



GALILEO TP
PROCESS EQUIPMENT

VACSOUND ECO

D12 – D18 – D28

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PURPOSE OF THE MANUAL

This manual details the procedures for installation and operation of the VACSOUND D12, D18 and D28 pumps.

The manual comprises 5 chapters, as described below:

1. Chapter 1, PREFACE, provides general safety precautions and information about the structure of the manual and how to use it;
2. Chapter 2, DESCRIPTION AND CHARACTERISTICS, provides a description of the structure of the pump with its main features, and lists the technical data;
3. Chapter 3, INSTALLATION AND OPERATION, provides the main items of information needed for correct installation and explain how to start and stop the pump;
4. Chapter 4, MAINTENANCE, is a summary of the main maintenance actions, with a table of lubrication oils and the Scheduled and Unscheduled Maintenance Cards;
5. Chapter 5, SPARE PARTS, contains a list of spare parts and accessories for the pump.

1. Preface

1.1 Purpose of this chapter

Chapter 1, PREFACE, provides the general safety rules and information on structure of the manual and how to use it.

1.2 Safety rules

Those working on this pump must be aware of and observe at all times the general and specific safety rules that are listed below.

Failure to observe the safety rules may result in harm being caused to personnel and/or damage to pump components.

With a view to preventing the risks deriving from operation of the pump, suitable protection devices must be installed, in accordance with the applicable national safety rules.

All pump installation and maintenance work is to be performed with the electric power line not connected.

Staff responsible for installation, maintenance and operation of the pump must realize that knowing and applying the safety precautions is an integral part of their work. In particular, those responsible for the following:

- **Putting the pump into service, or managing its operation;**
- **Performing different types of work on the pump,** especially regarding maintenance, control and repair of any of the pump's components before it is switched on, during operation, or even after it is switched off;

must read the documentation carefully so as to be aware of the potential dangers that they may encounter in the course of their work, both as regards operation and correct use of the safety devices.

When installing or replacing a part, take great care. Pay special attention to the three-phase motor, where an inversion of polarity causes inversion of the direction of rotation of the pump with consequent possibilities of mechanical damage.

Further safety rules will be found in the chapters on specific operations.

1.3 How to use this manual

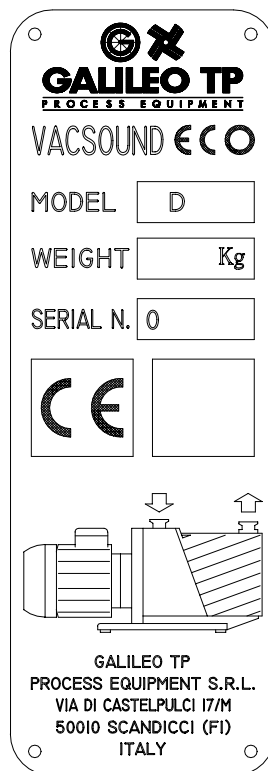
This section details some of the steps taken in the preparation of this manual.

The definitions below refer to all the CAUTIONS, WARNINGS and NOTES given throughout the manual.

CAUTION: Operating procedures, technical information and precautions which, if not respected and/or implemented correctly may cause damage to the pump.

WARNING: Operating procedures, technical information and precautions which, if not respected and/or implemented correctly may cause bodily harm to operators.

NOTE: Operating procedures, technical information and precautions that must be underlined.



2. Description and characteristics

2.1 Purpose of this chapter

CHAPTER 2, DESCRIPTION AND CHARACTERISTICS, describes the constituent parts of the pumps, illustrating their main features and listing the technical data.

2.2 Technical description

The VACSOUND ECO D12, D18 and D28 pumps are twin-stage, rotary, vane pumps with an oil-bath seal, driven by a single-phase or three-phase electric motor.

These high vacuum pumps are suitable for pumping of neutral gases and CFC, HCFC and HFC steams. The main features are:

- all parts in direct contact with the pumped fluid are free of copper alloys;
- all materials are carefully selected to provide longer life;
- a high capacity gas ballast device allows condensable vapours to be pumped;
- all parts are fully replaceable due to the close machining tolerances and centering obtained by using reference pins;
- with its design features and low number of gaskets, the pump requires minimal maintenance; disassembly and reassembly are extremely fast.

The pump works with forced lubrication, provided by an auxiliary gear-pump driven by the rotor of the vacuum pump itself. This ensures proper lubrication even when pressures are close to atmospheric.

The entire functional block (chambers, rotors, sides, valves etc.) is immersed in the oil contained in the casing. The oil guarantees perfect sealing of the discharge valves, enters the pump to ensure lubrication and sealing of the parts inside, facilitates heat dissipation and reduces pump noise.

The pump is equipped with a special anti-suckback device which automatically isolates the vacuum system when the pump stops. This avoids rises in pressure or oil flow in the vacuum system while air is allowed back into the stator chambers.

The air entering the pump after the anti-suckback device has closed prevents the oil in the casing from filling the stator chambers.

The inner seals are achieved by the lubricating oil, thanks to the close machining tolerances.

There is only one oil seal on the rotor shaft, the one preventing oil from seeping out of the pump. This seal acts on a bushing fitted onto the shaft. Simple replaceable of this seal grants the rotor a practically unlimited life (pumps D18, D28). On the D12 pump, this seal acts on a surface-hardened area of the shaft guaranteeing long rotor life.

The vacuum pumps are connected directly to the electric motor through a flexible coupling, so that motion is transmitted even in case of poor alignment.

A fan fitted on the joint and housed in the pump support produces a forced air flow over the finned surfaces of the casing to avoid oil overheating.

2.3 Lubrication

The pump's lubricating system is force-feed type. Oil circulation is obtained by means of a gear pump connected to the rotor shaft. The oil is sucked through a gauze filter to prevent any foreign bodies from entering the pump.

Shunt-mounted on the delivery line is a hydraulic piston which, besides actuating the anti-suckback device (see section 2.6), also regulates pressure by discharging excess oil flow directly into the tank. The required flow of oil under pressure passes through ducts that are drilled in the walls of the pump and lubricates the bearings and the inside parts.

The bearing on the motor side, is lubricated by oil sucked in through two orifices which communicate with the casing.

2.4 Vacuum seals

A special feature of this pump is the low number of gaskets that are used.

Careful surface finish of the various parts of the pump means that vacuum sealing of the functional block is ensured by the film of oil in the metal-metal contact of the surfaces. Sealing of the rotor shaft is guaranteed by a rotating gasket with dust-guard lip. The suction flange and duct are sealed by means of OR gaskets.

2.5 Gas ballast valve

When the pump sucks in vapours, these condense during compression and mix with the oil, forming an emulsion (an aqueous vapour, for example) or a solution (organic solvent vapours, for example).

A number of problems arise from this, such as the impossibility of obtaining high vacuums, the alteration of the properties of the oil, the danger of incrustations forming on parts of the pump.

To avoid this, during compression at the second stage, atmospheric air is let into the pump through an adjustable valve, or "gas ballast valve", located at the top of the pump.

In this way, the discharge valve of the second stage opens through the effect of the atmospheric air before the partial pressure of the vapour reaches saturation point, thus preventing condensation from occurring. The vapours are expelled mixed with air.

2.6 Anti-suckback device

The pump is equipped with a special anti-suckback device to avoid air pressure rises and/or oil backflow towards the evacuated vessel when the pump is switched off. This device has a shutter which automatically closes the suction duct.

In this way the pump and vacuum system are completely isolated from each other and air can enter the pump without any risk for the vacuum produced in the system.

The device includes some special features, namely:

- drive obtained avoiding any form of contamination of the suction duct by fluids (oil and/or air) used to command the shutter. Thanks to this, when the pump is started again, the pumpdown to vacuum conditions is extremely fast as these contaminants are not present and no degassing is therefore required;
- suction flange maintained closed even when the pump is idle, so that pollutants cannot enter from the environment and no oil can overflow from the pump.

2.7 Technical data

Table 2-1 lists the main technical data of the VACSOUND ECO D12, D18 and D28 pumps.

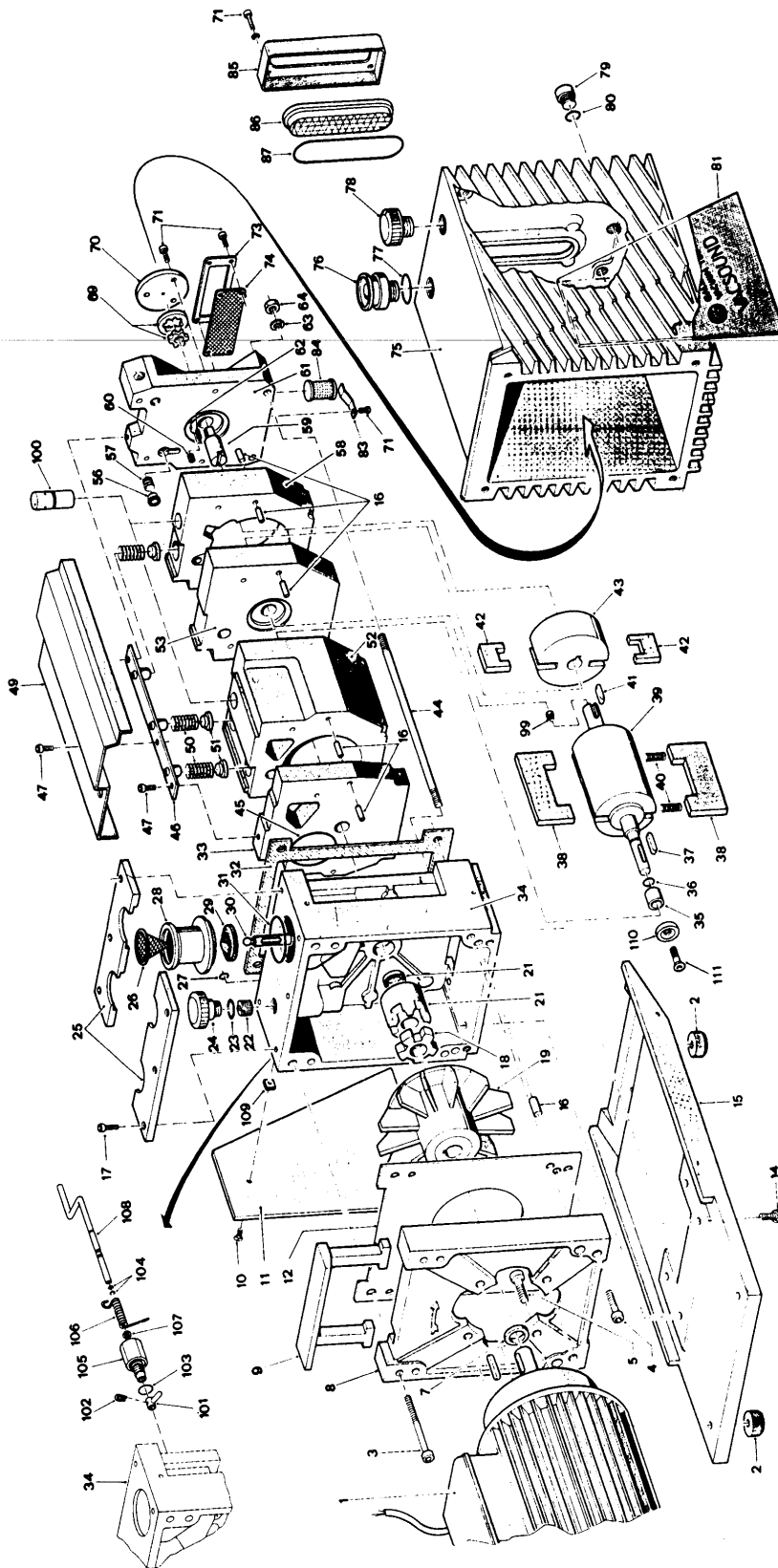
PROPERTY	UNIT	D12	D18	D28
Nominal flow 50 Hz	m ³ /h	14,2	20,5	30,2
Effective flow 50 Hz (*)	m ³ /h	11,4	17,4	26
Nominal flow 60 Hz	l/min	290	420	610
Nominal flow 60 Hz	cfm	10,2	14,8	21,5
Final vacuum (*)	mbar	10 ⁻³	10 ⁻³	10 ⁻³
Final vacuum with gas ballast (*)	mbar	5.10 ⁻²	5.10 ⁻²	5.10 ⁻²
Tolerated water vapor pressure	mbar	20	30	30
Max. water vapor pumped	g/h	160	350	550
Min./max. oil capacity	l	0,25/0,6	0,5/1	0,5/1
Electric motor 50 Hz (1ph/3ph)	kW	0,45/0,55	0,75/0,90	0,75/0,90
Electric motor 50/60 Hz (1ph/3ph)	kW	0,37/0,45	0,75/0,90	0,75/0,90
Rotation speed 50 Hz	rpm	1500	1500	1500
Rotation speed 60 Hz	rpm	1800	1800	1800
Noise level at final vacuum at 1 m.	dB(A)	52	52	52
Operating temperature (**)	°C (°F)	45 (113)	45 (113)	45 (113)
Weight with 50 Hz, 1ph motor (3ph)	kg	22,8	36,2	36,2
Weight with 50/60 Hz, 1ph motor (3ph)	kg	18,5	29,2	29,2
Dimensions (cf. also next Table):				
Length, 1ph (3ph)	mm	471 (450)	540 (510)	540 (510)
Width	mm	134	164	164
Height	mm	212	242	242
Suction and exhaust flanges	DN	25KF PN16	25KF PN16	25KF PN16

Table 2-1 Technical Data

(*)According to PNEUROP standards 6602

(**)At final vacuum (room temperature 20°C)

Legend (cf. figure 2-1)



1. Electric motor
2. Rubber foot
3. Screw
4. Screw
5. Screw
7. Spacer
8. Motor support
9. Handle
10. Screw
11. Right sideplate
12. Board
14. Screw
15. Support plate
16. Cylindrical pin
17. Screw
18. Rubber crown
19. Half-joint (motor side) with fan
20. Half-joint (pump side)
21. Oil-seal ring
22. Special screw
23. OR gasket
24. Gas Ballast Valve knob
25. Half-plate
26. Suction sieve
27. OR gasket
28. Suction flange
29. Anti-suckback shutter
30. Piston
31. OR gasket
32. Casing gasket
33. Inner sideplate
34. Pump support
35. Anti-wear bushing
36. OR gasket
37. Tongue
38. First stage vane
39. First stage rotor
40. Spring
41. Tongue
42. Second stage vane
43. Second stage rotor
44. Tie-rod
45. OR gasket
46. Bracket
47. Screw
49. Valve cover plate
50. Valve spring
51. Valve gasket
52. First stage stator
53. Partition wall
56. Gas Ballast Valve shutter
57. Gas Ballast Valve spring
58. Second stage stator
59. Oil pump shaft
60. Special screw
61. End sideplate
62. Tongue
63. Washer
64. Nut
69. Oil pump gears
70. Oil pump cover
71. Screw
73. Plate
74. Filter
75. Casing
76. Exhaust flange
77. OR gasket
78. Oil fill plug
79. Oil drain plug
80. Oil drain plug gasket
81. Left sideplate
83. Spring
84. Filter
85. Flange
86. Sight glass
87. OR gasket
99. Special screw
100. Piston
101. Arm
102. Spring
103. OR gasket
104. OR gasket
105. Sleeve
106. Spring
107. Ring
108. Arm
109. Insert
110. Special washer
111. Screw

Figure 2-1 View of the pump

2.7.1 Dimensions

PUMP		REFER TO FIGURE 2-2											
		A	B	C	D	H	L (1ph)	L (3ph)	M	N	P	R	W
D12	mm	30	30	35	3	212	471	450	244,5	104	105	205	134
	inch	1.2	1.2	1.4	0.12	8.4	18.5	17.7	9.63	4.09	4.2	8.1	5.3
D18	mm	40	40	40	6	242	540	510	261	130	100	230	164
	inch	1.6	1.6	1.6	0.24	9.5	21.3	20.0	10.2	5.12	3.9	9.1	6.5
D28	mm	40	40	40	6	242	540	510	261	130	100	230	164
	inch	1.6	1.6	1.6	0.24	9.5	21.3	20.0	10.2	5.12	3.9	9.1	6.5

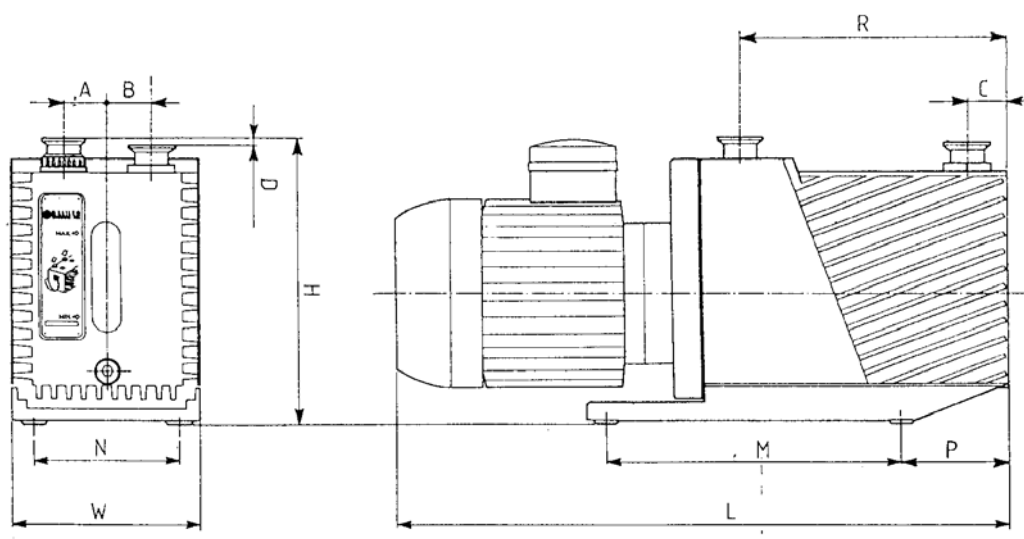


Figure 2-2: Pump dimensions

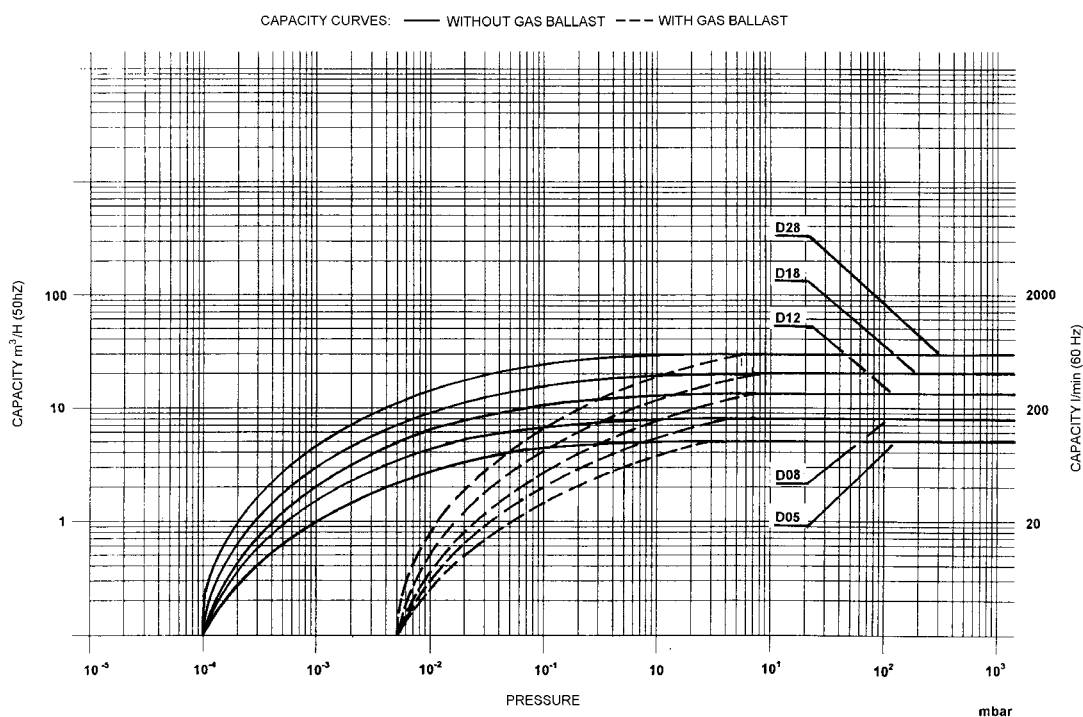


Figure 2-3: Typical Performance Curves

3. Installation and operation

3.1 Purpose of this chapter

Chapter 3, INSTALLATION AND OPERATION, provides the main information required for proper installation and the procedures for starting and stopping the pumps.

3.2 Safety rules

- Always carry the pump by means of the handles provided.
- The pump must be set in position taking the utmost care in order to avoid accidental falls.

WARNING: In case of a need to handle the pump after a period of operation, it must be left to cool first as the external surface temperature may be in excess of 60 °C.

3.3 Transport and installation

The pumps are shipped to the customer inside cardboard boxes. Total weight of the pack, including the pump, is 40 kg [daN]. The case must be handled with care, using appropriate lifting equipment.

CAUTION: When moving the case, ensure that it is securely bound to the lifting equipment and that the equipment is strong enough to support the weight.

The pump's working environment is a traditional industrial environment. Naturally sites with corrosive vapors or excessive heat are best avoided. Room temperature should ideally be between 12 °C and 45 °C. If the temperature is not inside this range, consult GALILEO TP technical service for the changes required. Setting the pump in position should be performed as follows:

- Pump laid on the ground. There are no special instructions for this type of installation, except that the floor should be as flat as possible and suited to bear the weight of the pump (it should ideally be a concrete floor) and of any accessories mounted on it. Verify that the pump is stable on its base plate. It should not be necessary to anchor it to the floor with bolts and screws; also vibrations to and from the pump are greatly reduced by the use of rubber feet.
- Pump off the ground. In this case, the user must design a suitable support structure, remembering the following points:
 - the plane supporting the pump must be perfectly horizontal;
 - the structure should be rigid;
 - apply the safety precautions in force.

Note also that the pump should be attached to the supporting structure after replacing the rubber feet with special anti-vibration feet, which should be screwed to the pump base and to the supporting plane.

After taking the pump out of its packing case, you are advised to make the following checks:

- a. Ensure that the pump has not suffered any damage during shipping.
- b. Check that the guards are mounted correctly (side plates, refs. 11 and 81 in fig. 2-1) and that there are no uncovered or loose parts.
- c. Examine the power cord carefully and check that the insulation has not been damaged.

3.4 Preliminary operations

Before starting the pump, fill up with lubricating oil as the pumps are delivered empty.

NOTE: A tin of oil is included in the packing.

For details on how to fill up, see Scheduled Maintenance Card 01 (Section 4.5).

CAUTION: Oil must be poured into the casing through the special threaded plughole and NOT through the suction line.

WARNING: Take out the protective caps on the suction and exhaust flanges before doing anything else. In the event of an accidental start-up, the air inside the pump could throw the caps against the operator.

3.5 Electrical connections

CAUTION: Check that your electrical mains voltage corresponds to that indicated on the motor's plate.

3.5.1 Models with single-phase motors

The pump is supplied with a power cable (twin-pole + earth) 2 m long, complete with plug. The motor has a bipolar switch. Direction of rotation of the motor needs not to be checked on these models.

The motor includes a thermal relay for protection against current overloads. If the motor is switched off by this relay, it may be started again by re-energizing the relay externally after removing the cause of the overload.

NOTE: If fuses are installed on the power line, they must have a rating of 10 A.

3.5.2 Models with three-phase motors

To connect the motor to the three-phase mains, follow the wiring diagram on the motor plate or on the inside of the terminal strip.

Install a multipolar omnipole switch on the power line, with contact spacing of at least 3 mm.. A magneto-thermal switch must be installed downstream of this switch, tripping at 130-140 % of the nominal current.

CAUTION: It is recommended to connect the pump to the power supply through a dedicated switch on the main electrical panel of the installation, or in proximity of the power supply connection point.

Before starting the pump, give a short activation to the power switch, in order to check that the motor turns in the direction indicated by the arrow on the motor body. Should it rotate in the opposite direction, invert the connection of any two phases on the motor terminals.

3.6 Connections on suction and exhaust sides

Remove the protective caps from both flanges. Connect the system to be evacuated to the suction flange, using a centering ring with OR and a locking collar.

NOTE: For guaranteed reliable sealing, use an OR gasket in Perbunan or Viton.

The suction duct is equipped with a sieve filter preventing solid particles from entering and damaging the pump.

NOTE: When the gases to be sucked out contain dust, it is advisable to insert a dust filter before the suction flange.

NOTE: When the gases to be sucked out contain large quantities of vapor, it is advisable to include a condensate separator before the suction flange.

To make best use of the pump's capacity, use only short, straight piping, with a diameter not less than that of the suction inlet.

NOTE: If rigid piping is used, it is good practice to use a flexible joint in order to avoid undue forcing of the connection on the pump.

The exhaust duct must be connected to a pipe that will take away the sucked out gases.

NOTE: Application of an oil trap filter is necessary to avoid pollution of the surrounding atmosphere by the oil present in the exhaust duct during pump operation.

CAUTION: Never block the pump exhaust line. This would cause overpressure in the casing with the risk of breaking the glass window of the level indicator and/or expelling the oil seal gasket.

3.7 Starting and running the pump

Before being put into service, in order to reach maximum vacuum, the pump must be left running for about an hour with the gas ballast valve open and the aspiration line closed. This will eliminate any humidity from the oil.

WARNING: The vacuum pump can't be used to pump the atmospheric pressure more than for 15 minutes; in this case can occur the seizure of some internal parts, for the not correct lubrication of the rotors.

WARNING: The pump is designed for operation with air, oil vapors Ester based and R134a vapors. It is absolutely forbidden to use potentially explosive or flammable substances.

NOTE: If the pump is started with cold oil, initially more than normal noise will be heard; this will last for a few minutes only until the oil reaches its working temperature.

There are no special instructions for normal operation of the pump, which is delivered to you after completion of a running-in cycle in the factory. The maintenance operations for a pump in working condition may be found on the Scheduled Maintenance Cards (Section 4.5).

If the pump is sucking in environments with liquids or vapors, it is important to leave it to run with the gas ballast open so as to avoid condensation of the vapors and contamination of the lubricating oil as a result. When there is no danger of the oil being contaminated, the gas ballast valve should be closed to reduce the pump's power absorption.

The gas ballast valve will prove useful in the cold season when, due to the lower room temperatures, it takes longer for the pump to reach rated temperature when switched on. Compression of the air forced in by the gas ballast valve develops heat, which in turn increases temperature of the oil faster.

NOTE: If gases without vapors are sucked in, you are advised to open the gas ballast device from time to time in order to eliminate the traces of humidity they contain.

NOTE: For repetitive work cycles, with brief time intervals in between, it is better not to stop the pump.

3.8 Stopping the pump

There are no special procedures for switching the pump off; it needs only to be disconnected from the electric power by means of the bipolar switch (version with single-phase motor - see section 3.5.1) or of the multipolar switch (version with three-phase motor - see section 3.5.2).

When the pump is stopped, the anti-suckback device makes it possible to maintain vacuum in the vessel connected on the suction side of the pumps.

If the pump is expected to be stopped for a lengthy period, or in any case if it has sucked in large amounts of vapors, it is good practice to run it with the gas ballast open and the suction line closed for a few minutes before switching off in order to limit the risk of corrosion or incrustations due to pollution of the oil by condensed vapors.

4. Maintenance

4.1 Purpose of this chapter

Chapter 4, MAINTENANCE, provides a rundown of the main maintenance operations, and contains a lubrication table; also included are the Scheduled Maintenance and Unscheduled Maintenance cards.

4.2 Safety rules

Personnel responsible for pump operation and maintenance must be well-trained and must be aware of the accident prevention rules.

The accident prevention precautions contained in this section must be respected at all times during operation and maintenance of the pump to avoid damage to operators and to the pump.

These precautions are provided in the form of WARNING and CAUTION notes.

WARNING: Operating procedures, technical information and precautions which, if not respected and/or implemented correctly may cause bodily harm to operators.

CAUTION: Operating procedures, technical information and precautions which, if not respected and/or implemented correctly may cause damage to the pump.

4.2.1 Warning notes

- a. Death may result from contact with high voltages. Always take extreme care and observe the accident prevention regulations in force.
- b. Always disconnect the power supply to the pump before commencing maintenance work. Place a special warning signs over the power supply breaker switch: MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON.
- c. If you are performing maintenance after the pump has been operating for a considerable time, allow sufficient time for it to cool as the external surface temperature may be in excess of 60 °C.
- d. Failure to provide the pump with an earth connection may cause serious damage to operators. Always ensure that there is an earth connection and that it complies with the standards.
- e. When cleaning the pump and its component parts, avoid the use of flammable or toxic solvents, such as benzine, benzene, ether or alcohol. The recommendation is to use a soap and water solution, preferably in ultrasound washing machines, taking care to dry all the cleaned parts at temperatures under 100 °C in order to eliminate residual moisture.
- f. Prolonged overloads or breakdowns may cause the electric motor to overheat, and to release noxious smoke; remove the power immediately as a precaution and do not approach the pump at least until you have provided ventilation to drive out the smoke. Take care not to breathe in the fumes remaining inside the pump in the course of repair work.
- g. In case of fire, do not throw water on the pump. Switch the power off and use CO2 extinguishers.
- h. Carefully inspect the flanges to ensure that there are no dust, oil, dirt or defects of the mating surfaces, before making the required connections.
- i. Ensure that all joints and couplings are locked correctly before starting the pump again after repair work.

- j. Do not wear any objects that may become entangled in the mechanisms and/or act as conductors (chains, bracelets, etc.).
- k. Ensure that the tools to be used are in perfect working condition and have insulating grips, where necessary. Check that the insulating material of the cables and that the conductors of the test equipment do not show any signs of damage.
- l. Do not replace the oil immediately after stopping the machine as the oil may still be at high temperature.
- m. m. Perform repairs in clean and, where possible, dust-free areas. Protect all the clearances of connection points with suitable plastic caps and cover the machined surface areas of all parts stripped down up until they are put back on the pump again.
- n. n. Do not start the pump if the protective sideplates (refs. 11 and 81 of fig. 2-1) are not properly in place.

4.2.2 Caution notes

- a. Before putting the pump back into operation after a breakdown, inspect it and check carefully for any other signs of damage.
- b. Use only tools that are in perfect working order and specially designed for the job; use of inappropriate or ineffective tools may cause serious damage.
- c. Perform repairs in clean and, where possible, dust-free areas. Protect all the clearances of connection points with suitable plastic caps and cover the machined surface areas of all parts stripped down up until they are put back on the pump again.
- d. Always check the lubricant and that it is properly distributed through the pump; inadequate lubrication may damage the pump seriously.
- e. Give the parts some form of marking as you strip them down to ensure that you reassemble them again in the proper order.
- f. Check that there are no scratches or grooves on the machined shafts, in their seats inside the pump or on machine-ground surfaces. Slight scratches and abrasions may be eliminated with very fine emery paper or by a little light grinding.
- g. Before putting a group together, always spread a little oil over inner parts and mating surfaces. Replace all seals with original spare parts before reassembling components.

4.3 Maintenance actions

Maintenance may be seen as the totality of all scheduled and unscheduled maintenance work.

Maintenance includes:

- a. **Scheduled maintenance:** maintaining the nominal state of operation;
- b. **Unscheduled maintenance:** restoring the nominal state of operation.

NOTE: The frequency with which repairs are performed depends on the process and presence of substances that shorten pump life (dust, abrasives, solvents, water, chemically aggressive substances).

The pump must be cleaned at regular intervals of time. Use only the strictly necessary amount of lubricant; an excess of lubricating oil, like when there is none, may sometimes compromise proper operation of the pump. Only the recommended lubricants, or lubricating oils with similar characteristics and known and experimented quality, should be used.

Oil changes must be made with the oil at a sufficiently high temperature, after leaving the pump to cool for a few minutes following operation. The drain and filler plugs must not be left open any longer than is strictly necessary.

When performing maintenance, look out for all signals that may precede a breakdown, in particular:

- traces of corrosion;
- oil leaks;
- slack joints or couplings.

Maintenance technicians must:

- be aware of all applicable national directives concerning accident prevention during work on motor-driven pumps and should know how to apply them;
- have read and understood all the sections on "Safety Rules ";
- be familiar with the essential design features and operation of the pump;
- know how to use and consult the pump documentation;
- be concerned about proper operation of the pump;
- make a note of any irregularities in operation of the pump and take the necessary action, where appropriate.

Use original spare parts wherever possible and repair a broken part as best as possible on site or send it back to the manufacturer for repairs.

For all problems arising, or to order spare parts, refer to our service department.

GALILEO TP Process Equipment

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4.4 Lubricants

It will be readily understood how important adequate lubrication is to high technology pumps like the GALILEO vacuum pumps. Correct use of appropriate lubricants makes a significant contribution to achieving best performance and warding off defects.

When handling lubricants, the following sanitary protection measures should be observed at all times:

- Avoid prolonged, excessive or repeated contact of the skin with products for lubrication, and also avoid directly inhaling the fumes or vapors of such products.
- Protect the skin by wearing appropriate clothes and equipment (e.g. special suits, glasses or, where permitted by the safety regulations, gloves) or by applying a special protective product.
- Clean the skin carefully after contact with the lubricants by washing freely with water and soap.
- Apply a skin cream after washing.
- Take off and change clothes or shoes on which oil has been spilled.
- Never put rags dripping with oil into the pockets of your clothes.

When disposing of waste lubricants, observe the following environment protection regulations:

- The lubricants risk contaminating the water and the ground! Therefore never pour lubricating products on to the ground, into water or in the sewage system. All violations of these rules are liable to persecution as provided for by law. When using lubricants always keep an oil can nearby.

- Take care in draining off waste oils. In disposal of these products respect all regulations in force concerning waste oil disposal.

The recommended lubricating oil depends on the type and conditions of use.

ROTOIL ES-68: compatible with HFC steams.

ROTOIL SH-200: mineral oil of standard viscosity, for pumping of chemically inert vapors and gases (SAE 30).

PROPERTY	UNIT	ROTOIL SH-200	ROTOIL ES-68
Specific weight (15°C)	g/cm ³	0.86	0,966
Kinematic viscosity 40°C	Cst	55	68
100°C	cSt	8.1	
Index of viscosity		90	101
Vapour pressure 25°C	Pa	1x10 ⁻³	---
Fire point	°C	244	260
Pour point	°C	- 15	-39

Table 4-1: Properties of ROTOIL oils

It is absolutely necessary to continue using the lubricants initially used to fill the tank. If this is not possible for organizational or business reasons, use only products with the same characteristics as the previous oils.

Only use of lubricants of suitable quality will guarantee safe operation of the pumps.

CAUTION: It is forbidden to mix different lubricants, because their composition and the related additives are not the same.

If you expect to have to use other lubricants, first find out if the two products are compatible. In cases of doubt, the lubricant used up to that time must be flushed out by way of a pump flushing procedure.

CAUTION: To avoid the risk of contaminating the oil, absolute cleanliness of the pump and surrounding area must be ensured during the lubrication procedures.

4.5 Scheduled maintenance cards

N°	FREQUENCY	PUMP STATUS (*)	OPERATION
1	MONTHLY	R	OIL LEVEL CHECKING
2	TWICE YEARLY	S	CLEANING THE SUCTION FILTER

(*) R = Running S = Stopped

Table 4-2 List of Scheduled Maintenance Cards

NOTE: When the pump is equipped with a condensation separator on the suction side these items must also be maintained, by following the Manufacturer's instructions.

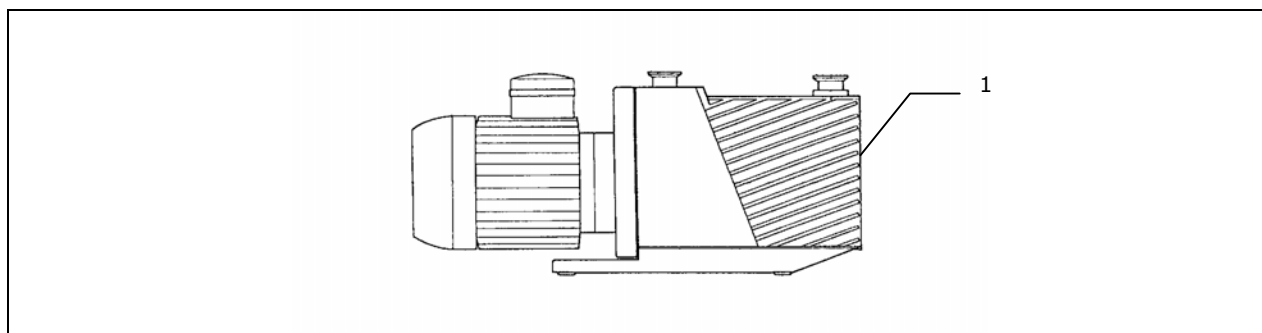
NOTE: The numbers used in the drawings on the Scheduled Maintenance Cards are those used in Figure 2-1 View of the pump.

Scheduled maintenance	Card No 1
------------------------------	---------------------

Pump type: VACSOUND ECO D12, D18, D28
--

Frequency: Monthly	Time: 5 min.	Machine status: R
---------------------------	---------------------	--------------------------

Type of action: Lubrication	Item: Lubricating oil
------------------------------------	------------------------------



N°	Description	Time	Equipment	Materials
1	Check the oil level and top up if necessary.	5 min.	• Cleaning rags • Liquid detergent	Oil

WARNING: Machine powered: take care on account of moving parts and high voltages.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60°C.

1. Check the oil level through the sight glass: there are two clearly visible arrows indicating maximum and minimum levels for proper pump operation.

NOTE: The amount of oil consumed depends on the type of work, particularly on the volume being evacuated and on the frequency of the vacuum cycles.

2. If necessary, open the pump filling plug on the top plane of the pump and add oil.

NOTE: Before starting the procedure, check that the quality and type of oil used corresponds to the indications of Table 4-1 of this manual.

Take great care to avoid oily residues or dust from entering the pump and jeopardizing proper operation.

3. Close the fill plug and, using cotton or other suitable material rags, clean thoroughly the outer surface of the top plane of the pump.

WARNING: Never mix lubricants of different brands or quality. To change from one oil to another, the pump must be stripped down and all parts washed carefully, taking care to eliminate oil residues.

4. Open the gas ballast valve to purify the oil.

Scheduled maintenance

Card No
2

Pump type: **VACSOUND ECO D12, D18, D28**

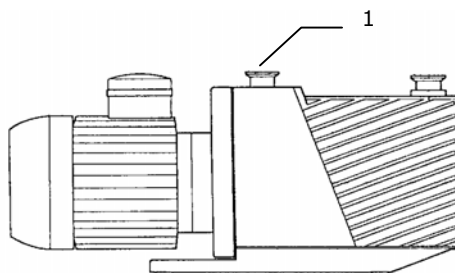
Frequency: **Twice yearly**

Time: **10 min.**

Machine status: **S**

Type of action: **Cleaning**

Item: **Suction filter**



N°	Description	Time	Equipment	Materials
1	Clean the suction filter	10 min.	Compressed air gun	

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.

1. Remove the filter (26) from the suction flange (28).
2. Clean the filter using an aqueous solution and dry with hot air.
3. Put the filter back in place.

CAUTION: The filter element is designed to prevent solid particles in the air from entering the inside of the pump and if it is not working properly, serious damage could be caused the pump's inner parts. In such cases, it may be worthwhile installing a large surface area filter in the pump's suction line to improve effectiveness and reduce maintenance frequency. If the pump sucks in gases and vapors that contain large quantities of solid particles, the filter must be checked and cleaned more often than indicated here.

4.6 Unscheduled maintenance cards

N°	SUBJECT	FREQUENCY
101	General warnings	
102	Changing the oil	Whenever necessary
103	Disassembly of oil level indicator	When damaged
104	Disassembly of anti-suckback device shutter	When damaged
105	Disassembly of electric motor and joint	When damaged
106	Disassembly of discharge valve	When damaged
107	Disassembly of oil pump	When damaged
108	Disassembly of anti-suckback valve	When damaged
109	Disassembly of pump body	When damaged
110	Replacement of oil seal ring/wear bushing	When damaged
111	Disassembly of functional block rotors	When damaged

Table 4-3 List of Unscheduled Maintenance Cards

NOTE: The numbers used in the drawings on the Unscheduled Maintenance Cards are those used in Figure 2-1 View of the pump.

Unscheduled Maintenance

Card No.
101

GENERAL WARNINGS

1. Pump disassembly and reassembly require some basic operations and use of tools found in most workshops.

NOTE: The pump's component parts are modular and therefore fully interchangeable. Whenever parts have to be replaced, please specify in the order:

- Pump type;
- Serial number (marked on pump identification plate);
- Reference number on the detailed diagram, name and part number as indicated on the spare parts and accessories list (section 5.2 of this manual).

To simplify maintenance work, two kits have been devised. The Gaskets Kit, containing all the gaskets recommended for substitution after disassembly of the pump and the most commonly used removable parts. You are advised to keep this kit in a dry room, away from heat and light (sun and UV rays) in order to prevent hardening of the elastomer parts.

The Maintenance Kit, including, as well as the Gaskets Kit, the 1st and 2nd stage vanes and other parts that it may be necessary to replace when overhauling the pump completely. These parts have a life of approx. two years under conditions of normal operation.

KIT	D12	D18	D28	CODE
GASKETS KIT	X			5.001.1.053
GASKETS KIT		X	X	5.001.1.056
GENERAL MAINTENANCE KIT	X			5.001.1.050
GENERAL MAINTENANCE KIT		X	X	5.001.1.052

Kits Table

2. Before reassembling the pump, all parts must be cleaned thoroughly with a soap and water solution and rinsed with demineralized water.

CAUTION: Particular care must be taken in cleaning the lubrication ducts and oil passage nozzles, which must always be kept free of impurities.

CAUTION: Take care that the soap and water solution does not remain in the various cavities and recesses of the pump, in the blind holes in particular.

3. Then dry the parts, by heating where possible but without using compressed air (it generally contains polluting substances), taking care not to exceed a temperature of 80 °C.
4. The sequence of reassembly is the inverse of the disassembly operation. Take the same precautions:
 - Spread some clean oil of the same type as used to lubricate the pump over the different parts, in particular the inner lip of the oil seal, the bearings and vanes.
 - If the oil seal has no inner dust-block lip, 2/3 fill the area between the two lips with grease.

CAUTION: Do not allow the grease into the area of the circumferential spring.

- Lock without forcing the nuts on the four tie-rods (44) connecting the parts of the pump block. Before locking, check that all parts are touching as required.

- Before putting the springs and shutters of the discharge valves back in, pour a little oil into the stators through the holes in the valves.

CAUTION: Before hooking the recall spring to the anti-suckback command bar, make sure you have put the bar all the way into the sleeve of the rotary feedthrough to avoid bending the tapered part of the bar.

NOTE: On D12 pump with pumps with single-phase motor, fit the joint on the motor shaft after careful removal of grease from the surfaces and application of LOCTITE 242.

Unscheduled maintenance

 Card No.
102

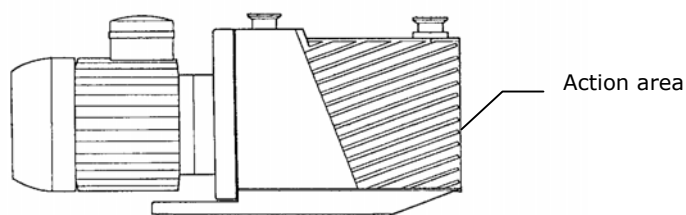
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **As required**

 Time: **30 min.**

 Machine status: **S**

 Type of action: **Changing oil**

 Item: **Lubricant**


Materials required	Equipment required
Oil ROTOIL SH-200 (1 liter)	- Fixed wrench for exhaust top. - Tank to collect oil. - Cotton (or other suitable material) rags for cleaning. - Soap and water solution for cleaning.

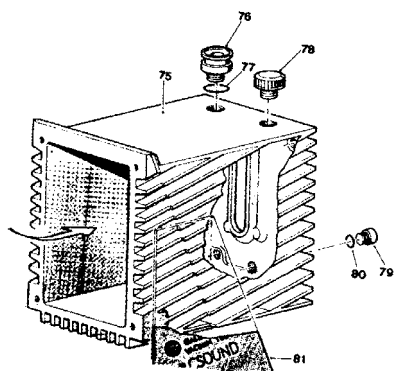
WARNING: Do not change the oil immediately after stopping the machine as the oil temperature may still be high.

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.

NOTE: The oil has to be replaced:

- when it has become particularly dirty due to the presence of contaminants in the environments being evacuated;
- when the degree of vacuum achieved by the pump is no longer satisfactory, even after running for one hour with the gas ballast device open.



1. Place a tank for the waste oil under the oil drain plug (79).

NOTE: You are advised to empty the pump before it cools down completely so that the oil flows out more easily.

NOTE: The pump contains up to 1 litre of oil - make sure the tank you use for the waste oil can hold this amount.

2. Open the oil drain plug slowly; let the oil flow out by opening the fill plug (78) located at the top of the pump. In the meantime, clean the inside of the drain plug (magnetic plug).
3. After closing the drainage hole with its plug, make the pump perform a number of turns, giving it a brief current pulse, so as to let residual oil in the pump chambers flow out. Then drain off the residual oil again.
4. After all the oil has been drained, close the drain plug tight; take the tank of waste oil away and clean thoroughly, using rags of cotton or other suitable material to dry.
5. Clean thoroughly the pourer lip of the new oil tin; pour the oil slowly into the pump through the filler plug.

WARNING: Monitor through the sight glass at the front of the pump that you are not exceeding the maximum oil level permitted.

CAUTION: For disposal of waste oil, it is strictly necessary to respect the currently applicable legislation on this matter.

6. To achieve a good vacuum level again, run the pump for one hour with the gas ballast open.

Unscheduled maintenance

 Card No.
103

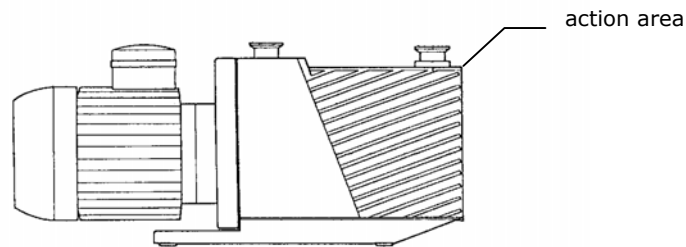
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **when damaged**

 Time: **30 min.**

 Machine status: **S**

 Type of action: **Disassembly**

 Item: **Sight glass**


Materials required

- OR gaskets (kit p/n 985700212001)
- Sight glass

Equipment required

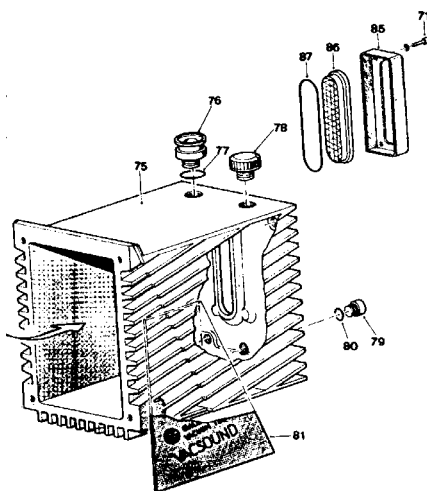
Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.

1. Drain off the oil from the pump.

NOTE: For a description of how to drain off the oil, see the Unscheduled Maintenance Card No. 102.



2. Unscrew the securing screws (71) and disconnect the flange (85) from the casing.

3. Take out the OR gasket (87) and the sight glass (86).

NOTE: When reassembling, replace the gaskets that you have stripped down.

CAUTION: When reassembly is complete, proceed to fill the pump with oil again following the instructions of Unscheduled Maintenance Card No. 102.

Unscheduled maintenance

 Card No.
104

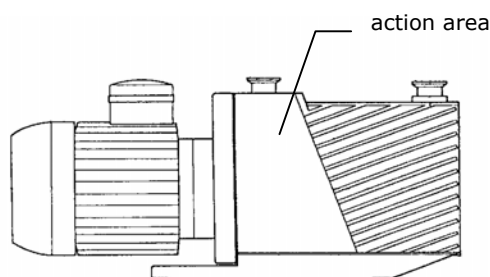
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **when damaged**

 Time: **30 min.**

 Machine status: **S**

 Type of action: **Replacement**

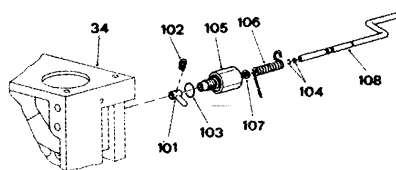
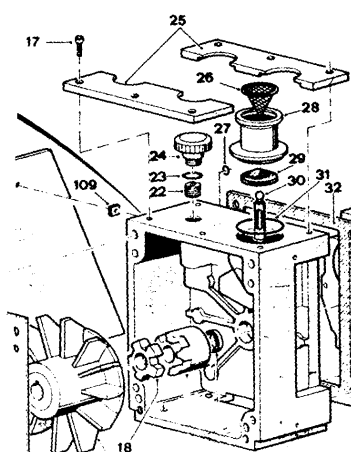
 Item: **Anti-suckback device shutter**


Materials required	Equipment required
Shutter	Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.

1. Disconnect the flange (28) from the suction pipe line.
2. Unscrew the 6 securing screws (17) and remove the two half-plates (25) pressing the suction flange (28) into its seat.



3. Remove the flange (28) and take out the piston (30) with the shutter (29) of the anti-suckback device, freeing it by exerting force on arm (101). Separate the shutter (29) from the piston rod simply by pulling.

Unscheduled maintenance

Card No.
105

Pump type: **VACSOUND ECO D12, D18, D28**

Frequency: **when damaged**

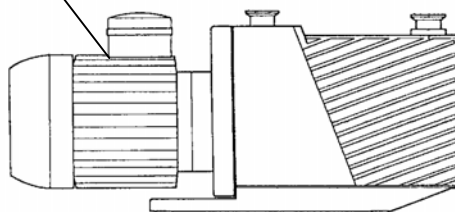
Time: **30 min.**

Machine status: **S**

Type of action: **Replacement**

Item: **Electric motor and joint**

action area



Materials required

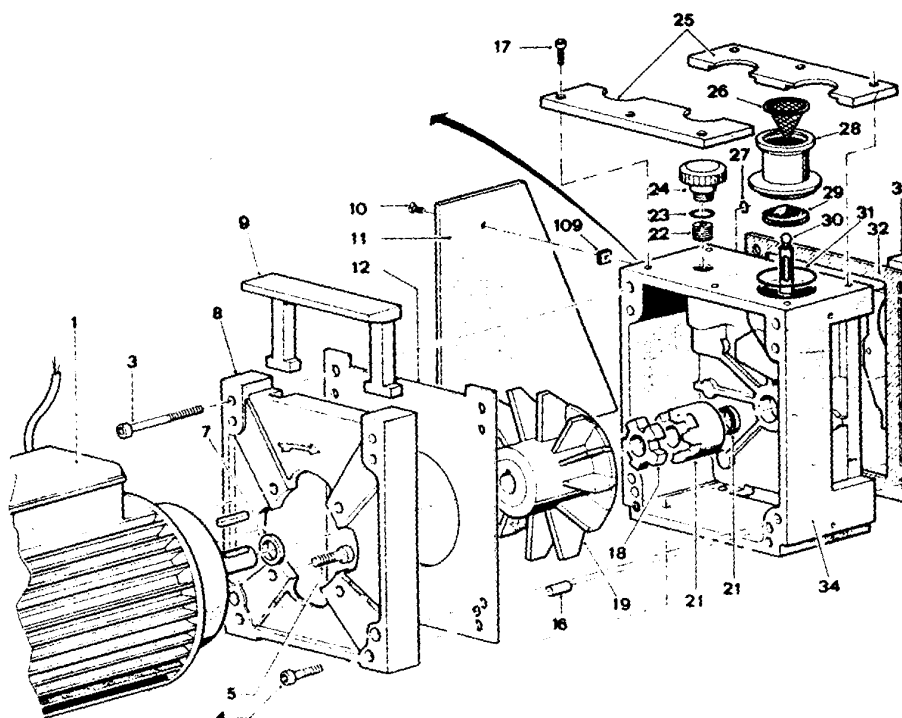
Electric motor

Equipment required

Mechanical tools

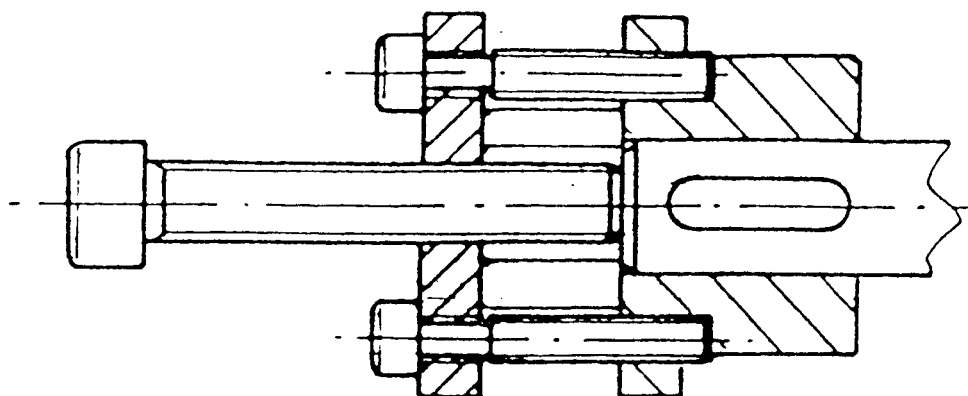
WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.



1. Disconnect the motor bearing plate (8) from the support (34) by unscrewing the four screws (4).

2. Remove the half-joint/fan (19) from the support, together with the motor (1), the plate (8) and the plate (12) (for the D18 and D28 only).
3. Slacken the nut blocking the half-joint (19) to the motor shaft and take it out, using leverage between the plate (8) and the back of the joint. For D12, D18, D28 and D12 pumps, the tool kit includes an extractor (see figure in the next page) for the half-joint (19). Tighten the three screws into their respective holes in the half-joint until the plate is pressed against the head of the teeth of the half-joint. Lock the central screw until the half-joint comes out of the motor shaft.
4. Unscrew the four screws (5) and separate the plate (8) from the motor (1).
5. Reassemble by proceeding in the inverse order.



Extractor

Unscheduled maintenance

 Card No.
106

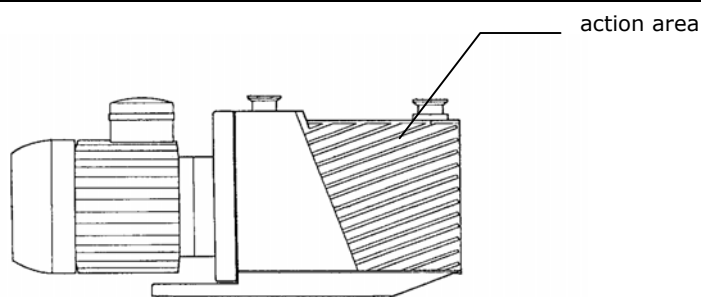
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **when damaged**

 Time: **1 hour**

 Machine status: **F**

 Type of action: **Disassembly**

 Item: **Discharge valves**


Materials required

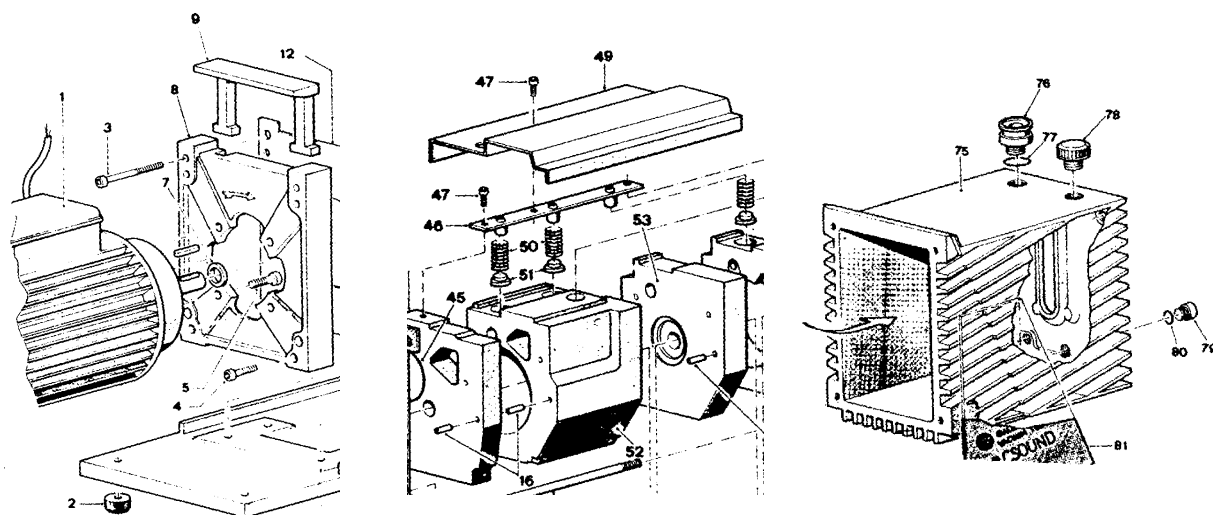
Shutters (Gaskets kit)

Equipment required

Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.



1. Drain off all the oil from the pump.

NOTE: For a description of how to drain off the oil, see the Unscheduled Maintenance Card No. 102.

2. Disconnect the discharge flange from its piping.
3. Unscrew the nuts (3) and remove the pump casing (75).
4. Unscrew the securing screw (47) holding the splash guard (49) and remove it.
5. Unscrew the two screws (47) on the valve press-bracket (46) and remove the bracket (46), the springs (50) and the shutters (51).
6. Reassemble by proceeding in the inverse order.

NOTE: When reassembling, replace all the gaskets stripped down.

CAUTION: When reassembly is complete, proceed to fill the pump with oil following the instructions of Unscheduled Maintenance Card No. 102.

Unscheduled maintenance

 Card No.
107

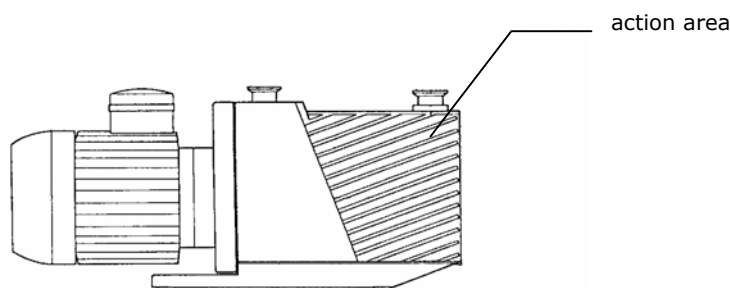
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **when damaged**

 Time: **1 hour**

 Machine status: **S**

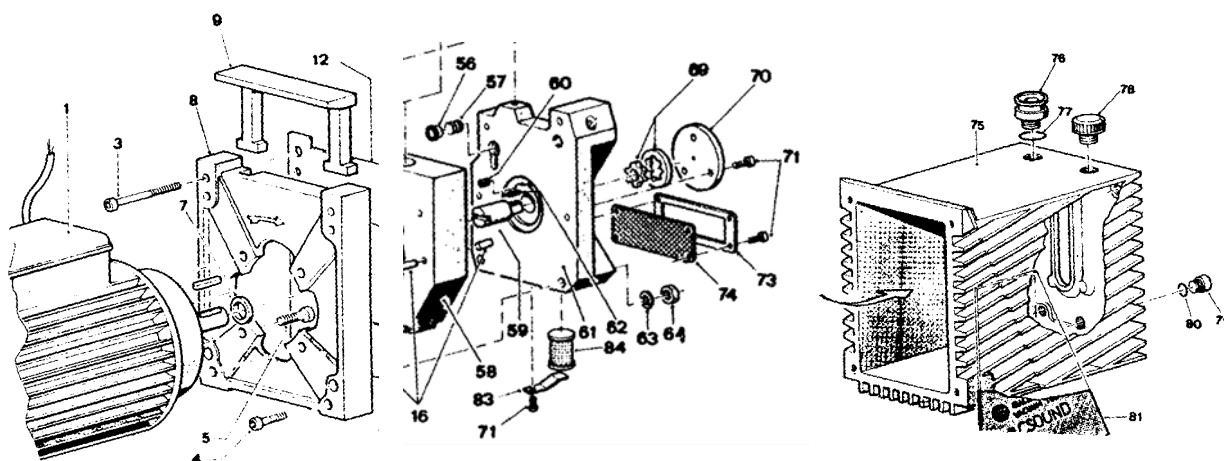
 Type of action: **Disassembly**

 Item: **Oil pump**


Materials required	Equipment required
Oil pump	Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.



1. Drain off all the oil from the pump.

NOTE: For a description of how to drain the oil from the pump, see the Unscheduled Maintenance Card No. 102.

2. Disconnect the discharge flange from its piping.
3. Unscrew the nuts (3) and remove the casing from the pump (75).

4. Unscrew the three screws (71) connecting the closing plate (70) to the side and take it out.
5. Remove the pump gear-wheels (69).

NOTE: A magnet may be used to remove the gear-wheels.

6. Reassemble by proceeding in the inverse order.

NOTE: When reassembling, replace all the gaskets you have stripped down.

CAUTION: When reassembly is complete, proceed to fill the pump with oil again following the instructions of Unscheduled Maintenance Card No. 102.

Unscheduled maintenance

 Card No.
108

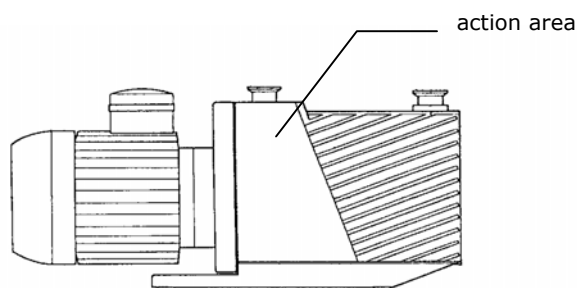
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **when damaged**

 Time: **1 hour**

 Machine status: **S**

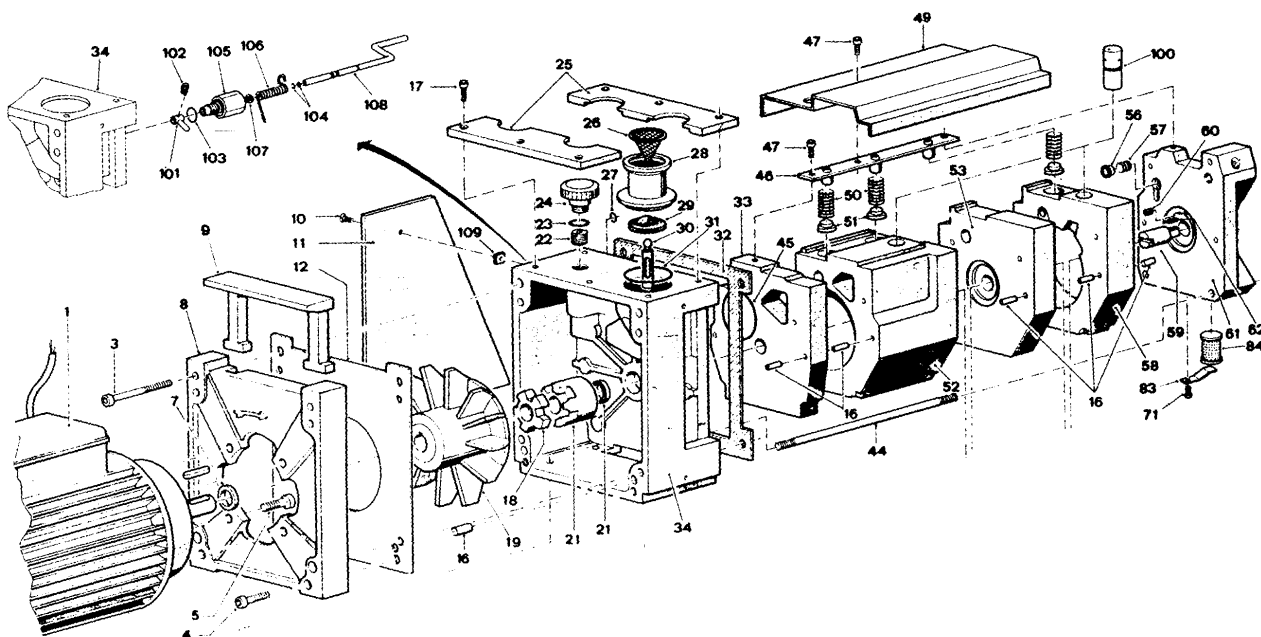
 Type of action: **Disassembly**

 Item: **Anti-suckback device**


Materials required	Equipment required
OR gaskets	Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.



1. Drain off all the oil from the pump.

NOTE: For a description of how to drain the oil, see the Unscheduled Maintenance Card No. 102.

2. Disconnect the discharge flanges from their piping.
3. Unscrew the locking nuts (3) and remove the casing (75) from the pump.
4. Unscrew the securing screw (47) and remove the splash guard (49).
5. Remove the shutter from the anti-suckback device.

NOTE: For more details on how to remove the anti-suckback device, see Unscheduled Maintenance Card No. 104.

6. Unscrew the screw (102), take out the arm (101) from the rod.
7. Release the spring (106) from the rod arm (108).
8. Pull the rod (108) out of the rotary feedthrough (105) sleeve.
9. Remove the two OR gaskets (104) from the rod (108) using a screwdriver, if necessary. Be careful not to bend the rod in doing so.
10. Unscrew the sleeve (105) and remove it from the support (34) together with its OR gasket (103).
11. Remove the hydraulic piston (100) from its seat in the body.
12. Reassemble by proceeding in the inverse order.

NOTE: When reassembling, replace all the gaskets stripped down.

CAUTION: When reassembly is complete, proceed to fill the pump with oil again following the instructions of Unscheduled Maintenance Card No. 102.

Unscheduled maintenance

Card No.
109

Pump type: **VACSOUND ECO D12, D18, D28**

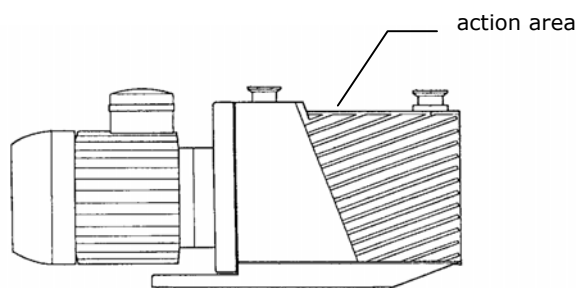
Frequency: **when damaged**

Time: **1 hour**

Machine status: **S**

Type of action: **Disassembly**

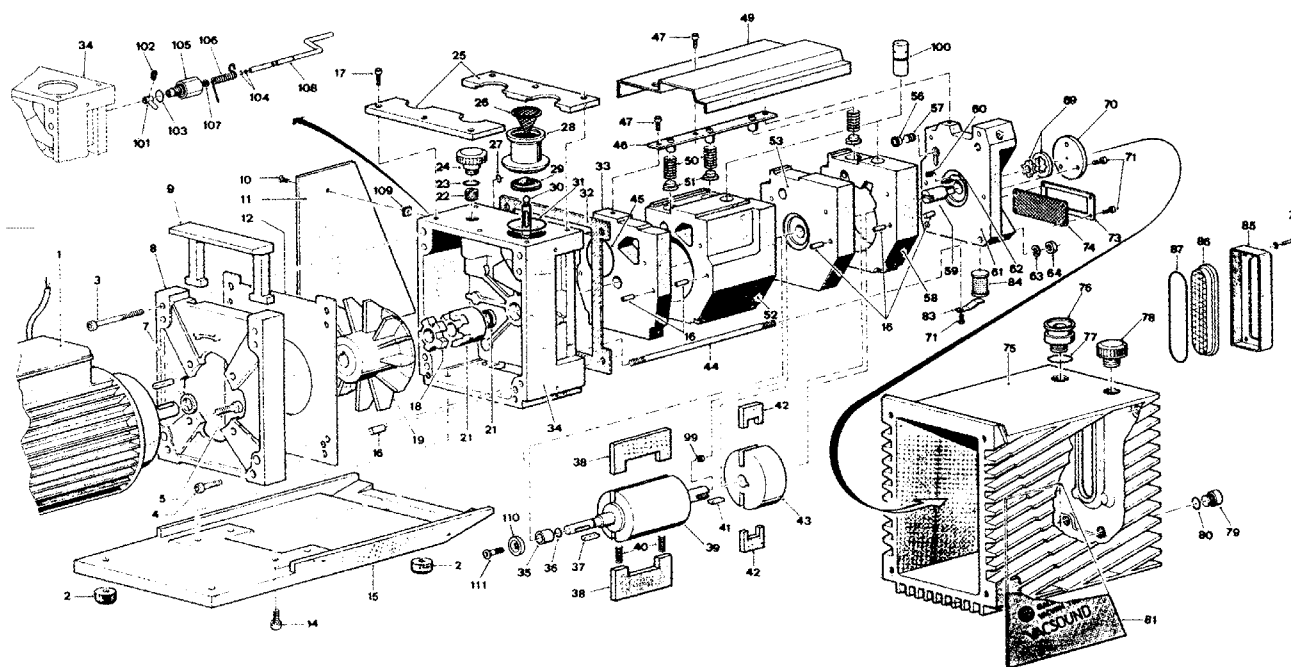
Item: **Pump body**



Materials required	Equipment required
OR gaskets	Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.



1. Drain off all the oil from the pump.

NOTE: For a description of how to drain off the oil, see the Unscheduled Maintenance Card No. 102.

2. Disconnect the discharge flange from its piping.
3. Disconnect the electric motor (1) complete with half-joint.

NOTE: For a description of how to disassemble the electric motor, see the Unscheduled Maintenance Card No. 105.

4. For D18 and D28 pumps only ; unscrew the screw (111) and remove the ring (110). Slacken the nut locking the half-joint (20) to the shaft of the rotor (39) and take out the half-joint. Remove the tongue (37) with it as well.
5. Unscrew the securing screw (47) and remove the valve screen (49).
6. Slacken the four nuts (64) and take out the tie-rods (44) and the complete functional block (76), lifting it from the pump support (34) and take out the OR gaskets (27) and (45), from the gas ballast line and suction line respectively.

WARNING: Be careful not to cut the lip of the oil seal with the sharp edges of the shaft key seat.

7. Reassemble by proceeding in the inverse order.

CAUTION: When reassembly is complete, proceed to fill the pump with oil again following the instructions of Unscheduled Maintenance Card No. 102.

NOTE: When reassembling, replace all the gaskets stripped down.

Unscheduled maintenance

 Card No.
110

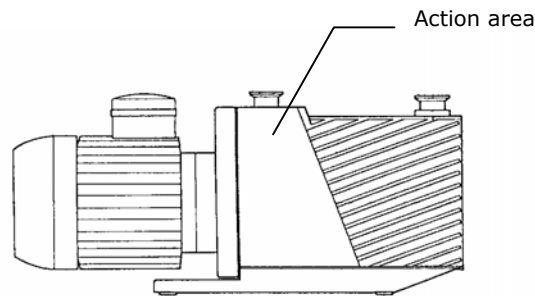
 Pump type: **VACSOUND ECO D12, D18, D28**

 Frequency: **when damaged**

 Time: **1 hour 15 min**

 Machine status: **F**

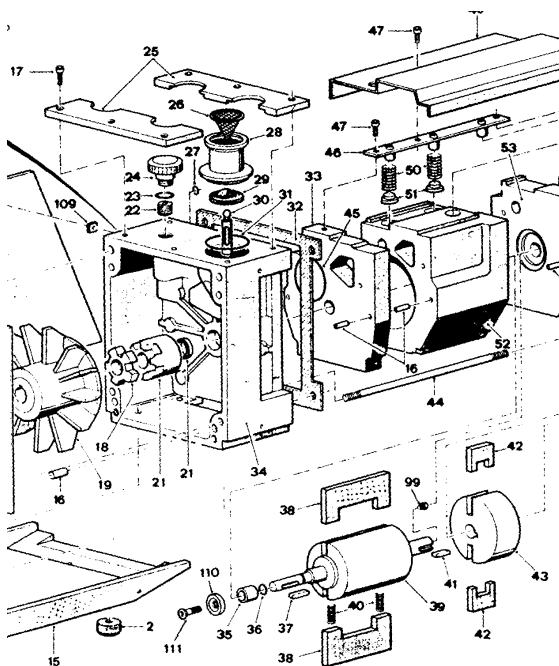
 Type of action: **Replacement**

 Item: **Oil seal/anti-wear bushing**


Required materials	Required equipment
- Oil seal - Anti-wear bushing - OR gaskets	Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.



1. Drain off all the oil from the pump.

NOTE: For a description of how to drain off the oil, see the Unscheduled Maintenance Card No. 102.

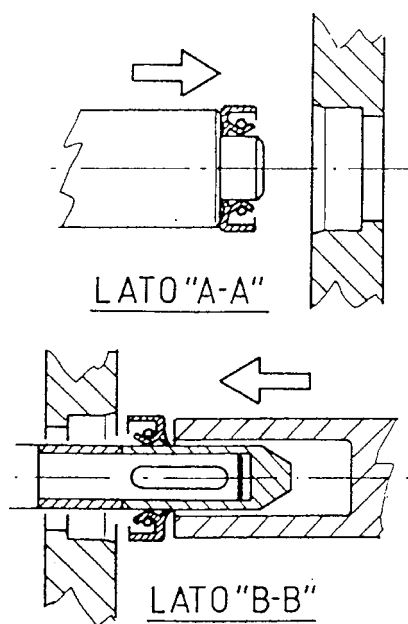
2. Separate the functional block from the pump support.

NOTE: For a description of how to separate the functional block from the support, see the Unscheduled Maintenance Card No. 109.

3. Remove the worn out oil seal (21) from the pump support (34) using a screwdriver for leverage and taking care not to scratch the seat.
4. Take the anti-wear bushing (35) off the shaft and take out the OR Gasket (36) (only D18, D28 pumps).

NOTE: For assembly of the new oil seal, use the special tool included in the toolkit.

5. After applying silicone grease to the external diameter of the oil seal, engage it on the "A-A" side of the tool and push it into its seat.

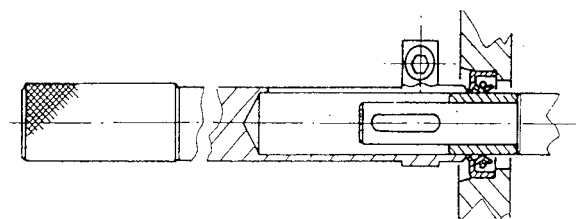


CAUTION: The flat part of the oil seal must be facing the motor. Ensure also that the seal touches against its seat along the entire circumference.

NOTE: It is possible to replace the oil seal without stripping down the rotor. After taking out the worn out seal using a screwdriver, cover the protruding part of the rotor shaft with the special sheath included in the tool kit (see figure above). Fit the suitably greased oil seal on to the rotor shaft and use the tool from side B-B to push it into its seat.

NOTE: It is possible to replace the anti-wear bushing without stripping down the pump, using the special extractor tool included in the tool kit (see following figure). Engage the extractor on the protruding part of the anti-wear bushing and after tightening the transverse screw, pull to slip the bushing off the rotor shaft.

6. Reassemble by proceeding in the inverse order.



NOTE: When reassembling, replace all the gaskets stripped down.

CAUTION: When reassembly is complete, proceed to fill the pump with oil again following the instructions of Unscheduled Maintenance Card No. 102.

Unscheduled maintenance

Card No.
111

Pump type: **VACSOUND ECO D12, D18, D28**

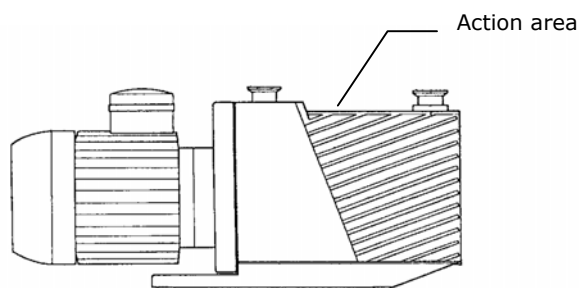
Frequency: **when damaged**

Time: **1 hour**

Machine status: **S**

Type of action: **Disassembly**

Item: **Functional block rotors**



Materials required	Equipment required
- Oil seal ring - Anti-wear bushing - OR gaskets 1st stage vanes 2nd stage vanes - Gas Ballast shutter (the above items of material are included in the General Maintenance kit)	Mechanical tools

WARNING: Machine safety: disconnect all power lines. Hang the card "MACHINE UNDERGOING MAINTENANCE - DO NOT POWER ON" from the main breaker switch. When finished, remove the safety warning.

WARNING: If you have to perform maintenance on the pump after a considerable time in operation, leave it to cool as temperature of the outer surface may be in excess of 60 °C.

1. Drain off all the oil from the pump.

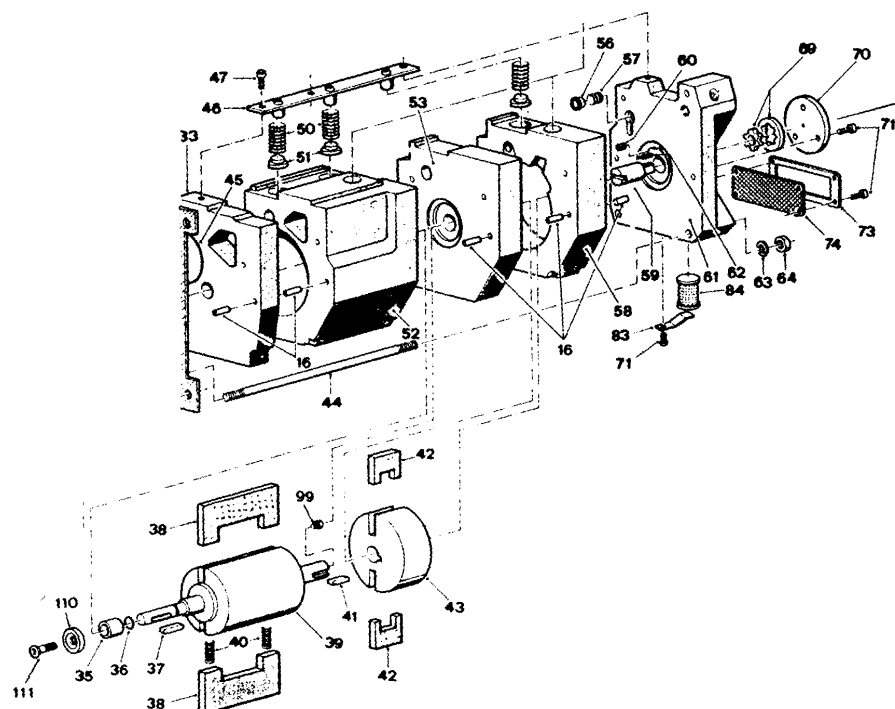
NOTE: For a description of how to drain the oil from the pump, see the Unscheduled Maintenance Card No. 102.

2. Detach the entire functional block from the pump support.

NOTE: For a description of how to detach the functional block, see the Unscheduled Maintenance Card No. 109.

3. Disassemble the discharge valves.

NOTE: For a description of how to disassemble the discharge valves, see the Unscheduled Maintenance Card No. 106.



4. Detach the end plate (61) from the rest of the pump body, exerting leverage if necessary on the reference notches between the parts. This will give you access to the retaining valve (56) and associated spring (57) at the gas ballast inlet.
5. Disconnect the 2nd stage stator (58), remove the two vanes (42), take the 2nd stage rotor (43) off the shaft and take out the key (41).
6. Remove the partition wall (53) from between the 1st and 2nd stages.
7. Detach the 1st stage stator (52) from the inner side (33), pressing back on the springs (40) of the vanes (38) to avoid the vanes from touching against the sharp corners of the body and becoming damaged.
8. Take out the 1st stage rotor (39), the vanes (38) and the springs (40).
9. Reassemble by proceeding in the inverse order.

NOTE: When reassembling, replace all the gaskets stripped down.

CAUTION: After reassembly is complete, proceed to fill the pump again with oil following the instructions of Unscheduled Maintenance Card No. 102.

4.7 troubleshooting and corrective action

NOTE: If the pump breaks down or does not work well, first check thoroughly that all the standards rules listed in the chapter INSTALLATION AND OPERATION are currently observed. If you cannot get sufficiently low pressure, the problem may lie with the system connected to the pump, i.e. the vacuum chamber and suction line. Even when the design sizes are correct, the problems listed below are still fairly frequent:

- a. faulty seals: check that the seals are fitted, are in good working order and are clean; check all joints, taps, sight glasses, weld joints, etc.
- b. unsuitable materials: avoid the use of rubber, plastic or even metal parts that are porous or permeable.
- c. volatile substances: as far as possible, eliminate humidity, grease, dirt, rust, solvents (even small traces).

Symptom		Probable cause	Suggested remedy	Card Ref.
The pump does not start (or stops immediately)	1.a	The motor-pump coupling is defective	Check state of the elastic joint and replace the parts as needed	105
	1.b	Viscosity of the oil has increased	Examine the oil and change if necessary (find out why it has deteriorated)	102
	1.c	Excessive friction inside pump	Test the resistance to rotation, by turning the joint by hand. If the rotors are blocked, disassemble the pump body and check state of the parts inside	111
	1.d	Electrical protections not set	Adjust the protections	
	1.e	Oil too viscous because of low room temperature	Heat the oil up to a temperature of 20 °C or use an oil recommended for low temperatures.	102
The pump stops (stalls)	2.a	Seizure of some internal parts	Proceed as at 1-C	
	2.b	Oil very dirty	Proceed as at 1-B	
The pump overheats	3.a	Too much friction inside	Proceed as at 1-C	
	3.b	Oil ducts clogged inside	Try changing the oil, otherwise disassemble the pump and clean it well	102, 111
	3.c	Direction of rotation inverted	Change over two phase wires of the electric power supply	111
Too much oil drained off by the exhaust	4.a	Gas Ballast device broken (always open)	Check the device to ensure the gas ballast is properly adjusted	111
	4.b	Heavy duty work (high suction pressures or very frequent cycles)	Check condition of the oil trap filter	
	4.c	Leak in system	Check the system (see "Note")	
The pump is losing oil	5.a	Seal on shaft defective	Replace the oil seal and the anti-wear bushing	110
	5.b	Other gaskets defective	Identify the areas where seeping occurs and check the associated gaskets	Refer to the card related to involved item
The pump is very noisy even at steady operating conditions	6.a	Exhaust valves damaged	Inspect the valves	106
	6.b	High suction pressure, or gas ballast device is open	Check the system and the gas ballast valve (see items 4-A and 4-B)	
	6.c	Elastic star of joint is damaged	Check and replace if necessary	
	6.d	A grain of the joint has become loose	Lock the grain after application of Loctite 222 (for slack threads)	
When the pump is stopped, the suction pressure rises rapidly	7.a	The anti-suckback device is defective	Disassemble and check the anti-suckback device	108
	7.b	The cause of the problem is not with the pump	See "Note"	

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The pump does not produce a sufficient vacuum	8.a	Not enough oil, or oil contaminated	Check level and appearance of the oil. Open the Gas Ballast for half an hour at least; change the oil whenever necessary	01, 102
	8.b	Oil ducts clogged inside	Proceed as at 3-B	
	8.c	Direction of rotation inverted	Proceed as at 3-C	
	8.d	OR gaskets communicating with the suction line defective	Replace the gaskets	109
	8.e	Exhaust valves damaged or out of place	Proceed as at 6-A	
	8.f	Insufficient oil pressure in the lubricating circuit, preventing the anti-suckback device from opening	Inspect the gears of the oil pump and check that it is working	107
	8.g	Internal moving parts worn	Disassemble the pump, and replace any worn parts	111
	8.h	Pump working with gas ballast device open	Close the gas ballast device	
	8.i	Anti-suckback valve fails to open	Disassemble the suction flange and check the device	104, 108
	8.j	Parts of the functional block not in perfect contact because of deposits of dirt or failure to put a plug on the service holes	Disassemble and check condition of the part surfaces and that plugs have been used	111
	8.k	The cause of the problem is not with the pump	See "Note"	

5. Spare parts

5.1 Purpose of this chapter

Chapter 5, SPARE PARTS, presents a list of spare parts and accessories for the pump.

5.2 Spare parts list

DESCRIPTION	D12	D18	D28	CODE	Ref. No.
ELECTRIC MOTOR 100V ,200-240V, 1ph, 50Hz 100-120V ,200-230 V 1ph ,60Hz	1			5.033.0.006	1
ELECTRIC MOTOR 100V ,200-240V, 1PH, 50Hz 100-120V ,200-230 V 1ph, 60Hz		1	1	5.033.0.008	1
ELECTRIC MOTOR 200-230V, 380-415V 3ph 50Hz 200-230 V, 460V 3ph 60Hz	1			5.033.0.007	1
ELECTRIC MOTOR 200-230V, 380-415V 3ph 50 Hz 200-230 V, 460V 3ph 60Hz		1	1	5.033.0.009	1
ELECTRIC MOTOR Eex-e 230V/400V 3ph 50 Hz		1	1	5.033.0.005	1
BUFFER FOOT	4	4	4	**	2
SCREW M6x60 UNI 5931	4			---	3
SCREW M8x80 UNI 5931		4	4	---	3
SCREW M6x16 UNI 5931	3			---	4
SCREW M6x30 UNI 5931		4	4	---	4
SCREW M6x12 UNI 5931	4			---	5
SCREW M6x16 UNI 5931		4	4	---	5
SPACER		1	1	100500850702	7
MOTOR SUPPORT	1			100500871892	8
MOTOR SUPPORT		1	1	100500871896	8
HANDLE	1			100501180020	9
HANDLE		1	1	100501180019	9
SCREW M4x8 UNI 5933	4	4	4	---	10
RIGHT SIDEPLATE	1			100500440277	11
RIGHT SIDEPLATE		1	1	100501051333	11
BOARD		1	1	100501051045	12
SCREW M6x16 UNI 5933	2	4	4	---	14
SUPPORT PLATE	1			200500500324	15
SUPPORT PLATE		1	1	200500500327	15
CYLINDRICAL PIN	12	12	12	---	16
SCREW M5x10 UNI 5931	6	6	6	---	17
RUBBER CROWN FOR 3PH - 1PH MOTOR	1	1	1	500501190001	18
HALF-JOINT WITH FAN FOR 1PH - 3PH MOTOR	1			200500970017	19
HALF-JOINT WITH FAN FOR 1PH - 3PH MOTORS		1	1	200500970014	19
HALF-JOINT FOR 1PH - 3PH MOTOR	1			100501680017	20
HALF-JOINT FOR 1PH - 3PH MOTOR		1	1	100501680010	20
OIL SEAL RING	1			*	21
OIL SEAL RING		1	1	*	21
SPECIAL SCREW	1	1	1	100500880349	22
OR GASKET	1	1	1	*	23
GAS BALLAST KNOB	1	1	1	100500500027	24
HALF-PLATE	2			100501051329	25
HALF-PLATE		2	2	100501051331	25
SUCTION SIEVE	1	1	1	200500430054	26
OR GASKET	1			*	27
OR GASKET		1	1	*	27
SUCTION FLANGE	1			100500321463	28
SUCTION FLANGE		1	1	100500321080	28
ANTI-SUCKBACK SHUTTER	1	1	1	*	29
PISTON	1	1	1	100500080059	30
OR GASKET	1			*	31
OR GASKET		1	1	*	31
CASING GASKET	1			*	32
CASING GASKET		1	1	*	32
INNER SIDEPLATE	1			100500440154	33

DESCRIPTION	D12	D18	D28	CODE	Ref. No.
INNER SIDEPLATE		1	1	5.001.1.060	33
PUMP SUPPORT	1			200500500261	34
PUMP SUPPORT		1	1	200500500287	34
ANTI-WEAR BUSHING		1	1	---	35
OR GASKET		1	1	*	36
KEY 4x4x16 UNI 6604	1			---	37
KEY 4x4x20 UNI 6604		1	1	---	37
1st STAGE VANE	2			**	38
1st STAGE VANE		2	2	**	38
1st STAGE ROTOR	1			200500580040	39
1st STAGE ROTOR		1	1	200500580031	39
SPRING	2	2	2	*	40
KEY 4x4x14 UNI 6604	1			---	41
KEY 5x5x16 UNI 6604		1	1	---	41
2nd STAGE VANE	2			**	42
2nd STAGE VANE		2	2	**	42
2nd STAGE ROTOR	1			100500260028	43
2nd STAGE ROTOR		1	1	100500260027	43
TIE-ROD	4			100500540252	44
TIE-ROD		4	4	100500540268	44
OR GASKET	1			*	45
OR GASKET		1	1	*	45
BRACKET	1			100500141528	46
BRACKET		1	1	100500141487	46
SCREW M4x8 UNI 5931	3			---	47
SCREW M5x8 UNI 5931		3	3	---	47
VALVE COVER	1			100500110198	49
VALVE COVER		1	1	100501051184	49
VALVE SPRING	3	3	3	*	50
VALVE GASKET	3	3	3	*	51
1st STAGE STATOR	1			100500240069	52
1st STAGE STATOR		1		100500240072	52
1st STAGE STATOR			1	100500240073	52
PARTITION WALL	1			100500440155	53
PARTITION WALL		1	1	200501250039	53
GAS BALLAST SHUTTER	1	1	1	*	56
GAS BALLAST SPRING	1	1	1	*	57
2nd STAGE STATOR	1			100500240071	58
2nd STAGE STATOR		1	1	100500240056	58
OIL PUMP SHAFT	1			***	59
OIL PUMP SHAFT		1	1	***	59
SPECIAL SCREW	1	1	1	***	60
END SIDEPLATE	1			200501250076	61
END SIDEPLATE		1	1	200501250074	61
KEY 2x2x6 UNI 6604	1	1	1	---	62
WASHER 6,4x11 UNI 6592	4	4	4	---	63
NUT M6 UNI 5588	4	4	4	---	64
OIL PUMP GEARS	1	1	1	***	69
OIL PUMP COVER	1	1	1	100500020127	70
SCREW M4x8 UNI 5931	8	11	11	---	71
PLATE		1	1	100500300415	73
FILTER		1	1	**	74
CASING	1			200500440164	75
CASING		1	1	200500440145	75
EXHAUST FLANGE	1	1	1	100500321155	76
OR GASKET	1	1	1	*	77
OIL FILL PLUG	1	1	1	500500740128	78
OIL DRAIN PLUG WITH WASHER	1	1	1	200501590004	79
OIL DRAIN PLUG WASHER	1	1	1	*	80
LEFT SIDEPLATE	1			100500440276	81
LEFT SIDEPLATE		1	1	100501051332	81
SPRING	1			100500060207	83
FILTER	1			**	84
FLANGE	1	1	1	100501280036	85
SIGHT GLASS	1	1	1	5.001.1.061	86
OR GASKET	1	1	1	*	87
SPECIAL SCREW	1	1	1	100500880368	99

DESCRIPTION	D12	D18	D28	CODE	Ref. No.
PISTON	1			100500080055	100
PISTON		1	1	100500080058	100
LEVER	1			100500620256	101
LEVER		1	1	100500620255	101
SPRING	1	1	1	**	102
OR GASKET	1	1	1	*	103
OR GASKET	2	2	2	*	104
SLEEVE	1	1	1	100500901164	105
SPRING	1			**	106
SPRING		1	1	**	106
RING	1	1	1	**	107
LEVER	1			100500340963	108
LEVER		1	1	100500340962	108
INSERT	1			500501170006	109
SPECIAL WASHER		1	1	100500100509	110
SCREW M5x16 UNI 5933		1	1	---	111

OTHER SPARE PARTS	D12	D18	D28	CODE
GASKETS KIT	X			5.001.1.053
GASKETS KIT		X	X	5.001.1.056
GENERAL MAINTENANCE KIT	X			5.001.1.050
GENERAL MAINTENANCE KIT		X	X	5.001.1.052
OIL PUMP KIT	X	X	X	2.002.1.041

ACCESSORY ITEM IN SUCTION	D12	D18	D28	CODE
CONDENSATION SEPARATOR DN25KF	X	X	X	5.001.1.047

ACCESSORY ITEM ON EXHAUST	D12	D18	D28	CODE
OIL TRAP FILTER DN25KF	X	X	X	2.009.0.003
OIL TRAP FILTER CARTRIDGE DN25KF	X	X	X	5.007.0.009

RECOMMENDED OIL	CODE	Q.TY
ROTOIL SH - 200	5.023.0.012	1 [l]
ROTOIL SH - 200	5.023.0.013	5 [l]
ROTOIL SH - 200	5.023.0.014	25 [l]
ROTOIL ES - 68	5.023.0.007	1 [l]
ROTOIL ES - 68	5.023.0.008	2 [l]
ROTOIL ES - 68	5.023.0.009	5 [l]
ROTOIL ES - 68	5.023.0.010	25 [l]

Legend:

- Parts marked with an asterisk (*) may be found in both the Gaskets Kit and the General Maintenance Kits.
- Parts marked with two asterisks (**) may be found in the General Maintenance Kit only.
- Parts marked with three asterisks (***) may be found in the OIL PUMP KIT.
- Parts marked with three dashes (---) are not scheduled for supply as spares.
- Parts marked with "X" letter are scheduled for supply as spares and/or accessories.