.2 for a list of possible causes for failure to achieve the specified performance; note however that the most common causes are:

- Your pressure measurement technique or gauge head is unsuitable or the gauge head is faulty.
- You have used an oil other than the recommended oil, and the vapour pressure of the oil is higher than the specified ultimate vacuum of the pump.

Use the following procedure to achieve ultimate vacuum:

1. Isolate the E-LAB 2 from your vacuum system and operate the E-LAB 2 for at least 1 hour (or overnight) to thoroughly purge the oil of contaminants.

2. Open the vacuum system isolation-valve and pump down to ultimate vacuum.

After you have pumped condensable vapours, you can (if necessary) decontaminate the oil: use the procedure in Section 4.3.

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4.3 To decontaminate the oil

The oil in the pump should be clear; if the oil is cloudy or discoloured, it is contaminated with process vapours.

1. Look at the condition of the oil in the oil-level sight-glass (Figure 1, item 8). If the oil is cloudy or discoloured, continue with the procedure at Step 2 below.
2. Close the vacuum system isolation-valve.
3. Operate the pump until the oil is clear.

4.4 Unattended operation

The E-LAB 2 is designed for unattended operation under the normal operating conditions specified in Section 2. However, we recommend that you check the pump at regular intervals of not more than 14 days, or more frequently if you pump high volumes of gas or vapour.

To automatically decontaminate the pump oil, and to ensure that the correct pump operating temperature is maintained, we recommend that you control the electrical supply to the pump and the operation of the vacuum system isolation-valve through a time-switch: refer to Table 4.

The motor is protected by an overload device which isolates the E-LAB 2 from the electrical supply when critical temperature or current levels are exceeded. The overload device resets automatically when the motor has cooled. When you check the E-LAB 2, make sure that the pump is not going through a repetitive cycle of thermal overload failures and automatic resets. If necessary, reduce the thermal load from the pumped gases, to prevent overheating of the pump.

Table 4 - Recommended time-switch settings

Time	Pump operation	Isolation-valve operation	Function
At least half an hour before the pump is required for use	Switch on	Closed	Pump warm-up time
During operation	Leave on	Open or closed, as required by pumping system operation	Maintain the operating temperature of the pump, decontaminate the pump oil
At least half an hour after use	Leave on	Closed	Decontaminate the pump oil
After the decontamination time	Switch off	Closed	Ready for future use

4.5 Shut-down

We recommend, as described in the procedure below, that you decontaminate the oil before you shut down the pump; this will prevent damage to the pump by the contaminates in the oil.

1. Refer to Section 4.3 and decontaminate the oil, as required.
2. Close the vacuum system isolation-valve (if not already closed).
3. Use the on/off switch to switch off the pump.
4. Switch off the electrical supply to the pump.

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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.

- Ensure that maintenance is done by a suitably trained and supervised technician. Obey your local and national safety requirements.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the pump-oil and the products processed by the pumping system.
- Check that all the required parts are available and of the correct type before you start work.
- Isolate the pump and other components from the electrical supply so that they cannot be operated accidentally.
- Allow the pump to cool (so that it is at a safe temperature for skin contact) before you start maintenance work. Make sure the pump is switched off in case the thermal overload device restarts the pump.
- Do not reuse 'O' rings and seals if they are damaged.
- After maintenance is completed, recheck the direction of pump rotation if the electrical supply has been disconnected.
- The pump, pump-oil, inlet catchpot, outlet oil mist filter and gas ballast oil return kit will be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and that you take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present if the pump has been heated to 310°C and above. Fluorinated materials are safe in normal use but can decompose into very dangerous substances (which may include hydrofluoric acid) if they are heated to 310 °C and above. The pump may have overheated if it was misused or if it was in a fire. Health and Safety Data sheets for fluorinated materials used in the pump are available on request: contact your supplier or Edwards.

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5.2 Maintenance plan

The plan shown in Table 5 details the routine maintenance operations necessary to maintain E-LAB 2 pumps in normal use. Instructions for each operation are given in the section shown.

Table 5 - Maintenance plan

Operation	Frequency	Refer to Section
Check the liquid level in the inlet catchpot	Weekly	5.3
Check the pump oil level	Monthly	5.4
Replace the pump oil	Every 3000 hours	5.5
Inspect the oil mist filter elements	Every 6 months	5.6
Inspect and clean the pump inlet-filter	Yearly	5.7
Inspect and clean the oil return assembly	Yearly	5.8
Clean the pump oil-level sight-glass	Yearly	5.9
Clean the motor fan cover	Yearly	5.10
Clean and overhaul the pump	Every 15000 hours	5.11
Test the motor condition	Every 15000 hours	5.12
Fit new blades to the pump	Every 30000 hours	5.13

More frequent maintenance may be required if the pump is used to pump corrosive or abrasive gases and vapours, such as solvents, organic substances and acids; in these circumstances, we recommend that you replace the pump seals every year (refer to Section 7 for details of available spares). If necessary, adjust the maintenance plan according to your experience.

When you maintain the E-LAB 2, use Edwards spares and maintenance kits; these contain all of the components necessary to complete maintenance operations successfully. The Item Numbers of the spares and kits are given in Section 7.

5.3 Check the liquid level in the inlet catchpot

Refer to Figure 1. Look at the level of fluid in the inlet catchpot (4). If the level is close to or above the MAX level mark:

1. Place a suitable container under the drain-plug (Figure 4, item 23).
2. Remove the drain-plug and allow the fluid to drain out of the inlet catchpot.
3. Refit the drain-plug to the inlet catchpot.
4. Dispose of the fluid safely: refer to Section 6.

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5.4 Check the pump oil level

Note: *If required, you can check the oil-level while the pump is operating, however you must switch off the pump and isolate the pump and other components in the pumping system from the electrical supply before you pour oil into the pump.*

Refer to Figure 1 for the items in brackets.

1. Check that the oil-level in the sight-glass (8) is between the MAX and MIN level marks on the bezel of the sight-glass.
2. If the oil-level is near to or below the MIN level mark, remove one of the filler-plugs (7) and pour more oil into the reservoir until the oil reaches the MAX level mark. If the oil-level goes above the MAX mark, remove the drain-plug (9) and drain the excess oil from the pump. Refit the filler-plug.
3. If the oil is contaminated, drain and refill the pump with clean oil as described in Section 5.5.

5.5 Replace the pump oil

The diagrams on the side panels of the pump and on the oil change tag give guidance on when to replace the pump oil. When the colour of the oil is approximately the same colour as the middle bar on the side panel (or tag), you must replace the oil as described below. If you continue to use the pump and the oil condition deteriorates until the colour of the oil is approximately the same as the lower bar on the side panel (or tag), you must clean and overhaul the pump, as described in Section 5.11.

Use the following procedure to replace the pump oil:

1. Refer to Figure 1. Operate the pump for approximately ten minutes to warm the oil, then use the on/off switch (12) to switch off the pump (this lowers the viscosity of the oil and enables it to be drained from the pump more easily).
2. Isolate the pump from your electrical supply and disconnect it from your vacuum system.
3. Remove one of the oil filler-plugs (7).
4. Place a suitable block under the pump-motor to tilt the pump and place a suitable container under the drain-plug (9). Remove the drain-plug and allow the oil to drain into the container.
5. If the oil drained from the pump is contaminated, pour clean oil into the filler-hole and allow it to drain out of the pump. Repeat this step until the oil reservoir in the pump has been thoroughly cleaned.
6. Refit the drain-plug, remove the block and reconnect the pump to your vacuum system.
7. Fill a suitable container with clean oil and pour the oil into the filler hole until the oil-level reaches the MAX level mark on the bezel of the sight-glass (8).
8. Allow a few minutes for the oil to drain into the pump. If necessary, add more oil. Refit the filler-plug.

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5.6 Inspect the oil mist filter elements

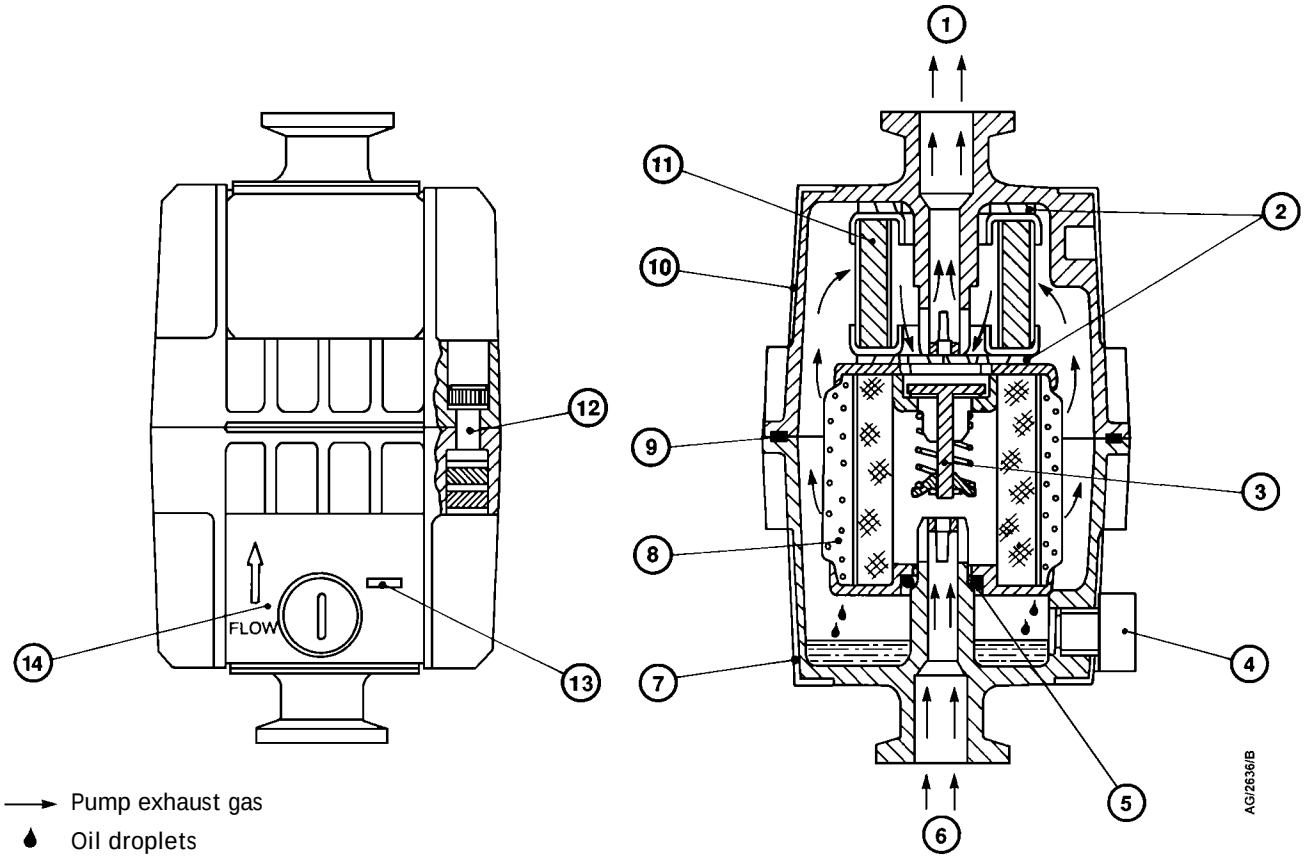
The oil mist filter has an odour element and an oil filter element. The life of the elements in the oil mist filter depends on the process application. If the filter element becomes blocked, the internal pressure relief valve in the filter will operate and unfiltered gases and oil mist will pass directly into your exhaust-extraction system.

Inspect the elements as described below and (if necessary) adjust the frequency (in the maintenance plan) that you do this operation, to ensure that you inspect the elements (and change them if necessary) before the filter element becomes blocked. Replace the odour element whenever the pump has an oily odour.

1. Refer to Figure 4. Undo the clamping ring (2) and remove the elbow (4) and Co-Seal (3) from the outlet (12) of the oil mist filter.
2. Refer to Figure 8. Undo and remove the four screws (12) which secure the upper body (10) to the lower body (7), then remove the upper body.
3. Lift out the elements (8, 10) and inspect the outer surface of the elements for contaminates:
   - If the elements need to be replaced, dispose of them safely (refer to Section 6) and obtain new elements.
   - If the elements do not need to be replaced, wipe them clean.
4. Wipe clean the inside of the upper body (10) and lower body (7) and the mating surfaces. Do not remove the 'D' seal (9).
5. Ensure that the filter element 'O' ring (5) is in place in the lower body (7), then fit the elements in the lower body; ensure that the foam sealing rings on the top and bottom of the elements are correctly seated.
6. Refit the upper body (10) to the lower body (7) and secure with the four screws (12) removed in Step 2.
7. Refer to Figure 4. Wipe clean the Co-Seal (3) and the outlet (12) of the oil mist filter, then place the Co-Seal on the outlet.
8. Refit the elbow (4) to the outlet and secure with the clamping ring (2).

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Figure 8 - The outlet oil mist filter



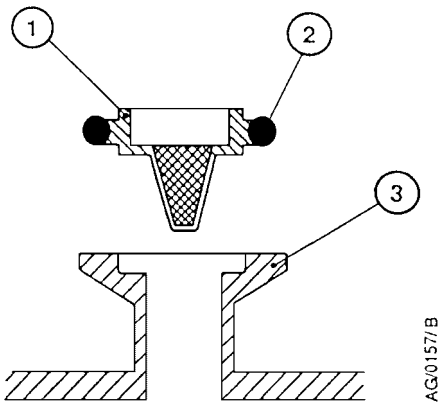
1. Outlet
2. Odour element seal
3. Pressure relief valve
4. Drain-plug
5. Mist filter element ‘O’ ring
6. Inlet
7. Lower body (white)
8. Mist filter element
9. ‘D’ seal
10. Upper body (grey)
11. Odour element
12. Securing screws
13. Maximum oil level mark
14. Sight panel

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5.7 Inspect and clean the pump inlet-filter

1. Refer to Figure 4. Undo the clamping ring (20) and remove the inlet catchpot (24) from the inlet of the pump.
2. Refer to Figure 9. Remove the centring-ring and filter assembly (1) and the 'O' ring (2) from the inlet of the pump. Inspect the centring-ring and the 'O' ring. If they are clean, continue at Step 7. If they are not clean, continue at Step 3.
3. Remove the 'O' ring (2) from the centring-ring and filter assembly (1). Do not allow the 'O' ring to come into contact with the cleaning solution.
4. Wash the centring-ring and filter assembly in a suitable cleaning solution and allow it to dry.
5. If necessary, wipe the 'O' ring with a clean, dry, lint-free cloth.
6. Refit the 'O' ring (2) to the centring-ring and filter assembly (1).
7. Refit the 'O' ring and centring-ring and filter assembly to the inlet.
8. Refer to Figure 4. Fit the inlet catchpot (24) to the pump inlet (19) and secure with the clamping ring (20).

Figure 9 - Pump inlet-filter assembly



1. Centring-ring and filter assembly
2. 'O' ring
3. Pump-inlet

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5.8 Inspect the oil return assembly

5.8.1 Check the installation of the assembly

1. Refer to Figure 5. Check that the oil return assembly (5) is securely fitted to the pump.
2. Check that the flexible oil-return tube (3) is securely fitted to the oil return assembly (5) and to the oil mist filter (1).
3. Check that there are no blockages in the tube. If the restrictor (7) is blocked, unblock it as described in Section 5.8.2.
4. Check that the oil return assembly operates correctly.
5. Refer to Figure 11. Inspect the air intake (2). If the air intake is blocked, unblock it as described in Section 5.8.3.

5.8.2 Unblock the restrictor (if necessary)

1. Switch off the pump and allow it to cool to a safe temperature. Isolate the pump from the electrical supply, so that it cannot be operated accidentally.
2. Refer to Figure 5. Undo and remove the hose clip (2) on the oil mist filter end of the oil-return tube (3), then remove the end of the oil-return tube from the drain adaptor (8) on the oil mist filter (1).
3. Remove the restrictor (7) from the oil return tube and remove the blockage from the restrictor.
4. Refit the restrictor (7) in the end of the oil-return tube (3), fit the end of the oil-return tube to the drain adaptor (8) on the oil mist filter, then use the hose clip (2) to secure the end of the oil return tube.
5. Reconnect the pump to the electrical supply.

5.8.3 Unblock the air intake (if necessary)

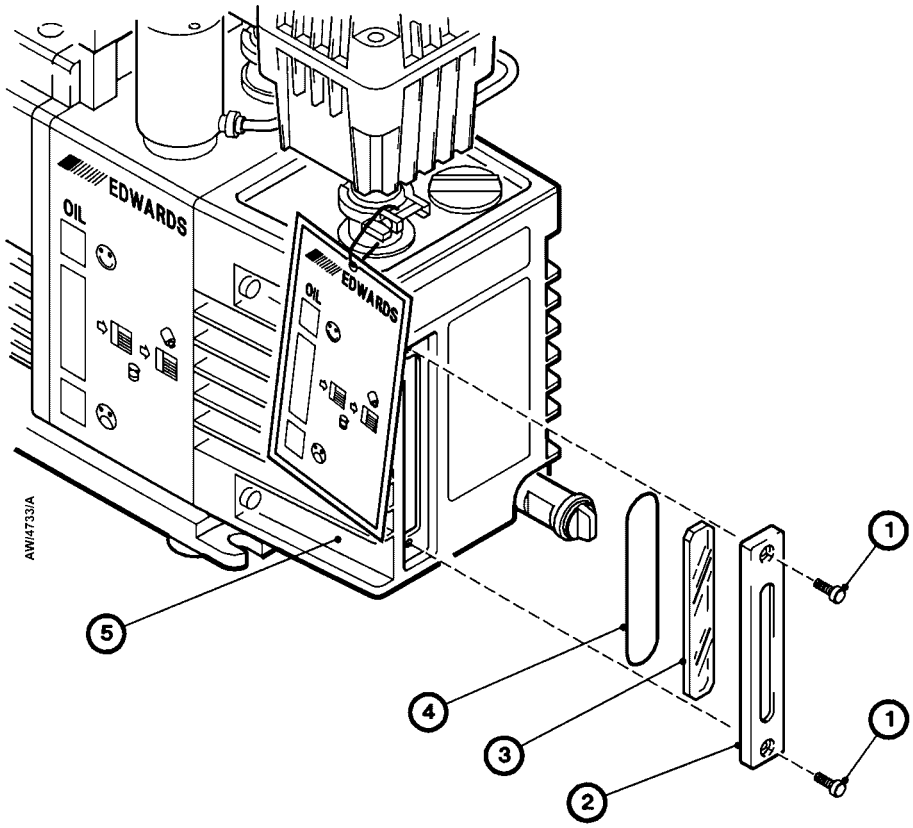
1. Switch off the pump and allow it to cool to a safe temperature. Isolate the pump from the electrical supply, so that it cannot be operated accidentally.
2. Refer to Figure 11. Undo and remove the three screws (1) which secure the top-piece (3) and remove the top-piece from the oil return assembly.
3. Use a suitable tool to remove the blockage from the air intake (2).
4. Refit the top-piece (3) to the oil return assembly and secure with the three screws (1), then reconnect the pump to the electrical supply.

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5.9 Clean the pump oil-level sight-glass

1. Refer to Figure 1. Move the oil change tag (10) to the side of the pump, so that you can access the oil-level sight-glass (8).
2. Drain the oil as described in Section 5.5.
3. Refer to Figure 10. Undo the two screws (1) and remove the bezel (2), the sight-glass (3) and the 'O' ring (4) from the oil-box (5).
4. Clean the screws, bezel and sight-glass with a suitable cleaning solution.
5. Wipe the 'O' ring with a clean, dry, lint-free cloth.
6. Wipe the sight-glass recess in the oil-box with the cloth.
7. Refit the 'O' ring, sight-glass and bezel and secure with the two screws.
8. Refill the pump with oil as described in Section 5.5.
9. Check that the sight-glass does not leak.
10. Refer to Figure 1. Move the oil change tag (10) to the front of the pump, over the sight-glass.

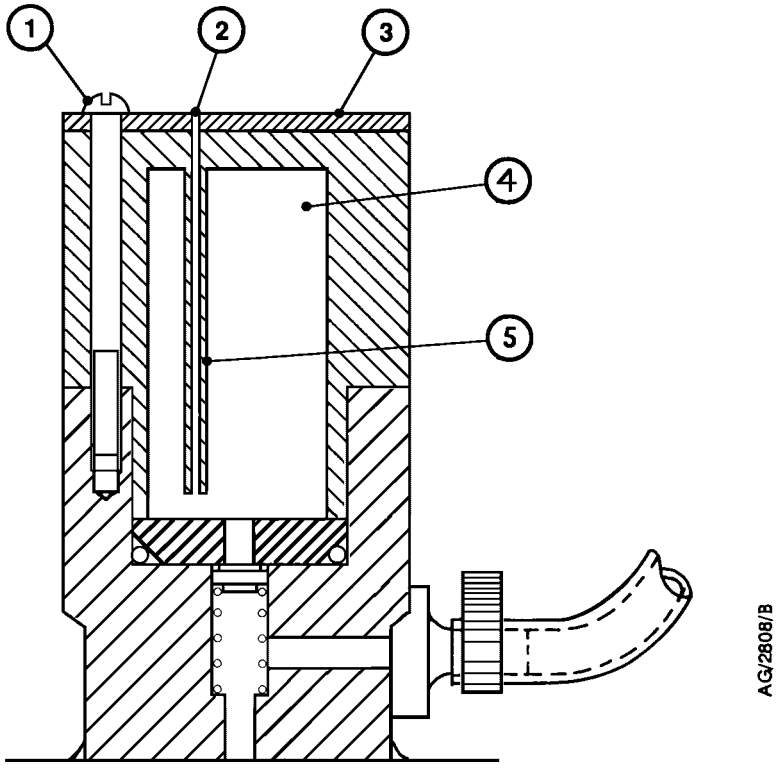
Figure 10 - Sight-glass assembly



1. Screws (2 off M6 x 20)
2. Bezel
3. Sight-glass
4. 'O' ring
5. Oil-box

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Figure 11 - Part sectional view of the oil return assembly



1. Screw
2. Air intake
3. Restrictor plate
4. Expansion chamber
5. Silencer tube

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5.10 Clean the motor fan cover

If the motor fan-cover and enclosure are not kept clean, the air-flow over the motor can be restricted and the pump may overheat.

1. Refer to Figure 1. Use the On/off switch (12) to switch off the pump, then disconnect it from the electrical supply.
2. Use a dry cloth and a soft brush to remove dirt and deposits from the fan-cover (13) and enclosure.

5.11 Clean and overhaul the pump

Clean and overhaul the pump as described in the instructions supplied with the clean and overhaul kit (see Section 7).

5.12 Test the motor condition

Test the earth continuity and the insulation resistance of the pump-motor, in accordance with local regulations for periodic testing of electrical equipment.

The motor of the E-LAB 2 complies with IEC 1010-1. We recommend that, to maintain compliance with IEC 1010-1, the earth continuity is less than 0.1Ω and the insulation resistance is greater than 10 MΩ.

If the motor fails these tests, you must replace the motor.

5.13 Fit new blades to the pump

Fit new blades to the pump as described in the instructions supplied with the blade kit (see Section 7).

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5.14 Fault-finding

A list of fault conditions and their possible causes is provided here to assist you in fault-finding. If you are unable to rectify a fault when you use this guide, call your nearest Edwards Service Centre for help.

5.14.1 The pump has failed to start

- The electrical supply fuse has blown
- The electrical supply voltage does not match that of the motor
- The outlet pipeline or the oil mist filter is blocked
- The oil temperature is below 12 °C
- The oil is too viscous
- The oil is contaminated
- The pump has seized after long storage
- The pump has been left to stand after contaminants have been pumped and has seized
- The motor is faulty.

5.14.2 The pump has failed to achieve the specified performance (has failed to reach ultimate vacuum)

- Your pressure measurement technique or gauge head is unsuitable or gives an incorrect indication of pressure. For example, a contaminated Pirani gauge can indicate a pressure which is several times higher than the actual pressure in the system.
- You have filled the pump with the wrong type of oil
- There is a leak in your vacuum system
- The oil-level is low
- The oil is contaminated
- Your vacuum fittings are dirty or damaged
- The inlet catchpot is blocked
- The pump has not warmed up.

5.14.3 The pump is noisy

- The motor fan-cover is damaged
- The motor bearings are worn
- The oil is contaminated with solid particles.

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5.14.4 The pump surface temperature is above 100 °C

- The ambient temperature is too high
- The cooling-air supply is insufficient or is too hot
- The electrical supply voltage is too high
- The oil mist filter or the outlet pipeline is blocked
- The oil-level is too low
- You have filled the pump with the wrong type of oil
- The oil is contaminated
- The process gas is too hot or the throughput is too high.

5.14.5 The vacuum is not fully maintained after the pump is switched off

- The gas-ballast oil return assembly is incorrectly fitted
- The inlet valve-pad is damaged
- The inlet valve has not closed.

5.14.6 The pumping speed is poor

- The connecting pipelines are too small in diameter
- The connecting pipelines are too long
- The inlet catchpot is blocked.

5.14.7 There is an external oil leak

- The outer shaft-seal is worn or damaged
- The oil-box gaskets have deteriorated
- There is an oil leak from the gas-ballast oil return assembly
- There is an oil leak from the drain-plug
- There is an oil leak from the sight-glass.

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6 Storage and disposal

6.1 Storage

CAUTION

Observe the storage temperature limits stated in Section 2. Storage below -30 °C will permanently damage the pump seals.

Note: *If you will store a new pump in conditions of high humidity, remove the pump from its cardboard packaging box; dispose of the box (refer to Section 6.2).*

Use the following procedure to store the pump:

1. Shut-down the pump as described in Section 4.
2. Disconnect the pump from the electrical supply.
3. Purge your vacuum system and the pump with dry nitrogen and disconnect the pump from your vacuum system.
4. Drain any fluid from the inlet catchpot and drain any oil from the oil mist filter.
5. Replace the oil as described in Section 5.5.
6. Place and secure protective covers over the inlet and outlet-ports.
7. Store the pump in cool, dry conditions until required for use. When required, prepare and install the pump as described in Section 3. If the pump has been stored for more than a year, before you install the pump you must clean and overhaul it as described in the instructions supplied with the clean and overhaul kit.

6.2 Disposal

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

Particular care must be taken with components and waste oil which have been contaminated with dangerous process substances.

Do not incinerate fluoroelastomer seals and ‘O’ rings.

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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, France, Germany, Hong Kong, Italy, Japan, Korea, Switzerland, United Kingdom, U.S.A and a worldwide 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, state for each part required:

- Model and Item Number of your equipment
- Serial number
- 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 available

Product	Item Number
Edwards Ultragrade 19 oil (1 l)	H110-25-015
Edwards Ultragrade 19 oil (4 l)	H110-25-013
Clean and overhaul kit	A652-01-131
Blade kit	A652-01-130
Inlet-valve kit	A652-01-036
Motor starting relay kit	A505-10-000
Outer shaft seal kit	A652-01-134
Electric motor	
Pumps with Item Numbers -903 and -906	A652-99-000
Pumps with Item Numbers -904	A652-98-000
Cartridge Kit	A652-01-032
Oil mist filter oil element	A224-04-198
Oil mist filter odour element (pack of five)	A223-04-079
Oil mist filter ‘D’ seal	A271-59-535
Gas ballast oil return assembly service kit	A505-23-825
Oil change tag (pack of 10)	A200-03-017
Side panel (gas ballast side)	A652-07-196
Side panel (pump inlet side)	A652-07-017

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