

# *Instruction Manual*

## E2M28 Rotary Pump Maintenance Kits

Description	Item Number
Clean and Overhaul Kit (Hydrocarbon filled pumps)	A373-01-131
Blade Kit for E2M28	A373-01-135
Clean and Overhaul Kit (PFPE (Fomblin) filled pumps)	A373-01-136



## Important safety Information

- Vacuum pumps are potentially dangerous if incorrectly used, repaired or maintained, so please approach the repair or maintenance with caution.
- Any incorrectly fitted spare parts could damage your pump and could be potentially dangerous.
- Never allow unqualified personnel to attempt to remove or replace any part of the pump.
- If you have any doubts about the servicing procedures or the products capabilities please contact Edwards.
- Before returning any equipment to Edwards for repair please follow the Edwards HS1 procedure and complete an HS2 declaration form to warn of any substances used or produced in the equipment that can be dangerous. The procedure and forms are included with the pump instruction manuals and can be downloaded together with Edwards local contact details from [www.edwardsvacuum.com](http://www.edwardsvacuum.com)
- Always conform to service schedules unless adverse conditions necessitate more frequent servicing.
- Report any defect before an accident or consequential damage can occur.
- Observe local and country specific regulations, norms and guidelines.
- Never allow anyone to remove large or heavy components without adequate lifting equipment.
- Before maintenance work is begun, ensure the pump is switched off and isolated from the mains.
- The pump may have been exposed to processes which use hazardous substances or produces by-products which are dangerous to human health and safety, for example, chemically active, biologically active or radioactive substances.
- Before working on a pump, ensure that the correct personal protective equipment is available and being used. Always wear safety goggles. Wear a breather mask with positive air pressure and take other precautions if you believe the pump may be contaminated with hazardous substances and dusts.
- When applying sealants and lubricants, prevent contact with the skin by wearing suitable gloves.
- Seals may contain fluoroelastomer, which when properly handled is not dangerous but which may produce a toxic and corrosive residue (hydrogen fluoride or hydrofluoric acid) in the event of excessive heat or fire depending on the circumstances of degradation and other materials involved.
- On completion of maintenance, check the pump functions correctly and that all guards and protection devices are fitted and working correctly and that the pump is electrically safe.
- If the pump is used for handling hazardous substances check the pump for leak-tightness before use.
- Dispose of waste oil and any process by-products in accordance with local and national safety and environmental requirements. It is usually illegal to dispose of waste oil into drains or water courses, or to bury it.

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For return of equipment, complete the HS Forms at the end of this manual.

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# 1 Introduction



## **WARNING**

The mass of the pump is 44 kg; Use suitable lifting equipment to move the pump. If you do not, you can injure yourself or damage the pump.

These instructions apply to the Clean and Overhaul kits and Blade kit for Hydrocarbon filled rotary pumps and PFPE (Fomblin) filled pumps. When ordering or installing these kits care must be taken to ensure that the correct Clean and Overhaul kit is used. Due to the more aggressive nature of Fomblin lubricants it is essential that only the Fomblin kit is only used on PFPE prepared pumps. Failure to do so could result in damage to the pump or cause injury to people.

The Blade kit is compatible for use in both Hydrocarbon and PFPE filled pumps.

PFPE (Fomblin) oil has different properties from other pumps, therefore:

- Take additional care if you suspect that the pump (and hence the PFPE oil) has overheated.
- Do not touch or inhale the thermal breakdown products of PFPE oil, which may be present, if the pump has been heated to 260 °C and above. PFPE oils are safe in normal use but can decompose into very dangerous substances if they are heated to 260 °C and above. The pump may have overheated if it was misused, if it malfunctioned, or if it was in a fire. Material Safety Data Sheets for PFPE oils used in the pump are available on request; contact your supplier or Edwards.
- If you fill your PFPE-prepared EM pump with Fomblin oil, we recommend that you regularly check for oil leaks, particularly around the shaft seals.
- If you detect an oil leak, contact your supplier or Edwards for advice.

## **CAUTION**

Never mix Hydrocarbon and PFPE lubricants.

## **CAUTION**

Never use Hydrocarbon lubricants in a PFPE-prepared pump.

- We recommend that you use all the items in the Clean and Overhaul kit when you service the pump, particularly all rubber components. The items supplied in the kit are listed in [Table 1](#) and [2](#). These items are illustrated in [Figure 1](#) to [3](#). Instructions for the use of the kit are given in [Section 3](#). Kit items are grouped and packed in separate bags to aid identification.
- Use a Blade kit together with a Clean and Overhaul kit when you must replace rotary pump blades. You must renew all blade assembly items with those supplied in the Blade Kit. The items supplied in the Blade kit are listed in [Table 3](#). These items are illustrated in [Figure 1](#). Instructions for the use of the Blade kit are given in [Section 5](#).

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## 2 Parts in the clean and overhaul kit

*Note: If you are in doubt about which oil your pump is compatible with, contact your supplier or Edwards for advice.*

Table 1 - Clean and overhaul kit items- hydrocarbon filled pumps

Bag Pack Reference	Item No.	Description Size (mm) and feature (if applicable) Length x diameter (x width) * = inside diameter (x)= number of coils in a spring O-ring dimensions relate to I.D. x section	Quantity supplied
Bag 1	36	Exhaust warning label	1
	64	Seal 111 x 29 x 2 (Nitrile)	1
	66	Oil box gasket	1
		Oil box O-ring 194.5 I.D. x 3 sect	1
	67	Sight glass gasket	1
		Sight glass O-ring 69.5 I.D. x 3 sect	1
	102	O-ring 11.1 x 1.6	2
		O-ring 14.1 I.D. x 1.6	1
	103	O-ring 28.2 x 3.5 (fluoroelastomer)	2
	Bag 2	17	Filter seal 28.8 O.D. x 3.2
18		Gas ballast filter pad	2
19		Gas ballast gauze	2
38		Felt pad	1
39		Oil filter assembly	1
58		Coupling element	1
91		Inner shaft seal 30 x 40 x 7 (fluoroelastomer)	1
92		Outer shaft Simrit seal 25.0 x 35.0 x 5.8 (fluoroelastomer)	1
93		O-ring 6.6 x 2.4	7
96		O-ring 29.5 x 3.0	1
98		O-ring 44.5 x 3.0	2
99		O-ring 79.5 x 3.0	1
100		O-ring 89.5 x 3.0	1
101		Dowty O-ring 107 x 2.6	1
Bag 3		65	Gasket
	89	Dowty seal 2BA	1
	90	Dowty seal	1
	94	Gas ballast O-ring 13.6 x 2.4 (fluoroelastomer)	1
	95	Gas ballast O-ring 15.6 x 2.4 (fluoroelastomer) and drain plug	2
	97	Inlet O-ring 35.5 x 3.0	1

Table 1 - Clean and overhaul kit items- hydrocarbon filled pumps (continued)

Bag Pack Reference	Item No.	Description Size (mm) and feature (if applicable) Length x diameter (x width) * = inside diameter (x)= number of coils in a spring O-ring dimensions relate to I.D. x section	Quantity supplied
Bag 4	21	Gas ballast valve	1
	57	Valve pad	3
	59	Exhaust spring 28.9 x 14 *(14)	1
	61	Valve spring H.V. 30 x 9 *(10)	2
	104	O-ring 7.9 x 2.6 (fluoroelastomer)	2
Bag 5	60	Distributor spring 14 x 10.3 *(5)	1
	63	Distributor rubber	1
	147	Waved washer	1

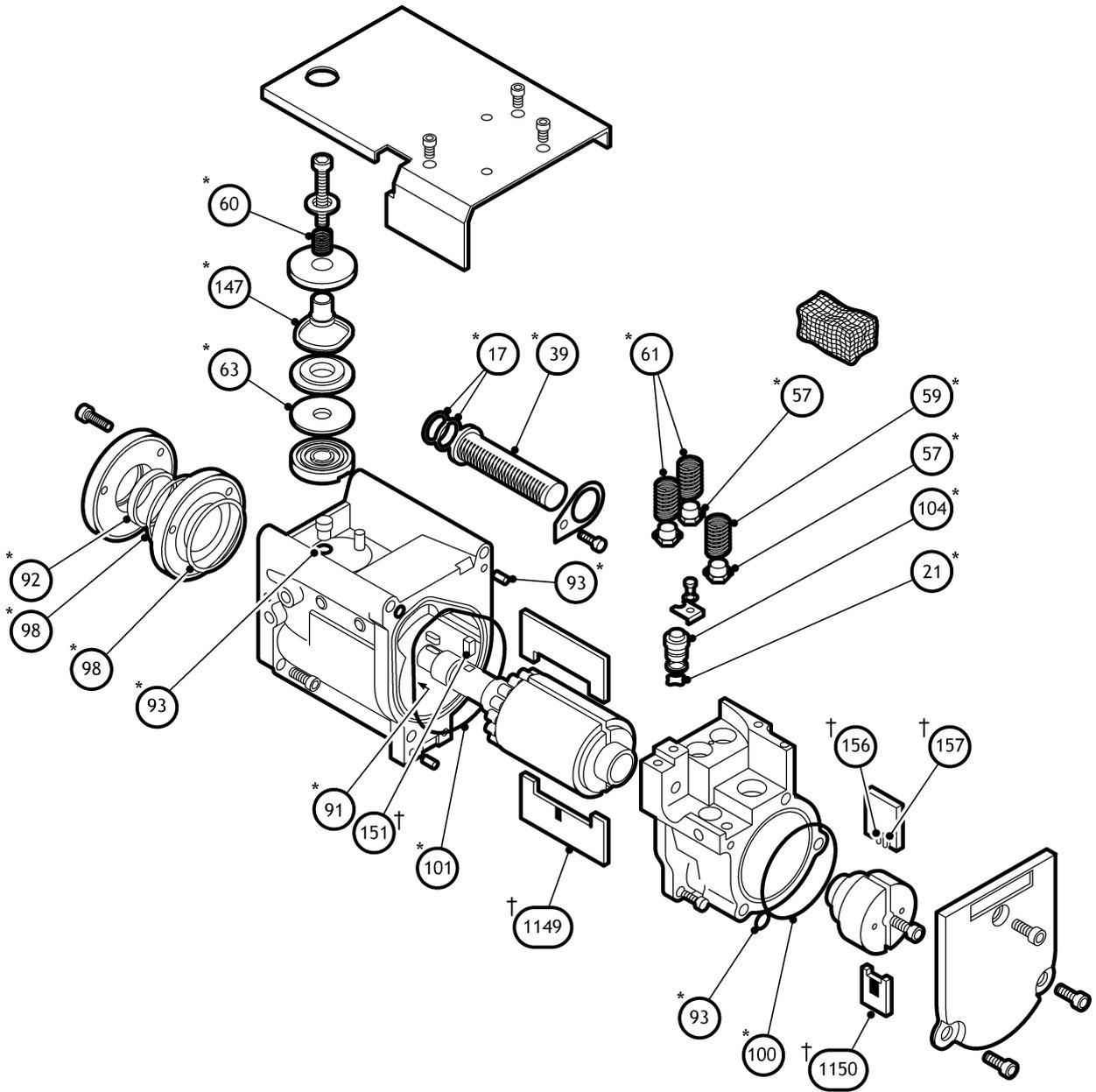
Table 2 - Clean and overhaul kit items- PFPE filled pumps

Bag Pack Reference	Item No.	Description Size (mm) and feature (if applicable) Length x diameter (x width) * = inside diameter (x)= number of coils in a spring O-ring dimensions relate to I.D. x section	Quantity supplied
Bag 1	36	Exhaust warning label	1
	66	Oil box O-ring 194.5 I.D. x 3 sect	1
	67	Sight glass 'O' ring 69.5 I.D. x 3 sect	1
	102	O-ring 14.1 I.D. x 1.6	1
	103	O-ring 1.109 I.D. x 0.139 (Viton)	2
Bag 2	17	Filter seal 28.8 O.D. x 3.2	2
	18	Gas ballast filter pad	2
	19	Gas ballast gauze	2
	38	Felt pad	1
	39	Oil filter assembly	1
	58	Coupling element	1
	91	Inner shaft seal 30 x 40 x 7 (fluoroelastomer)	1
	92	Outer shaft oil seal 25.0 x 35.0 x 5.8 (Viton)	1
	93	O-ring 6.6 x 2.4 (Nitrile)	7
	96	O-ring 29.5 x 3.0 (Nitrile)	1
	98	O-ring 44.5 x 3.0 (Nitrile)	2
	99	O-ring 79.5 x 3.0 (Nitrile)	1
	100	O-ring 89.5 x 3.0 (Nitrile)	1
	101	Dowty O-ring 107 x 2.6	1

Table 2 - Clean and overhaul kit items- PFPE filled pumps (continued)

Bag Pack Reference	Item No.	Description Size (mm) and feature (if applicable) Length x diameter (x width) * = inside diameter (x)= number of coils in a spring O-ring dimensions relate to I.D. x section	Quantity supplied
Bag 3	89	Dowty seal 2BA	1
	94	Gas ballast O-ring 13.6 x 2.4 (fluoroelastomer)	1
	95	Gas ballast O-ring 15.6 x 2.4 (fluoroelastomer)	1
	97	Inlet O-ring 35.5 x 3.0 (Nitrile)	1
Bag 4	21	Gas ballast valve	1
	57	Valve pad	3
	59	Exhaust spring 28.9 x 14 *(14)	1
	61	Valve spring H.V. 30 x 9 *(10)	2
	104	O-ring 7.9 x 2.6 (fluoroelastomer)	2
Bag 5	60	Distributor spring 14 x 10.3 *(5)	1
	63	Distributor rubber	1
	147	Waved washer	1

Figure 1 - Kit items (HV and LV stators)



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\* Item in Clean and Overhaul Kit  
 † Item in Blade Kit (Supplied Separately)

Figure 2 - Kit items (adaptor and oil box)

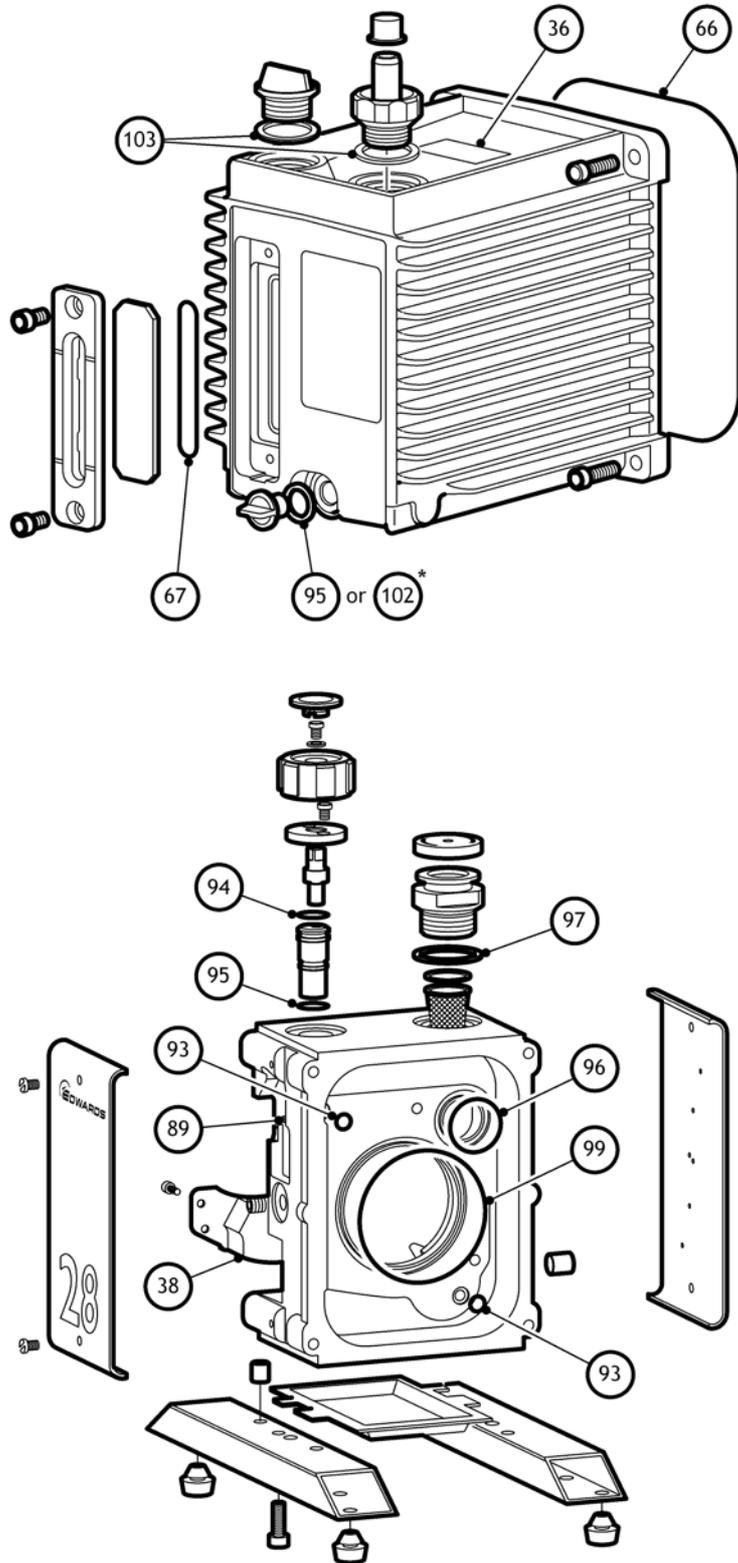
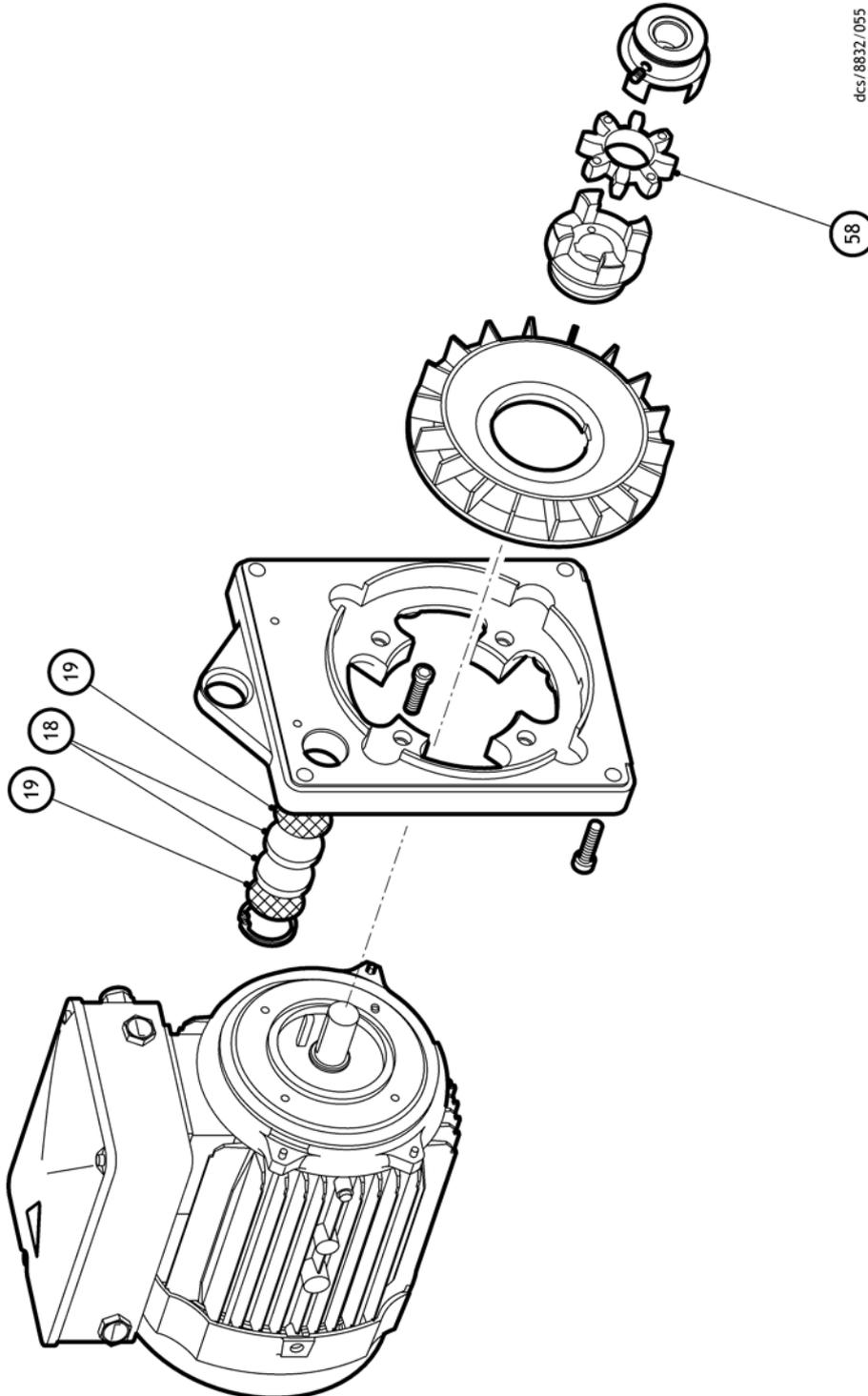


Figure 3 - Kit items (motor and adaptor plate)



### 3 How to use the clean and overhaul kit



#### WARNING

The mass of the pump is 44 kg; Use suitable lifting equipment to move the pump. If you do not, you can injure yourself or damage the pump.

#### CAUTION

Never mix hydrocarbon and PFPE lubricants.

#### CAUTION

Never use hydrocarbon lubricants in a PFPE-prepared pump.

Where appropriate, refer to the instruction manual for information about routine maintenance of the pump.

1. Disconnect the rotary pump from the electrical supply and allow it to cool.
2. Drain the oil from the rotary pump. Unscrew the bolts which secure the oil box and remove the oil box.
  - For PFPE (Fomblin) prepared pumps take additional care if you suspect that the pump (and hence the PFPE oil) has overheated.
  - Do not touch or inhale the thermal breakdown products of PFPE oil, which may be present, if the pump has been heated to 260 °C and above. PFPE oils are safe in normal use but can decompose into very dangerous substances if they are heated to 260 °C and above. The pump may have overheated if it was misused, if it malfunctioned, or if it was in a fire. Material Safety Data Sheets for PFPE oil used in the pump are available on request: contact your supplier or Edwards.
3. Remove any debris from inside the oil box. Clean all surfaces with a suitable cleaning fluid.
4. Dismantle the rotary pump and, referring to [Figure 1](#), [2](#) and [3](#), replace the relevant components with those in the Clean and Overhaul kit. Clean all exposed surfaces encountered during a service with a suitable cleaning fluid.
  - Dispose of any components removed from the pump and any contaminated cleaning materials safely and 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.
5. Inspect the rotary pump blade assembly for signs of wear. Ensure there is less than 0.15 mm clearance between each blade and its rotor slot: if the clearance is greater than 0.15 mm, you must replace the blades if you wish to obtain good vacuum performance. Refer to [Section 5](#) for instructions on the use of the Blade Kit.
6. Re-fit the oil box to the pump. Use the new oil box O-ring from the kit. Fill the rotary pump oil box with the correct quantity of new oil.
7. The kit contains a warning label (item 36). If this is not already in place, remove the backing strip from the label. Stick the label on the top of the oil box lid close to the exhaust outlet, see [Figure 2](#).
8. Connect the electrical supply and switch on the rotary pump. Check that the oil level in the sight glass at the end of the rotary pump drops by 3 to 5 mm when the pump is started. If this does not happen, refer to the rotary pump instruction manual.
9. Open the gas ballast valve and run the rotary pump for at least one hour.

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## 4 Parts in the blade kit

Table 3 - E2M28 blade kit items

Illustration Item	Description	Quantity
1149	HV blade (2 blade pack)	1
1150	LV blade (2 blade pack)	1
151	Oil pump blade	1
156	Spring	2
157	Pin	2

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## 5 How to use the blade kits



### WARNING

The blade material contains aramid fibres which could be hazardous to health if inhaled. Obey the safety precautions when you fit the blades.

In addition to the procedure in [Section 3](#), if you must replace the blade assembly items, use the new items from the appropriate kit as described below:

1. Follow [Step 1](#) to [5](#) in [Section 3](#).
2. Fit new HV and LV blades.
3. Check the clearance between each new blade and its rotor slot is between 0.06 mm and 0.10 mm. If the clearance is less than 0.06 mm, follow the instructions in [Step 4](#) and [5](#) below to rub the blades down: if the clearance is correct, continue at [Step 6](#).
4. Remove the new HV blades and the oil pump blade; rub down these blades as described below:
  - Where possible, work out of doors or in a well-ventilated area.
  - Before you rub down the new blades, dampen the surfaces of the blades with pump oil. Keep the blades moistened with pump oil while you rub down the blades.
  - Place the blades on a flat metal work surface when you rub them down.
  - Use a piece of emery paper to rub down the blades; the piece of emery paper must be larger than the blade to ensure that you obtain an even finish.
  - Apply an even pressure over all of the blade when you rub it down.
  - When you have finished, seal all waste (emery paper, old blades and any paper or cloth which you have used to clean the blades and the work surface) inside a plastic bag. Place this bag inside a second plastic bag; seal the bag.
  - Dispose of the waste bag at a licenced waste disposal facility.
5. Refit the new HV and LV blades and check that the clearances are now correct.
6. Remove the blades and fit the springs and pins in the holes. Compress the blade set together and fit it to the motor slot taking care not to score the blades.
7. Fit the oil pump blade.
8. Continue from [Step 6](#) in [Section 3](#).

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# Appendix A1 Pre O-ring sealed oilbox superceded assemblies

The following pages have been retained for information purposes only.

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## A1.1 2 Parts in the clean and overhaul kit

Table A1 - Table 1 - Clean and overhaul kit items

Bag Pack Reference	Item No.	Description Size (mm) and feature (if applicable) Length x diameter (x width) * = inside diameter (x)= number of coils in a spring O-ring dimensions relate to I.D. x section	Quantity supplied
Bag 1	36	Exhaust warning label	1
	64	Seal 111 x 29 x 2 (nitrile)	1
	66	Oil box gasket	1
	67	Sight glass gasket	1
	102	O-ring 11.1 x 1.6	2
	103	O-ring 28.2 x 3.5 (fluoroelastomer)	2
Bag 2	17	Filter seal 28.8 O.D. x 3.2	2
	18	Gas ballast filter	2
	19	Gas ballast gauze	2
	38	Felt pad	1
	39	Oil filter assembly	1
	58	Coupling element	1
	91	Inner shaft seal 30 x 40 x 7 (fluoroelastomer)	1
	92	Outer shaft Simrit seal 25.0 x 35.0 x 5.8 (fluoroelastomer)	1
	93	O-ring 6.6 x 2.4	7
	96	O-ring 29.5 x 3.0	1
	98	O-ring 44.5 x 3.0	2
	99	O-ring 79.5 x 3.0	1
	100	O-ring 89.5 x 3.0	1
	101	Dowty O-ring 107 x 2.6	1
Bag 3	65	Gasket	1
	89	Dowty seal 2BA	1
	90	Dowty seal	1
	94	Gas ballast O-ring 13.6 x 2.4 (fluoroelastomer)	1
	95	Gas ballast O-ring 15.6 x 2.4 (fluoroelastomer)	1
	97	Inlet O-ring 35.5 x 3.0	1
Bag 4	21	Gas ballast valve	1
	57	Valve pad	3
	59	Exhaust spring 28.9 x 14 *(14)	1
	61	Valve spring H.V. 30 x 9 *(10)	2
Bag 5	104	O-ring 7.9 x 2.6 (fluoroelastomer)	2
	60	Distributor spring 14 x 10.3 *(5)	1
	63	Distributor rubber	1
	93	O-ring 6.6 x 2.4	2
	147	Waved washer	1

## A1.2 4 Parts in the blade kit

Table A2 - Table 3 - E2M28 Blade Kit items

Illustration Item	Description	Quantity
149	HV blade	2
150	LV blade	2
151	Oil pump blade	1
156	Spring	2
157	Pin	2

Figure A1 - Figure 3 - E2M18/28 Interim oil sight glass assembly

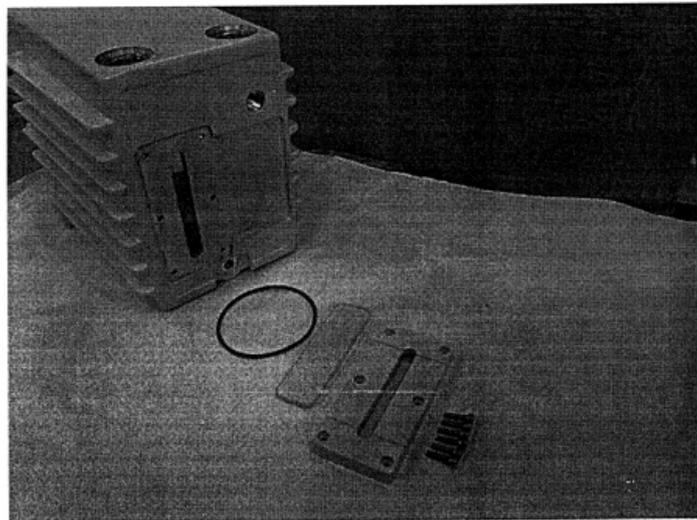


Table A3 - Table 2 - E2M18/28 interim oil sight glass assembly

Description	Part No	Qty
E2M18/28 Oil box	A36301012	1
Sight glass clamp	A36301016	1
Sight glass	A29201018	1
'O' ring	23724-072	1
M4 x 16 SS Cap screws	218231290	6

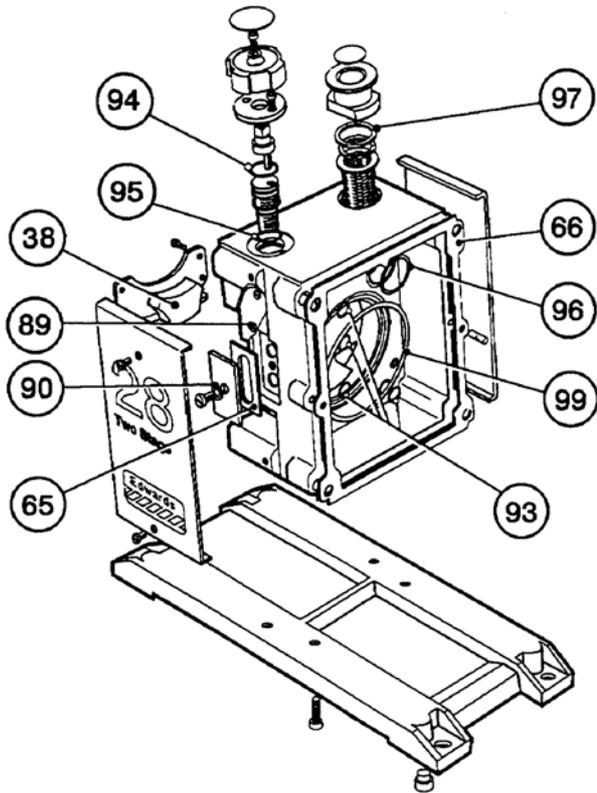
### A1.3 2.1 Sight glass assembly

Make sure that the machined surface is free from scratches. Check that the sight glass is a close fit in the clamp recess. Put the sight-glass in the clamp recess, followed by the 'O' ring, you must not use any lubricant. Make sure that the 'O' ring is located centrally in the recess.

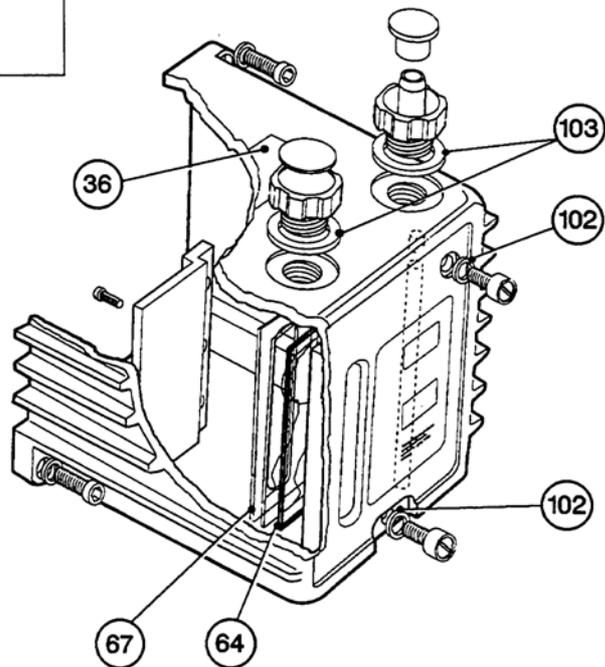
Put the clamp assembly on to the oil box, make sure that the 'O' ring has not moved.

Insert the six screws, progressively tighten the screws starting with the two screws in the middle and tighten the screws diagonally.

Figure A2 - Figure 2 - Kit items (adaptor and oil box)



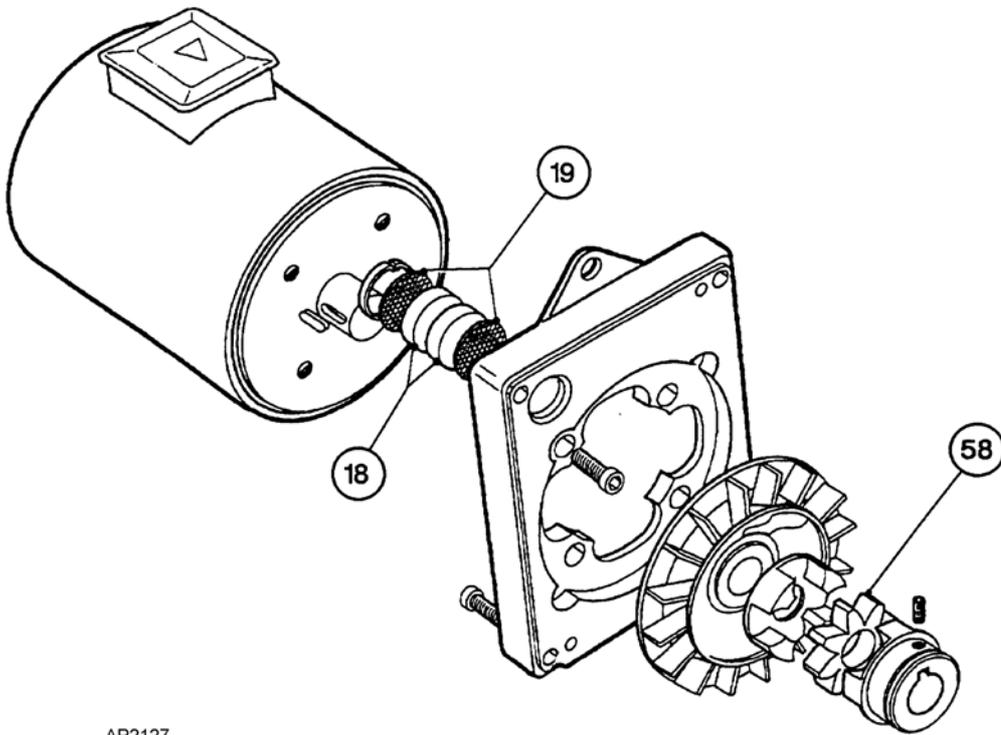
○ Items in Clean and Overhaul Kit



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Figure A3 - Figure 4 - Kit items (motor and adaptor plate)

○ Items in Clean and Overhaul Kit



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Figure A4 - Figure 2 - Kit items (adaptor and oil box)

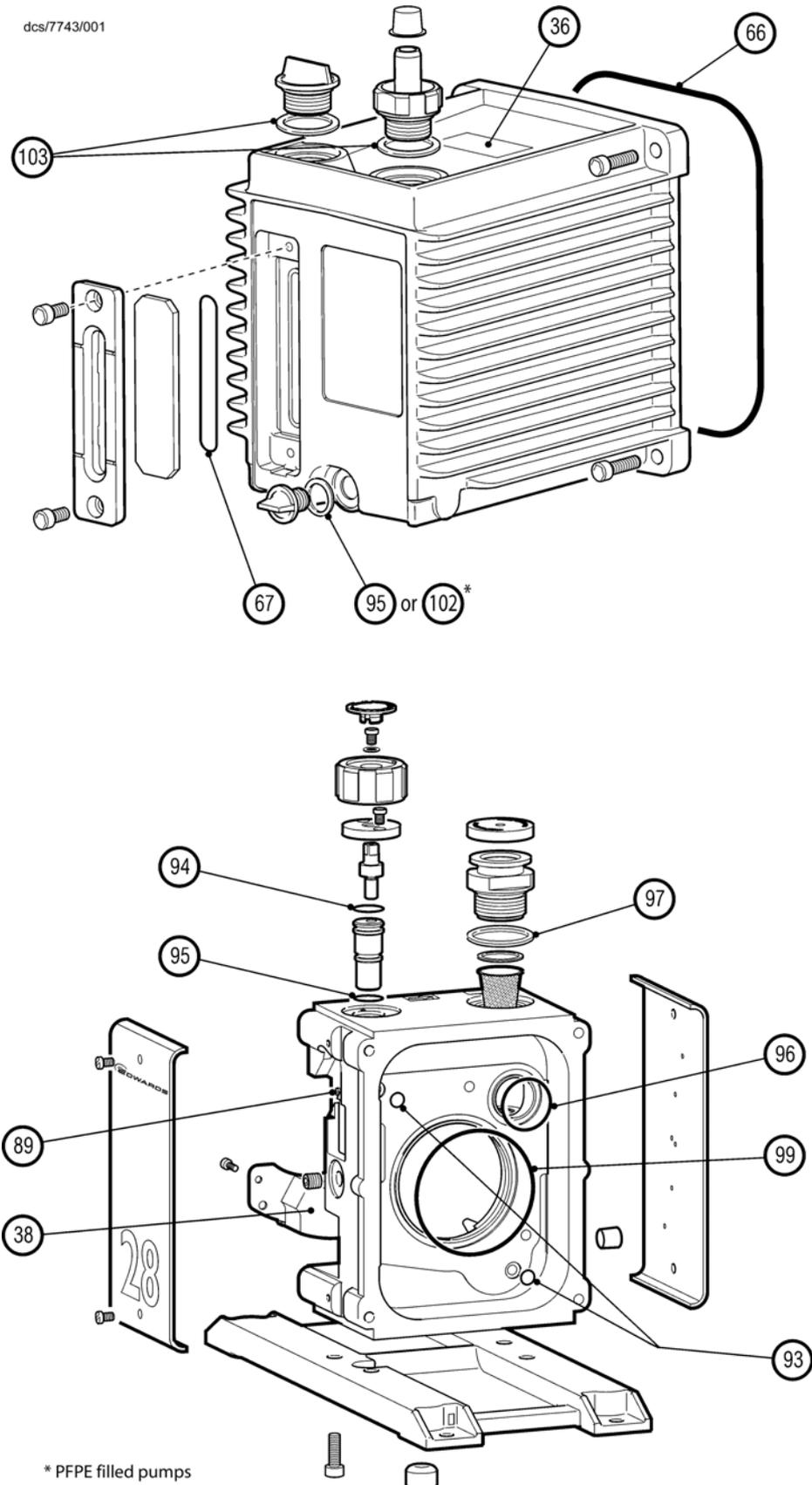


Figure A5 - Figure 3 - Kit items (motor and adaptor plate)

