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A360-01-880
Issue H

Instruction Manual

Rotary Vacuum Pumps
E2M2, E1/E2M5 and 8, E2M12

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declare under our sole responsibility that the product(s)

E2M2, E1M5, E2M5, E1M8, E2M8 and E2M12 Rotary Vacuum Pumps:

A341-01-912	A342-01-912	A342-15-903	A360-01-912
A360-01-916	A360-01-981	A360-01-996	A360-02-930
A360-11-916	A360-11-981	A360-11-982	A360-12-930
A361-01-912	A361-01-916	A361-02-981	A361-02-982
A361-11-916	A361-12-981	A361-12-982	A361-13-930
A362-01-912	A362-01-982	A362-05-912	A362-10-940
A362-11-912	A362-11-916	A362-11-981	A362-11-982
A362-12-920	A362-15-903	A370-01-912	A370-15-903

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

IEC34 Parts 1, 5, 8†, 11*	General Requirements for Rotating Electrical Machines.
C22.2 Nº 77-1988 #	Motors with Inherent Overheating Protection.
C22.2 Nº 100-92 #	Motors and Generators.

† 3-phase pumps only.
* 1-phase pumps only.
# 1-phase pumps only - Canadian Standards Association.

following the provisions of

89/392/EEC	Machinery Safety Directive.
89/336/EEC	Electromagnetic Compatibility Directive.
73/023/EEC	Low Voltage Directive.

A Troup.

Dr A. P. Troup, Director of Technology

8/10/96 Crawley.

Date and Place

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

EDWARDS

P900-77-000 Issue A 2B01-010

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Associated publications

Publication title	Publication number
Vacuum Pump and Vacuum System Safety	P300-20-000

1 INTRODUCTION

1.1 Scope of this manual

This manual provides installation, operation and maintenance instructions for the Edwards E2M2, E1/E2M5 and 8, and E2M12 rotary vacuum pumps. The item numbers for each pump are listed in Section 2. You must use the pump as specified in this manual. Read this manual before you install and operate the 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.

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

The following warning symbols are on the pump:



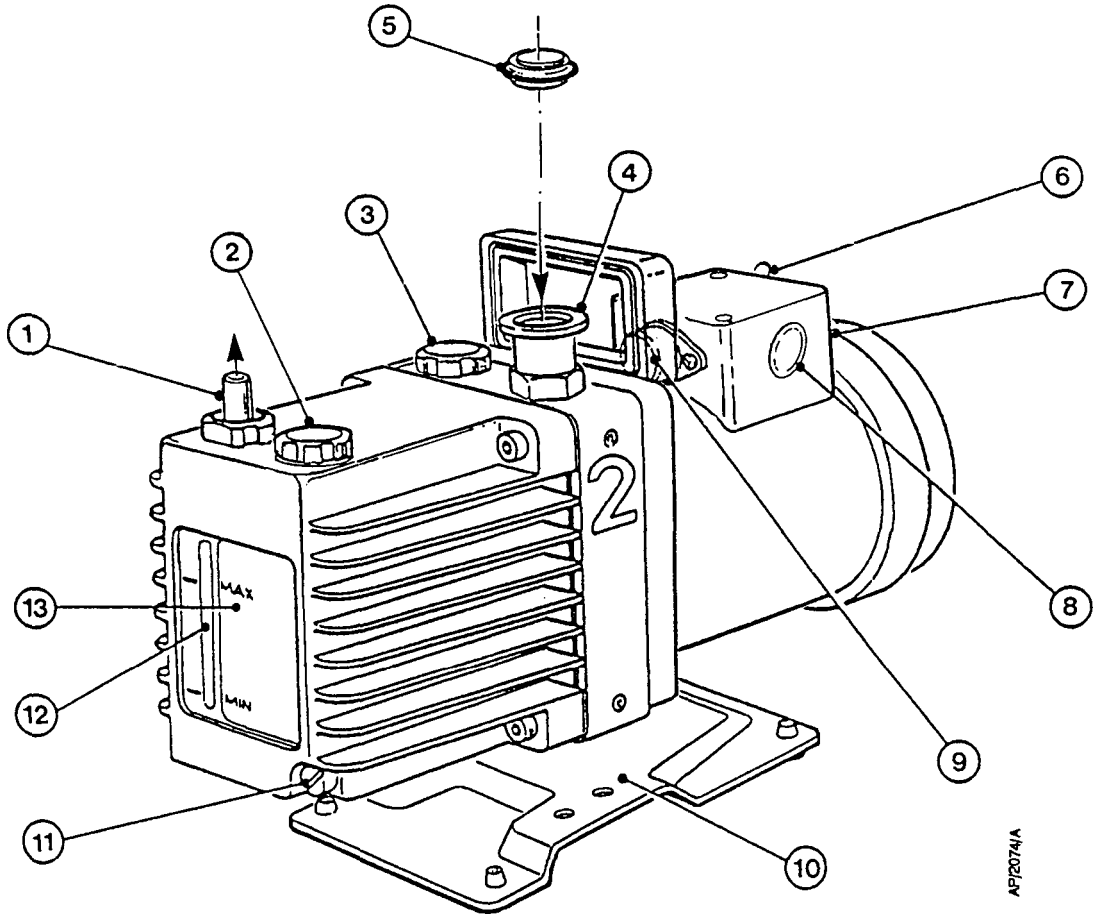
Caution - refer to accompanying documents.



Caution - risk of electric shock.



Caution - hot surface.



1. Outlet nozzle
2. Oil filler-plug
3. Gas-ballast control
4. NW25 inlet-port (adaptor flange)
5. NW25 centring ring and 'O' ring (supplied)
6. On/Off switch (single-phase motors only)
7. Motor terminal box
8. Cable gland
9. Overload reset button (single-phase motors, where applicable)
10. Baseplate
11. Oil drain-plug
12. Oil sight-glass
13. Pump identification label

Figure 1 - The E2M2 pump (single-phase motor shown)

1.2 Description

The Edwards E2M2, E1/E2M5 and 8, and E2M12 pumps are shown in Figure 1. Refer to Figure 1 for item numbers in brackets in the following descriptions.

The E2M2, E1/E2M5 and 8, and E2M12 pumps are single and two-stage, direct drive, sliding vane pumps. The pumps are oil-sealed and designed for reliable, long-term operation in both laboratory and industrial environments. The pumps are free-standing units. The drive is provided through a flexible coupling by a single-phase or three-phase (four pole) motor.

The motors are totally enclosed and are cooled by the motor-cooling fan which directs air along the motor fins.

The single-phase motors have either an automatic or manual reset thermal overload device. When the motor is too hot, the thermal overload device switches off the pump. If the thermal overload device has an automatic reset, when the pump cools down, the device resets and the pump will restart. If the thermal overload device has a manual reset when the motor cools down, you must manually reset the device before you can switch on the pump again. The single-phase motors have on/off switches.

An oil pressure system lubricates the pump shaft bearing surfaces and rotor sealing faces. The pump has an oil distribution valve which prevents discharge of oil to the pump interior (suckback) after the pump stops. The pumping chambers are air-tight, so this arrangement prevents air suckback unless the gas-ballast valve is open. For protection in this case, refer to Section 1.3.

You can inspect the level and condition of oil in the oil box reservoir through the oil sight-glass (12). An oil filler-plug (2) is fitted to the top of the oil box. An oil drain-plug (11) is fitted at the bottom of the oil box.

The pump has an inlet-port (4), outlet nozzle (1) and gas-ballast control (3). The pump is mounted on an aluminium alloy or steel baseplate (10) on rubber pads. Details of suitable vibration isolators and other recommended accessories are given in Section 7.

1.3 Gas-ballast

To pump high vapour loads, gas-ballast is delivered into the pump to prevent condensation of the vapour carried by the pumped gases.

Air (or another gas) can be delivered through the gas-ballast control. The gas-ballast control is a multi-turn valve which you can adjust, as required, between closed and fully open.

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	45 to 65 °C
Maximum humidity (operation)	90% RH
Ambient temperature range (storage)	-30 to 70 °C

2.2 Electrical data: single-phase motors

The electrical data for single-phase motors is given in Table 1. The motor start-up current is drawn for less than one second, so you must use slow-blow fuses to prevent unnecessary fuse failure when the pump starts. If you use the pump at temperatures lower than 12 °C, the start-up current will be drawn for longer; this may cause the motor thermal overload device to open.

2.3 Electrical data: three-phase motors

The electrical data for three-phase motors is given in Table 2. The motor start-up current is drawn for less than one second, so you must use slow-blow fuses to prevent unnecessary fuse failure when the pump starts.

2.4 Lubrication data

Note: An Edwards Health and Safety Data Sheet for the following oil is available on request.

Recommended oil*	Ultragrade 19
Maximum oil capacity	0.6 litre (E1M5 or 8) 0.55 litre (E2M2, 5 or 8) 0.8 litre (E2M12)

* To operate the pump when the ambient temperature is outside the range specified in Section 2.1, or to optimise the pump performance when you process condensable vapours, you may need a different oil.

Pump	Item Number	Voltage (V)	Frequency (Hz)	Full load current (A)	Start current (A)	Recommended fuse rating (A)	Auto (A) or manual (M) thermal overload reset	Electrical supply connection Figure	Dimension Figure	Dimensions (mm)			
										A	B	C	D
E2M2	A360-01-996	100	50	7.0	34.0	15	M	8	2	449	131	-	-
		200	60	3.5	17.0	10		9					
	A360-01-981	115	60	4.4	33.0	15	M	8	2	423	131	46	-
		230	60	2.2	16.5	10		9					
	A360-01-912	220-240	50	2.7	21.8	10	M	7	2	423	131	-	-
	A360-02-930	220-240	50/60	3.5	31.0	13	M	7	2	453	131	-	-
E1M5	A341-01-912	220-240	50	2.7	21.8	10	M	7	2	423	153	-	-
	A361-02-981	115	60	7.2	39.0	20	M	8	2	470	153	46	-
		230	60	3.6	19.5	13		9					
	A361-01-912	220-240	50	2.7	21.8	10	M	7	2	445	153	-	-

Table 1 - Electrical and mechanical data, single phase motors (continued on next page)

Pump	Item Number	Voltage (V)	Frequency (Hz)	Full load current (A)	Start current (A)	Recommended fuse rating (A)	Auto (A) or manual (M) thermal overload reset	Electrical supply connection Figure	Dimension Figure	Dimensions (mm)			
										A	B	C	D
E1M8	A342-01-912	220-240	50	3.8	29.5	13	M	7	2	448	153	-	-
E2M8	A362-01-912	220-240	50	3.8	29.5	13	M	7	2	470	153	-	-
	A362-05-912	220-240	50	3.8	29.5	13	M	7	2	448	153	-	-
	A362-15-903	110	50	7.0	37.0	20	A	10	3	444	153	-	44
		115-120	60	7.0	36.0	20		10					
		220-240	50	3.8	22.0	13		11					
		230-240	60	3.6	21.0	13		11					
E2M12	A370-01-912	220-240	50	3.8	18.5	13	M	7	5	503	177	46	
	A370-15-903	110	50	7.0	37.0	20	A	10	6	477	177	-	44
		115-120	60	7.0	36.0	20		10					
		220-240	50	3.8	22.0	13		11					
		230-240	60	3.6	21.0	13		11					

Table 1 - Electrical and mechanical data, single-phase motors

Pump	Item Number	Voltage (V)	Frequency (Hz)	Full load current (A)	Start current (A)	Recommended fuse rating (A)	Electrical supply connection Figure	Dimension Figure	Dimensions (mm)	
									A	B
E2M2	A360-01-916	220-240	50	1.21	5.5	6	14	2	423	131
		380-420	50	0.70	3.2	4	15			
E2M5	A361-02-982	230	60	1.60	9.0	10	12	2	445	153
		460	60	0.80	4.5	4	13			
	A361-01-916	220-240	50	1.21	5.5	6	14	2	423	153
		380-420	50	0.70	3.2	4	15			
E1M8	A342-01-982	230	60	1.60	9.0	10	12	2	423	153
		460	60	0.80	4.5	4	13			
E2M8	A362-01-982	230	60	1.60	9.0	10	12	2	445	153
		460	60	0.80	4.5	4	13			
	A362-10-940	200-220	50	2.50	14.0	10	16	4	449	153
		200-230	60	2.90	12.0	10	16			
		380-415	50	1.50	9.0	10	17			
		460	60	1.50	8.7	10	17			

Table 2 - Electrical and mechanical data, three-phase motors

2.5 Performance

	E2M2	E1M5	E2M5	E1M8	E2M8	E2M12
Maximum displacement 50 Hz electrical supply 60 Hz electrical supply	 2.8 m^3h^{-1} 3.4 m^3h^{-1}	 5.6 m^3h^{-1} 6.7 m^3h^{-1}	 5.6 m^3h^{-1} 6.7 m^3h^{-1}	 9.5 m^3h^{-1} 11.4 m^3h^{-1}	 9.5 m^3h^{-1} 11.4 m^3h^{-1}	 14.3 m^3h^{-1} 17.3 m^3h^{-1}
Maximum speed - Pneurop 50 Hz electrical supply 60 Hz electrical supply	 2.4 m^3h^{-1} 2.9 m^3h^{-1}	 5.0 m^3h^{-1} 6.0 m^3h^{-1}	 5.0 m^3h^{-1} 6.0 m^3h^{-1}	 8.2 m^3h^{-1} 9.8 m^3h^{-1}	 8.2 m^3h^{-1} 9.8 m^3h^{-1}	 12.0 m^3h^{-1} 14.8 m^3h^{-1}
Motor rotational speed 50 Hz electrical supply 60 Hz electrical supply	1450 1750					
Ultimate vacuum without gas-ballast (partial pressure) without gas-ballast (total pressure) with full gas-ballast (partial pressure)	 2.5×10^{-4} mbar (2.5×10^{-2} Pa) 1×10^{-3} mbar (1×10^{-1} Pa) 3×10^{-2} mbar (3 Pa)	 3×10^{-2} mbar (3 Pa) 3×10^{-2} mbar (3 Pa) 2 mbar (2×10^{2} Pa)	 2.5×10^{-4} mbar (2.5×10^{-2} Pa) 1×10^{-3} mbar (1×10^{-1} Pa) 3×10^{-2} mbar (3 Pa)	 3×10^{-2} mbar (3 Pa) 3×10^{-2} mbar (3 Pa) 2 mbar 2×10^{2} Pa	 2.5×10^{-4} mbar (2.5×10^{-2} Pa) 1×10^{-3} mbar (1×10^{-1} Pa) 3×10^{-2} mbar (3 Pa)	 2.5×10^{-4} mbar (2.5×10^{-2} Pa) 1×10^{-3} mbar (1×10^{-1} Pa) 3×10^{-2} mbar (3Pa)
Maximum water vapour inlet pressure Maximum water vapour pumping rate	 15 mbar (15×10^{2} Pa) 0.03 kgh^{-1}	 35 mbar (35×10^{2} Pa) 0.13 kgh^{-1}	 15 mbar (15×10^{2} Pa) 0.06 kgh^{-1}	 45 mbar (45×10^{2} Pa) 0.27 kgh^{-1}	 15 mbar (15×10^{2} Pa) 0.1 kgh^{-1}	 15 mbar (15×10^{2} Pa) 0.18 kgh^{-1}
Maximum permitted outlet pressure (at full pump throughput)	0.5 bar gauge 1.5 bar absolute 1.5×10^{5} Pa					

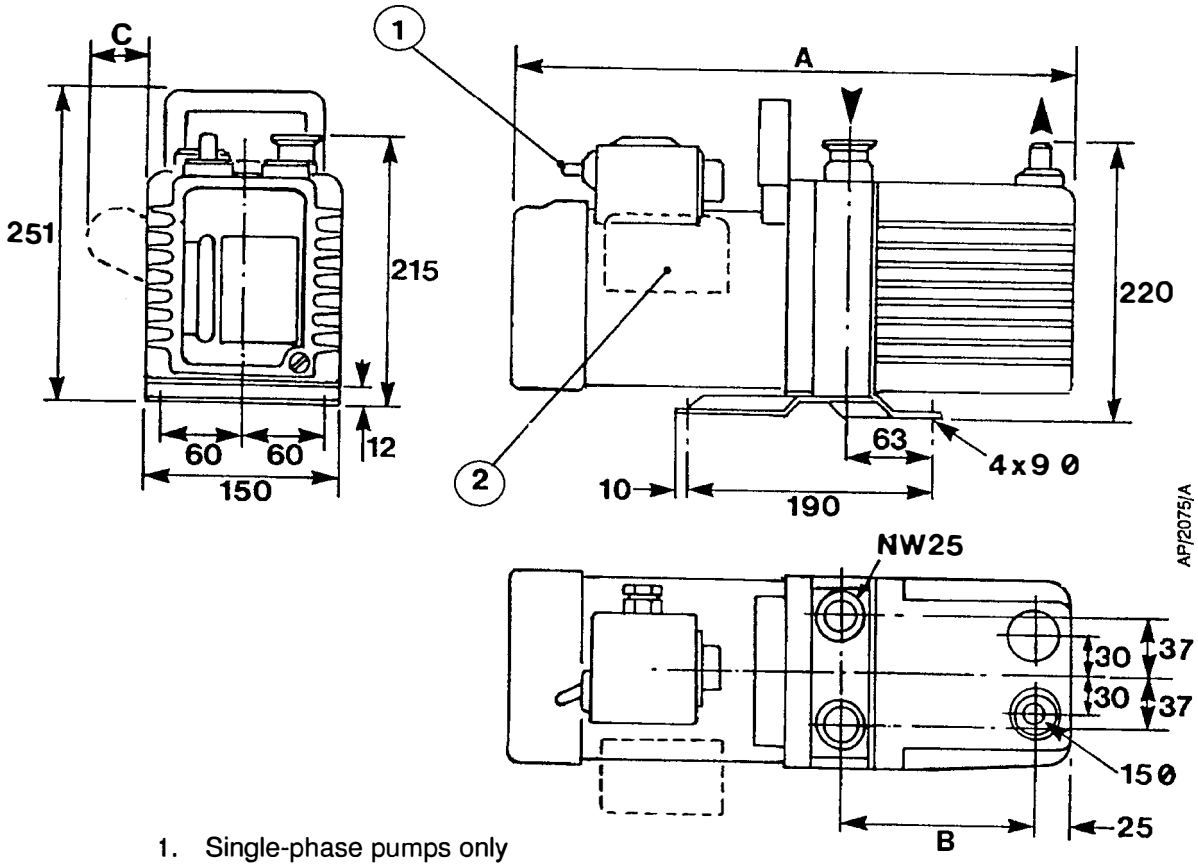
Table 3 - Performance data

Note: Where total pressures are shown in Table 3, measurements were taken using an untrapped total pressure capacitance diaphragm gauge on a header, as specified by Pneurop standards.

	E2M2	E1M5	E2M5	E1M8	E2M8	E2M12
Mass (approximate)	18.2 kg	16.8 kg	19.6 kg	20 kg	22.8 kg	26 kg
Dimensions	Refer to Tables 1 and 2					
Enclosure rating single-phase pumps three-phase pumps	 IP44 IP44	 IP44 IP44	 IP44 IP44	 IP44 IP44	 IP44 IP44	 IP44 IP44
Pump inlet-port Pump outlet-port	NW25 (Flange can be removed from 1 inch BSP threaded hole) 5 mm external diameter nozzle (nozzle can be removed from threaded hole) *					
Noise level at 1 metre	52 dB(A)					

* EM2, 5, 8 pumps have 3/4 inch BSP thread hole
EM12 pumps have 1 inch BSP thread hole

Table 4 - Mechanical data



1. Single-phase pumps only
2. Some single-phase pumps only
   (refer to dimension C in Table 1)

Figure 2 - Dimensions E2M2, E1M/E2M5 and 8 (refer to Tables 1 and 2 for applicability) (mm)

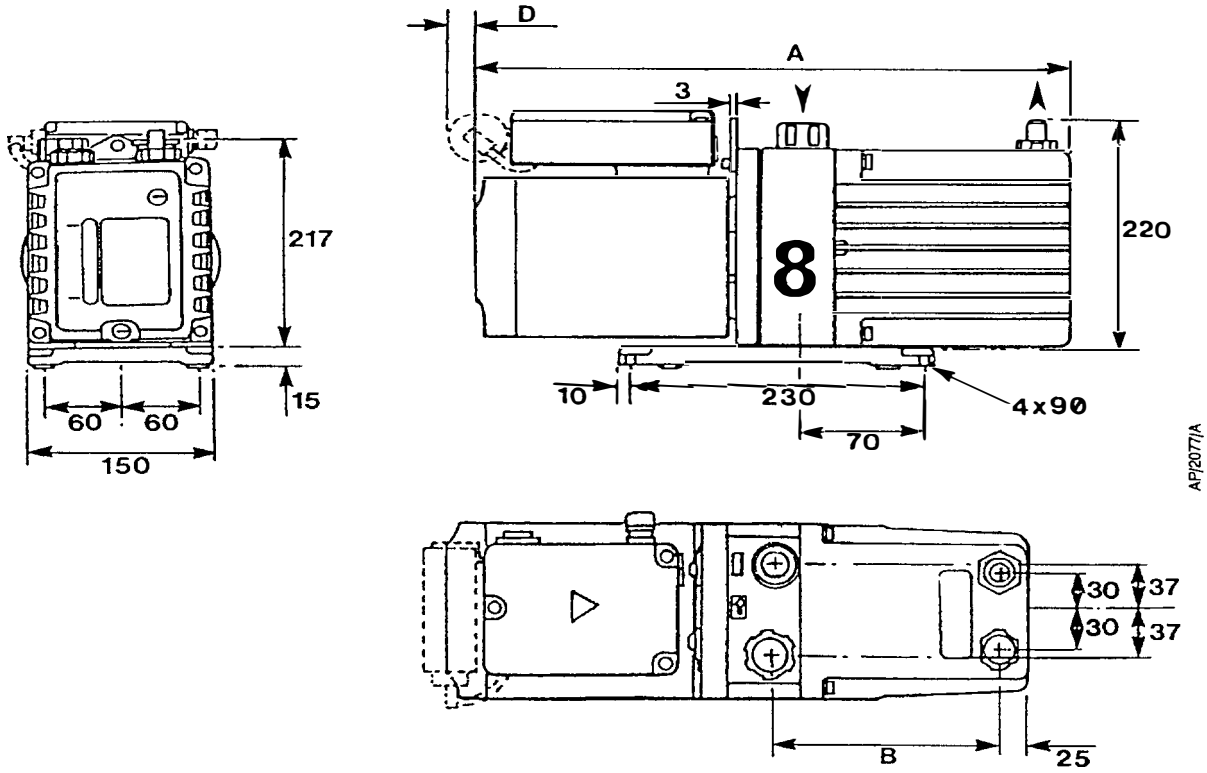


Figure 3 - Dimensions E1M/E2M8 (some single-phase pumps: refer to Table 1 for applicability) (mm)

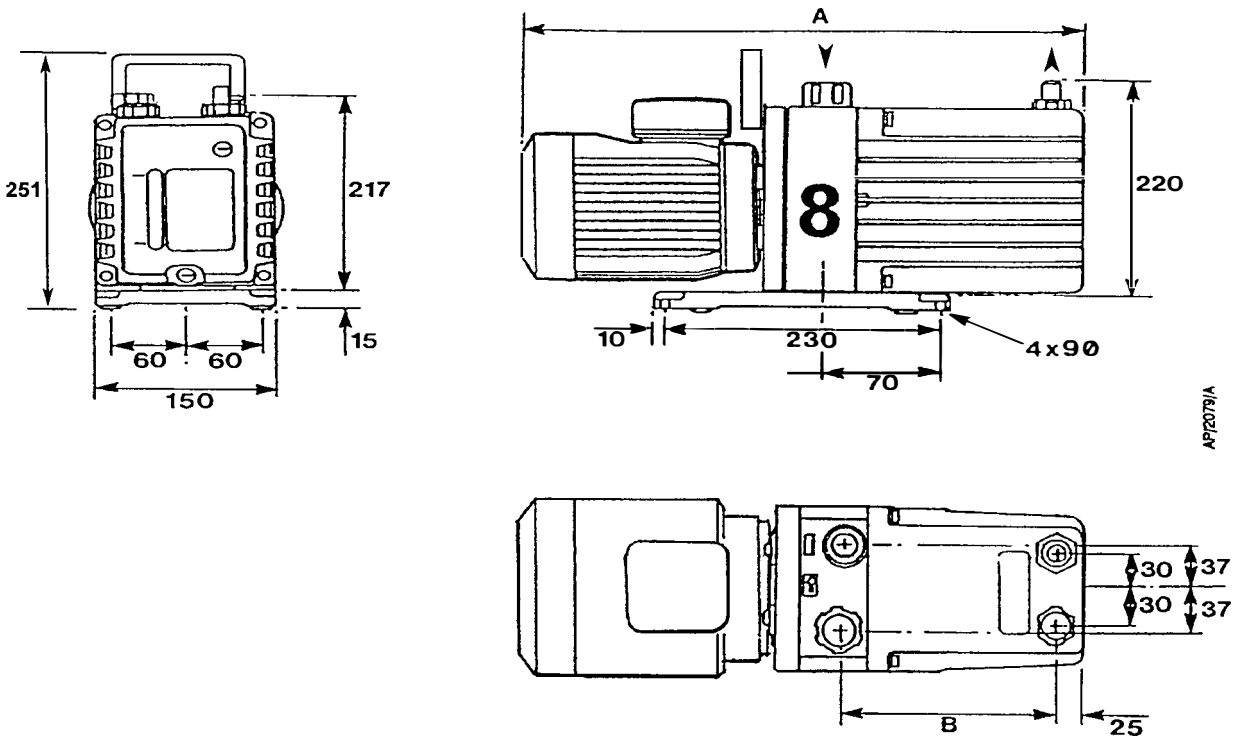
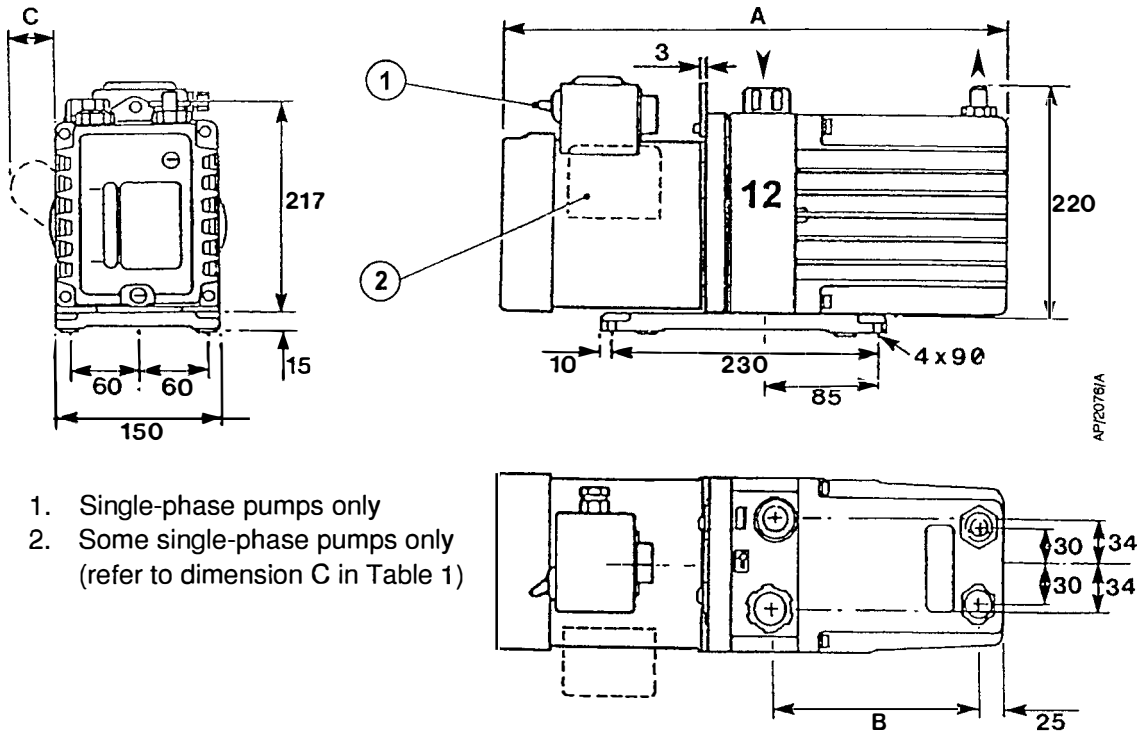


Figure 4 - Dimensions E2M8 (some three-phase pumps only: refer to Table 2 for applicability) (mm)



1. Single-phase pumps only
2. Some single-phase pumps only (refer to dimension C in Table 1)

Figure 5 - Dimensions E2M12 (some single-phase pumps: refer to Table 1 for applicability) (mm)

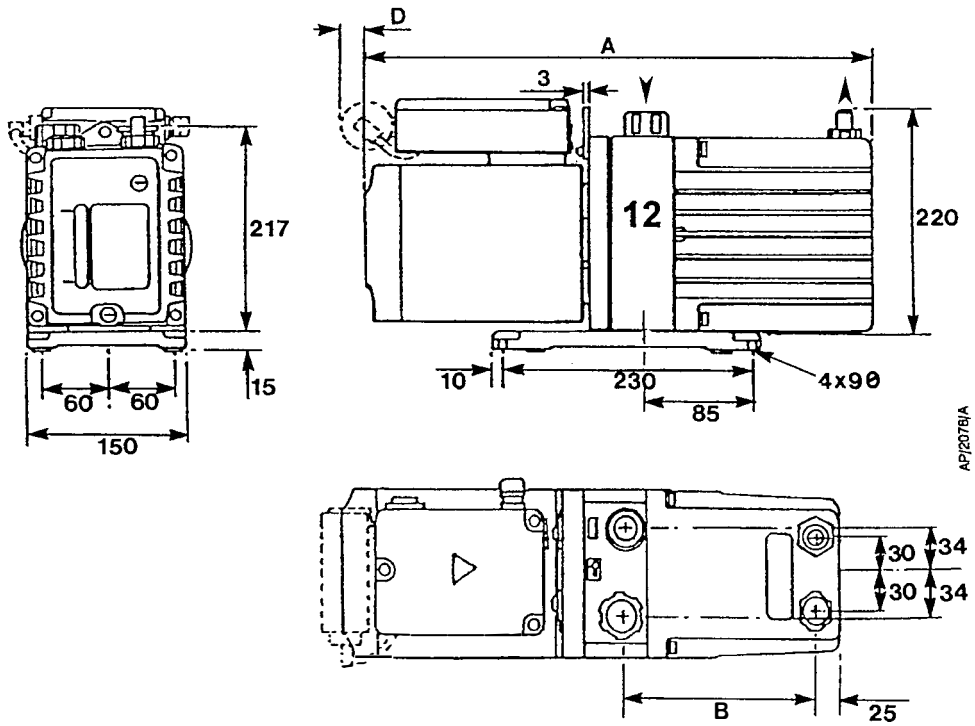


Figure 6 - Dimensions E2M12 (some single-phase pumps: refer to Table 1 for applicability) (mm)

3 INSTALLATION

3.1 Safety

WARNING

These pumps are not recommended for pumping hazardous substances.

WARNING

If you use a hydrocarbon oil in this pump, you must not use the pump to process oxygen in concentrations greater than 25% in volume. If you do, there is a risk of fire or explosion in the oil-box of the pump

You must ensure that the pump is suitable for your application, If you have any doubts as to the suitability of the pump for your application, refer to the Edwards guidelines on vacuum pump and vacuum system safety (see the Associated Publication at the end of the contents list at the front of this manual).

Obey the safety instructions listed below when you install the pump, especially when you connect the pump into an existing system. Details of specific safety precautions are given at the appropriate point in the instructions.

- The installation of your pump must be performed by a suitably trained and supervised technician.
- 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 processed by the pumping system. 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.

3.2 System design

Consider the following points when you design your pumping system:

- Use a suitable inlet-valve to isolate the pump from your vacuum system if you need to allow the pump to warm up before you pump condensable vapours or if you need to maintain vacuum when the pump is switched off.
- Avoid high levels of heat input to the pump from the process gases, otherwise the pump may overheat and seize, and cause the motor thermal overload device to open.
- If you use the pump 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 outlet-isolation valve, make sure that you cannot operate the pump with the valve closed.
- Provide for a purge of inert gas when you shut down the pumping system, to dilute dangerous gases to safe concentrations. A suitable gas-ballast control valve for introduction of purge gas into the pump is available as an accessory (see Section 7.3.5).

3.3 Unpack and inspect

Remove all packing materials and protective covers and check the pump. If the pump 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.

Check that your package contains the items listed in Table 5. If any of these items are missing, notify your supplier within 3 days.

If the pump is not to be used immediately, replace the protective covers. Store the pump in suitable conditions, as described in Section 6.

Qty	Description	Check (✓)
1	E2M2, E1/E2M5 or 8, or E2M12 rotary vacuum pump	❑
	Fitting pack containing the following:	
1	Hexagon wrench 4 mm	❑
1	Hexagon wrench 6 mm	❑
1	NW25 centring ring	❑
1	'O' ring for centring ring	❑
1	'O' ring for oil filler-plug/outlet-port	❑
1	Dowty seal for 1/8 inch BSP oil drain-plug	❑
6	Receptacle connectors, various sizes (supplied with some single-phase motors)	❑

Table 5 - Check list

3.4 Locate the pump

> WARNING
>
> Use suitable lifting equipment to move the pump. The mass of the pumps is approximately 17 kg to 26 kg.

The pump can be either free-standing on its baseplate, or fixed by bolts through the four fixing holes in the baseplate, or used with vibration isolators. For the location of fixing holes in the baseplate, refer to Tables 1 and 2 Figures 2 to 5 as appropriate. Provide a firm, level platform for the pump. Locate the pump so that the oil-level sight-glass is visible and the oil filler-plug, oil drain-plugs and gas-ballast control are accessible.

If your pump 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.

3.5 Fill the pump with oil

Fill the pump with oil as described below. Refer to Figure 1 for the item numbers in brackets.

1. Remove the oil filler-plug (2).

2. Pour oil into the pump until the oil-level just reaches the MAX mark on the bezel at the top of the oil sight-glass (12). If the oil-level goes above the MAX mark, remove the oil drain-plug (11) 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 Electrical installation: single-phase motors

WARNING

Ensure that the electrical installation of the pump conforms with your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth point.

CAUTION

If your pump-motor can be used with more than one voltage range, you must ensure that the motor is configured for your electrical supply voltage and frequency. If you do not, you may damage the motor.

Note: *All of these pumps will restart automatically when the electrical supply is restored after an interruption. In addition, some pumps will also restart automatically when the pump cools after it has overheated. If you do not want the pump to restart automatically, use electrical control equipment that must be reset manually.*

Ensure that your electrical supply voltage corresponds with the voltage specified on the motor data plate. Table 1 gives the figure reference of the correct electrical supply connection diagram, and details the recommended fuse rating. To complete the electrical installation of your pump, refer to either Section 3.6.1 or 3.6.2

The diameter of the outer sheath of the electrical supply cable must be within the range 7 mm to 10.5 mm. The cable must conform in size and colour coding with your local and national electrical installation regulations.

3.6.1 Electrical cable connection, method 1

If the electrical connection diagram for your pump is Figure 7, 8 or 9 , use this method to connect the electrical supply cable.

1. Remove the cover from the motor terminal box (Figure 1, item 8).
2. Remove the cable-gland and lock nut from either the fitting pack or the inside of the terminal-box. Fit the cable-gland to the cable leadthrough hole in the side of the terminal-box.
3. Pass the electrical supply cable through the gland.
4. Connect the electrical supply cable to the appropriate terminals as shown in Figures 7 to 9.
5. Tighten the dome shaped nut on the cable-gland until the outer sheath of the cable is firmly gripped. Do not overtighten.
6. Check that the cable connections are correct, then refit the cover on them motor terminal-box.

3.6.2 Electrical cable connection, method 2

If the electrical connection diagram for your pump is Figure 10 or 11, use this method to connect the electrical supply cable.

1. Remove the cover from the motor terminal box (Figure 1, item 8).
2. Remove the cable-gland from the inside of the terminal-box and fit the cable-gland to the cable leadthrough hole in the side of the terminal-box.
3. Pass the electrical supply cable through the gland.
4. Remove the receptacle and ring connectors from the fitting pack.
5. Select the correct size of receptacle and ring connectors for your cable wires: use the red connectors for wire sizes 0.75 mm^2 to 1.5 mm^2 or the blue connectors for wire sizes 1. 5 mm^2 to 2.5 mm^2.
6. Fit a ring connector to your earth wire.
7. Attach the appropriate connector to the live and neutral wires.
8. Connect the electrical supply cable to the appropriate terminals as shown in Figures 10 to 11.
9. Tighten the dome shaped nut on the cable-gland until the outer sheath of the cable is firmly gripped. Do not overtighten.
10. Check that the cable connections are correct, then refit the cover on the motor terminal-box.

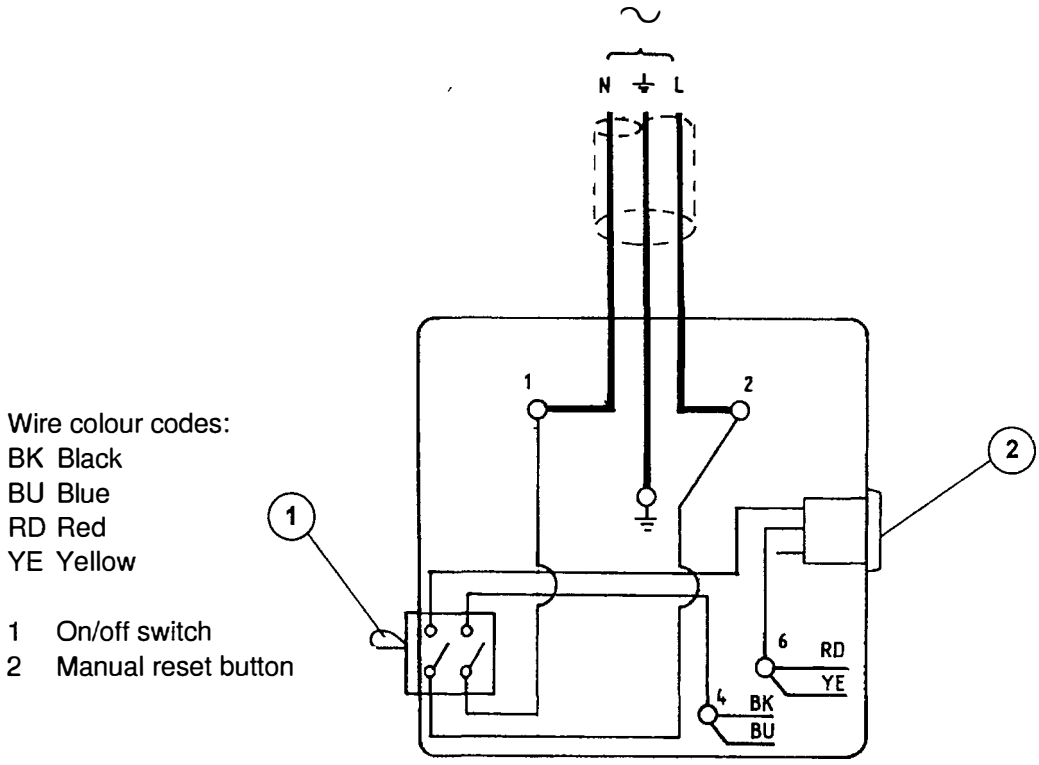


Figure 7 - Electrical supply connection, single-phase motors

Wire colour codes:
BK Black
BU Blue
BN Brown
RD Red
WH White
YE Yellow

1. On/off switch
2. Manual reset button

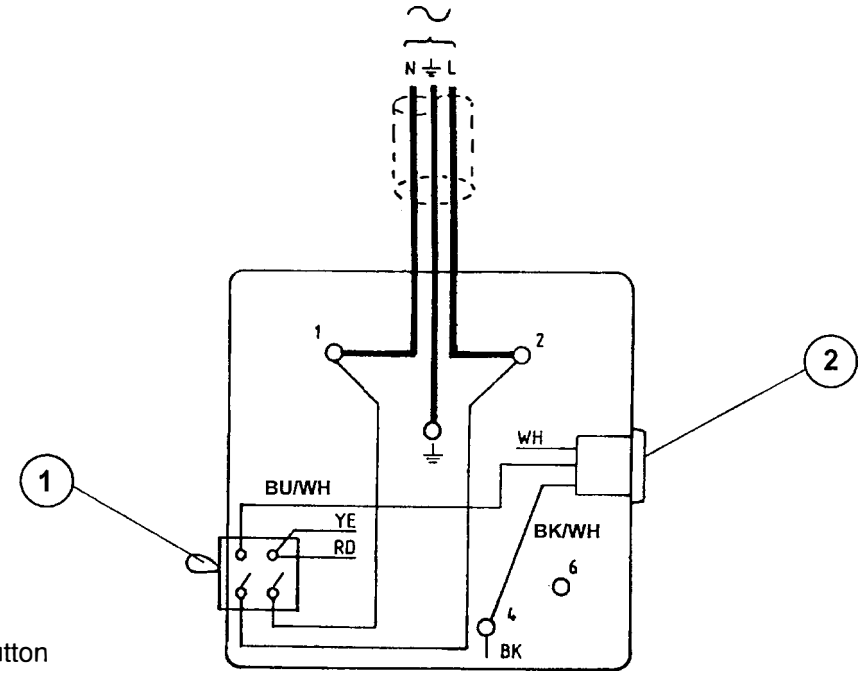


Figure 8 - Electrical supply connection, single-phase motors, (low voltage) (see Table 1 for applicability)

Wire colour codes:
BK Black
RD Red
WH White
YE Yellow

1. On/off switch
2. Manual reset button

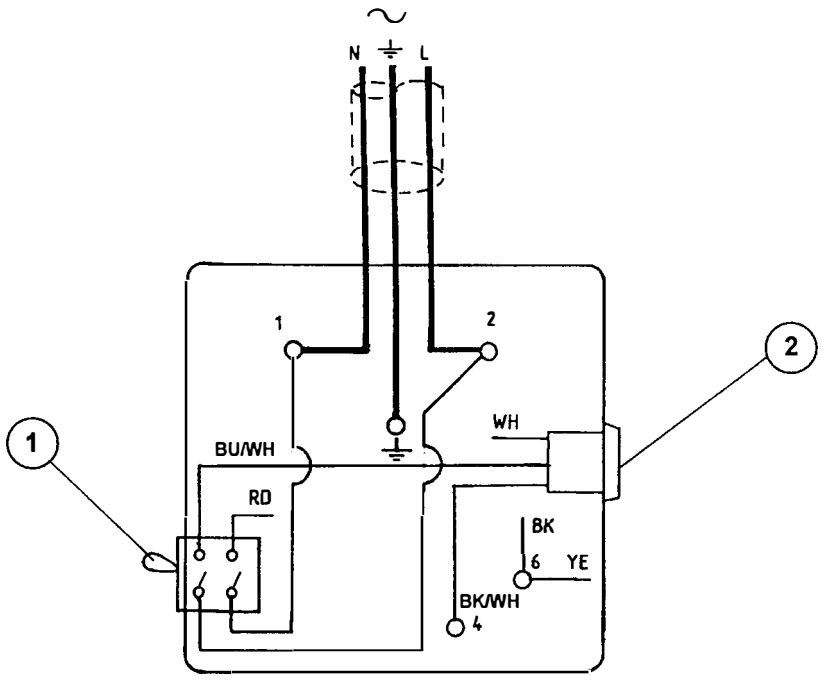
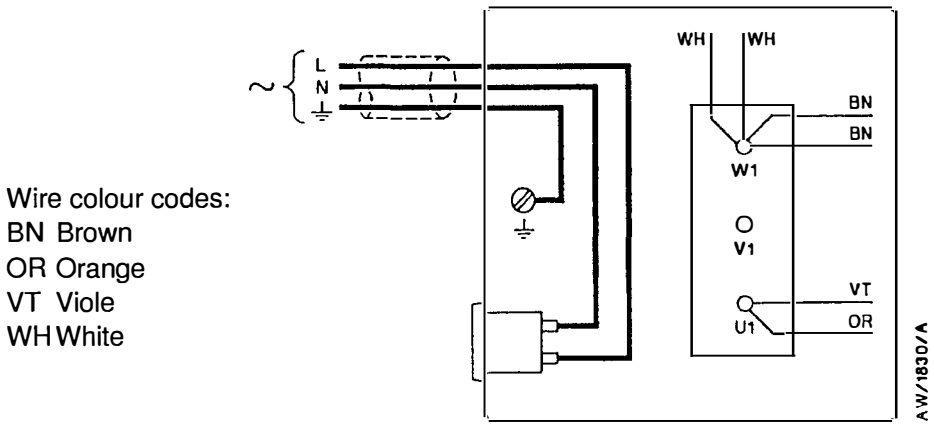
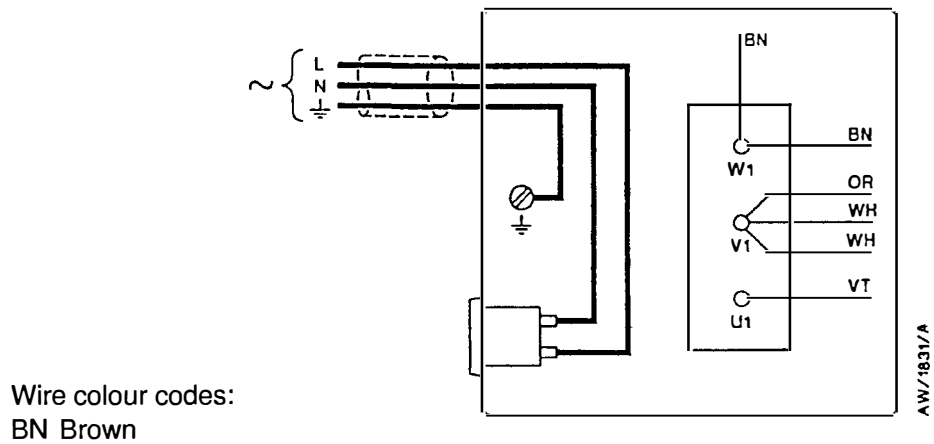


Figure 9 - Electrical supply connection, single-phase motors, (high voltage) (see Table 1 for applicability)



Wire colour codes:
BN Brown
OR Orange
VT Viole
WH White

Figure 10 - Electrical supply connection, single-phase motors, (low voltage)
(see Table 1 for applicability)



Wire colour codes:
BN Brown
OR Orange
VT Violet
WH White

Figure 11 - Electrical supply connection, single-phase motors (high voltage)
(see Table 1 for applicability)

3.7 Electrical installation: three-phase motors

3.7.1 Connect the pump to your electrical supply

> WARNING
>
> Ensure that the electrical installation of the pump conforms with your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth point.

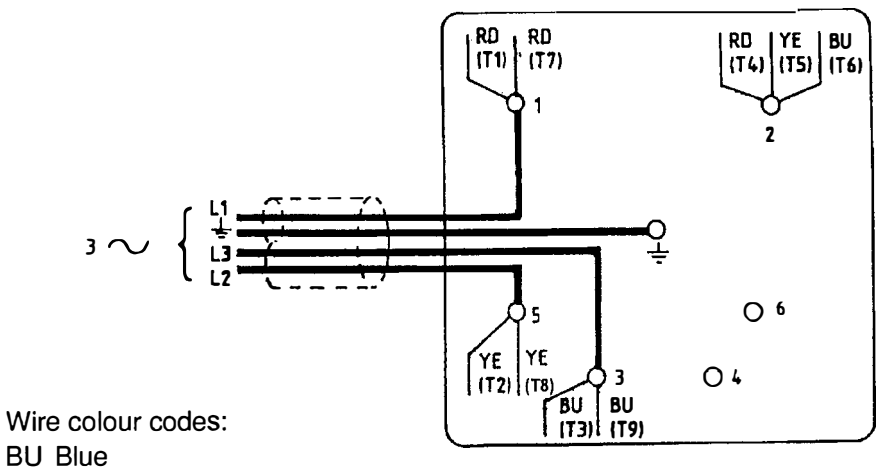
> CAUTION
>
> If your pump-motor can be used with more than one voltage range, you must ensure that the motor is configured for your electrical supply voltage and frequency. If you do not, you may damage the motor.

Note: *The pump will restart automatically when the electrical supply is restored after an interruption. If you do not want the pump to restart automatically, use electrical control equipment which must be reset manually.*

We recommend that you connect the electrical supply to the motor through a starter or circuit breaker which has thermal over-current protection which can be adjusted to suit the full load current ratings shown in Table 2. The fuse ratings in Table 2 are provided for guidance only. The supplier of your thermal over-current protection device may specify different values to ensure correct operation of the fuse and the over-current protection device. Ensure that the fuse you use is suitable for the starting currents given in Table 2. Table 2 also gives the figure reference of the correct electrical supply connection diagram for your motor.

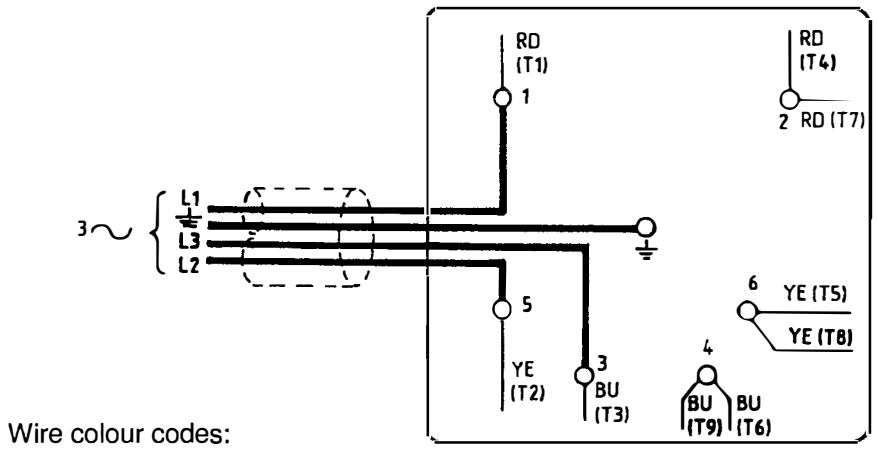
The diameter of the outer sheath of the electrical cable must be in the range 10-14 mm. The cable must conform in size and colour coding with your local and national electrical installation regulations.

1. Remove the cover from the motor terminal-box.
2. Remove the cable-gland from the inside of the terminal-box and fit the cable-gland to the cable leadthrough hole in the side of the terminal-box.
3. Refer to the electrical supply connection diagram for your pump, (Figures 12, 13, 14, 15, 16 or 17). Make sure that the metal links are connected as shown; if they are not, move the links to the position shown.
4. Pass the electrical supply cable through the cable-gland and connect to the appropriate terminals, as shown in Figures 12, 13, 14, 15, 16 or 17.
5. Tighten the cable gland until the outer sheath of the cable is firmly gripped. Do not overtighten.



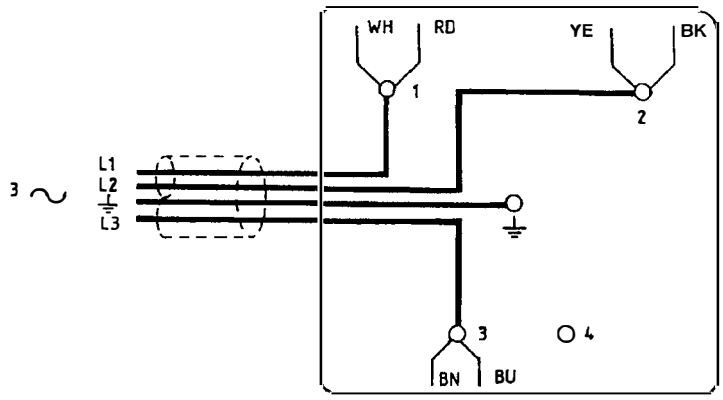
Wire colour codes:
BU Blue
RD Red
YE Yellow

Figure 12 - Electrical supply connection, three-phase motors, (low voltage)
(see Table 2 for applicability)



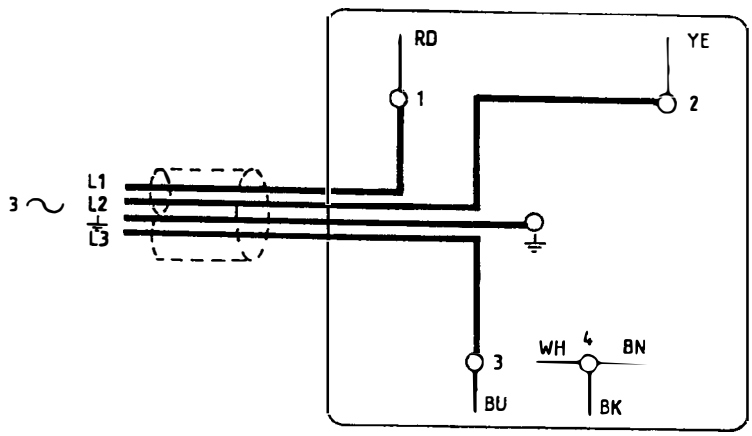
Wire colour codes:
BU Blue
RD Red
YE Yellow

Figure 13 - Electrical supply connection, three-phase motors (high voltage)
(see Table 2 for applicability)



Wire colour codes:
BK Black
BN Brown
BU Blue
RD Red
WH White
YE Yellow

Figure 14 - Electrical supply connection, three-phase motors (low voltage)
(see Table 2 for applicability)



Wire colour codes:
BK Black
BN Brown
BU Blue
RD Red
WH White
YE Yellow

Figure 15 - Electrical supply connection, three-phase motors (high voltage)
(see Table 2 for applicability)

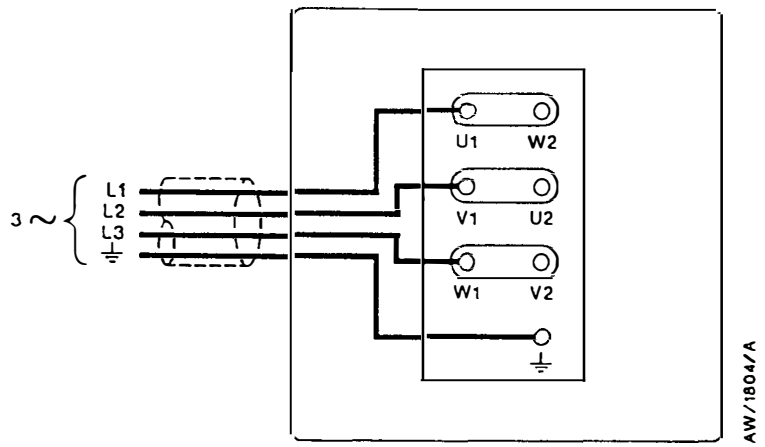


Figure 16 - Electrical supply connection, three-phase motors, (low voltage)
200-220 V 50 Hz, or 200-230 V 60 Hz 200 V 50/60 Hz, 220-240 V 50 Hz

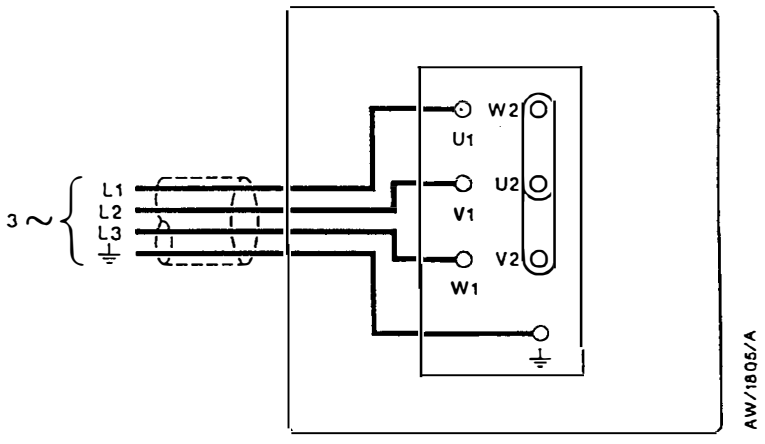


Figure 17 - Electrical supply connection, three-phase motors,) (high voltage)
380-415 V 50 Hz, or 460 V 60 Hz, 380-420 V 50 Hz

6. Ensure that the gasket seal for the terminal box cover is correctly positioned, then refit the cover to the terminal-box and secure with the screws.

3.7.2 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.

1. Watch the motor cooling-fan through the motor fan-cover.
2. Switch-on the electrical supply to the motor for a few seconds.
3. Check that the motor cooling-fan rotates in the correct direction shown by the arrow on the motor mounting plate. If the direction of rotation is incorrect:
   - Switch off the electrical supply immediately.
   - Isolate the pump from the electrical supply.
   - Remove the terminal-box cover and swap wires L1 and L3: see Figures 12, 13, 14, 15, 16 or 17, as appropriate.
   - Refit the cover to the terminal-box.

3.8 Inlet connection

Connect your vacuum system to the inlet-port (Figure 1, item 4). To make this connection, you can:

- Connect to the NW25 flange supplied: use the NW25 centring ring and 'O' ring supplied.
- Remove the NW25 flange and connect to the 1 inch BSP threaded hole.
- Use an NW25 to 28 mm bore tube adaptor available as an optional accessory, see Section 7.

Take note of the following information when you connect the pump to your vacuum system. Refer to Section 7 for details of the accessories mentioned below.

- For optimum pumping speeds, ensure that the pipeline connected to the inlet-port is as short as possible and has an internal diameter not less than the inlet-port diameter.
- Support the vacuum pipelines to prevent loading of the coupling-joints.
- If necessary, incorporate flexible bellows in your system pipelines to reduce the transmission of vibration and to prevent loading of coupling-joints. If you use flexible bellows, you must ensure that you use bellows 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 bellows.

- Use a suitable catchpot if you pump condensable vapours or if you use the pump for very dusty applications.
- Ensure that sealing surfaces are clean and scratch-free.

3.9 Outlet connection

> WARNING
>
> Connect the pump outlet to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere. Use a catchpot to prevent the drainage of contaminated condensate back into the pump.

To connect the pump to your outlet accessories or to your exhaust treatment plant, you can:

- Connect 10 mm internal diameter vacuum hose or 12 mm internal diameter plastic hose to the outlet nozzle (Figure 1, item 1).
- Remove the outlet nozzle and connect to the 3/4 inch BSP threaded hole.
- Remove the outlet nozzle and replace it with an NW25 flange adaptor (available as an optional accessory, see Section 7) and then connect to the NW25 flange.

Take note of the following information before you connect to the pump outlet:

- The exhaust system must be configured so that the maximum pressure at the pump outlet does not exceed 0.5 bar gauge (1.5 bar absolute, 1.5×10^5 Pa) at full pump throughput.
- In the following circumstances, we recommend that you fit an oil mist filter to the pump outlet:
  - if you use the pump with the gas-ballast control open
  - if you operate the pump with an inlet pressure greater than 10 mbar for extended periods or
  - if you frequently pump down from atmospheric pressure.

  The mist filter will trap the oil exhausted from the pump: you can re-use the oil if it is not contaminated.

3.10 Gas ballast inlet connection

The position of the gas ballast inlet is shown in Figure 1 (item 3). The gas ballast inlet has several filters (shown in Figure 19) to trap any dust and debris if you use air as the gas ballast supply.

If you want to use a different gas for the gas ballast supply, or if you want to connect a valve to the gas ballast inlet, remove the filters (as described in Section 5.6) and connect your gas supply or valve to the 1/4 inch BSP threaded hole.

3.11 Leak-test the system

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

4 OPERATION

4.1 Gas-ballast control

Use the gas-ballast control (Figure 1, item 3) to change the flow of gas-ballast into the low vacuum stage of the pump.

Use the gas-ballast control closed:

- to achieve ultimate vacuum
- to pump dry gases.

Turn the gas-ballast control 5 turns anti-clockwise to open it fully.

Use gas-ballast control open:

- to pump high concentrations of condensable vapour
- to decontaminate the oil.

When you operate the pump with the gas-ballast control open, there will be an increased rate of oil loss from the pump.

4.2 Start-up procedure

> WARNING
>
> Do not block the pump outlet or allow the outlet pressure to rise above 1.5 bar absolute. If you do, the oil box may fracture: this may cause injury to people nearby.

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 for the pump, the pump may operate at a reduced speed for a few minutes. On single-phase pumps, if the pump continues to operate at reduced speed, the motor thermal overload device will open and the pump will stop. If the pump has an automatic reset thermal overload device, when the pump cools the device will reset automatically and the pump will re-start. If the pump has a manual reset thermal overload device, use the procedure in Section 4.3 to reset the device.

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 5.3.

2. Turn the gas-ballast control to the required position (refer to Section 4.1).

3. Switch on the electrical supply to the pump.

4. Check that the oil-level in the sight-glass drops slightly (3 to 5mm) after start-up. This shows that the pump has primed with oil.

5. If the pump fails to prime, operate the pump with the inlet open to atmosphere for approximately 30 seconds. Then isolate the inlet and check that the oil-level drops 3-5 mm.

6. If you want to achieve ultimate vacuum, to pump condensable vapours or to decontaminate the pump oil, refer to the procedures in Sections 4.3, 4.4 and 4.5 respectively. Otherwise, open the vacuum system isolation-valve.

4.3 Re-set the thermal overload device (pumps with manual reset)

> WARNING
>
> Disconnect the pump from the electrical supply before you press the motor reset button. If you do not, under fault conditions, you may injure yourself.

If the pump motor has a manual thermal overload device, the thermal overload device switches off the pump when the motor is too hot. The pump motor may be too hot because the ambient temperature is too high, or because the pump has seized, or because the motor is faulty. If the thermal overload device operates again after you have reset it, you must investigate and rectify the cause of the thermal overload.

Use the procedure below to restart the thermal overload device.

1. Disconnect the pump from the electrical supply and allow the pump to cool for 10 minutes.

2. Press the reset button, (Figure 1, item 9) then reconnect the pump to the electrical supply.

4.4 To achieve ultimate vacuum

If the pump 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 5.11.2 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 pump from your vacuum system.

2. Turn the gas-ballast control fully anti-clockwise (fully open) and operate the pump for at least 1 hour (or overnight) to thoroughly purge the oil of contaminants.

3. Close the gas-ballast control.

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

4.5 To pump condensable vapours

Use gas-ballast (open the gas-ballast control) when there is a high proportion of condensable vapours in the process gases.

1. Close the vacuum system isolation-valve.

2. Turn the gas-ballast control anti-clockwise to fully open and operate the pump for 30 minutes to warm the oil; this will help to prevent vapour condensation in the pump.

3. Open the vacuum system isolation-valve and continue to operate the pump with the gas-ballast control open.

After you have pumped condensable vapours, you can (if necessary) decontaminate the oil; use the procedure in Section 4.6.

4.6 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 sight-glass (Figure 1, item 12). If the oil is cloudy or discoloured, continue with the procedure at Step 2 below.

2. Close the vacuum system isolation-valve.

3. Turn the gas-ballast control fully anti-clockwise.

4. Operate the pump until the oil is clear.

4.7 Unattended operation

The pump is designed for unattended operation under the normal operating conditions specified in Section 2. However, we recommend that you check the pump at a regular interval of not more than 14 days; check the pump more frequently if you pump high volumes of gas or if you operate the pump with the gas-ballast control open.

Single-phase motors are cooled by internal fans. These motors have either an automatic or manual reset thermal overload device. When the motor is too hot, the thermal overload device switches off the pump. If the thermal overload device has an automatic reset, when the pump cools down, the device resets and the pump will restart. If the thermal overload device has a manual reset when the motor cools down, you must manually reset the device before you can switch on the pump again. The single-phase motors have on/off switches. If the pump has an automatic reset overload device, 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.

4.8 Shut-down

Note: *If the gas-ballast control is open and the pump is switched off for any reason, the pump drive shaft may rotate in the reverse direction, causing a system pressure rise. To prevent this, use a gas-ballast control valve (refer to Section 7.3.5).*

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 4.6 and decontaminate the oil, as required.
2. Close the vacuum system isolation-valve (if not already closed).
3. Close gas-ballast (that is, turn the gas-ballast control clockwise).
4. Switch off the electrical supply to the pump.

5 MAINTENANCE

5.1 Safety information

WARNING
Obey the safety instruction 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.
- Allow the pump to cool to a safe temperature before you start maintenance work.
- Isolate the pump and other components in the pumping system from the electrical supply so that they can not be operated accidentally.
- After maintenance is completed, recheck the pump rotation direction if the electrical supply has been disconnected.
- Do not reuse 'O' rings and seals if they are damaged.
- The pump and its fluid 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 260 °C and above. These breakdown products are very dangerous. Fluorinated materials in the pump may include oils, greases and seals. The pump may have overheated if it was misused, if it malfunctioned or if it was in a fire. Edwards Health and Safety Data sheets for fluorinated materials used in the pump are available on request: contact your supplier or Edwards.
- Leak-test the system after maintenance work is complete if you have connected or disconnected any vacuum or exhaust joints; seal any leaks found.

5.2 Maintenance plan

The plan shown in Table 6 details the routine maintenance operations necessary to maintain the pump in normal use. Instructions for each operation are given in the section shown.

More frequent maintenance may be required if the pump is used to process corrosive or abrasive gases and vapours; in these circumstances, we recommend that you replace the pump seals every year. If necessary, adjust the maintenance plan according to your experience.

When you maintain the pump, 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.

Examine the condition of any external accessories, filters or traps (if fitted). Refer to the instructions supplied with these accessories for maintenance procedure.

Operation	Frequency	Refer to Section
Check the oil-level	As required, at least monthly	5.3
Replace the oil	3000 operation hours	5.4
Inspect and clean the inlet-filter	Every oil change	5.5
Clean or replace the gas-ballast filters	Yearly	5.6
Clean the motor fan-cover	Yearly	5.7
Clean and overhaul the pump	15000 operation hours	5.8
Fit new blades	30000 operation hours	5.9
Test the motor condition	15000 operation hours	5.10

Table 6 - Maintenance plan

5.3 Check the 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 oil sight-glass (12) 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 the oil filler-plug (2) 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 oil drain-plug (11) and drain the excess oil from the pump. Refit the oil filler-plug.

3. If the oil is contaminated, drain and refill the pump with clean oil as described in Section 5.4.

5.4 Replace the oil

Refer to Figure 1 for the items in brackets.

1. Operate the pump for approximately ten minutes to warm the oil, then switch off the pump. (This lowers the viscosity of the oil and allows the oil 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 the oil filler-plug (2).

4. Place a suitable block under the pump-motor to tilt the pump and place a suitable container under the oil drain-plug (11). Remove the oil drain-plug and allow the oil to drain into the container.

5. If the oil is dirty or contaminated, pour clean oil into the pump and allow it to drain out of the pump. Repeat this step until the oil reservoir is clean.

6. Refit the oil 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 oil sight-glass (12).

8. Allow a few minutes for the oil to drain into the pump. If necessary, add more oil. Refit the oil filler-plug.

5.5 Inspect and clean the inlet-filter

Refer to Figure 18.

1. Unscrew the inlet adaptor (1) and remove the 'O' ring (2), circlip (3) and inlet-filter (4).

2. Wash the filter in a suitable cleaning solution. Allow the filter to dry.

3. Replace items (4), (3), (2), and (1).

1. Inlet adaptor
2. 'O' ring
3. Circlip
4. Inlet-filter

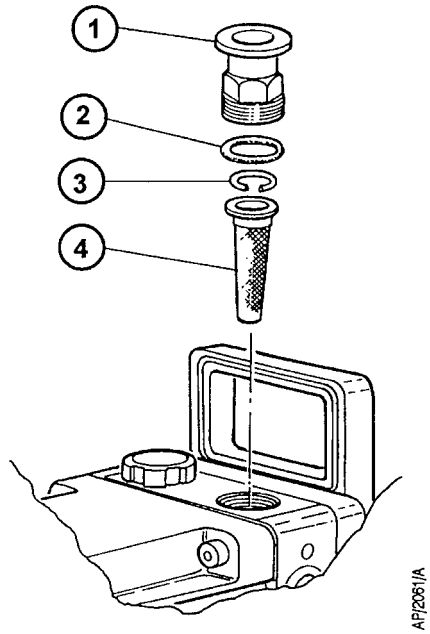
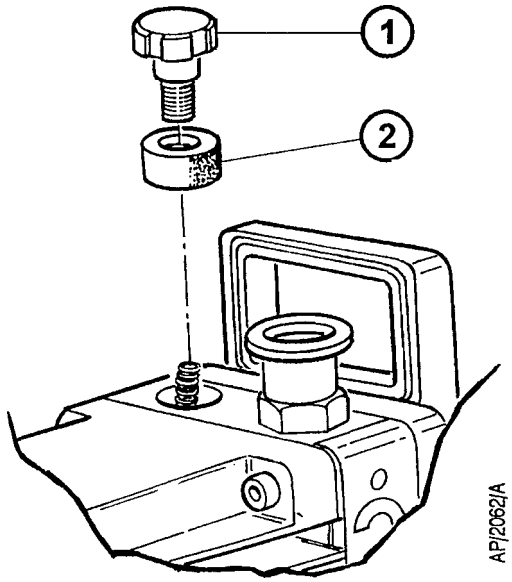


Figure 18 - Inlet-filter removal and replacement (E2M2 illustrated)

5.6 Clean the gas-ballast filter

Refer to Figure 19.

1. Unscrew and remove the gas-ballast control (1).
2. Remove the filter element (2) from its position below the control.
3. Wash the filter element in a suitable cleaning solution. Replace the filter element if it is damaged.
4. Replace the filter element carefully on its seat. Screw the gas-ballast control back into the pump, and reset to the required position.



1. Gas-ballast control
2. Filter element

Figure 19 - Gas-ballast filter removal and replacement (E2M2 illustrated)

5.7 Clean the motor fan-cover

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

1. Switch off the pump and disconnect it from the electrical supply.
2. Use a dry cloth and a brush to remove dirt and deposits from the fan-cover.

5.8 Clean and overhaul the pump

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

5.9 Fit new blades

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

5.10 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. We recommend that, the earth continuity is less than 0.1 Ω and the insulation resistance is greater than 10 MΩ. If the motor fails these tests, you must replace the motor.

5.11 Fault finding

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

5.11.1 The pump has failed to start

- The electrical supply fuse has blown.
- The motor is incorrectly wired.
- The operating voltage does not match that of the motor.
- The exhaust filter or exhaust line is blocked.
- The oil temperature is below 12 °C.
- The oil is too viscous.
- The oil is contaminated.
- The pump is seized after long storage, or has been left to stand after pumping contaminants.
- The motor is faulty.

5.11.2 The pump failed to achieve specified performance (Failure to reach ultimate vacuum)

- Your measuring technique or gauge is unsuitable.
- There is a leak in the external vacuum system.
- The gas-ballast control is open.
- The oil-level is too low.
- You have filled the pump with the wrong type of oil.
- The oil is contaminated.
- The pump has not primed.
- The vacuum fittings are dirty.
- The inlet-filter is blocked.
- The pump has not warmed up.
- The motor shaft rotates in the wrong direction - three-phase motors only.

5.11.3 The pump is noisy

- The motor fan-cover is damaged.
- The coupling and fan assembly are poorly adjusted.
- The motor coupling is loose.

- The motor bearings are worn.
- The oil is contaminated with solid particles.
- One of the pump blades is sticking.

5.11.4 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 cooling-air supply is blocked.
- The electrical supply voltage is too high.
- The exhaust filter or exhaust line is blocked.
- The oil-level is too low.
- The pump is filled with the wrong type of oil.
- The oil is contaminated.
- The process gas is too hot, or the throughput is too high.

5.11.5 The vacuum is not maintained after the pump is switched off

- The gas-ballast control is open.
- 'O' ring(s) are damaged or missing.
- The shaft seals have deteriorated.

5.11.6 The pumping speed is poor

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

5.11.7 There is an external oil leak

- The oil pump shaft seal is worn or damaged.
- The oil box gasket has deteriorated.
- There is an oil leak from gas-ballast control.
- There is an oil leak from the drain-plug.

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 4.8.
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. Replace the oil as described in Section 5.4.
5. Place and secure protective covers over the inlet and outlet-ports.
6. 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, the oil and any components removed from the pump in a safe manner in accordance with all local and national safety and environmental requirements.

Particular care must be taken with the following:

- Components which have come into contact with the pump fluid.
- Components which have been contaminated with dangerous process substances.

Do not incinerate fluoroelastomer seals and 'O' rings.

7 SPARES AND ACCESSORIES

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 Spares

The following maintenance kits contain all of the parts you will need to maintain your pump. The maintenance kits also include instructions for the use of the kits. Use the Clean and Overhaul Kit for routine maintenance operations. Use the Blade Kit together with the Clean and Overhaul Kit when you must renew the blade assembly in the rotary pump.

Maintenance kit	**Item Number**
E2M2, E1/E2M5 and 8 Clean and Overhaul Kit	A341-01-131
E2M12 Clean and Overhaul Kit	A371-01-131
E2M2 Blade Kit	A360-01-129
E1M5 Blade Kit	A341-01-129
E2M5 Blade Kit	A361-01-129
E1M8 Blade Kit	A342-01-129
E2M8 Blade Kit	A362-01-129
E2M12 Blade Kit	A370-01-129

7.3 Accessories

A range of accessories is available for the E2M2, E1/E2M5 and 8, and E2M12 pumps; refer to Figure 12.

7.3.1 Inlet catchpot

The inlet catchpot traps any liquid droplets and prevents their entry into the pump.

Product	**Item Number**
IT020K Inlet catchpot	A441-10-000

7.3.2 Inlet dust filter

The inlet dust filter protects the pump against abrasive dust.

Product	Item Number
ITF20K Inlet dust filter	A442-15--000

7.3.3 Inlet desiccant trap

Use a desiccant trap when you pump limited quantities of water vapour at high pumping speeds to a low vapour pressure.

Product	Item Number
ITD20K Inlet desiccant trap	A445-10-000

7.3.4 Inlet chemical trap

The inlet chemical trap protects the pump against chemically active gases.

Product	Item Number
ITC20K Inlet chemical trap	A444-10-000

7.3.5 Solenoid operated gas-ballast control valve

The valve provides remote or automatic on/off control of gas-ballast. The valve can be connected to shut-off ballast to prevent the return of air to the vacuum system when the pump is switched off.

Product	Electrical supply	Item Number
EBV20 Gas-ballast control valve	220/240 V, single-phase, 50/60 Hz	A500-06-930
	100/120 V, single-phase, 50/60 Hz	A500-06-984

7.3.6 Foreline trap

Use a foreline trap on a clean pumping system to prevent back-migration of rotary pump oil vapour into your vacuum system.

Product	Item Number
FL20K Foreline trap	A133-05-000

7.3.7 Solenoid operated pipeline valve

Fit the pipeline valve between your vacuum system and the pump inlet to provide additional system protection when the pump is switched off.

Product	Electrical supply	Item Number
PV25EK Valve	200/240 V, single-phase, 50/60 Hz	C413-01-000.
	110/127 V, single-phase, 50/60 Hz	C413-03-000

7.3.8 Outlet mist filter

The outlet mist filter separates and traps oil droplets in the pump outlet to prevent oil mist discharge.

Product	Item Number
EMF10 Outlet mist filter (E2M2, E1/E2M5 and 8)	A462-26-000
EMF20 Outlet mist filter (E2M12)	A462-29-000

7.3.9 Oil drain extension

Fit the oil drain extension between the oil drain port on the pump and the oil drain-plug to make the drainage of oil from the pump easier.

Product	Item Number
ODP20 Oil drain extension	A500-02-000

7.3.10 Vibration isolators

The vibration isolators reduce transmission vibration and noise when the pump is floor or frame mounted and to help to reduce strain when the mounting area is uneven.

Product	Item Number
Vibration isolators (pack of four)	A248-01-404

7.3.11 Pump inlet adaptor

NW25 to 28mm bore tube adaptor, supplied with connection hardware. Attach this adaptor to the NW25 pump-inlet to connect 28mm bore plastic or rubber tube.

Product	Item Number
Pump inlet adaptor	C105-20-201

7.3.12 Flexible bellows

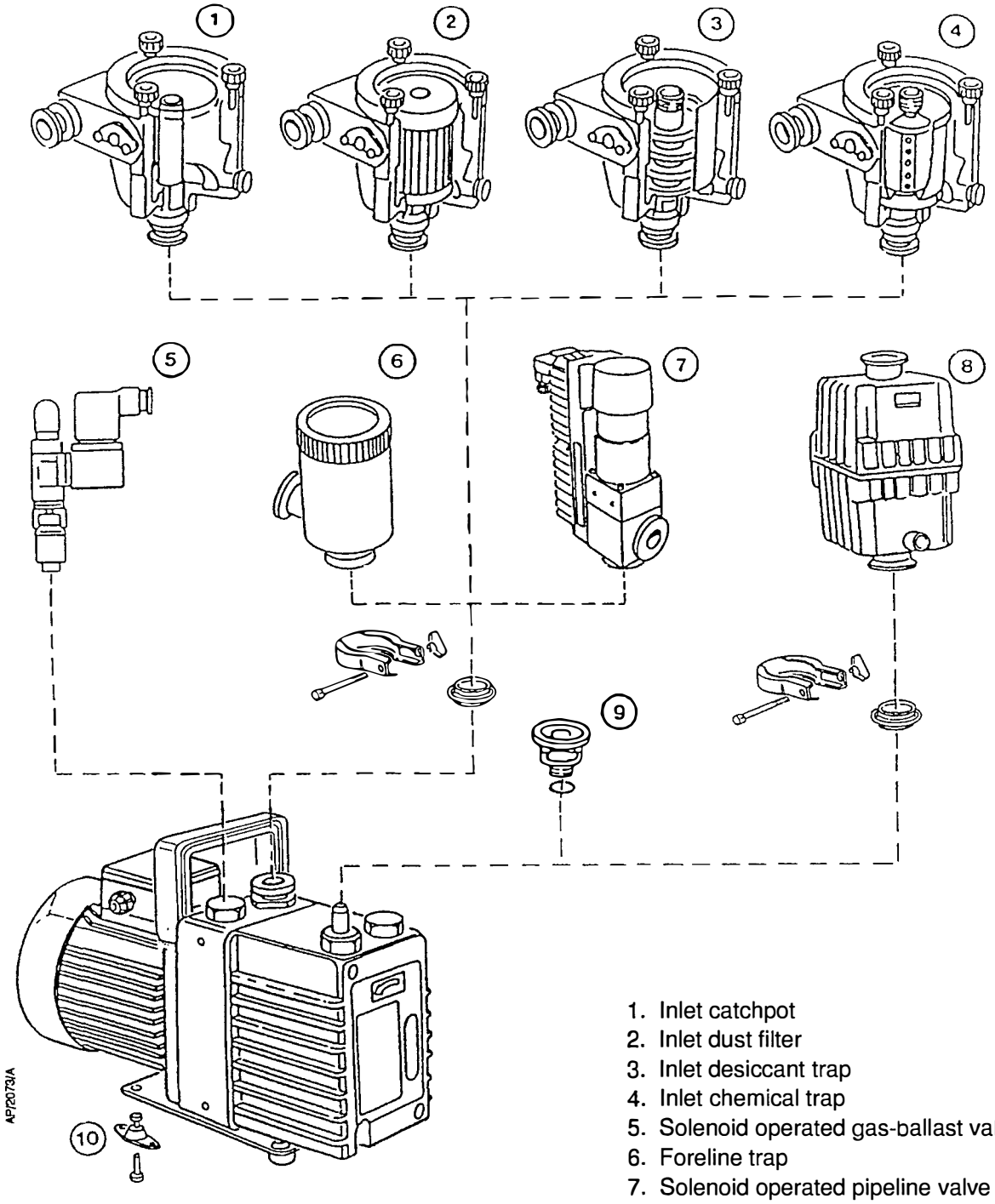
Use flexible bellows to connect the pump-inlet to your vacuum system. We recommend that you use bellows when you use vibration isolators.

Product	Item Number
Flexible bellows	C105-11-670

7.3.13 Pump outlet adaptor

3/4 inch BSP to NW25 adaptor. Use this adpator when you remove the hose adaptor supplied fitted to the pump outlet, to adapt the 3/4 inch BSP thread to a NW25 flange.

Product	Item Number
Pump outlet adaptor	C105-01-414



1. Inlet catchpot
2. Inlet dust filter
3. Inlet desiccant trap
4. Inlet chemical trap
5. Solenoid operated gas-ballast valve
6. Foreline trap
7. Solenoid operated pipeline valve
8. Outlet mist filter
9. Pump outlet adaptor
10. Vibration isolators

Figure 20 - Accessories

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