Edwards

Instructions
M05764/1.
September. 1976

EO SERIES
OIL VAPOUR
DIFFUSION PUMPS

	Water-cooled	Air cooled
Model E02:	05-B008-43-110	05-B008-44-110
	05-B008-43-210	05-B008-44-210
	05-B008-43-240	05-B008-44-240
Model E04:	05-B009-23-110	
	05-B009-23-210	
	05-B009-23-240	

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PUMP FLUIDS, LUBRICANTS AND SOLVENTS - OPERATING AND HANDLING PRECAUTIONS

General

The chemical properties and characteristics of the recommended range of fluids and lubricants used in Edwards pumps are specified in our catalogue publication 'Fluids and Sealants'. It should be noted that pump fluids and lubricants are non-toxic and safe to handle under normal conditions.

However, certain hazards are inherent with some of these products and the following operating and handling precautions are essential in order to comply with health and safety requirements.

All normal handling precautions should be observed to avoid excessive skin contact and possible infection (i.e dermatitis). Ensure pump installations are well ventilated to avoid toxic effects of certain fluid vapours.

Solvents (for cleaning and sealants)

GENKLENE is the preferred cleaning solvent for Edwards products but in common with all highly volatile oil and grease solvents, the main hazard is the narcotic, anaesthetic and toxic effects of breathing concentrations of vapour resulting from its use in confined spaces.

Ensure there is adequate ventilation and rate of air change in the cleaning area.

Owing to flammability of solvents, avoid cleaning operations close to ignition sources. Smoking must be prohibited.

Note: The above will also apply to solvents utilised with sealants.

*Note: For improved pump stability, the fluid charge in the E02 pump should be decreased to 50ml when using Santovac 5 fluid; also where stability when pumping light gases is important then a 450 watt heater should be fitted.

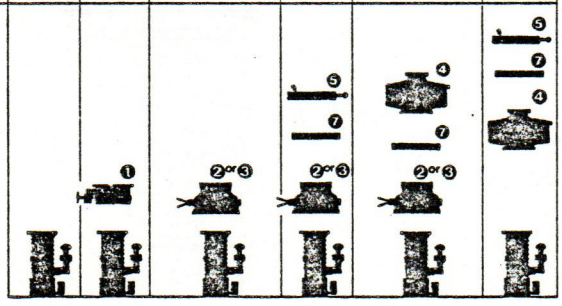
PERFORMANCE AND TECHNICAL DATA

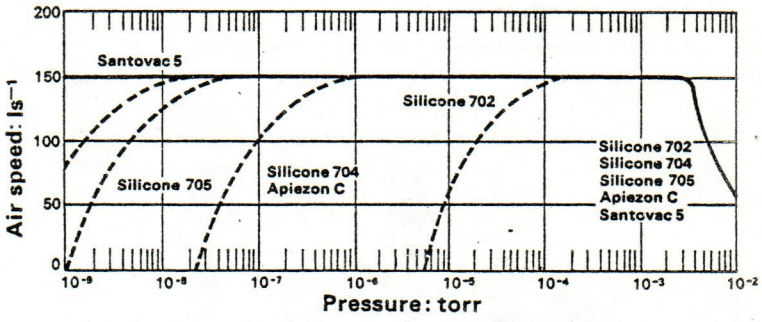
Model E02	Water cooled	Air cooled
Pumping speed (air)	ISO 150 ls^{-1}	AVS 170 ls^{-1}
(hydrogen)	200 ls^{-1}	
Ultimate vacuum	10^{-10} torr	
Pump fluid charge	75ml (50ml - *Santovac 5)	
Recommended fluids	See 'Performance' table (below)	
Minimum backing pump displacement maximum throughput	$6m^3h^{-1}$	
Recommended backing pump	ES100 or ED100 or EDM6 (for many applications - ES50, ED50 or EDM2)	
Backing connexion	SC10 coupling	
Cooling water connexion	6mm connector	-
Minimum cooling water flow at 20°C	35 lh^{-1}	-
Heater loading	0.4kW	
Weight	4kg	7kg

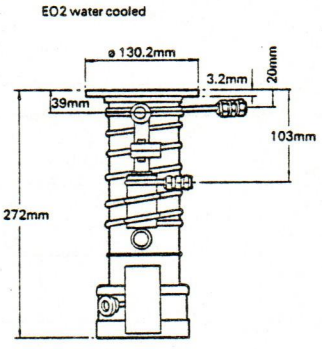
Product description	Ordering number	Ordering number
Pump 110-125V s.ph 50/60Hz	05-B008-43-110	05-B008-44-110
210-225V s.ph 50/60Hz	05-B008-43-210	05-B008-44-210
230-250V s.ph 50/60Hz	05-B008-43-240	05-B008-44-240

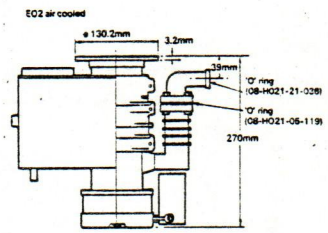
Performance

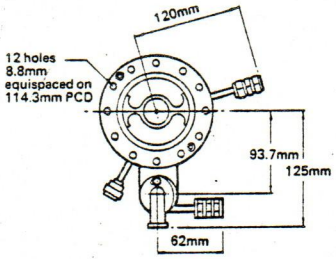
Fluid	Critical backing pressure (torr)	Ultimate vacuum—torr (better than) A	B	C indium wire seals	D	E	F indium wire seals	G
Silicone 702	0·7	5×10^{-6}	5×10^{-6}	5×10^{-6}	5×10^{-6}	10^{-7}	—	3×10^{-7}
Silicone 704	0.5	5×10^{-7}	5×10^{-6}	3×10^{-6}	3×10^{-7}	3×10^{-6}	10^{-10}	3×10^{-7}
Silicone 705	0.35	5×10^{-7}	3×10^{-6}	10^{-6}	3×10^{-7}	3×10^{-6}	10^{-10}	3×10^{-7}
Apiezon 'C'	0.35	5×10^{-7}	5×10^{-6}	3×10^{-6}	3×10^{-7}	3×10^{-6}	2×10^{-9}	3×10^{-7}
Santovac 5	0.30	5×10^{-7}	3×10^{-6}	5×10^{-10}	3×10^{-7}	3×10^{-6}	10^{-10}	3×10^{-7}
Air speed ls^{-1}	150	80	95		70	65		65
Hydrogen speed ls^{-1}	200	150	165		140	140		135

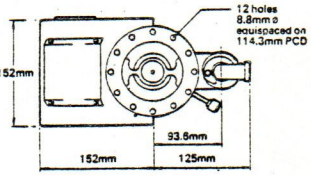












Accessories 63mm/2in system

1. Model H5L2B baffle and isolation valve	06-B015-15-000
2. Model CB63 chevron baffle	06-B364-04-000
3. Model DCB63 thermo-electric (Peltier) cooled baffle with water-cooled heat sink	06-B364-03-000
or Model DCB63 air cooled heat sink	06-B364-05-000
Power pack for DCB63 baffles	06-D241-14-000
4. Model CT63 liquefied gas trap	06-B384-01-000
5. Model QSB63 quarter swing valve	06-B424-02-000
or model QSB63P (pneumatically operated)	06-B424-03-000
6. 63mm spacer	06-B444-01-000
7. 63mm rotatable flange pack	08-C100-07-010
Air and water flow thermal snap switch	06-B023-02-000

M05764

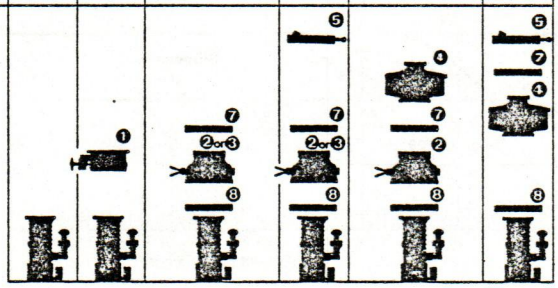
Model E04

Pumping speed (air)	ISO 600 $l s^{-1}$ AVS 680 $l s^{-1}$
(hydrogen)	800 $l s^{-1}$
Ultimate vacuum	10^{-10} torr
Pump fluid charge	175ml
Recommended fluids	See 'Performance' table (below)
Minimum backing pump displacement for maximum throughput	6.6 $m^3 h^{-1}$
Recommended backing pump	ES200 or ED200 or EDM12
Backing connexion	SC25 coupling
Cooling water connexion	6mm connector
Minimum cooling water flow at 20°C	75 $l h^{-1}$
Heater loading	0.85 kW
Weight	8kg

Product description	Ordering number
Pump 110–125V s.ph 50/60Hz	05-B009-23-110
210–225V s.ph 50/60Hz	05-B009-23-210
230–250V s.ph 50/60Hz	05-B009-23-240

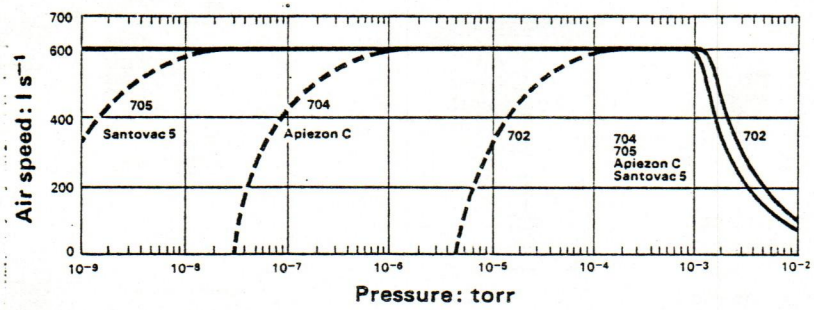
Performance

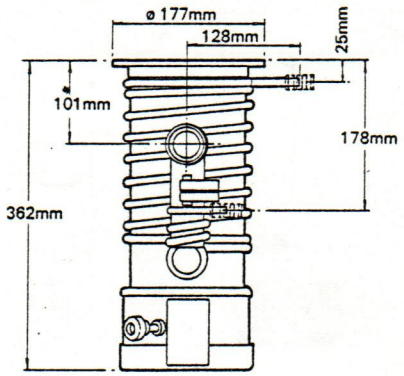
Fluid	Critical backing pressure (torr)	Ultimate vacuum—torr (better than) A	B Indium wire seals	C	D	E	F Indium wire seals	G
Silicone 702	1.0	5×10^{-6}	5×10^{-6}	5×10^{-6}	5×10^{-6}	10^{-7}	—	10^{-7}
Silicone 704	0.8	5×10^{-7}	5×10^{-6}	3×10^{-6}	3×10^{-7}	3×10^{-6}	10^{-10}	10^{-7}
Silicone 705	0.7	5×10^{-7}	3×10^{-6}	5×10^{-10}	3×10^{-7}	3×10^{-6}	10^{-10}	10^{-7}
Apiezon C	0.7	5×10^{-7}	5×10^{-6}	3×10^{-6}	3×10^{-7}	3×10^{-6}	2×10^{-9}	10^{-7}
Santovac 5	0.6	5×10^{-7}	3×10^{-6}	5×10^{-10}	3×10^{-7}	3×10^{-6}	10^{-10}	10^{-7}
Air speed $l s^{-1}$	600	270	290		200	190		200
Hydrogen Speed $l s^{-1}$	800	560	600		490	470		490

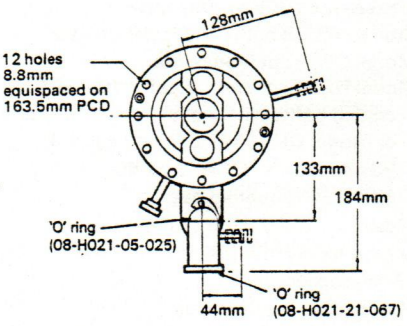


Accessories 100mm/4in system

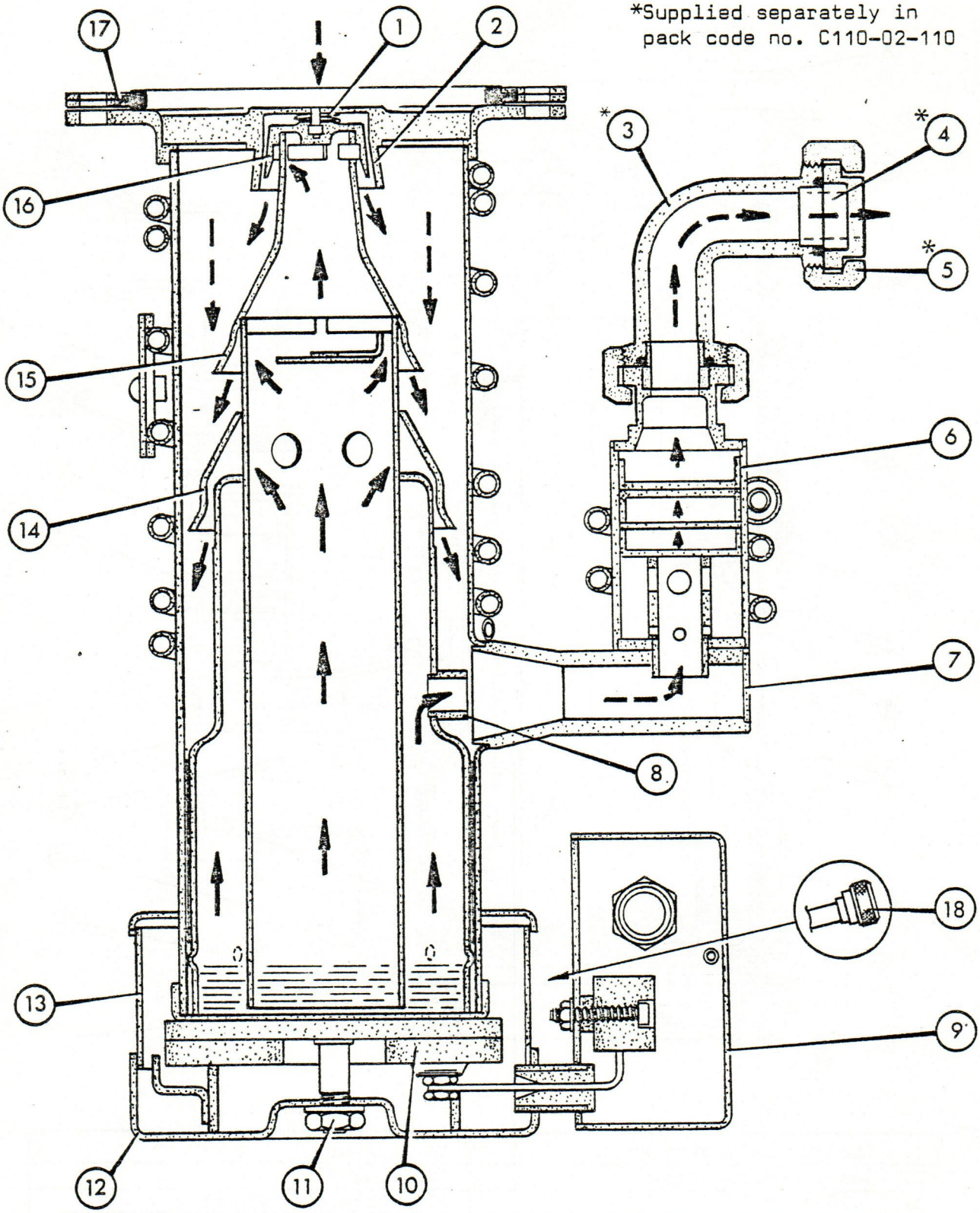
1. Model H7L4B baffle and isolation valve	06-B016-11-000
2. Model CB100 water-cooled chevron baffle	06-B366-04-000
3. Model DCB100 thermo-electric (Peltier) cooled baffle with water-cooled heat sink	06-B366-03-000
Power pack for DCB100 baffles	06-D241-14-000
4. Model CT100 liquefied gas trap	06-B386-01-000
5. Model QSB100 quarter swing valve	06-B426-02-000
Model QSB100P (pneumatically operated)	06-B426-03-000
6. 100mm spacer	06-B446-01-000
7. 100mm rotatable flange	08-C100-09-010
8. Adaptor flange	08-B271-58-006
Air or water flow thermal snap switch	06-B023-02-000





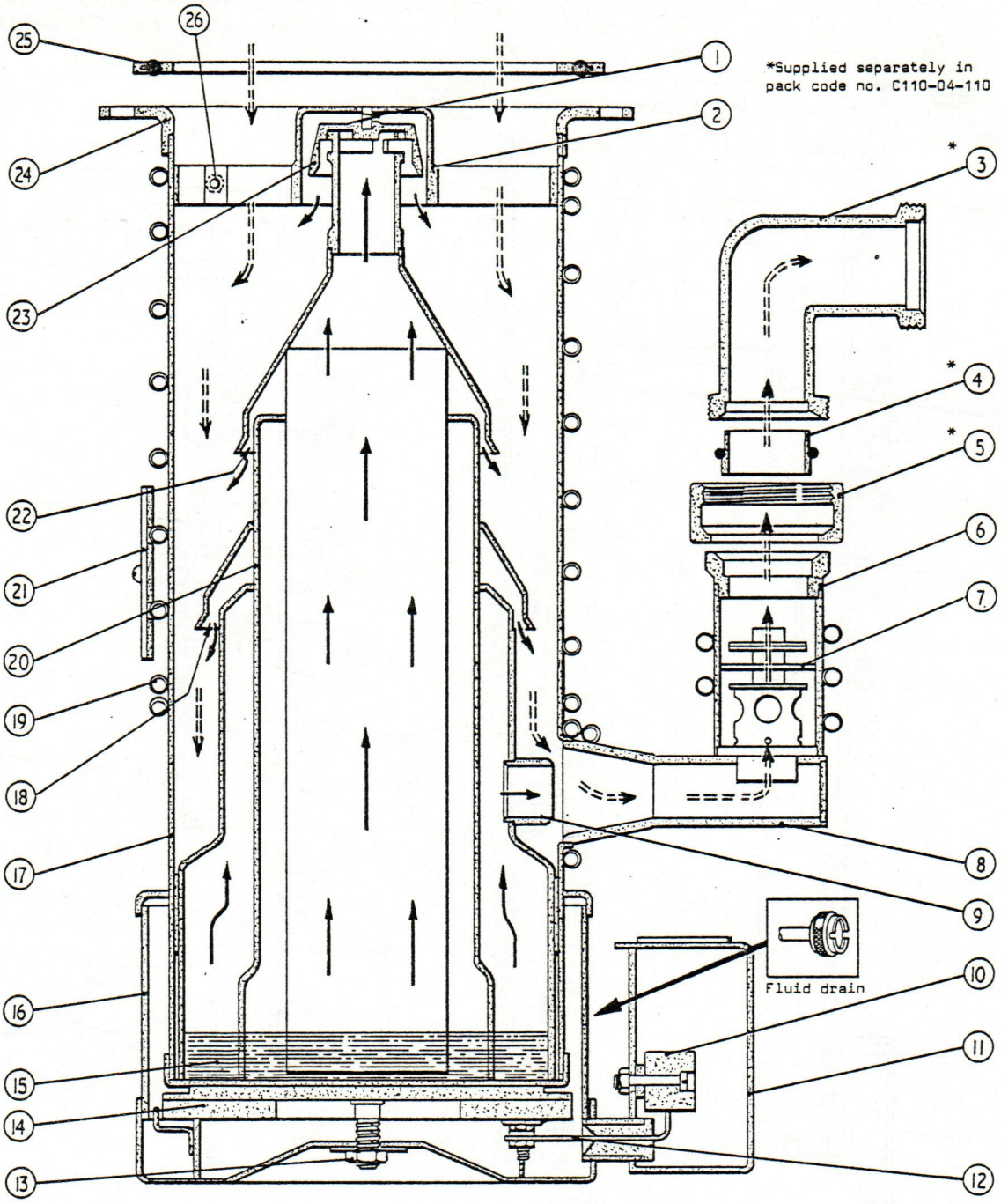


*Supplied separately in pack code no. C110-02-110



1. Retaining spring	10. Heater
2. Guard ring	11. Heater securing nut
3. Elbow	12. Heater sub-assembly
4. O-ring carrier (stepped)	13. Radiation shield
5. Coupling nut	14. Lower jet nozzle
6. Condenser	15. Centre jet nozzle
7. Backing tube	16. Top jet nozzle
8. Side ejector nozzle	17. Co-seal
9. Terminal box	18. Fluid drain connexion

Fig.1 Model E02 oil vapour diffusion pump



1. Top jet retaining spring	14. Heater
2. Guard ring assembly	15. Pump fluid
3. SC25 elbow	16. Radiation shield
4. SC25 O-ring carrier (stepped)	17. Pump body
5. SC25 coupling nut	18. Lower jet nozzle
6. Backing connexion	19. Cooling water coil
7. Condenser baffles	20. Interior assembly
8. Backing spout	21. Thermal switch mounting plate
9. Ejector jet nozzle	22. Centre jet nozzle
10. Heater terminal block	23. Top jet nozzle
11. Terminal box	24. Pump inlet flange
12. Heater electrical lead	25. O-ring seal assembly
13. Heater assembly securing nut	26. Adjuster screw

Fig.2 Model E04 diffusion pump

General description

The EO Series oil vapour diffusion pumps are fully fractionating 3 stage units with final ejector stage. The pump essentially comprises a stainless steel body and backing tube/condenser with a mild steel interior jet assembly. This assembly is a fabricated unit consisting of a top jet nozzle surmounted by a guard ring, centre and lower jet nozzles and a vapour tube. An O-ring seal or Edwards co-seal (EO2 pump) is provided for vacuum sealing of the pump inlet flange and the backing connexion is made by means of an Edwards SC screwed coupling. A single element, plate type heater is fitted in the base of the pump (boiler) and the electrical connexions to the heater are made via an external terminal block.

Operation

The pump fluid in the boiler is heated to generate a suitable boiler pressure within the jet system. The resultant vapour travels upwards through the jet stages and emerges from the jet nozzles as high velocity vapour streams to impinge and condense on the cooled pump body wall and subsequently drain to the boiler. Under normal operation, a portion of any gas arriving at the pump inlet (top jet) is trapped, compressed and transferred to the next stage. This process is repeated through the pump jet stages until the gas is removed by the backing pump via the cooled backing connexion.

The guard ring reduces backstreaming of working fluid molecules into the vacuum system by condensation on the cooled ring surface. The fractionating device provides a means of continuously purging the fluid charge of undesirable light fractions and foreign matter; this results in a lower ultimate vacuum. The ejector jet ensures a high critical backing pressure even when using low vapour pressure fluids, it also ensures that fluid returning to the boiler is continuously purged of contaminants; this, in conjunction with the fully fractionating interior, also results in lower ultimate pressures.

Installation

Unpacking

On receipt of the equipment, carefully unpack and remove all packing material. Remove the inlet flange cover and, if necessary, clean the flange with 'Genklene' or other suitable solvent. Observe the precautions recommended when using solvents for cleaning purposes.

General

Note: (i) The pump is despatched with a thin film of Santovac 5 fluid covering all internal surfaces. This film (remaining from laboratory tests) acts as a surface protection. If the pump has remained open to the atmosphere for some time before installation, or if a different fluid is to be used, the oil film should be cleaned off with a suitable solvent as described in 'MAINTENANCE'.

(ii) Air-cooled pumps should be located in an area which is adequately ventilated.

Vacuum Connexions

The pump inlet flange can be bolted to the vacuum system using the holes provided (see 'Technical data') and a reliable vacuum seal can be made by means of the seal supplied with the pump. An Edwards co-seal is provided for the E02 pump and an O-ring seal assembly for the E04 pump.

The backing connexion can be made as shown, Fig.1 or Fig.2 using the SC coupling components supplied separately in polythene pack Code No. C110-02-110 for E02 pump and pack Code No. C110-04-110 for E04 pump.

Vacuum testing

The pump should be installed and the system tested for vacuum-tightness before placing fluid in the boiler, as outgassing from the fluid may render subsequent testing difficult. For most purposes, it is sufficient to test the system with the rotary backing pump and to assess the overall vacuum-tightness by the closeness to which the vacuum attained at the inlet of the pump, or in the apparatus, approaches the ultimate vacuum of the rotary pump. More stringent testing may be carried out to suit the operating vacuum-tightness required.

Fluid filling/draining

The E0 series pumps will operate satisfactorily using any of the fluids specified on Page 3 - ('Performance and Technical Data'). To charge the pump with fluid, use a suitable container and pour the charge (*75ml - E02 pump; 175ml - E04 pump) down the inner wall of the pump body. The pump may also be filled through the backing spout. A drain connexion is provided on the pump boiler.

*Note: For improved pump stability, the fluid charge in the E02 pump should be decreased to 50 ml when using Santovac 5 fluid; also where stability when pumping light gases is important then a 450 watt heater should be fitted.

Cooling System

(a) The cooling water supply should be connected to the 6mm pressure couplings provided so that the water flows down the pump and out via the connexion on the backing spout. If a baffle is fitted on top of the diffusion pump, the cooling water should flow via the valve downwards through the pump. Do not switch the pump heater on unless the cooling water is flowing.

Minimum cooling water flow: 35 lh^{-1} at 20°C.

Note: Cooling water flow requirements are calculated for a 10°C temperature rise; thus, with a high water inlet temperature it may be necessary to increase the flow to maintain the outlet temperature below 35°C - this temperature should not be exceeded, otherwise the thermal switch may cut out and fluid loss to the backing line increase. High cooling water temperatures should not have any appreciable effect on pump performance except to increase the vapour pressure of the fluid; in a system where a water cooled baffle is utilised, this would result in an increase in ultimate pressure.

(b) The cooling fan motor on air-cooled pumps should be wired so that it is switched on simultaneously with the rotary backing pump. This will permit the diffusion pump heater to be switched off and the cooling fan to remain on to cool the diffusion pump.

Ensure that air-cooled pumps are installed in a location which is adequately ventilated.

Electrical Supply

(a) Check that the mains supply voltage corresponds with the voltage specified on the pump data plate.

(b) Connect the electrical leads to the pump heater via the terminal block - ensure a satisfactory earth is made to the screw on the terminal box cover.

Note: The leads are colour coded to BS requirements - BROWN to live - BLUE to neutral - YELLOW/GREEN to earth.

Thermal Switch

This device can be supplied as an optional accessory to protect the vapour pump against damage due to failure of the cooling water supply. If the temperature of the pump increases above the normal operating level, the switch will operate to disconnect the heater from the electrical supply. The switch is pre-set before despatch and automatically re-sets when the temperature of the pump returns to normal.

The switch may be mounted on the fixing plate which is permanently attached to the cooling system and should be connected to the positive lead from the electrical supply to the pump heater.

NOTE: When assembling the switch, ensure the metal mounting flange is in direct contact with the diffusion pump mounting plate. Refer to instructions M06669 for assembly details.

Operating notes

WARNING ✕ Allow a minimum cooling period of 20 minutes before handling or touching the pump boiler.

General

(a) A certain amount of backstreaming always occurs in any diffusion pump, i.e a small percentage of molecules of the working fluid suffer collisions in the jet region, causing migration into the high vacuum system. In the EO series pumps, this backstreaming is reduced to a very low value by a guard ring which is fitted above and shrouds the top jet cap.

Any residual backstreaming is sometimes undesirable and necessitates the use of a baffle. It is advantageous to combine this baffle with a high vacuum isolation valve, and for this reason a combination baffle/valve recommended for use with the pump is available (see 'Accessories' pages 3,4). The disposition of the valve plate relative to the cooled valve body ensures that very few molecules backstreaming from the pump mouth can enter the vacuum system.

It should be noted that the baffle fitted to an oil vapour diffusion pump is only wholly effective when the pressure is low enough for inter-molecular collision to be neglected. For this reason, the baffle valve must not be left open for long periods at pressures above 10^{-2} torr. If the vacuum system is at ambient temperature and the baffle valve is not water cooled, some pump fluid vapour may escape past the baffle valve and condense on the walls of the vacuum system.

The baffle valve is a standard accessory and is water cooled; this will reduce the temperature of the baffle valve sufficiently to minimise condensation of pump fluid vapour on the walls of the vacuum system.

(b) If a baffle valve is not fitted, the pump heater should preferably be switched off and the pump allowed to cool before air is admitted to it, otherwise on re-evacuating the system, the fluid will superheat and evolve a quantity of vapour which will pass into the backing pump. On valveless systems, the use of Silicone fluids will prolong the working periods of continuous use before fluid recharging becomes necessary.

(c) Air must always be admitted to the rotary backing pump when it is switched off, unless it is fitted with an automatic oil non-return valve, otherwise oil from this pump will be forced into the system.

1. Vacuum system
2. High vacuum isolation valve
3. Diffusion pump
4. Roughing valve
5. Backing valve
6. Backing pressure gauge head
7. Air admittance valve
8. Rotary backing pump

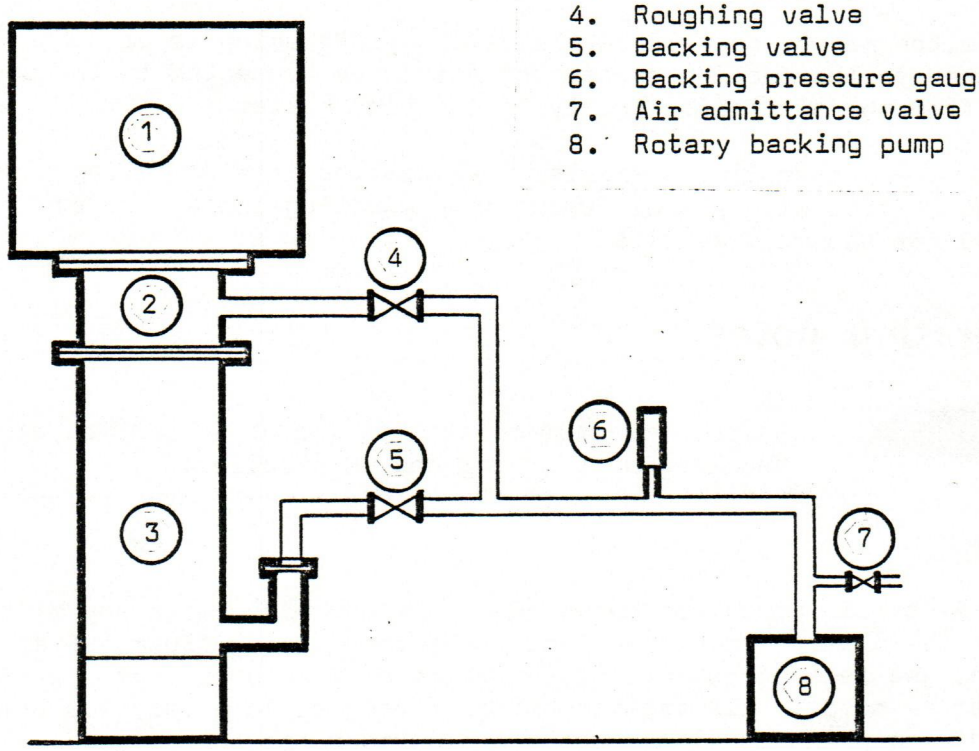


Fig.3 Typical Pumping System

OPERATING PROCEDURE

It is assumed that the pump will be operated in conjunction with a fully valved system as indicated, Fig.3.

Starting Up (This applies when both pump and apparatus are at atmospheric pressure).

(a) Close the baffle valve and air admittance valves and all other openings to the atmosphere.

(b) Open the roughing valve and the backing valve.

(c) Switch on the cooling water supply then switch on the rotary pump.

(d) When the backing pressure reaches 0.5 torr or better, switch on the electrical supply to the diffusion pump heater.

(e) After a warming up period of 10 to 15 minutes, and provided that the backing pressure is below the critical value for the pump fluid being used, close the roughing valve and open the baffle valve.

Note: It is permissible to switch the pump heater on immediately the roughing and backing valves are opened, provided the rotary backing pump is capable of evacuating the apparatus to 0.5 torr in 5 minutes or less. Ensure that the diffusion pump is being cooled satisfactorily before switching the heater on.

Admission of air to the vacuum system

(a) Close the baffle valve.

(b) Open the vacuum chamber air admittance valve.

Re-evacuation of system

(a) Close the chamber air admittance valve and all other openings to the atmosphere.

(b) Close the backing valve and open the roughing valve.

(c) When the chamber pressure falls to 0.5 torr or below, close the roughing valve and open the backing valve.

(d) Open the baffle valve.

Closing down

(a) Close the baffle valve and switch off the diffusion pump heater. Allow the pump to cool down.

(b) Close the backing valve.

(c) Open the rotary pump air admittance valve and switch off the rotary pump.

(d) Turn off the water supply.

Note: This method of closing down ensures that the vapour pump is left evacuated, thus preventing the pump fluid from absorbing air. When starting up subsequently, evacuate the system via the roughing line to a pressure of about 0.5 torr before opening the backing valve.

FAULT DIAGNOSIS AND CORRECTION

Fault	Probable cause	Correction
Poor ultimate pressure	1. Leak in system, virtual or real.	Locate and rectify.
	2. System dirty.	Clean system.
	3. Contaminated pump fluid.	Examine and renew. (Refer to 'MAINTENANCE' for detailed procedure).
	4. Low heat input.	Check heater voltage. Check for continuity, burned out element, poor thermal contact.
	5. Insufficient cooling water.	Check water pressure. Check tubing for obstructions and back pressure.
	6. High backing pressure.	Check for leak in backing line, poor mechanical pump performance, break-down of pump fluid.
Low Speed (Prolonged cycle)	1. Low heat input.	Check heater.
	2. Low fluid level.	Top up fluid. (Refer to 'INSTALLATION').
	3. Malfunctioning pump assembly. Improperly located jets. Damaged jet system.	Check and rectify. (Refer to 'MAINTENANCE').
Inlet pressure surges.	1. Incorrect heater input.	Check and correct.
	2. Fluid outgassing.	Condition fluid.
	3. Leak in system ahead of pump inlet.	Check and correct.
	4. Trapped volume in system	Check and correct.
	5. Excessively lubricated O-ring seals.	Check and correct.
High chamber contamination	1. High backing pressure.	Check for leak in backing line; poor mechanical pump performance; break-down of pump fluid.
	2. Prolonged operation at high throughput at pressures above 10^{-3} torr.	Review procedures.
	3. Incorrect system operation and air release procedures.	Review procedures.

Maintenance

Routine maintenance

Changing the pump fluid:

If the pump ceases to give a satisfactory ultimate pressure in a clean leak-tight system, the fluid must be drained and inspected. If it is badly charred or discoloured, the pump must be cleaned and a fresh fluid charge used. An excessively hot heater may indicate that there is insufficient fluid in the pump.

Lubrication - Air-cooled pumps:

The bearings on the cooling fan motor must be lubricated periodically with 0.1 to 0.2 ml of Edwards No.15 oil by means of the lubricating holes provided.

Radiation shield:

To maintain thermal efficiency, the radiation shield around the boiler should be kept clean.

Dismantling, cleaning and inspection

WARNING Allow a minimum cooling down period of 20 minutes before handling or touching the pump boiler.

(a) Unscrew the drain connexion and drain the fluid from the pump boiler - to assist draining, the pump heater can be switched on for a few minutes to warm the fluid.

(b) Isolate the mains electrical supply and disconnect the electrical leads at the pump terminal block.

(c) Disconnect the pump from the vacuum system and remove the inlet flange seal.

(d) Slacken the retaining screws on the guard ring (E02) or the adjuster screw (E04) then lift off the guard ring.

(e) Remove the top jet cap and retaining spring then withdraw the interior jet assembly from the pump.

Cleaning and inspection:

WARNING Ensure there is adequate ventilation in the cleaning area and observe normal precautions when using volatile solvents for cleaning purposes.

(a) Wash the pump interior, the backing tube/condenser and the jet stages in GENKLENE or other suitable solvent.

(b) Remove all traces of solvent by washing the components in acetone, then remove the acetobe by baking at 75°C or by passing warm, dry air over the components.

(c) Inspect all O-ring seals and the co-seal for damage or deterioration and renew if defective. Ensure all sealing faces are free from scratches or damage.

Note: The Co-Seal must never be cleaned with solvent - use a dry (lint-free) cloth or paper tissue. If removal of solvent from an elastomer is necessary, light baking under rough vacuum is advised.

Re-assembly:

(a) Insert the interior jet assembly in the pump body, locating the slot in the bottom of the interior assembly over the pin in the base of the pump body to ensure the ejector jet aligns with the backing tube.

(b) Assemble the top jet cap and the retaining spring. Fit the guard ring and position it on the jet cap.

Note: The centering pin in the top jet cap must be flush with the top surface of the guard ring. Ensure the guard ring is positioned centrally over the top jet cap then carefully tighten the retaining screws (or adjuster screw, as applicable) to secure the guard ring. Do not overtighten the adjusting screw (E04 pump).

(c) Check that the pump inlet flange is thoroughly clean then position the co-seal or O-ring seal (as applicable) on the flange.

(d) Tighten the drain plug in the boiler then re-charge the pump with the recommended grade of fluid - Refer to 'INSTALLATION' for detailed procedure.

(e) Reconnect the vacuum connexions then connect the electrical supply leads to the terminal block.

Renewing the heater element

Note: When renewing the heater element, it is recommended that the condition and quantity of the fluid charge is checked.

(a) Isolate the pump from the mains electrical supply. Detach the terminal box cover then disconnect the electrical leads from the terminal block.

(b) Remove the heater assembly securing nut from the underside of the pump then detach the heater assembly.

(c) Carefully raise the heater to remove the terminal nuts then disconnect the electrical leads.

(d) Remove the defective heater and fit a replacement heater as specified in 'SPARES' page 15 . Ensure the heater voltage corresponds with that specified on the pump data plate. Reconnect the electrical leads to the heater and secure with the terminal nuts. Locate the heater on the support plate.

(e) Position the heater assembly on the retaining stud underneath the pump so that the radiation shield is securely located in the heater assembly skirt and the terminal box aligns with the backing tube. Lightly coat the threads of the retaining stud with 'THRED-GARD' anti-seize* compound (or equivalent) then fit the nut to secure the heater assembly.

(f) Reconnect the electrical leads at the terminal block and replace the terminal box cover. Ensure the heater terminal screws are secure.

*See 'SPARES', Page 15 .

Spares

Fig./Index	Code No.	Nomenclature	Qty.
E02 Pump			
1/10	14-H017-00-182	Heater 0.4kW 110/125V	1
	14-H017-00-185	Heater 0.4kW 210/225V	1
	14-H017-00-183	Heater 0.4kW 230/250V	1
1/17	*08-B271-58-150	Co-seal, pump inlet flange	1
1/-	08-H021-06-115	O-ring, drain plug	Pack of 5
1/-	08-H021-21-036	O-ring, backing connexion (metric)	Pack of 10
1/-	08-H021-05-119	O-ring, backing connexion (imperial)	Pack of 10
E04 Pump			
2/25	08-H021-05-213	O-ring, pump inlet flange	Pack of 10
-	08-H021-06-115	O-ring, drain plug	Pack of 5
2/-	08-H021-21-067	O-ring, backing connexion (metric)	Pack of 10
2/-	08-H021-05-025	O-ring, backing connexion (imperial)	Pack of 10
Fluids, lubricants, etc.			
	09-H024-00-007	Fluid, silicone 702, 500ml.	
	09-H024-00-020	Fluid, silicone 704/F4, 200ml.	
	09-H024-00-009	Fluid, silicone 704/F4, 500ml.	
	09-H024-00-027	Fluid, silicone 705, 500ml.	
	09-H023-00-046	Fluid Apiezon C, 500ml.	
	09-H023-00-046	Fluid Santovac 5, 500ml.	
	—	Anti-seize compound 'THRED-GARD', 1 lb. tin, (Suppliers: Crane Packing Limited, Slough, Bucks, England).	

*Nitrile - supplied as standard.
(Plastic housing colour coded - black).

Viton Co-seal,
Code No. 08-B271-58-151
available as alternative.
(Plastic housing - colour coded - red).

Communication with Edwards

Any communication relating to the subject of this instruction should be addressed to Edwards High Vacuum or to the supplier from whom it was purchased.

Please specify:

1) the model, serial number and code.

2) the date of purchase.

3) your order number and the suppliers sales reference.

Equipment should not be returned to the supplier without prior arrangement.

IMPORTANT Health and Safety

Under Section 3 of the Health and Safety at Work Etc Act 1974 every employer has a duty to conduct his business so as not to expose persons not in his employment to risks to their health and safety. When goods are returned to the supplier, therefore, warning must be given if their usage is likely to render the equipment hazardous in any way.

Edwards High Vacuum and its distributors reserve the right to refuse acceptance of any equipment returned which they have reason to believe may be hazardous.

Damage in transit

If any damage has occurred in transit, it is important to inform both the carrier and the supplier within three days of delivery.

Edwards

Instructions

09-H023-01-880
January 1979

VAPOUR DIFFUSION PUMP FLUIDS - HEALTH/SAFETY ASPECTS

Table 1

Fluid grade	Product class	*Flash Point °C	**Auto-ignition point °C	Molecular Weight
+ Apiezon AP201	A	196	305	310
Apiezon A	A	210	370	354
Apiezon B	A	243	405	420
Apiezon C	A	246	420	479
Silicone 702	B	193	500	530
Silicone 704/F4	B	221	500	484
Silicone 705	B	243	500	546
Santovac 5	B	288	590	446
Fomblin Y Vac 18/8	B	-	-	2650
Apiezon AP301	B	277	450	584

*Determined by Pensky-Martens closed cup method (PMCC)
**Determined by ASTM D2155 method except for AP201 which is determined by ASTM D286-58T method.
+For special precautions when using Apiezon AP201 - refer to Health/Safety Publication M09614 or 09607.

Edwards recommended vapour diffusion pump fluids (Table 1) are not normally hazardous when used correctly. However, certain hazards may arise due to misuse or accident and the following precautions should be observed to avoid danger to health or safety:

Skin and eye contact

Class A - Mineral oil based fluids are only slightly to moderately irritating to skin and eyes. Prolonged exposure of skin to mineral oils may give rise to dermatitis.

The main precautionary measures entail minimising contact with the skin and the observance of good hygiene. Where skin rashes or other abnormalities occur as a result of prolonged contact with mineral oils, medical advice should be sought immediately.

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Protective clothing, regularly laundered overalls and personal clothing plus careful skin cleansing, are all important measures to limit contact. Such measures are detailed in HM Factory Inspectorate Cautionary Notices, SHW 295, Effects on the Skin of Mineral Oil and SHW 397, Effects of Mineral Oil on the skin.

Class B - These products are in general only slightly irritant. Prolonged exposure may, however, give rise to dermatitis. As with the previous classes of products, the principal precautionary measures are to minimise contact with skin and observe good hygiene.

Inhalation

Class A - Lubricants and related products do not normally give rise to harmful concentrations of vapour except where high temperature and open systems are involved.

Class B - Edwards recommended products in Class B are particularly inert and are unlikely to give rise to harmful vapours when used in the applications for which they are recommended.

Care should, however, be taken to avoid inhalation of vapours or mists arising from undue heating or excessive mist generation. In the case of fluorinated compounds (eg. Fomblin, Halocarbon) avoid contact with excessive heat ($>300^{\circ}C$), eg. lighted cigarettes, heater elements, etc.

Ingestion and Aspiration

Ingestion and aspiration of lubricants and related products are not regarded as health hazards likely to arise in normal industrial use.

In the unlikely event of accidental ingestion (swallowing), the main hazard is aspiration of liquid into the lungs. Class B products are believed to be of slight to moderate oral toxicity.

Fire hazards, storage and spillage

These products require no special fire precautions but it is recommended practice to store away from heat. When heat is required to facilitate handling of the product, this should be kept to a minimum.

If the pump operates in close proximity to possible sources of ignition or where oxygen or other flammable gases may form a large proportion of the pumped load, then suitable fire-resistant fluids should be utilised. Refer to our catalogue publication 'Fluids and Sealants' for details of recommended fluids; refer also to Edwards Technical Division for advice.

Fluid spillage should be absorbed with sand, earth or mineral absorbent and disposed of in accordance with the Disposal of Poisonous Wastes Act and Control of Pollution Act 1974.

In the event of large spillages, steps should be taken to prevent pollution of drainage systems, rivers or waterways, or infringement of the above acts.