

varian 
vacuum products

Turbo-V 250 pumps

969-9007 series
969-9008 series

MANUALE ISTRUZIONI

BEDIENUNGSHANDBUCH

NOTICE DE MODE D'EMPLOI

MANUAL DE INSTRUCCIONES

MANUAL DE INSTRUÇÕES

BEDRIJFSHANDLEIDING

INSTRUKSTIONSBOG

BRUKSANVISNING

INSTRUKSJON MANUAL

OHJEKÄSIKIRJA

ΟΔΗΓΙΕΣ ΧΡΗΣΕΩΣ

INSTRUCTION MANUAL

INSTRUCTIONS FOR USE

GENERAL INFORMATION

This equipment is destined for use by professionals. The user should read this instruction manual and any other additional information supplied by Varian before operating the equipment. Varian will not be held responsible for any events occurring due to non-compliance, even partial, with these instructions, improper use by untrained persons, non-authorized interference with the equipment or any action contrary to that provided for by specific national standards.

The Turbo-V 250 series pumps are turbo-molecular pumps for high and ultra-high vacuum applications and can pump almost any type of gas. They are not suitable for pumping liquids or solid particles.

The pumping action is obtained through a high speed turbine (max. 56000 rpm) driven by a high-output 3-phase electric motor. The Turbo-V 250 pumps are free of contaminating agents and, therefore, are suitable for applications requiring a "clean" vacuum.

The following paragraphs contain all the information necessary to guarantee the safety of the operator when using the equipment. Detailed information is supplied in the appendix "Technical Information".

This manual uses the following standard protocol



The warning messages are for attracting the attention of the operator to a particular procedure or practice which, if not followed correctly, could lead to serious injury.



The caution messages are displayed before procedures which, if not followed, could cause damage to the equipment

NOTE

The notes contain important information taken from the text.

STORAGE

When transporting and storing the pumps, the following environmental requirements should be satisfied:

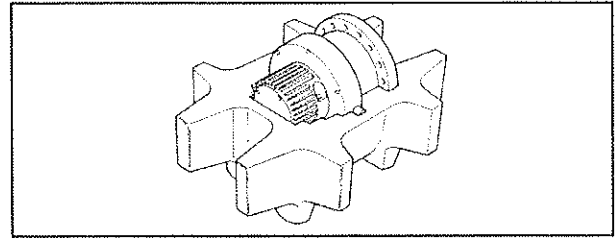
- temperature: from -20° to + 70° C
- relative humidity: 0 - 95% (without condensation)

If the storage time is longer than 9 months, start the pump using the SOFT START mode (see control unit manual).

PREPARATION FOR INSTALLATION

The pump is supplied in a special protective packing. If this shows signs of damage which may have occurred during transport, contact your local sales office. When unpacking the pump, ensure that it is not dropped or subjected to any form of impact.

Do not dispose of the packing materials in an unauthorized manner. The material is 100% recyclable and complies with EEC Directive 85/399



CAUTION

In order to prevent degassing problems, do not use bare hands to handle components which will be exposed to vacuum. Always use gloves or other appropriate protection.

NOTE

Normal exposure to the environment cannot damage the pump. Nevertheless, it is advisable to keep it closed until it is installed in the system, thus preventing any form of pollution by dust.

INSTALLATION

Do not install or use the pump in an environment exposed to atmospheric agents (rain, snow, ice), dust, aggressive gases, or in explosive environments or those with a high fire risk.

During operation, the following environmental conditions must be respected:

- maximum pressure: 2 bar
- temperature: from + 5° C to + 35° C
- relative humidity: 0 - 95% (without condensation)

In the presence of magnetic fields of intensity greater than 10 mT, the pump should be protected using a ferromagnetic shield.

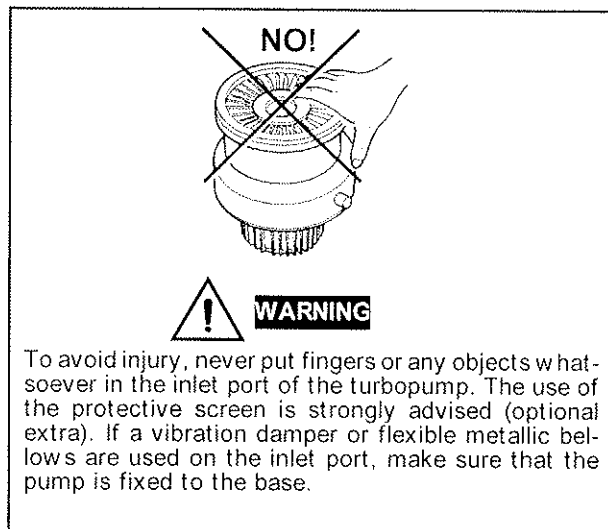
The Turbo - V 250 series pumps must only be used with one of the special Varian controllers (series 969-9423, 969-9504, 969-9525, 969-9425 or 969-9866), and must be connected to a primary pump (see "Technical Information").

The turbopump can be installed in any position. Fix the turbopump in a stable position connecting the inlet flange of the turbopump to a fixed counter-flange capable of withstanding a torque of 1000 Nm around its axis, or use the optional base fixing kit.

CAUTION

Do not remove the adhesive and protective cap before connecting the turbopump to the system.





NO!

WARNING

To avoid injury, never put fingers or any objects whatsoever in the inlet port of the turbopump. The use of the protective screen is strongly advised (optional extra). If a vibration damper or flexible metallic bellows are used on the inlet port, make sure that the pump is fixed to the base.

The turbopump with ISO inlet flange must be fixed to the vacuum chamber by means of clamps or claws. The following table shows, for each flange and fixing device, the necessary number of clamps or claws and the relevant fixing torque.

| FLANGE | FIXING DEVICE | N. | FIXING TORQUE |
|---------|---------------|----|---------------|
| ISO 100 | M10 clamps | 4 | 22 Nm |
| | M8 claws | 8 | 11 Nm |

The turbopump with ConFlat inlet flange must be fixed to the vacuum chamber by means of the appropriate Varian hardware. See the appendix "Technical Information" for a detailed description.

To fix the pump by means of its base, it is necessary to use three M4 screws fixed to the foreseen holes of the pump base. The used screws must have a minimum strength point of 500 N/mm², and must be fixed with a torque of 0.9 Nm.

For installation of optional accessories, see "Technical Information".

USE

All the instructions for the correct use of the turbopump are contained in the control unit manual.

Read the manual carefully before using the pump.

In order to improve the pressure limits, the pump casing may be heated using the optional heater. During the chamber heating process, the temperature at the inlet flange must not be more than 120° C. Always use the water cooling system during the heating operations.



Do not touch the turbopump or any of its accessories during the heating process. The high temperatures may cause burns.



Use air or inert gas free from dust or particles for pump aeration. The pressure at the vent port must be less than 2 bar.



Avoid impacts or harsh movements of the pump when in operation. The bearings may become damaged.



For pumping aggressive gases, use the specially designed versions of the Turbo - V 250 pump. These pumps are fitted with a special port through which a flow of inert gas must be passed between 0,4 and 1 mbar l/s.

MAINTENANCE

The Turbo-V 250 series pump does not require any maintenance. Any work performed on the pump must be carried out by authorized personnel.



Before carrying out any work on the turbopump, disconnect it from the supply, aerate the pump by opening the appropriate valve and wait until the rotor has stopped turning.

In the case of breakdown, contact your local Varian service center who can supply a reconditioned pump to replace that broken down.

NOTE

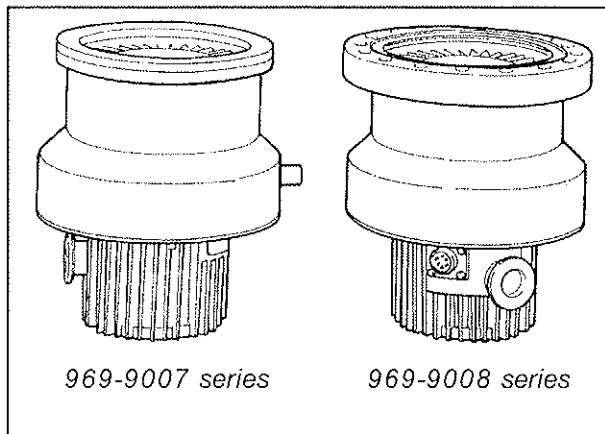
Before returning the pump to the constructor for repairs, or replacement with a reconditioned unit, the "Health and Safety" sheet attached to this instruction manual must be filled-in and sent to the local sales office. A copy of the sheet must be inserted in the pump package before shipping.

If a pump is to be scrapped, it must be disposed of in accordance with the specific national standards.

DESCRIPTION OF THE TURBOPUMP

The Turbo-V250 pump is available in two versions. The difference between the two versions lies purely in the high vacuum connection. The two versions are:

- Model 969-9007
- with ISO 100 high vacuum flange
- Model 969-9008
- with ConFlat® 6" external diameter high vacuum flange



The Turbo-V250 pump consists of a high frequency motor driving a turbine fitted with 8 bladed stages and 3 Macrotrorr stages. The turbine rotates in an anticlockwise direction when viewed from the high vacuum flange end.

The turbine is constructed in high strength light aluminium alloy, and is machined from a single block of aluminium. The turbine blades have five different angles, from 42° to 10°, while the Macrotrorr stages are in the form of discs.

The turbine rotor is supported by permanently lubricated high precision ceramic ball bearings installed on the fore-vacuum side of the pump.

The static blades of the stator are fabricated in stainless steel with five different angles, from 36° to 10°. These are supported and accurately positioned by spacer rings.

The Macrotrorr stators are in the form of self-positioning machined discs with pumping channels and an opening restricted by the corresponding rotor discs. These are fabricated in aluminium alloy.

During normal operation, the motor functions with a power feed at 58 Vac three-phase at 933 Hz. To reduce losses during start-up to a minimum, the frequency increases according to a ramp with a higher initial voltage/frequency ratio.

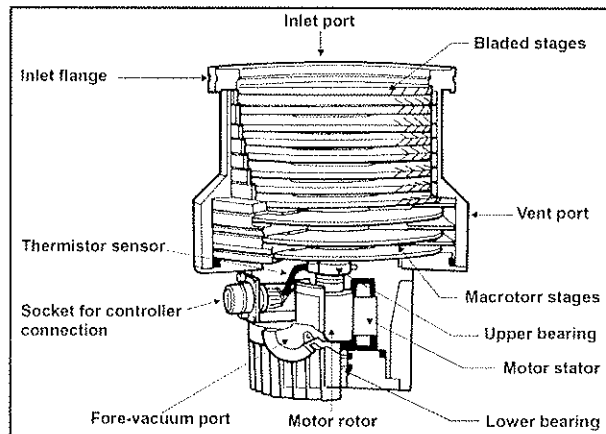
The external body of the pump is fitted with fins which allow the pump itself to function with natural convection air cooling. Kits are available for water cooling or air cooling (optional) to cool the pump in the cases where it is used under heavy load or when natural convection is insufficient for cooling purposes.

A thermistor sensor is mounted near to the upper bearing to prevent the pump from overheating.

The thermistor sensor, the motor stator windings and the earth are connected to a Turbo-V controller through a 6 pin socket on the side of the pump.

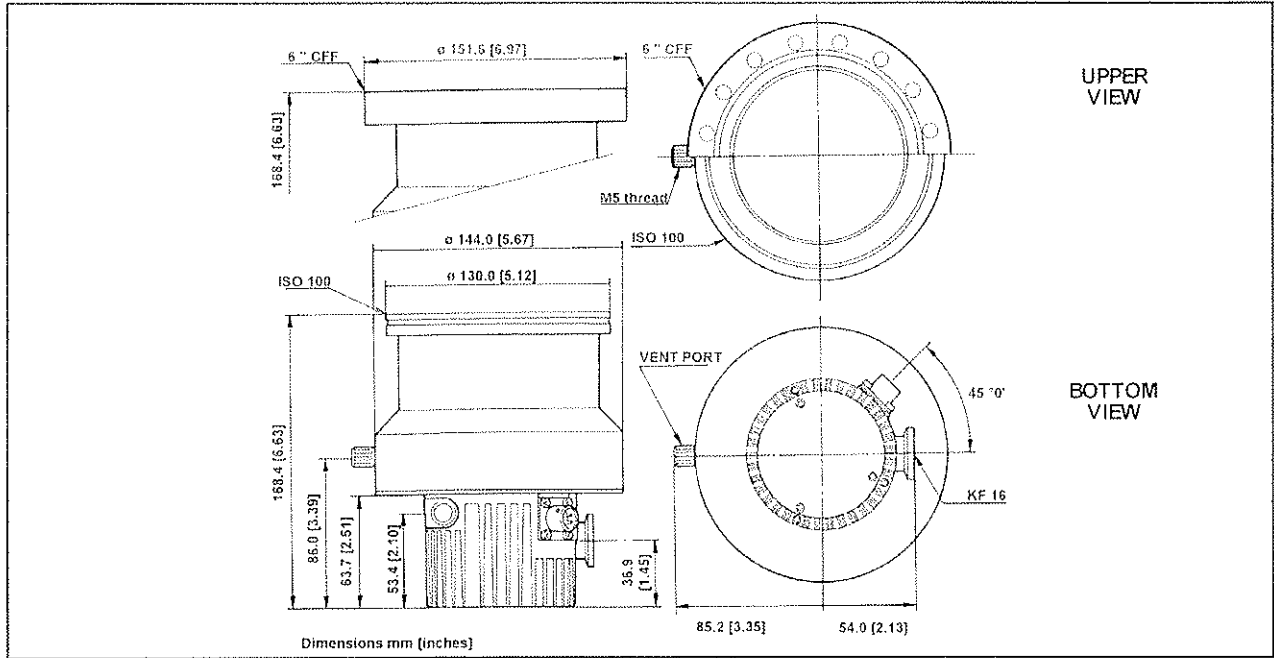
The pump is balanced after assembly with a residual vibration amplitude less than 0.01 µm.

The pump can operate in any position and can be supported on the high vacuum flange or on its base. The connection of the fore-vacuum on the side of the pump is a KF 16 NW flange.



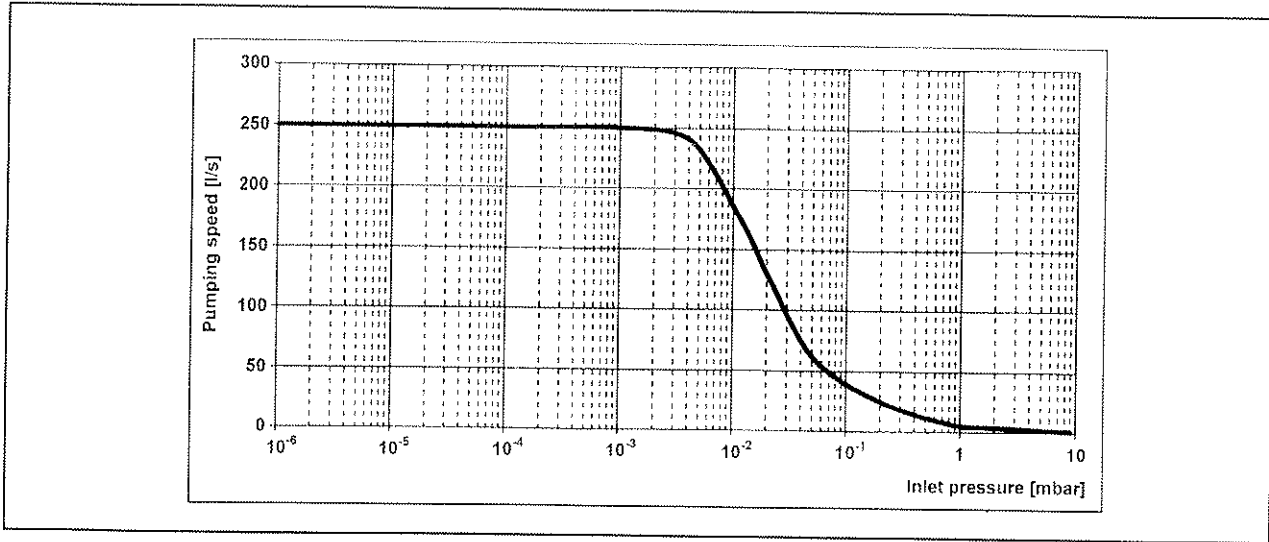
TECHNICAL INFORMATION

TECHNICAL SPECIFICATION

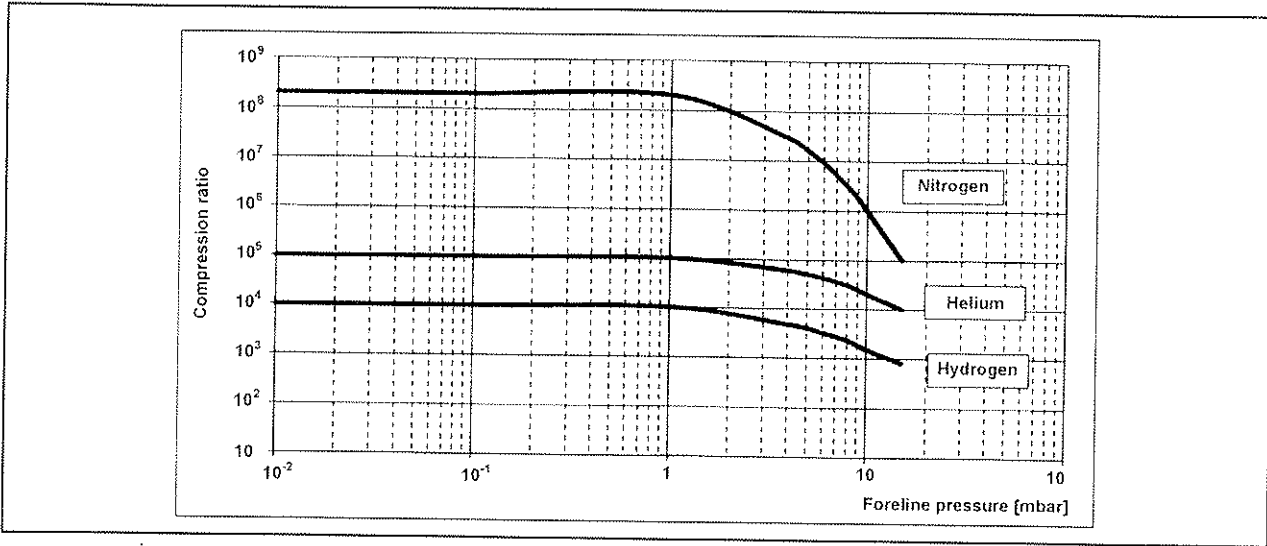


| | | | | | |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------|--------------------------------|------------------------------------------------------------------------------------|
| Pumping speed (l/s) | N ₂ , 250 | He, 220 | H ₂ , 200 | Operating ambient temperature | + 5° C to + 35° C |
| Compression ratio | N ₂ , 2 x 10 ⁸ | He, 1x10 ⁵ | H ₂ , 1x10 ⁴ | Coolant water | flow: 30 l/h (0,13 GPM) temperature: + 10° C to + 30° C pressure: 3 to 4 bar |
| Base pressure* | with recommended mechanical forepump: 2x10 ⁻¹⁰ mbar (1.5x10 ⁻¹⁰ Torr) with recommended diaphragm fore pump: 2x10 ⁻⁹ mbar (1.5x10 ⁻⁹ Torr) | | | Bakeout temperature | 120° C at inlet flange maximum |
| Inlet flange | DN 100 CFF (6" OD) DN 100 ISO | | | Vibration level (displacement) | < 0,01 μm at inlet flange |
| Foreline flange | NW 16 KF | | | Noise level | 45 dB (A) at 1 metre |
| Rotational speed | 56000 RPM | | | Input | 58 Vac, three phase 933 Hz |
| Start-up time | < 3 minutes | | | Lubricant | permanent lubrication |
| Recommended forepump | Two stage rotary pump: SD-40 Diaphragm pump: VDP 30 | | | Storage temperature | - 20° C to + 70° C |
| Operating position | any | | | Weight lbs (kg) | ISO : 7.5 (3.4); CFF: 11.4 (5.2) |

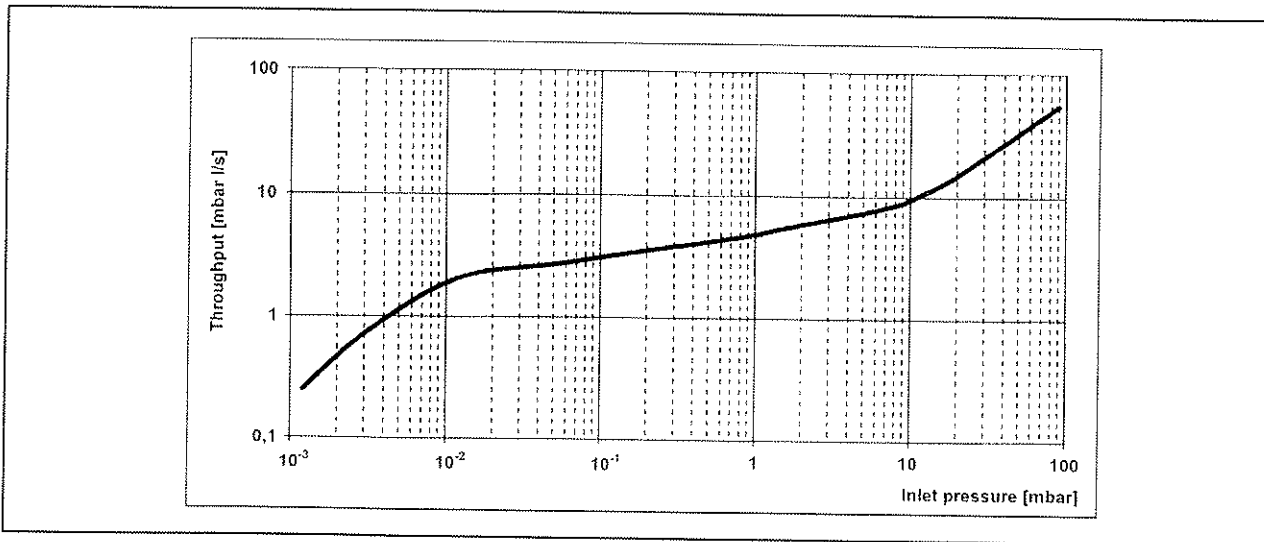
* According to standard DIN 28 428, the base pressure is that measured in a leak-free test dome, 48 hours after the completion of test dome bake-out, with a Turbopump fitted with a ConFlat flange and using the recommended pre-vacuum pump.



Graph of nitrogen pumping speed against inlet pressure



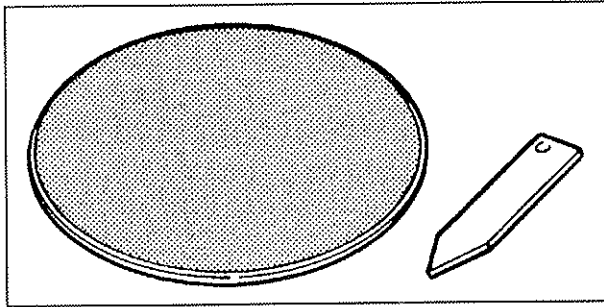
Graph of compression ratio against foreline pressure



Graph of nitrogen throughput against inlet pressure using the recommended mechanical fore-vacuum pump

TECHNICAL INFORMATION

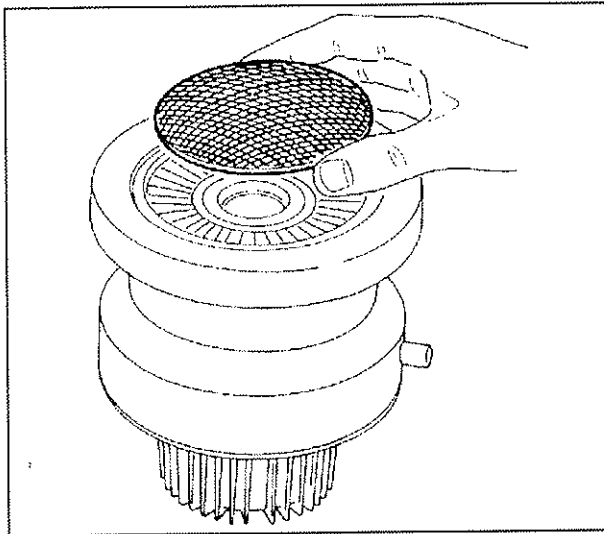
INLET SCREEN INSTALLATION



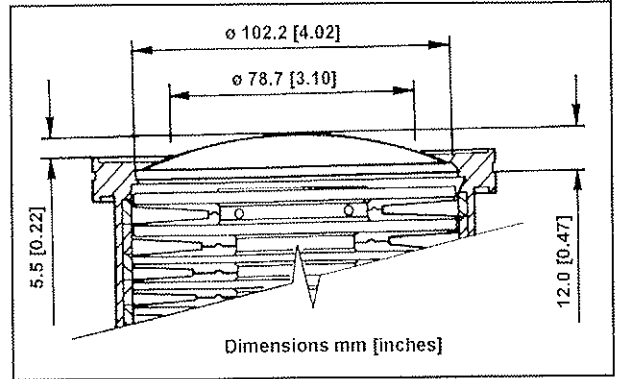
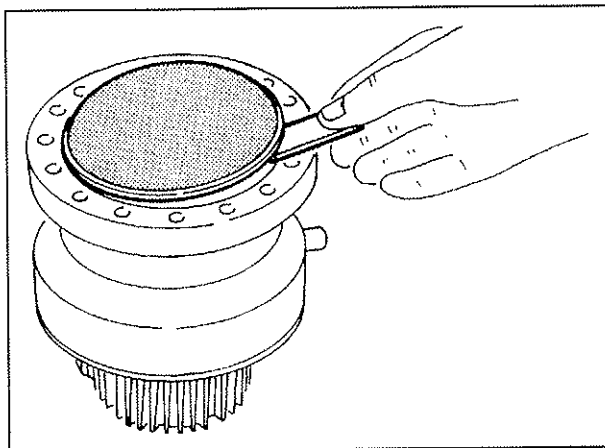
The inlet screen mod. 969-9302 prevents the blades of the pump from being damaged by debris greater than 0.7 mm diameter.

The inlet screen, however, does reduce the pumping speed by about 10%.

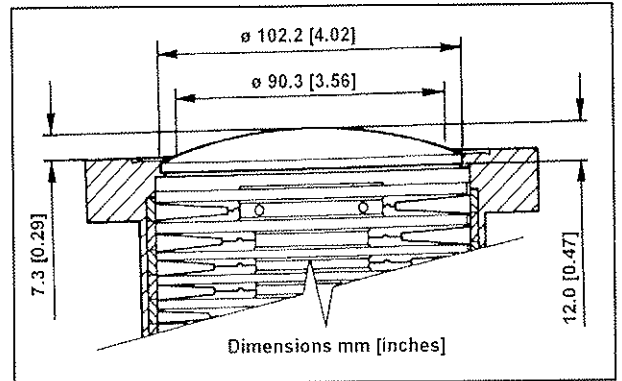
The inlet screen is fitted in the upper part of the pump, as shown in the figure.



The screen can be mounted on either pump series and is supplied with a small tab for easy removal (see figure).

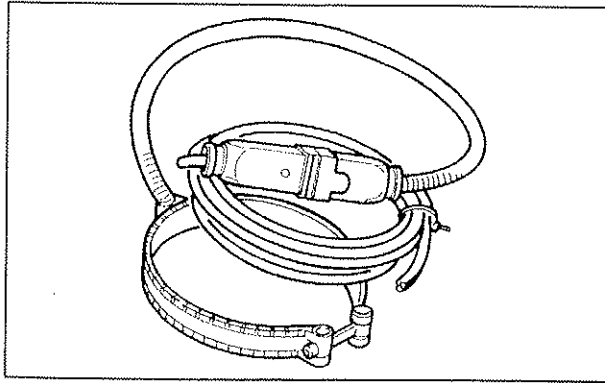


Overall dimensions with the protection screen fitted on pump series 969-9007 (with ISO 100 flange).



Overall dimensions with the inlet screen fitted on pump series 969-9008 (with ConFlat 6" flange).

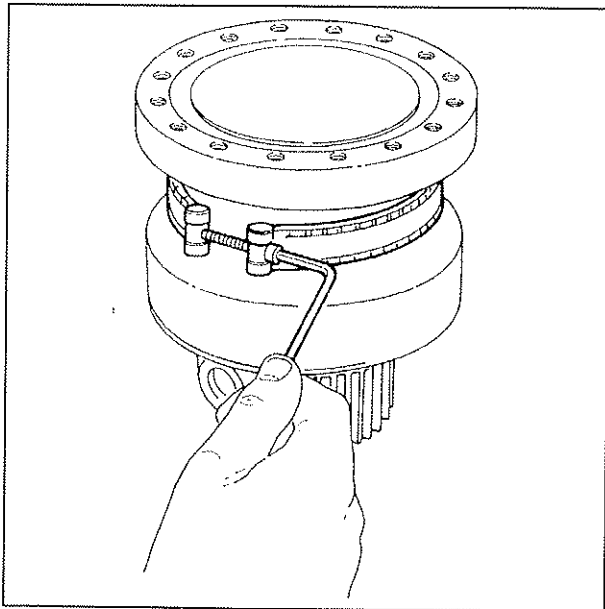
HEATER BAND INSTALLATION



The heater band model 969-9803 and 969-9804 can be used to heat the pump envelope when a bakeout is needed.

This type of heater band fits only on 969-9008 series pumps. It is applied to the upper part of the pump envelope, as shown in the figure, and heats it to a temperature of about 80°C.

The heater band must be mounted such that there is perfect thermal contact with the pump wall to obtain fast heating.



Switch on the heater while the turbopump is in operation. If, for any reason, the turbopump body overheats, it will be automatically cut out by the thermistor sensor.

NOTE

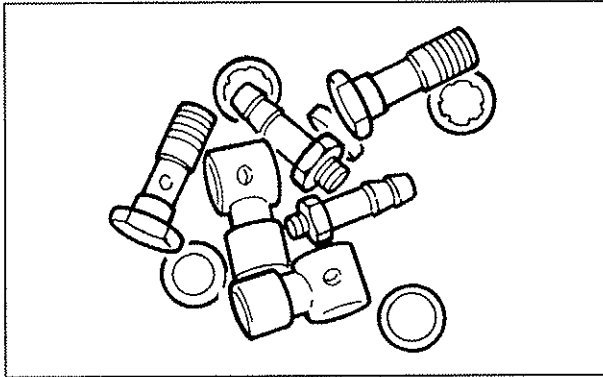
The turbopump must be "baked" only when operating with an inlet pressure less than 10^{-4} mbar and with water cooling.

CAUTION

If the chamber of the system is "baked" at a high temperature, a shield should be installed to prevent thermal radiation heating the high vacuum flange on the pump. The maximum temperature allowed for the inlet flange is 120°C.

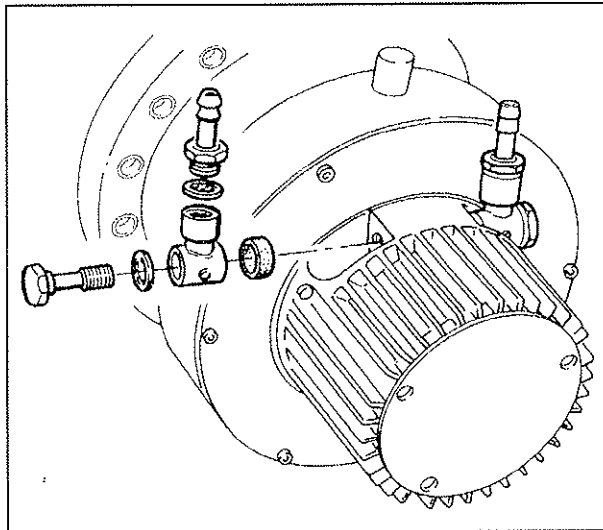
TECHNICAL INFORMATION

WATER COOLING KIT INSTALLATION



The water cooling kit mod. 969-9318 must be installed when the pump is used under heavy load or when air cooling is insufficient.

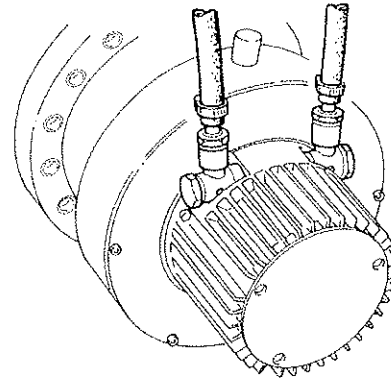
The kit is assembled as shown in the figure.



Two 6 mm (1/4") internal diameter rubber or plastic hoses from the water supply must be fitted to the two nozzles.

NOTE

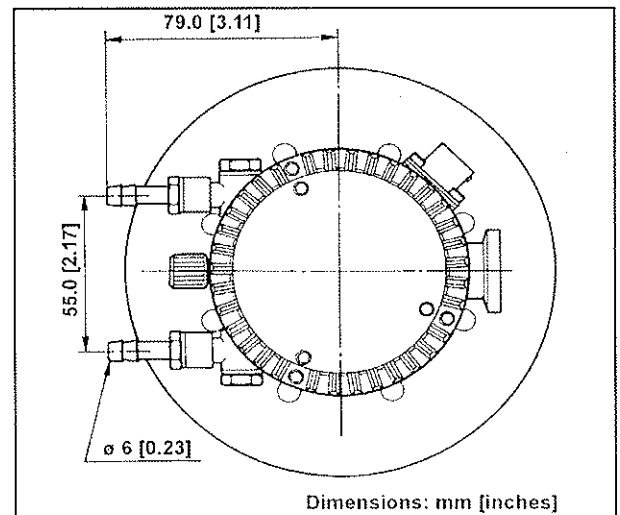
These hoses must be held on the respective nozzles using hose clips to ensure the tube do not detach during operation.



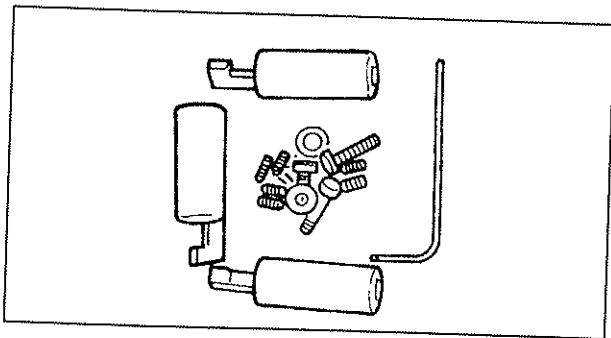
Cooling may be carried out through an open circuit with eventual discharge of the water, or using a closed circuit cooling system.

In both cases, the water temperature must be between +10°C and +30°C, with an inlet pressure between 3 and 4 bar. This allows a flow of about 30 l/h.

The overall dimensions with the water cooling kit mounted are shown in the figure.



BASE FIXING KIT INSTALLATION

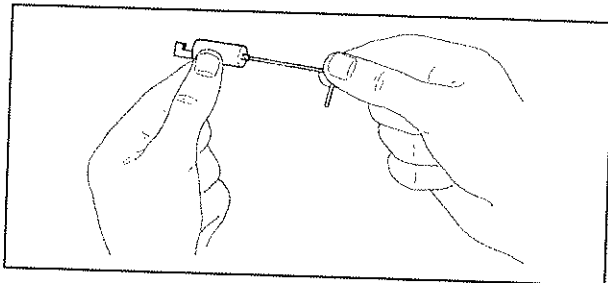


The kit mod. 969-9326 enables the pump to be fixed at the base.

Open the package containing the feet and respective screws.

Insert the three grub screws in the three feet from the rear, as shown in the diagram, and screw them in ensuring that they do not protrude from the other end.

Use the Allen key supplied for this purpose.

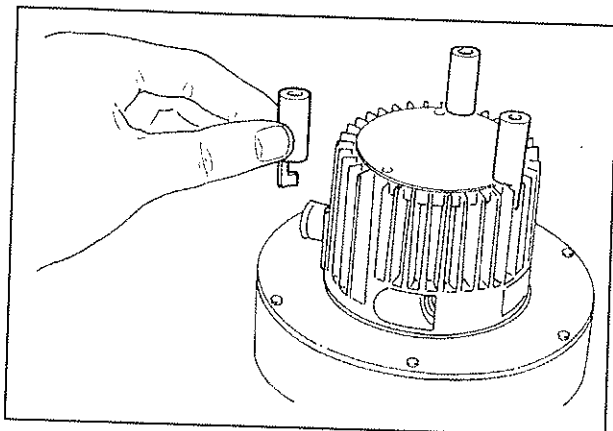


Turn the pump upside down.

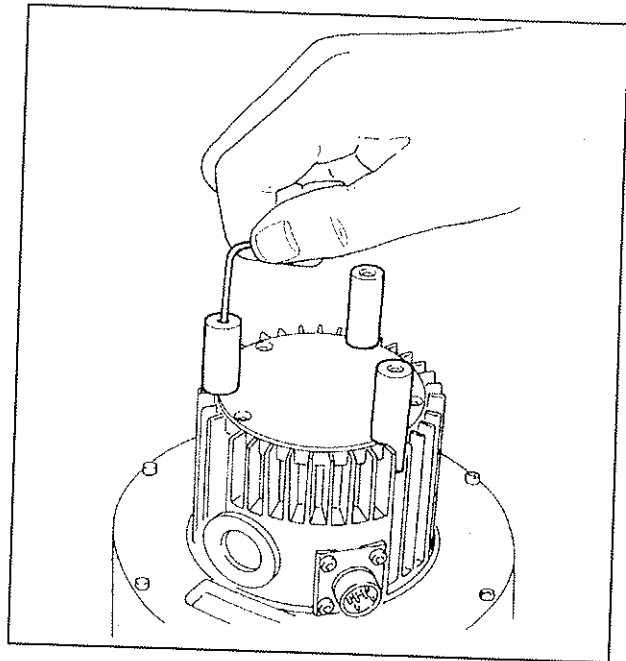
 **CAUTION**

Before overturning the pump, remove the protection screen, if fitted.

Insert the three feet as shown in the figure, bearing in mind that the position must be as indicated in the figure.



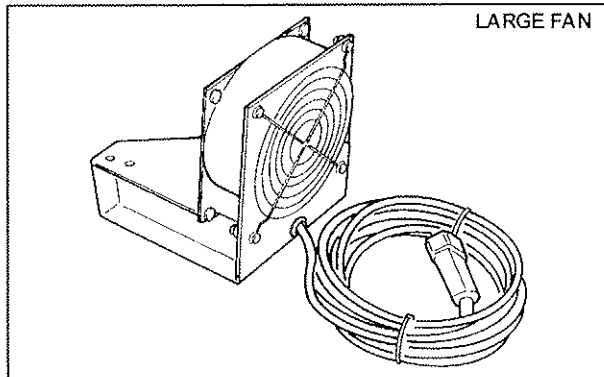
Fix the feet to the pump by tightening the previously inserted grub screws with the Allen key.



Turn the pump the right way up. Fix the pump to a base by using the three screws provided (M4 thread) in the holes in the three feet.

TECHNICAL INFORMATION

AIR COOLING KIT INSTALLATION



Two fan kits are available for air cooling the pump, when natural air convection is insufficient.

Specification for small fan (mod. 969-9310):

- air flow: 9 l/s (10 CFM)
- input voltage: 24 Vdc
- maximum power: 2.16 W
- dimensions: 60 x 60 mm (2.36 x 2.36 inches)

Specification for large fan (mod. 969-9313):

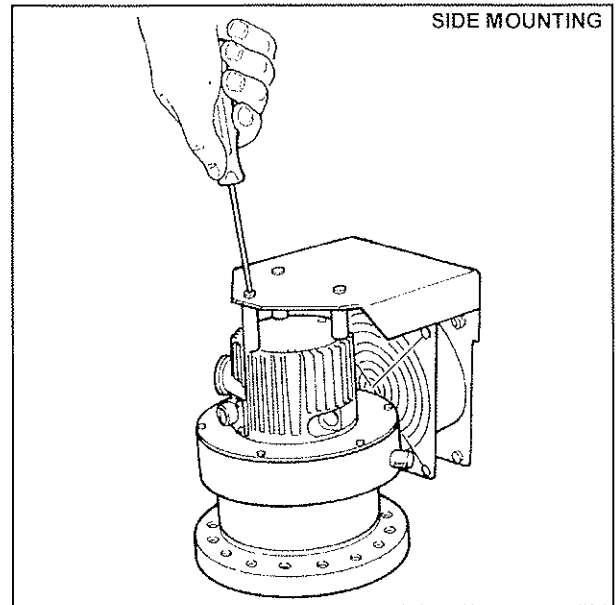
- air flow: 25 l/s (51 CFM)
- input voltage: 120 Vac, 50-60 Hz
- maximum power: 17 W
- dimensions: 119 x 119 mm (4.69 x 4.69 inches)

Open the package containing the feet and respective screws and install them as indicated in the installation of the base fixing kit.

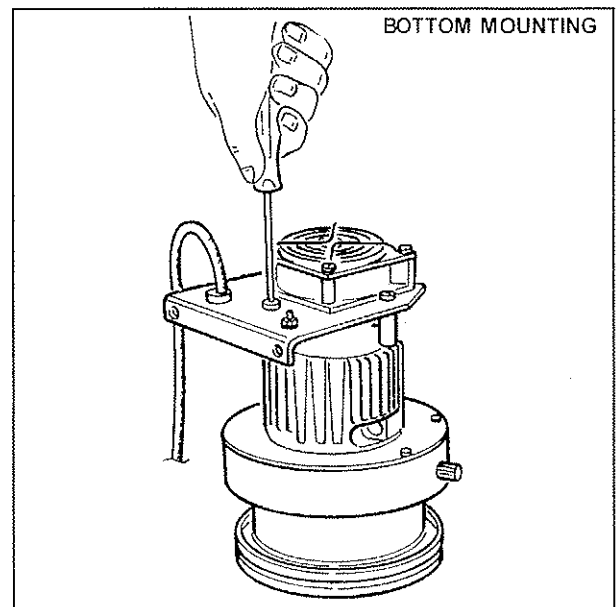
Position the fan on the pump, ensuring that the holes in the plate line up with those in the feet.

Insert the respective washers and screws and tighten with a screwdriver.

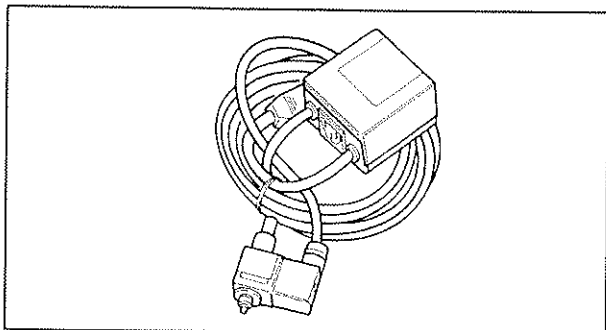
Connect the fan to the controller.



The low power fan can also be mounted under the pump as shown in the figure.

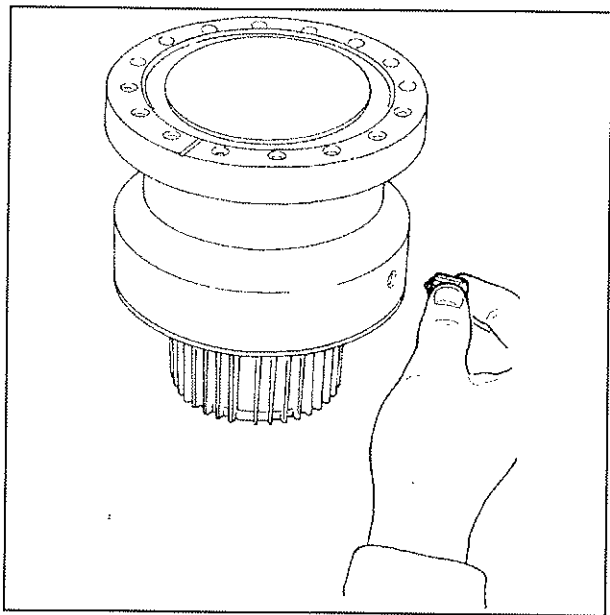


VENT VALVE INSTALLATION

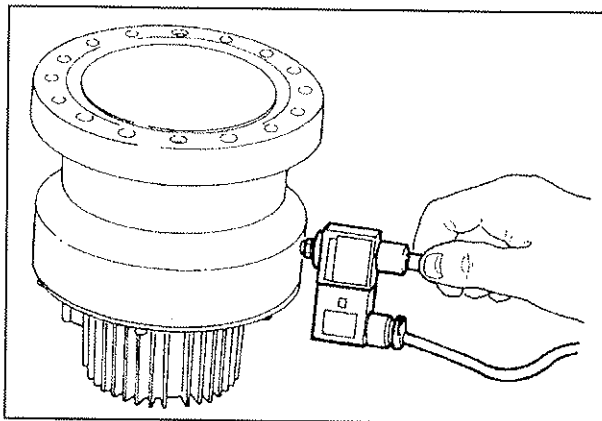


The vent valve mod. 969-9833 enables undesired pump operation during a temporary power failure (5 sec maximum) to be avoided, and enables an automatic vent operation.

Unscrew the threaded plug.



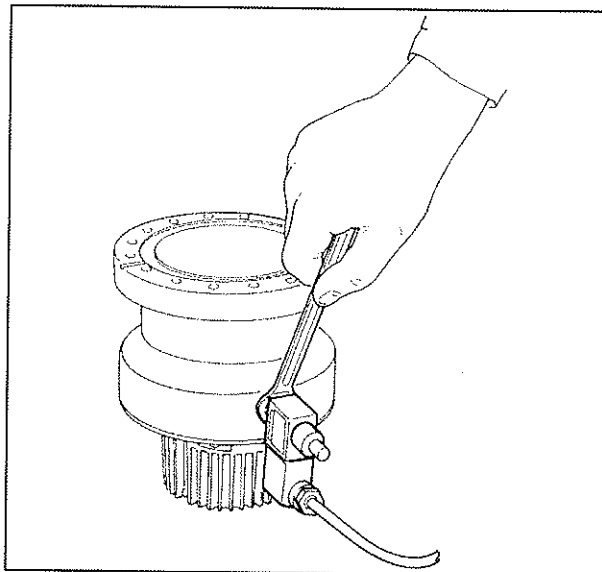
Screw the vent valve into the pump.



Tighten the valve using a 10 mm. hexagonal spanner.

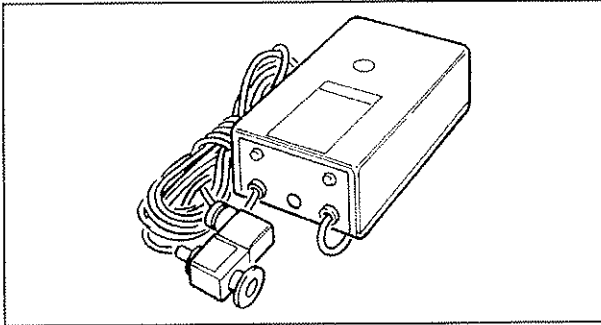
 CAUTION

Do not overtighten the valve as this may damage the thread on the pump.



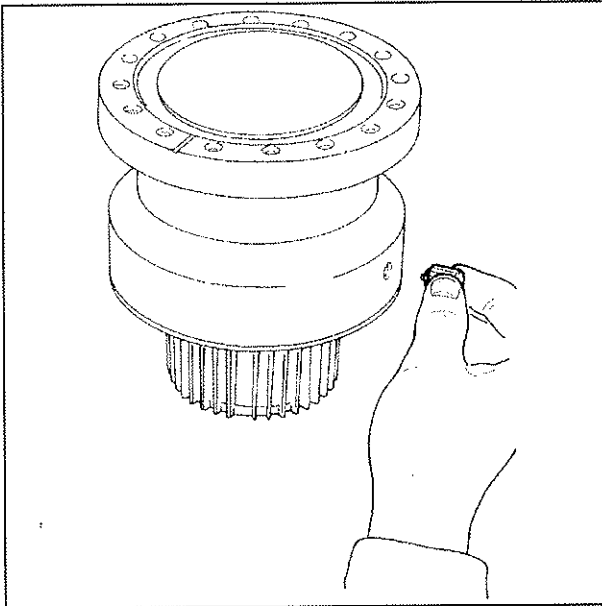
TECHNICAL INFORMATION

VENT DEVICE INSTALLATION



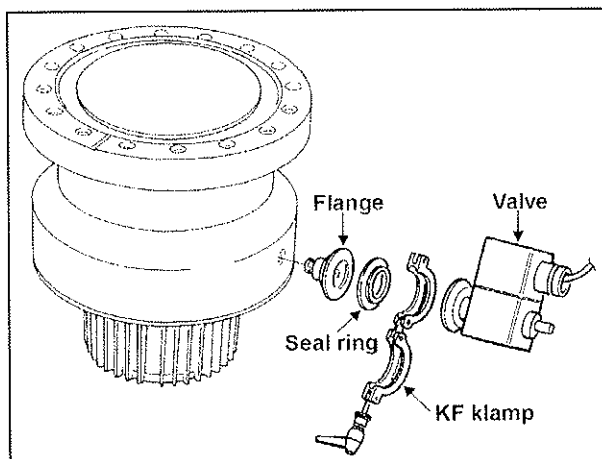
The vent device mod. 969-9831 allows to avoid undesired pump aeration during a temporary power failure (adjustable time up to 36 min.), and enables automatic vent operation.

Unscrew and remove the threaded plug.



Screw the flange mod. 969-9109 on the pump, taking care of the o-ring right position.

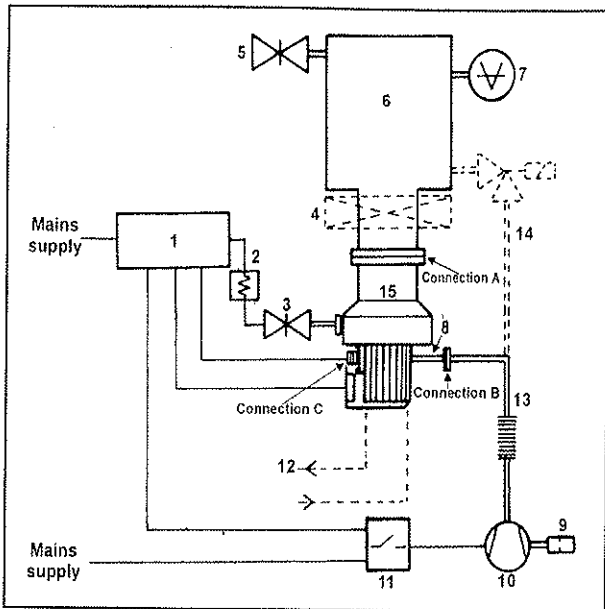
Assemble the seal ring and lock the vent device in position using the KF klamp.



VIBRATION ISOLATOR INSTALLATION

Vibration isolators for both ISO and CF version pumps are available as accessories. They can reduce the vibration transmitted from the Turbo-V 250 pump to the system. Please refer to the relevant instruction manual.

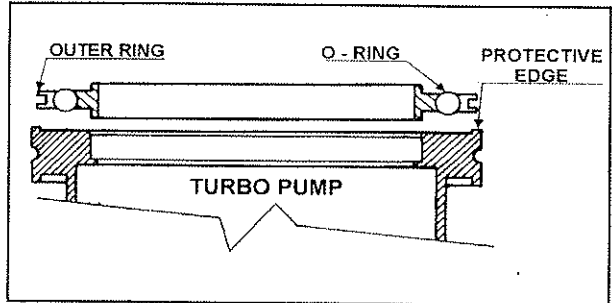
TYPICAL LAYOUT DIAGRAM



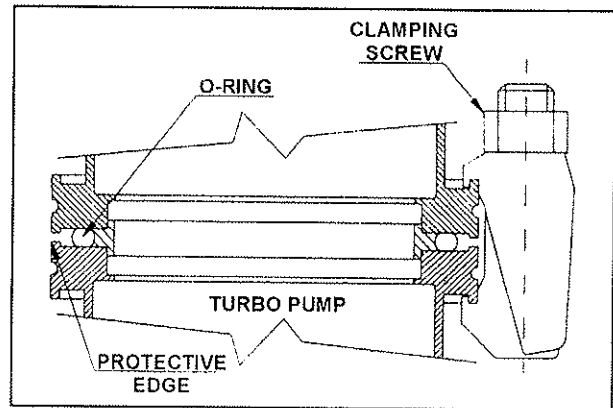
- 1 Turbo-V controller
- 2 Vent valve / vent device control unit
- 3 Vent valve
- 4 Vacuum pump shut-off valve (optional)
- 5 System vent valve (optional)
- 6 Vacuum chamber
- 7 Ionisation gauge
- 8 Fore-vacuum pump connecting flange
- 9 Oil mist eliminator
- 10 Fore-vacuum pump with internal one-way valve
- 11 Fore-vacuum pump control relay
- 12 Connection for water cooling
- 13 Fore-vacuum line
- 14 Roughing line with valve (optional)
- 15 Turbopump

Connection A - HIGH VACUUM FLANGE

To connect the Turbo-V 250 pump to the ISO inlet flange, remove the outer ring and position the centering ring as shown in the figure.



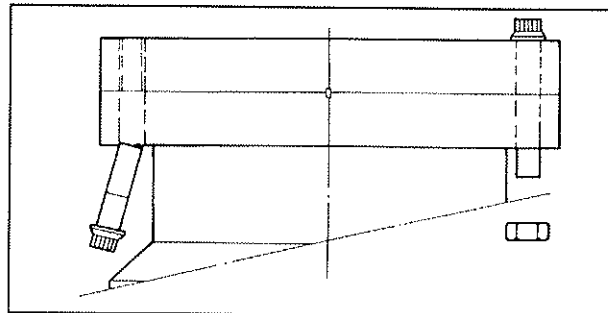
Then fix the two flanges with the clamps as shown in the figure.




For ConFlat flange connections we recommend using Varian hardware.

To facilitate assembly and dismantling, apply Fel-pro C-100 high temperature lubricant to the screw threads protruding from the flange and between the nuts and flange.

Attach the units and tighten each one in turn. Repeat the sequential tightening until the flange faces meet.



 CAUTION

Exercise care when tightening nuts and bolts to avoid creating dents in the envelope as this may cause the pump rotor to lock.

TECHNICAL INFORMATION

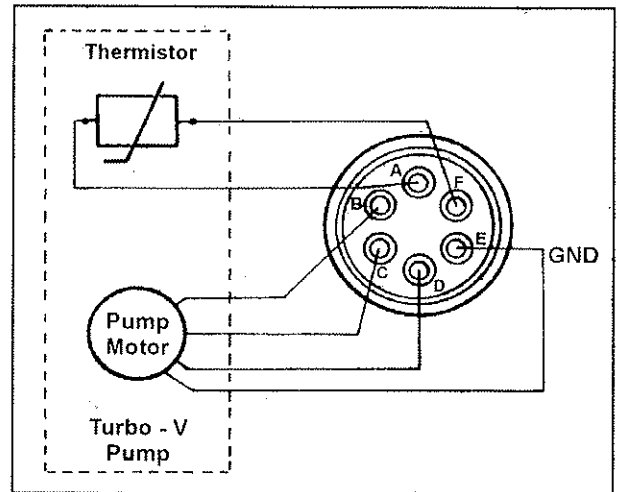
Connection B - FORE-VACUUM PUMP

A flange KF 16 NW is available to connect the Turbo-V 250 pump to the fore-vacuum pump. A hose or vacuum approved pipe can be used. If a rigid pipe is used, any vibration generated by the mechanical pump must be eliminated through the use of bellows.

NOTE

The Turbo-V 250 pump is characterised by its high compression ratio also for oil vapours. When using a mechanical oil-sealed pump, it is advisable to install a suitable trap between the turbopump and the fore-vacuum pump in order to prevent oil backstreaming.

Connection C - ELECTRICAL



The turbopump is connected to the controller through a 6-pin connector. Pins B, C and D are the 3-phase supply to the motor, pins A and F are connected to the temperature sensor (NTC type, 30 K Ω resistance at 25 $^{\circ}$ C) and pin E is connected to the pump earth.

If the temperature sensor is disconnected, the pump will not start. To prevent damage to the pump when the temperature exceeds 60 $^{\circ}$ C, the sensor automatically cuts out the power supply.

ACCESSORIES

| Description | Part number |
|----------------------------------------|----------------|
| Inlet screen DN100 | 969-9302 |
| Heater band, 120 V | 969-9804 |
| Heater band 220 V | 969-9803 |
| Base fixing kit | 969-9326 |
| Water cooling kit | 969-9319 |
| Air cooling kit (small) | 969-9310 |
| Air cooling kit (large) | 969-9313 |
| Vibration isolator ISO 100 | 969-9342 |
| Vibration isolator 6" CFF | 969-9332 |
| Centering ring ISO 100 (with O-ring) | IC-100 SV |
| ISO clamp | IC-063-100-A |
| Copper gaskets for 6" CFF (10-Pack) | FG-0600-CI |
| Nut and bolt set for 6" CFF (25-Pack) | FB-0450-C12 |
| Vent valve with fixed delay time | 969-9833 |
| Vent device with adjustable delay time | 969-9831 |
| Vent flange NW 10 KF | 969-9109 |
| Thread, lubricant Fel-pro C-100 | 953-0031 |
| Forepump SD 40, 120 V, 50 - 60 Hz | 0418-P1111-301 |
| Forepump SD 40, 220 V, 50 Hz | 949-0785-830 |
| Forepump VDP 30, 120 V | 949-9451 |
| Forepump VDP 30, 220 V | 969-9452 |

For a complete overview of Varian's extensive product lines, please refer to the Varian catalog.

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