INSTRUCTION MANUAL

MoniTorr

Model 969-9251
Model 969-9252
Model 969-9253
Model 969-9254
MoniTorr
Dear Customer,

Thank you for purchasing a VARIAN vacuum product. At VARIAN Vacuum Technologies we make every effort to ensure that you will be satisfied with the product and/or service you have purchased.

As part of our Continuous Improvement effort, we ask that you report to us any problem you may have had with the purchase or operation of our product. On the back side you find a Corrective Action Request form that you may fill out in the first part and return to us.

This form is intended to supplement normal lines of communications and to resolve problems that existing systems are not addressing in an adequate or timely manner.

Upon receipt of your Corrective Action Request we will determine the Root Cause of the problem and take the necessary actions to eliminate it. You will be contacted by one of our employees who will review the problem with you and update you, with the second part of the same form, on our actions.

Your business is very important to us. Please, take the time and let us know how we can improve.

Sincerely,

[Signature]

Sergio PIRAS
Vice President and General Manager
VARIAN Vacuum Technologies

Note: Fax or mail the Customer Request for Action (see backside page) to VARIAN Vacuum Technologies (Turin) - Quality Assurance or to your nearest VARIAN representative for onward transmission to the same address.
CUSTOMER REQUEST FOR CORRECTIVE / PREVENTIVE / IMPROVEMENT ACTION

TO :  VARIAN VACUUM TECHNOLOGIES TORINO - QUALITY ASSURANCE

FAX N° :  XXXX - 011 - 9979350
ADDRESS:  VARIAN S.p.A. - Via F.Ili Varian, 54 - 10040 Leini (Torino) - Italy
E-MAIL :  marco.marzio@varianinc.com

<table>
<thead>
<tr>
<th>NAME</th>
<th>COMPANY</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ADDRESS :

TEL. N° :  __________________   FAX N° :  __________________
E-MAIL :  __________________

PROBLEM / SUGGESTION :

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

REFERENCE INFORMATION (model n°, serial n°, ordering information, time to failure after installation, etc.) :

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

DATE  ______________

CORRECTIVE ACTION PLAN / ACTUATION  LOG N° __________
(by VARIAN VTT)

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

XXXX = Code for dialing Italy from your country (es. 01139 from USA; 00139 from Japan, etc.)

VARIAN
OVERVIEW

This equipment is intended for professional use. Before using such equipment, the operator must carefully read this instruction manual and any other additional information provided by Varian. Varian declines all responsibility regarding the total or even partial failure to comply with the instructions provided, the improper usage of the equipment by untrained personnel, unauthorized interventions or usage that fails to comply with specific national regulations. The MoniTorr controller utilizes solid state components and has autodiagnostic and self-protection features. This device analyzes the operating conditions of the turbopump so as to predict any possible pump failure caused by excessive bearing wear. The system continuously monitors the pump, storing in memory all the data relating to the latest period of operation.

The MoniTorr allows to:

- perform programmed maintenance on the turbopump
- continuously monitor and store the turbopump controller-MoniTorr system operating conditions
- identify the wear conditions of one or two bearings.

The following sections provide all the information needed to guarantee the operator’s safety when using the equipment. Detailed information is provided in the appendix entitled “Technical Information”.

The following conventions are used in this manual:

- **DANGER!** The Danger messages attract the operator’s attention to a specific procedure or step that could cause serious injury if not performed correctly.

- **WARNING!** The Warning messages are provided before procedures that could damage the equipment if not observed.

- **NOTE** Notes contain important information extracted from the text.

STORAGE

The following environmental conditions must be complied with during the MoniTorr transportation and storage:

- temperature: from -20 °C to +70 °C
- relative humidity: 0 - 95% (non-condensing)

BEFORE INSTALLATION

The MoniTorr comes in a special protective packaging; if you detect any sign of damage that may have been caused during transportation, contact your local sales office. When unpacking the MoniTorr, be particularly careful to avoid dropping or bumping it. Do not dispose the packaging material in the environment. This material is completely recyclable and complies with the ECC directive 85/399 that safeguards the environment.
INSTRUCTIONS FOR USE

INSTALLATION

The controller comes with a three-wire power cord equipped with internationally approved plugs. Always use this power cord and insert the plug into an appropriately grounded socket to avoid electrical discharges.

There are voltages inside the controller that could cause serious injury or death. Before proceeding with any controller installation or maintenance procedure, unplug the controller from the electrical outlet.

NOTE

The controller can be installed either on a table or inside an appropriate rack. In both cases the cooling air flow must circulate freely inside the apparatus. Do not install nor use the controller in environments exposed to atmospheric agents (rain, frost, snow) dust, aggressive gases, in explosive environments or with a high risk of fire.

The following environmental conditions must be complied with during operation:
- temperature: 0 °C to +40 °C;
- relative humidity: 0 - 95% (non-condensing).

Refer to the section “Technical Information” for the procedures regarding installation and connection to the related pump.

USAGE

This section provides the major operating procedures. For more information and for the procedures that involve connections or options, refer to the section “Usage” in chapter “Technical Information”. Before using the MoniTorr perform all connections and refer to the manual of the connected pump.

DANGER!

To avoid personal injury and damage to the apparatus, if the pump needs to be rested on a table make sure that the table is stable. Never operate the pump if the input flange is not connected to the system or not closed by the closing flange.

Controls, LEDs and Connectors

Shown below is the controller’s control panel and interconnection panels. For more information refer to the section “Technical Information”.

![MoniTorr 969-9251, 969-9252 969-9253 and 969-9254 Front Panel](image)

1. TURBO PUMP STATUS: Function currently not active but available for future evolutions.
2. COMMUNICATION PORT: Flashing yellow LED. It signals the data exchange via serial port with a personal computer or modem. The flashing frequency is not fixed and depends on the status of the data exchange.
3. DATA ACQUISITION: Yellow LED that indicates when the MoniTorr is receiving data from an accelerometer. This LED usually flashes at a frequency between 0.1 and 0.5 seconds.
4. POWER: Green LED that indicates when the controller is powered on. When the main power switch is set to the ON position, this LED is connected directly to the line voltage.
5. Model identification plate:
   - MoniTorr 300/1000
   - MoniTorr 2000
INSTRUCTIONS FOR USE

USAGE PROCEDURES

Powering on the MoniTorr
Power on the MoniTorr by plugging the power cord into the electrical outlet and setting the line voltage switch to the I position. The POWER LED comes on and the system proceeds with its selfconfiguration routine by automatically detecting the type of pump and controller connected. Data acquisition and processing will be automatically activated the moment in which the turbo pump reaches its maximum speed (set using the controller’s Speed Adjust parameter).

Operation
At predefined intervals, the system will also store data related to the vibration spectrums, power and temperature in addition to other data detected by the Turbo controller thus making it possible to analyze the history of the entire Turbopump-Controller-MoniTorr system throughout the latest period of operation. All the data stored in memory can then be transferred to a PC (by means of the appropriate software; refer to Technical Information) where it is stored and where it can then be analyzed by specialized personnel.

MAINTENANCE

The controllers of the MoniTorr series do not require maintenance. Any intervention must be carried out by authorized personnel.

In case of failure, the Varian Repair Service is available or Advanced Exchange Service that provides you with a regenerated controller in replacement of the faulty one.

DANGER!

Unplug the power cord before proceeding with any type of intervention on the controller.

If a controller needs to be scraped, proceed in compliance with the specific national norms.
MONITORR CONTROLLER DESCRIPTION

The MoniTorr is a controller with a microprocessor-based electronic architecture and with dimensions equivalent to 1/4 of a rack. It can work with either the ICE series controllers or with HT series controllers delivered by Varian later than 01/10/98.

The system has been designed to continuously monitor the turbopump to which it is associated and to maintain in memory all data regarding the turbopump's last period of operation (default = 1 month).

The MoniTorr can work autonomously, replying to the queries received from the local PC via RS232 or remotely via modem (optional).

It is available in the following four versions:

<table>
<thead>
<tr>
<th>MoniTorr Model</th>
<th>Pump Type</th>
<th>Controller Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>969-9251</td>
<td>TV300 ICE</td>
<td>969-9433/9533</td>
</tr>
<tr>
<td></td>
<td>TV 550 ICE</td>
<td>969-9434/9534</td>
</tr>
<tr>
<td></td>
<td>TV 700 ICE</td>
<td>969-9446/9546</td>
</tr>
<tr>
<td></td>
<td>TV 1000 ICE</td>
<td>969-9447/9547</td>
</tr>
<tr>
<td>969-9252</td>
<td>TV 2000 ICE</td>
<td>969-9448/9449</td>
</tr>
<tr>
<td></td>
<td>TV 2000 HT</td>
<td>969-9462/9562</td>
</tr>
<tr>
<td>969-9253</td>
<td>TV 300 HT</td>
<td>969-9424/9524</td>
</tr>
<tr>
<td></td>
<td>TV 550 HT</td>
<td>969-9444/9544</td>
</tr>
<tr>
<td></td>
<td>TV 700 HT</td>
<td>969-9445/9545</td>
</tr>
<tr>
<td>969-9254</td>
<td>TV 1000 HT</td>
<td>969-9454/9554</td>
</tr>
</tbody>
</table>

The MoniTorr is physically connected to the pump's controller from which it receives certain parameters.

For example:
- Current absorption
- Power absorption
- Temperature of the upper bearing

The accelerometer secured to the turbopump detects the spectrum of the low frequency (150 - 2,000 Hz) and of the high frequency (2,000 - 12,000 Hz) vibrations.

WARNING!

The MoniTorr controller is equipped with a 3-wire power cord and plug (internationally approved) for user's safety. Use this power cord and plug in conjunction with a properly grounded power socket to avoid electrical shock. High voltage developed in the controller can cause severe injury or death. Before servicing the unit, disconnect the input power cable.

The following subsystems are embedded into the PCB:
- Power supply
- Amplifier and filter of the signals from the accelerometer
- Signal acquisition logics
- Microprocessor
- 1 MB Flash EPROM used as the mass storage memory
- Serial data exchange management clock and logic
- EEPROM for the storage of the configuration parameters
CONTROLLER SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>300/1000 HT/ICE 2000 HT/ICE</td>
</tr>
<tr>
<td>Input:</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>90 260 Vac 1-phase</td>
</tr>
<tr>
<td>Frequency</td>
<td>47 to 63 Hz</td>
</tr>
<tr>
<td>Power</td>
<td>30 VA maximum</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 °C to +45 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20 °C to +70 °C</td>
</tr>
<tr>
<td>Fuse (mains)</td>
<td>2 x T 1A (slow blow) disregard</td>
</tr>
<tr>
<td>Radio interference</td>
<td>EN 55011 class A group 1</td>
</tr>
<tr>
<td>suppression</td>
<td>IEC1000-4 -2/3/4</td>
</tr>
</tbody>
</table>

Safety

- EN 61010 - 1

Cable

- Mains, 3 meters long
- RS232 serial cable for connection to the pump controller
- RS232 serial cable for connection to the local PC
- Cable with accelerometer

Weight: 1.7 Kg (4 lbs)

CONTROLLER OUTLINE

The outline dimensions for the MoniTorr controllers are shown in the following figures.

Controller Outline
INSTALLATION

The following block diagram provides a schematic approach to the connections to be made for a correct MoniTorr installation.

When performing the connections shown in the diagram above, pay close attention to the installation of the accelerometer.

**Accelerometer Installation**

To correctly install the accelerometer on the turbopump, use the specific support according to the type of pump being used.


Proceed as follows for a correct installation:

- Secure support A to threaded blind hole B present on the pump.

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Accelerometer Support for ICE and 2000 HT Series Turbopumps
Installation Procedure for Turbo-V 300/550/700/1000 HT Pumps

Proceed as follows for a correct installation:

- Secure support A to pump vent port B (there still is the possibility of installing a Vent Valve).

Accelerometer Support for HT Series Turbopumps

Installing the Transfer Software

The MoniTorr is provided with the software needed to transfer via RS232 all the data stored. To install the software simply insert the diskette into the PC drive and then launch the Setup file. The following screen will be displayed on the personal computer monitor:

NOTE

It is suggested that you maintain the directory and path proposed so as to facilitate the identification of the files generated by the system.

Click on the Finish button to continue with installation. The following screen will be displayed on the personal computer monitor. The program’s activation icon will be generated at the end of the installation procedure.
INTERCONNECTIONS

The following figure shows the controller's interconnections.

Controller Interconnections
**FUSE HOLDER**

Proceed as follows to replace the fuses:

- Unplug the power cord from the controller rear panel socket.
- Using a small screwdriver, pull out the voltage selector and fuses by levering in position A.
- Replace the fuse.

Use only T-type fuses of the following characteristics:
- 1 A (slow blow)

**Transmission Channel Characteristics**

- levels: RS 232
- baud rate: 9600
- character length: 8 bits
- parity: none
- stop bit: 1 bit
- protocol: The type of protocol to be used is compatible with the transfer software protocol.

During the acquisition phase, the MoniTorr replies to each query made by the Host PC with the following message:

0x16 0xEA 0xFF

**P8 RS 232 - Data Exchange Descriptions**

- This data exchange channel used for the transfer of data via monitor differs from the serial RS232 (connector P5) for the presence of four new signals that are used for managing the data exchanges with the modem.

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**Rear Panel**

**P5 RS 232 - Data Exchange Descriptions**

**Transmission Channel Characteristics**

- levels: RS 232
- baud rate: 9600
- character length: 8 bits
- parity: none
- stop bit: 1 bit
- protocol: The type of protocol to be used is compatible with the transfer software protocol.

During the acquisition phase, the MoniTorr replies to each query made by the Host PC with the following message:

0x16 0xEA 0xFF
**P6 RS 232 - Data Exchange Descriptions**

---

**RS 232 Data Exchange Serial Port Connections**

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**Transmission Channel Characteristics**

- **levels:** RS 232
- **baud rate:** 9600
- **character length:** 8 bits
- **parity:** none
- **stop bit:** 1 bit
- **protocol:** The type of protocol to be used is automatically selected by the MoniTorr and depends on the controller to which it is connected.

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**Connector J9 (Future Evolution)**

Connector J9 is currently not used.

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**Connector J10 (Accelerometer)**

Pins 4 and 5 are not used.
USE

General
Prior to operating the MoniTorr controller, make all vacuum manifold and electrical connections and read this manual.

CAUTION!
Before plugging in the controller power cord, be sure that the selected operating voltage matches the power source to avoid equipment damage.

Operating Procedure
Proceed as follows to correctly use the controller:

- Power on the system using the main switch located on the rear panel. The related LED on the front panel will come on.

  By means of a specific procedure, the MoniTorr automatically recognizes the type of pump and controller to which it is connected and automatically configures itself accordingly.

- By using the SpeedAdjust signal, the MoniTorr detects when the pump’s maximum rotation speed is reached. At this point the acquisition and analysis of the data deriving from the pump begins and is signalled by the flashing of the Data Acquisition LED (yellow).

  The data acquisition and processing procedure is automatically repeated at 2-minute intervals.

It is furthermore possible to monitor the turbopump-MoniTorr-controller system by using a local PC or a remote PC connected via modem.

Transfer Software
The FILETRAN program acquires the files present in the MoniTorr and stores them on hard disk. This is automatically performed by the program when it is launched, and then at regular intervals depending on the parameters set.

Functionality
As soon as it is activated, FILETRAN establishes a connection with the MoniTorr and updates the data that are present on the panel displayed on the personal computer monitor. If during this stage the MoniTorr does not respond, an appropriate dialog box will signal a communication error in which case you have the option to either Retry or Exit.

Once communication is established, the file uploading procedure will begin. The status indicated on the main panel will be updated as each file is transferred.

When all the files are successfully loaded, FILETRAN will automatically reduce to an icon and remain in standby until the next transfer procedure or until operator intervention.

The following figure shows the FILETRAN screen; a brief description of the fields is provided after this screen:

A: This field indicates the model of the pump; if due to a communication problem the name of the model is not recognized, the word ‘Unknown’ will be displayed in this field.

B: These two fields indicate the progress of the file transfer operation in numeric and graphical format: the progress is updated at the end of each file transfer.

C: Clicking on this button allows you to change the parameters indicated in point D; this button is not active during file transfers.

D: These fields indicate the configuration parameters and can only be changed by clicking on the MODIFY button and entering a password (provided on request).

E: Clicking this button allows you to display the information screen, as shown in the following figure.

F: Clicking on this button exits from the application.
Modifying the Parameters

The operator can change the configuration of the parameters D (related to the MONITOR) by clicking on the MODIFY button. When pressing the C key you will be asked to enter a password in the following screen display:

The password that grants access to the time-related parameter modification environment can be entered with small or capital letters.

If an incorrect password is entered, the previous screen will be displayed. If the password is correct, the following screen will be displayed:
It is now possible to modify the parameters and transfer the new values to the MONITORR by clicking on the CONFIRM button. At the end of the operation a dialog box is displayed to inform that the operation ended successfully.

Provided below is a description of the parameters that can be modified:

- **Acquire time**: Defines the time frame between one MONITORR acquisition and the next. The minimum value for this parameter is 2 minutes.
- **Save time**: Defines the time frame between two successive storages in the monitor's local memory of the acquisitions indicated above. The default value for this parameter is 1,000 minutes.
- **Alarm time**: Defines the timeout after which an alarm condition is signaled.

**Storing the Files Transferred**

The files that are present in the MONITORR are transferred to, and stored in, a directory which is automatically created during installation and which resides in the personal computer where FILETRAN is run. The following figure shows the directory path:

Provided below is a brief description of the content of each individual directory.

- **Varian**: Name of the directory where the application resides.
- **File**: Indicates where the files can be located.
- **Model number**: Indicates the pump controller model number (9699434 in the example)
- **Serial number**: Indicates the serial number of the controller to which the MONITORR is connected (000000 in the example); this directory hosts the files that will have to be sent via e-mail to VARIAN for the related analysis.
- **Send**: Name of the directory which is temporarily used by the program to host the files that are moved during the reading phase.

**Power Failure**

In the event of a power failure (temporary or lasting a long period of time), the controller is switched off. When power is restored, the controller will restart automatically.

**REPLACEMENT**

**General**

Replacement controllers are available on advance exchange basis through Varian service/sales organization.

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**WARNING!**

High voltage in the controller can cause severe injury or death. Before servicing, turn power off the controller and unplug the power cord.

**Troubleshooting**

At power on the controller undergoes an autodiagnosis routine during which all the LEDs come on for a few seconds.

If a failure is detected the LEDs will remain on. In this case contact Varian Technical Support.
Request for Return

1. A Return Authorization Number (RA#) WILL NOT be issued until this Request for Return is completely filled out, signed and returned to Varian Customer Service.

2. Return shipments shall be made in compliance with local and international Shipping Regulations (IATA, DOT, UN).

3. The customer is expected to take the following actions to ensure the Safety of workers at Varian: (a) Drain any oils or other liquids, (b) Purge or flush all gasses, (c) Wipe off any excess residues in or on the equipment, (d) Package the equipment to prevent shipping damage, (for Advance Exchanges please use packing material from replacement unit).

4. Make sure the shipping documents clearly show the RA# and then return the package to the Varian location nearest you.

North and South America
Varian Vacuum Technologies
121 Hartwell Ave
Lexington, MA 02421
Phone: +1 781 8617200
Fax: +1 781 8609252

Europe and Middle East
Varian SpA
Via Flli Varian 54
10040 Leini (TO) – ITALY
Phone: +39 011 9979111
Fax: +39 011 9979330

Asia and ROW
Varian Vacuum Technologies
Local Office

CUSTOMER INFORMATION

Company name: ……………………………………………………………………………………………………………………………………………………
Contact person: Name: …………………………………………… Tel: …………………………………………………………………………………
Fax: …………………………………………… E-Mail: …………………………………………………………………………………
Ship Method: …………………………………………… Shipping Collect #: …………………………………………… P.O.#: ……………………………

Europe only: VAT reg. Number: …………………………… USA only: ☐ Taxable ☐ Non-taxable
Customer Ship To: …………………………………………… Customer Bill To: ……………………………………………
……………………………………………………………………………………………………………………………………………………...

PRODUCT IDENTIFICATION

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Varian P/N</th>
<th>Varian S/N</th>
<th>Purchase Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TYPE OF RETURN (check appropriate box)

☐ Paid Exchange ☐ Paid Repair ☐ Warranty Exchange ☐ Warranty Repair ☐ Loaner Return
☐ Credit ☐ Shipping Error ☐ Evaluation Return ☐ Calibration ☐ Other ………………

HEALTH and SAFETY CERTIFICATION

Varian Vacuum Technologies CAN NOT ACCEPT any equipment which contains BIOLOGICAL HAZARDS or RADIOACTIVITY. Call Varian Customer Service to discuss alternatives if this requirement presents a problem.

The equipment listed above (check one):

☐ HAS NOT been exposed to any toxic or hazardous materials

OR

☐ HAS been exposed to any toxic or hazardous materials. In case of this selection, check boxes for any materials that equipment was exposed to, check all categories that apply:

☐ Toxic ☐ Corrosive ☐ Reactive ☐ Flammable ☐ Explosive ☐ Biological ☐ Radioactive

List all toxic or hazardous materials. Include product name, chemical name and chemical symbol or formula.

………………………………………………………………………………………………………………………………………………

Print Name: …………………………………… Customer Authorized Signature: ……………………………………
Print Title: …………………………………… Date: ……./…./……

NOTE: If a product is received at Varian which is contaminated with a toxic or hazardous material that was not disclosed, the customer will be held responsible for all costs incurred to ensure the safe handling of the product, and is liable for any harm or injury to Varian employees as well as to any third party occurring as a result of exposure to toxic or hazardous materials present in the product.

Do not write below this line

Notification (RA)#: …………………………… Customer ID#: ……………………… Equipment #: ……………………………
## FAILURE REPORT

### TURBO PUMPS and TURBOCONTROLLERS

<table>
<thead>
<tr>
<th>Problem</th>
<th>Position</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not start</td>
<td>Vertical</td>
<td>Power: Rotational Speed:</td>
</tr>
<tr>
<td>Does not spin freely</td>
<td>Horizontal</td>
<td>Current: Inlet Pressure:</td>
</tr>
<tr>
<td>Does not reach full speed</td>
<td>Upside-down</td>
<td>Temp 1: Foreline Pressure:</td>
</tr>
<tr>
<td>Mechanical Contact</td>
<td>Other:</td>
<td>Temp 2: Purge flow:</td>
</tr>
<tr>
<td>Cooling defective</td>
<td>Overtemperature</td>
<td>OPERATION TIME:</td>
</tr>
</tbody>
</table>

### ION PUMPS/CONTROLLERS

<table>
<thead>
<tr>
<th>Problem</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad feedthrough</td>
<td>Poor vacuum</td>
<td></td>
</tr>
<tr>
<td>Vacuum leak</td>
<td>High voltage problem</td>
<td></td>
</tr>
<tr>
<td>Error code on display</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### VALVES/COMPONENTS

<table>
<thead>
<tr>
<th>Problem</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Main seal leak</td>
<td>Bellows leak</td>
<td></td>
</tr>
<tr>
<td>Solenoid failure</td>
<td>Damaged flange</td>
<td></td>
</tr>
<tr>
<td>Damaged sealing area</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### LEAK DETECTORS

<table>
<thead>
<tr>
<th>Problem</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot calibrate</td>
<td>No zero/high backround</td>
<td></td>
</tr>
<tr>
<td>Vacuum system unstable</td>
<td>Cannot reach test mode</td>
<td></td>
</tr>
<tr>
<td>Failed to start</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### INSTRUMENTS

<table>
<thead>
<tr>
<th>Problem</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge tube not working</td>
<td>Display problem</td>
<td></td>
</tr>
<tr>
<td>Communication failure</td>
<td>Degas not working</td>
<td></td>
</tr>
<tr>
<td>Error code on display</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### PRIMARY PUMPS

<table>
<thead>
<tr>
<th>Problem</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump doesn’t start</td>
<td>Noisy pump (describe)</td>
<td></td>
</tr>
<tr>
<td>Doesn’t reach vacuum</td>
<td>Over temperature</td>
<td></td>
</tr>
<tr>
<td>Pump seized</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### DIFFUSION PUMPS

<table>
<thead>
<tr>
<th>Problem</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater failure</td>
<td>Electrical problem</td>
<td></td>
</tr>
<tr>
<td>Doesn’t reach vacuum</td>
<td>Cooling coil damage</td>
<td></td>
</tr>
<tr>
<td>Vacuum leak</td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### FAILURE DESCRIPTION

(Please describe in detail the nature of the malfunction to assist us in performing failure analysis):

**NOTA:** Su richiesta questo documento è disponibile anche in Tedesco, Italiano e Francese.
**REMARQUE :** Sur demande ce document est également disponible en allemand, italien et français.
**HINWEIS:** Auf Aufrage ist diese Unterlage auch auf Deutsch, Italienisch und Französisch erhältlich.
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