Betriebsanleitung • Operating Instructions

Translation of the Original Operating Instructions

TurboDrag Pump

TMH 071 P
TMU 071 P

PT 0063 BE/C (0702)

PFEIFFER VACUUM

Index

Please note: Current operating instructions are available via www.pfeiffer-vacuum.net

For information about certifications, if applicable, please see the signet on the pump or:
☞ www.tuvdotcom.com
☞ TUVdotCOM-ID 0000021320

1. Safety Instructions

☞ Read and follow all instructions in this manual.
☞ Inform yourself regarding:
  – Hazards which can be caused by the pump;
  – Hazards which can be caused by your system.
  – Hazards which can be caused by the media being pumped.
☞ Avoid exposing any part of the body to vacuum.
☞ Observe the safety and accident prevention regulations.
☞ Regularly check that all accident prevention measures are being complied with.
☞ Do not operate the turbopump with open high vacuum flange.
☞ Do not carry out any unauthorised conversions or alterations to the turbopump.
☞ When returning the turbopump observe the shipping instructions.
☞ The turbopump must be anchored in accordance with the installation instructions.
☞ Do not disconnect the plug between the electronic drive unit and accessory components during operations.
☞ Disconnect the voltage supply to the electronic drive unit before opening the turbopump.
☞ When working on the turbopump, the high vacuum flange should only be opened once the rotor is at rest.
☞ When using sealing gas, the pressure in the hose connection should be limited to 2 bar via the overpressure valve.
☞ If a heater is in use temperatures of up to 120 °C can be present in the area of the high vacuum flange. Take care to avoid burns !
☞ During operations, temperatures of up to 65 °C can arise in the lower part of the turbopump. Take care to avoid burns!
☞ Keep leads and cables well away from hot surfaces (> 70 °C).
☞ Operate the turbopump only in conjunction with the relevant electronic drive unit and power supply (accessory).
☞ The turbopump has been accredited protection class IP 30.
☞ The mains connection must be subject to a safe connection to the PE (protection class 1).
☞ The housing screws do not loosen, pull tight, remove or replace, since otherwise the guarantee for the security of the turbopump expires.

1.1. For Your Orientation

Instruction in the text
➡ Working instruction: here, you have to do something.

Symbols used
The following symbols are used throughout in all illustrations.

Ⓗ High vacuum flange
Ⓥ Fore-vacuum flange
Ⓕ Venting connection
Cooling water connection
Air cooling
Electric connection
Ⓖ Sealing gas connection

Abbreviations used

DCU	=	Display and operating unit
HPU	=	Display and operating unit
TCP/TCK	=	Electronic drive unit, turbopump
TPS	=	Power supply

Position numbers
The same pump and accessory parts have the same position numbers in all illustrations.

1.2. Pictogram Definitions

Danger of burns from touching hot parts.

Danger of an electric shock.

Danger of personal injury.

Danger of damage to the pump or to the system.

Danger of injury from rotating parts.

Attention to particulary important information on the product, handling the product or to a particular part of the documentation.

Modifications reserved.

2. Understanding The Pumps TMH 071 P/TMU 071 P

2.1. Main Features

Turbomolecular Drag Pump TMH/U 071 P

1 High vacuum flange
2 Fore-vacuum flange
4 Venting screw
5 Electric connection
6 Rubber feet

Electronic drive unit
For operating the turbopumps TMH/TMU 071 the following electronic drive units can be used:

Electronic drive unit (accessories)	Responsible operating instructions
TCK 100 TCP 350	PT 0055 BN PT 0092 BN

PLEASE NOTE

For controling and monitoring the turbopump a Display And Operating Unit DCU or HPU (see accessories) can be used at operating with the TCK 100.

Cooling
- Enhanced convection cooling with cooling unit (accessory),
- air cooling (accessory) or
- water cooling (accessory).

Integrated protective measures against excess temperatures: The electronic drive unit reduces the rotor rotation speed.

Bearings
High vacuum side: Wear free permanent magnetic bearing.
Fore-vacuum side: Oil circulatory lubricated ball bearing with ceramic balls.

Ambient conditions
The turbomolecular pump needs to be installed in compliance with the following ambient conditions:

Installation location:	protected against the weather (rooms within buildings)
Temperature:	+5 °C to +40 °C
Relative humidity of the air:	max. 80 % at T ≤ 31 °C up to max. 50% at T ≤ 40 °C
Air pressure:	77 kPa - 106 kPa
Installation altitude:	2000 m max.
Pollution degree:	2
Overvoltage category:	II
Connection voltage:	24 VDC ±5%

Proper Use

- The Turbomolecular Pumps TMH 071 P/TMU 071 P may only be used for the purpose of generating vacuum.
- The turbopumps may only be used to pump those media against which they are chemically resistant. For other media the operator is required to qualify the pumps for the processes involved.
- If the process produces dust, the maintenance intervals must be specified accordingly and sealing gas must be used.
- If the pump to be operated with more then 50% of the permissible gas load, sealing gas must be used.
- The turbopump must be connected to a backing pump in accordance with Section 3.3.
- Only Pfeiffer Vacuum electronic drive units and corresponding connection cables may be used to operate the turbopump.
- Only Pfeiffer Vacuum power supplys may be used to operate with the TCK 100. The use of other power supplys requires the prior agreement of the manufacturer and equalization with the valid specification.
- The pumps may only be operated providing the ambient conditions in compliance with Protection Type IP 30 are observed.

Improper Use

The following is regarded, inter alia, as improper:

- The pumping of explosive or corrosive gases.
- Operating the pumps in areas where there is a danger of explosion.
- The pumping of gases and vapours which attack the materials of the pumps.
- The pumping of corrosive gases without sealing gas.
- The pumping of condensating vapours.
- Operations involving impermissibly high levels of gas loads.
- Operations with improper gas modes.
- Operations involving too high levels of heat radiation power (see Section 8. "Technical Data").
- Operations without the use of cooling equipment.
- Operating the pump in environments which require a protection class superior to IP 30.
- Installation of the pumps in systems where the turbomolecular pumps are subjected to impact-like stress and vibrations or the effect of periodically occurring forces.
- The use of other power supplys or accessories which are not named in this manual or which have not been agreed by the manufacturer.
- The connection to power supplys with earthing of a direct voltage pole.

Improper use will cause all claims for liability and guarantees to be forfeited.

2.2. Differences Between The Pump Types

Feature	TMH 071 P	TMU 071 P
High vacuum flange	ISO-KF / ISO-K	CF-F
High vacuum seal	Elastomer	Metal
Attainable final pressure	$< 1 \cdot 10^{-7}$ mbar without baking-out)	$< 5 \cdot 10^{-10}$ mbar (with baking-out)

Abbreviations on the type of the pump

Suffix **"P"**: Purge gas connection for the prevention of the ingress of aggressive gases into the motor and bearing arena.

2.3. Scope Of Delivery

Turbomolekular pump with:

- protecting cover for high vacuum flange,
- protecting cover for fore vacuum flange,
- only DN 63 ISO-K: 2 bracket screws.

3. Installation

3.1. Preparations For Installation

Do not carry out any unauthorised conversions or alterations to the turbopump.

In case the rotor blocks suddenly, torque levels up to **820 Nm** can occur which need to be absorbed by the system and the high vacuum flange.

- The maximum permissible rotor temperature of the pump is 80 °C. If the vacuum chamber or parts in the vacuum chamber are heated, the values stated in the technical data relating to the level of heat which may be radiated into the pump must not be exceeded. If necessary, suitable shielding must be fitted in the vacuum chamber before the turbopump (constructional suggestions available on request).
- The temperature of the high vacuum flange must not exceed 120 °C.
- Only remove the blank flange from the high and fore vacuum side immediately before connection.
- On Turbopumps TMH/TMU 071 P the lubricant reservoir is already fitted and filled.
- Where magnetic fields of > 3 mT are involved suitable shielding must be provided (available on request).
- Either enhanced convection, air or water cooling is necessary for operating the pump (please see "Accessories").
- If the pump is baked out, the heating sleeve and the body of the pump must be insulated to prevent burns from accidental contact.
- Floor mounting of the turbomolecular pump is only admissible after consulting the manufacturer.

The person responsible for commissioning must ensure that the installation is carried out in accordance with the legal regulations and the pertinent industrial standards.

3.2. Connecting The High Vacuum Side

The utmost cleanliness must be observed when fitting all high vacuum parts. Unclean components prolong the pumping time.
All installations units for the flange must be with installation grease-free, dust free and drying.

Use a Pfeiffer Vacuum splinter shield or protective screen
The use of a Pfeiffer Vacuum splinter shield or protective screen in the high vacuum flange protects the turbopump against foreign bodies coming from the vacuum chamber but does reduce the volume flow rate as followed:

	Reduced volume flow rate in %		
	N_2	He	H_2
Splinter shield DN 63	13	5	3
Protective screen DN 63	3	1	1
Splinter shield DN 40	26	13	8

Connecting via a Pfeiffer Vacuum vibration compensator
The high vacuum side can be flanged onto the vacuum chamber either directly or via a Pfeiffer Vacuum vibration compensator (see Section 10. Accessories).

When using a Pfeiffer vacuum vibration compensator, suitable securing needs to be introduced capable of absorbing the energy of the rotor should it suddenly block, since the vibration compensator itself alone cannot absorb the occurring forces. Please consult the manufacturer.

The maximum permissible temperature at the vibration compensator is 100 °C.

Installing the high vacuum flange

- In case the rotor blocks suddenly, torque levels up to **820 Nm** can occur which need to be absorbed by the system and the high vacuum flange.
- For installing the turbomolecular pumps to the high vacuum flange, the components listed in the following **must** be used exclusively. Otherwise the turbomolecular pump may twist or tear off. The clamps, bolts, nuts and centering rings are special designs from Pfeiffer Vacuum
- The minimum strength of 170 N/mm^2 of the flange material needs to be observed.

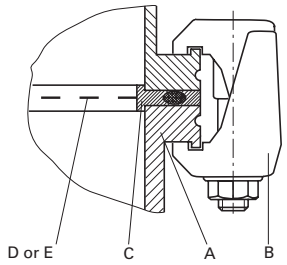
Installation is done as follows:

ISO-K flange with ISO-K flange

The components for installation are enclosed in the appropriate set of mounting material (see sec. 10. Accessories).

Bracket screw (ISO-K with ISO-K)

A ISO-K flange
B Bracket screw
C Centering ring, coated
D Splinter shield
E Protective screen



➡ See that the sealing surface is not damaged.
➡ Flange the turbopump according to the drawing and the component parts in your set of mounting material. Use **4** bracket screws.
➡ Tighten the bracket screws crosswise in three steps. Tightening torque: 25 ±2 Nm

ISO-K flange with ISO-F flange

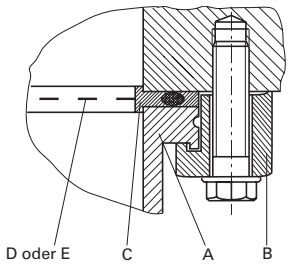
WARNING

If the pumps are secured with an ISO-K flange on a vacuum chamber with an ISO-F flange it can come to twisting at the flange in case the rotor blocks suddenly.

The components for installation are enclosed in the appropriate set of mounting material (see sec. 10. Accessories).

Claw grip (ISO-K with ISO-F)

A ISO-K flansch
B Claw grip
C Centering ring, coated
D Splinter shield
E Protective screen



➡ See that the sealing surface is not damaged.
➡ Flange the turbopump according to the drawing and the component parts in your set of mounting material. Use **4** claw grips.
➡ Tighten the claw grips crosswise in three steps. Tightening torque: 16 ±1 Nm

ISO-KF flange with ISO-KF flange

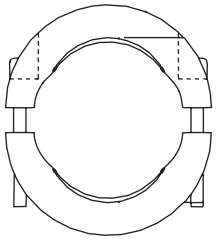
For installing the following components are available.

WARNING

If the pumps are secured with this attachment it can come to twisting the flange in case the rotor blocks suddenly.

Connection nominal-diameter	Designation	Order number
DN 40 ISO-KF	Clamping ring for metal seal	PF 105 040 -T
	Centering ring	PF 110 140 -T
	Splitter shield	PM 600 375 -X

Clamping ring for metal seal



➡ The screws on the clamping ring need to be tightened with a tightening torque of 3.7 Nm.

CF-F flange

Applications for installing an CF-F to an CF-F flange are "Stud screw with blind hole" and "Hexagon screw and clearance hole". The following items are needed: the particular set of mounting material and a copper seal. Using asplinter shield or protective screen is optional.

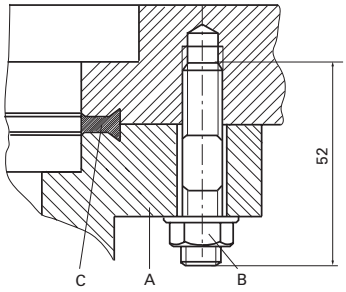
Don't touch the copper seal with bare hands, this may affect the sealings efficiency. See that the sealing lip is not damaged.

Stud screw with blind hole

➡ If used: Insert the splinter shield and protective screen in the high vacuum flange with the clamping lugs downward (towards the pump).
➡ Bring the seal centric into the correct position.
➡ Connect the flanges via **8** pieces of stud screws (M8) with washers and nuts. The stud screws need to be tightened revolving with a tightening torque of 22 ±2 Nm. Control the torque afterwards, because of the sealing material's flowing a retightening of the screws may be required.

Stud screw with blind hole

A CF-F flange
B Stud screw with washer and nut
C Copper seal

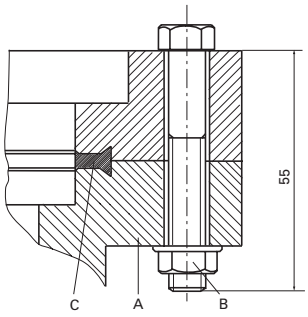


Hexagon screw and clearance hole

➡ If used: Insert the splinter shield and protective screen in the high vacuum flange with the clamping lugs downward (towards the pump).
➡ Bring the seal centric into the correct position.
➡ Connect the flanges via **8** pieces of hexagon screws (M8) with washers and nuts. The hexagon screws need to be tightened revolving with a tightening torque of 22 ±2 Nm. Control the torque afterwards, because of the sealing material's flowing a retightening of the screws may be required.

Hexagon screw and clearance hole

A CF-F-flange
B Hexagon screw with washer and nut
C Copper seal



The components for installing to an CF-F flange are to be ordered under the following numbers:

Connection nominal-diameter	Designation	Order-number
DN 63 CF-F	Hexagon screw M8 with washer and nut (25 pieces[1)])	PF 505 002 -T
	Stud screw M8 with washer and nut (18 pieces[1)])	PF 507 002 -T
	Copper seal (10 pieces[1)]) or copper seal silvered (10 pieces[1)])	PF 501 406 -T PF 501 506 -T
	Splinter shield	PM 016 312
	Protective screen	PM 016 333

1) supplied pieces

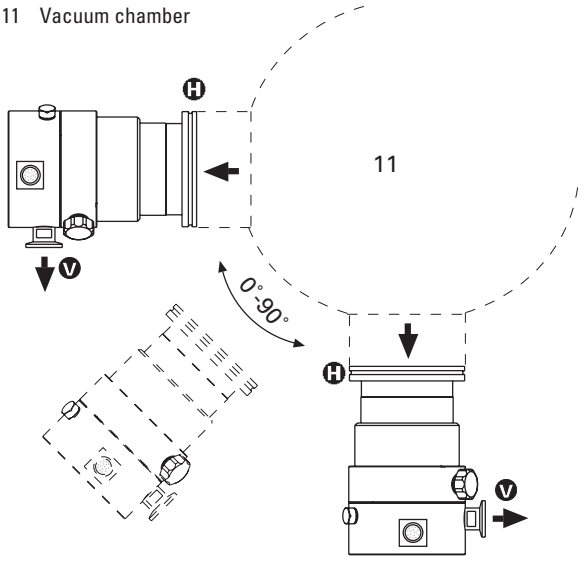
Directly flanging the pump
The turbopump can be flanged onto the vacuum chamber vertically (0°) up to an angle of 90° maximum.

CAUTION

The fore-vacuum flange must always point downwards.

Permissible installation positions for the turbopump

11 Vacuum chamber



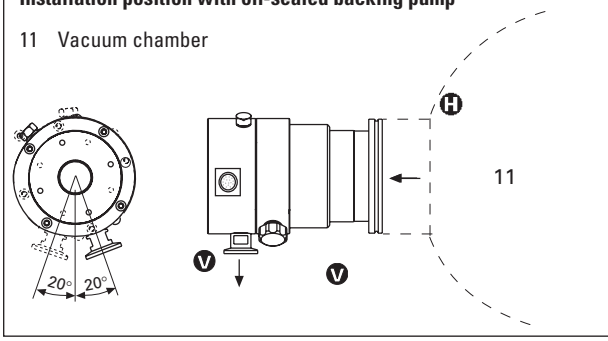
CAUTION

The maximum loading capacity of the high vacuum flange is 200 N (equivalent to 20 kg).
Assymetric loading on the high vacuum flange must be avoided.

With horizontal pump installation and oil-sealed backing pumps (e.g. rotary vane pumps) the fore-vacuum flange of the turbopump must be aligned vertically downwards (maximum deviation ±20°), otherwise the turbopump could become dirty.

Installation position with oil-sealed backing pump

11 Vacuum chamber



CAUTION

No forces from the piping system must be allowed to act on the pump where turbopumps are anchored.
Suspend or support all pipes to the pump.

3.3. Connecting The Fore-Vacuum Side

Backing pump: Vacuum pressure 10 mbar; with enhanced convection cooling < 0.1 mbar.
Recommendation: Oil-free diaphragm pump or rotary vane vacuum pumps from the Pfeiffer Vacuum range (note installation position, turbopump, see Section 3.2.).

Connecting the backing pump
All connections of the fore-vacuum line: with the usual small flange components or hose screw connections.

CAUTION

Be sure to conduct away the exhaust gases from the backing pump. Do not reduce the free cross section of the fore-vacuum flange with following components.

WARNING

The exhausted process gases and vapours can represent a health hazard and can also be environmentally damaging.
Comply with all the gas manufacture's safety instructions.

➡ With rigid pipe connections: fit a bellows in the connecting line to reduce vibration.
➡The electrical connection of the backing pump is made via a relay box (see accessories).

Please refer to Operating Instructions PT 0030 BN for details on the relay box, backing pump and its installation.

3.4. Connecting The Cooling Unit

Turbopumps TMH 071 P/TMU 071 P can optionally be provided with enhanced convection cooling, air cooling or water cooling (see accessories).

The turbopumps must be operated with air or water cooling where the fore-vacuum pressure is increased (> 0.1 mbar) and/or operations with gas loads.

Use and installation:
- For water cooling please refer to Operating Instructions PM 0546 BN.
- For air cooling please refer to Operating Instructions PM 0543 BN.
- Permissible installation positions for the cooling unit where convection cooling is involved please see Section 8.1. "Dimensions Diagram".

3.5. Connecting The Venting Valve

The Venting Valve TVF 005 provides automatic venting in the event of a power failure and switching off.

Fitting the venting valve

➡ Unscrew the venting screw from the venting connection of the turbopump.

➡ Screw in venting valve 42 with seal (USIT ring) on hexagonal SW 14.

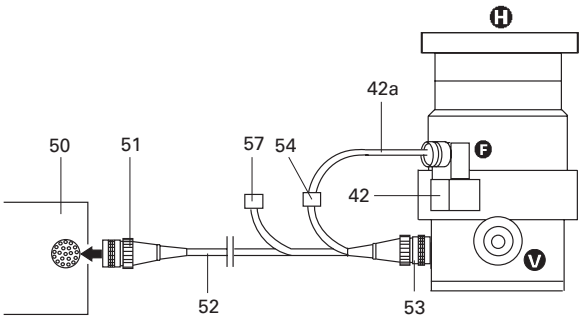
Electrical connection

TCP 350

➡ Connect the control cable 42a of the venting valve by means of an adapter to the control cable "VENT" (54) on the connecting cable turbopumpe - TCP 350 (52). The adapter is enclosed with the connecting cable turbopump.

TCP 350 - Connecting the venting valve

42 Venting Valve TVF 005
42a Control cable TVF 005
50 Electronic Drive Unit TCP 350
51 Bayonet plug TCP 350
52 Connecting cable turbopump - TCP 350
53 Bayonet plug - turbopump
54 Control cable "VENT"
57 Control cable "FAN/HEAT"

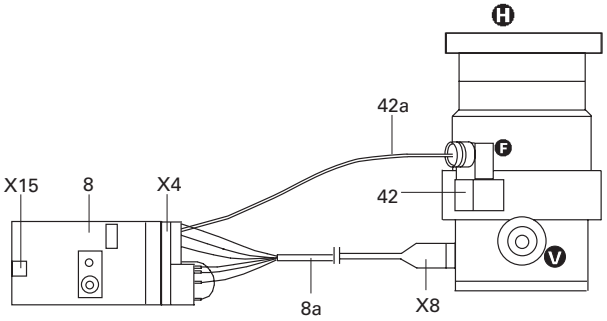


TCK 100

➡ Connect the control cable 42a of the venting valve as shown in the connections diagram (see Section 3.10.).

TCK 100 - Connecting the venting valve

X4 Connection TCK 100
X8 Connection turbopump
X15 Connection the Interface RS 485
8 Electronic Drive Unit TCK 100
8a Connecting cable TCK 100 - turbopump
42 Venting Valve TVF 005
42a Control cable venting valvel



For more details please refer to operating instructions of the elektronic drive units (see Section 3.7.).

The venting mode of the venting valve is selected via the DCU/HPU (see accessories) or Serial Interface RS 485.

The maximum pressure at the venting valve is 1.5 bar absolute.

For more details on the Venting Valve TVF 005 please refer to Operating Instructions PM 0507 BN.

3.6. Connecting The Casing Heating Unit

The attainment of final pressures is accelerated when turbopumps and vacuum chambers are baked out.
The heating duration is dependent on the degree of dirt and on the required final pressure level. The heating duration should be at least 4 hours.

PLEASE NOTE

Where casing heating is involved the turbopump must be water cooled.

CAUTION

The temperature of the high vacuum flange must not exceed 120 °C (additional references please see Section 3.1.).

WARNING

High temperatures are generated when the turbopump is baked out. There is a danger of burns resulting from touching hot parts, even after the casing heating has been switched off. Ideally, the heating sleeve and the pump casing should be insulated during installation. Do not touch the heating sleeve and the pump casing during the baking out process.

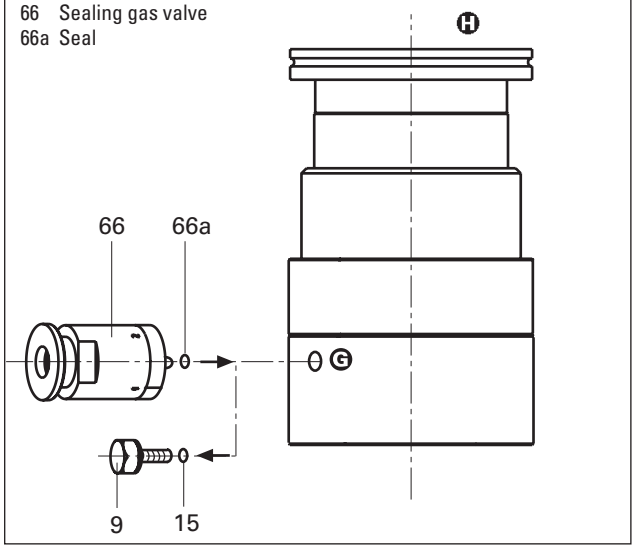
Please refer to Operating Instructions PM 0542 BN for details on the casing heating unit and its installation.

3.7. Connecting The Sealing Gas Valve

To protect the pump, particularly where corrosive or dust producing processes are involved, it is necessary to use sealing gas. Connection is made via the sealing gas valve (please see "Accessories").

Connecting the sealing gas valve

9 Locking screw sealing gas connection
15 Seal
66 Sealing gas valve
66a Seal



➡ Please refer to Operating Instructions PM 0229 BN for details on installing the sealing gas valve and adjusting the sealing gas flow.

3.8. Connecting The Electronic Drive Unit

WARNING

Voltages of > 50 $V_{eff.}$ can be present on the open electrical contacts on a slowing down pump. There is danger of an electrical shock if the contacts are touched.
Disconnect the plug to the electronic drive unit only once the pump is completely at rest and the electronic drive unit has been disconnected from the mains.

The Turbopumps TMH/TMU 071 P can be operated with the following electronic drive units:
– TCK 100
– TCP 350

➡ For connection the electronic drive unit please refer to the corresponding operating instructions (see the following table) and the connections diagram, Section 3.9.

Corresponding operating instructions

Electronic drive unit	Operating instruction
TCK 100	PT 0055 BN
TCP 350	PT 0092 BN

The connecting cables electronic drive unit/turbopump and the mains cable for the power supply have to be ordered separately (see accessories).

CAUTION

Once operations voltage has been supplied, the electronic drive unit performs a self test (duration approx. 10 seconds).

3.9. TCK 100 - Installing The Power Supply TPS 100

CAUTION

Voltage for the TCK 100 may only be supplied with the Pfeiffer Vacuum power supplys (Accessory). The use of other power supplys requires the prior agreement of the manufacturer and equalization with the valid specification (power supply specifications available on request).

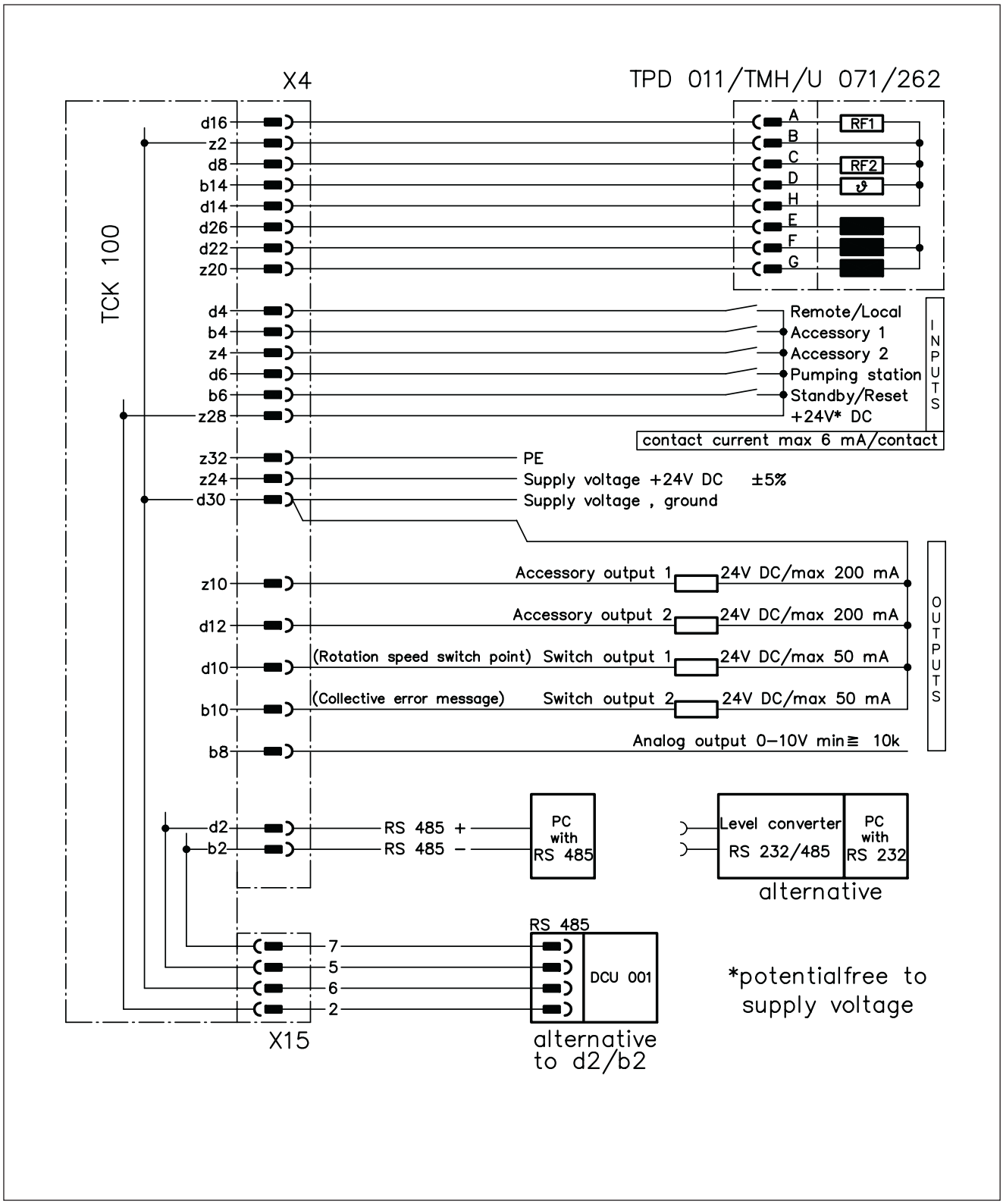
Please refer to Operating Instructions PM 0521 BN for details on the Power Supply TPS 100.

CAUTION

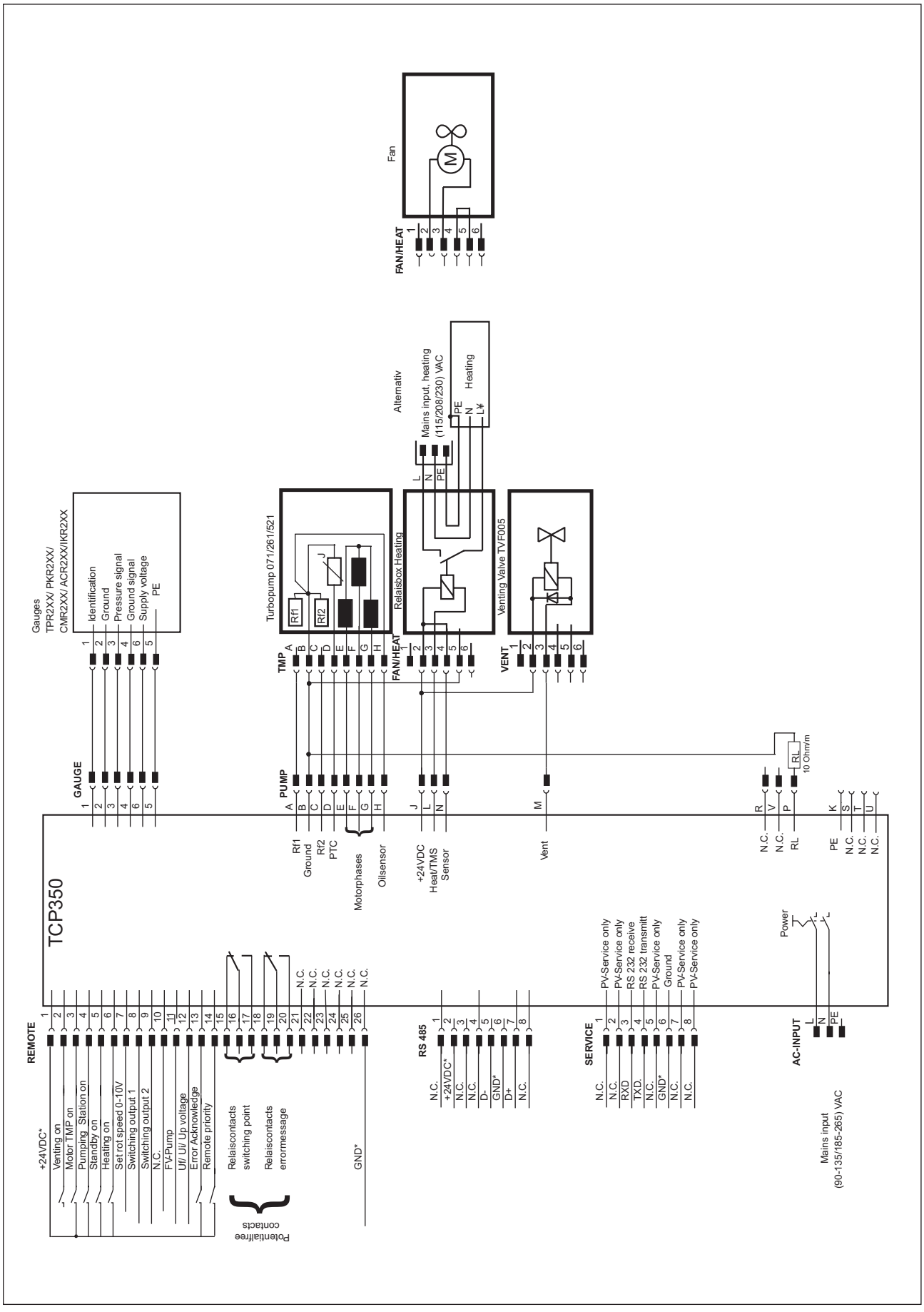
The mains connection must be freely accessible at all times.

3.10. Connections Diagram

Electronic Drive Unit TCK 100



Electronic Drive Unit TCP 350



4. Operations

4.1. Before Switching On

Turbopump rotors rotate at high speed. When the high vacuum flange is open there is a danger of injury and of damage to the pump caused by objects falling into the pump. Therefore never operate the pump with open high vacuum flange.

➡ With water cooling: Open cooling water supply and check flow.

➡ Plug connecting cable between electronic drive unit (TCK 100 or TCP 350) and turbopump.
Connect TCK 100 with Power Supply TPS on X2 according to the connections diagram (see sec. 3.10).

Please note:
The following pre-settings have been programmed:

TCK 100 / TCP 350	
Running up time	8 min.
Rotation speed switchpoint	80 %
Automatic venting	50 %

Take care when pumping hazardous gases and observe the safety precautions of the gas manufacturer.

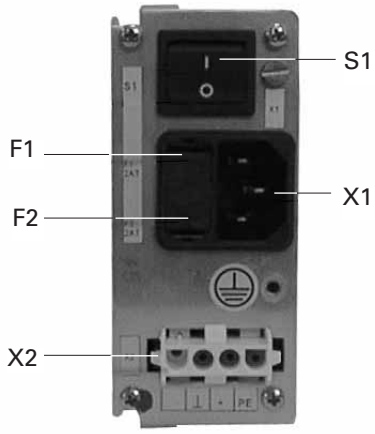
4.2. Switching ON

TCK 100

➡ Switch on the Power Supply TPS 100 with switch S1. Control the turbopump via inputs or RS485 at X4 of the TCK 100. For more details on TCK 100 refer to operating instructions PT 0055 BN.

Rear panel, TPS 100

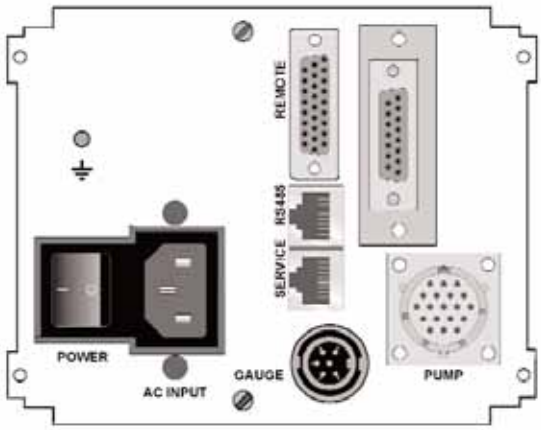
S1 ON/OFF switch
X1 Mains connection
X2 Connection TCK 100
F1 Fuse
F2 Fuse



TCP 350

➡ Switch on the TCP 350 using the "Power" switch on the rear side of the unit. Control the turbopump via frontpanel, remote or RS485 of the TCP 350. For more details on TCK 100 refer to operating instructions PT 0092 BN.

Rear panel TCP 350



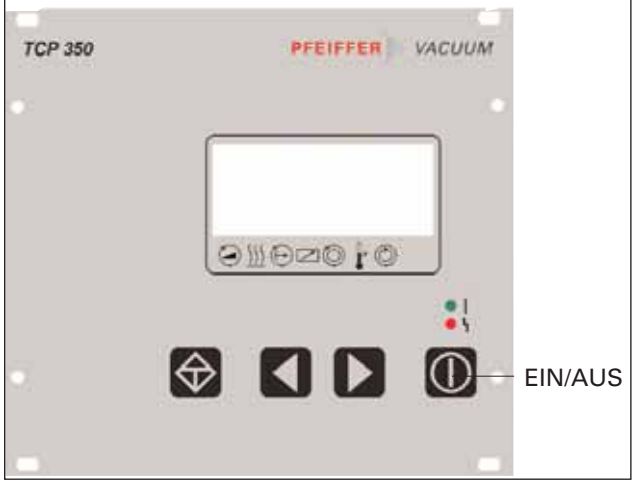
– With air cooling the cooling fan is switched on via electronic drive unit.
– Once the self test has been successfully completed on the electronic drive unit the turbopump and the backing pump (if connected) begin operating.

4.3. Switching OFF And Venting

Before coming to rest after switching off, the turbopump must be vented in order to prevent contamination.

➡ Close the fore-vacuum.
➡ Switch off the turbopump and the pumping station:
Operating with TCK 100:
with S1 on the Power Supply TPS 100 (see Section 4.2.)
Operating with TCP 350:
with ON/OFF switch on the front panel.

Front panel TCP 350



➡ Venting
There are three possibilities to vent turbopump:
– **Manual venting**
Open the venting screw (on delivery, screwed in) on the venting connection about one turn.
– **Venting with the Venting Valve TVF 005** (accessories)
Venting release via the remote control or via the serial interface which is selectable via DCU or interface (see Operating Instructions, "Pumping Operations With The DCU", PM 0547 BN).
– **Venting in two stages** when the vacuum chamber should be vented as quickly as possible.
First stage: venting with a pressure increase rate of 15 mbar/s for 20 seconds.
Second stage: venting with an optionally large venting valve.

The valve cross-section for a venting rate of 15 mbar/s must be compatible with the size of the vacuum chamber. Where small vacuum chambers are involved, the Pfeiffer Vacuum Venting Valve TVF 005 can be used for first stage venting.

➡ Shut off water supply (if installed).

4.4. Gas Type Dependent Operations

CAUTION

Water cooling is required if the pumps are to be operated with gas load.

Where high level gas loads and rotation speeds are involved, the resulting friction subjects the rotor to the effect of great heat. To avoid over-heating, a power rotation speed characteristic line is implemented in the TC 600; this ensures that where maximum gas loads are involved, the pump will operate at any rotation speed without the danger of damage arising.
The maximum power is dependent on the type of gas. Two characteristic lines are available for any type of gas in order to fully exploit the power potential of the pump:

– "Gas-Mode 0" for gases with molecular mass 40 as, for example, Argon;
– "Gas-Mode 1" for all lighter gases.

Works setting: "Gas-Mode 0"

➡ Set the applicable gas mode on the TCP 350 (see Operating Instructions, PT 0092 BN) or on the TCK 100 with DCU (see Operating Instuctions "Pumping operations with DCU", PN 800 547 BN).

WARNING

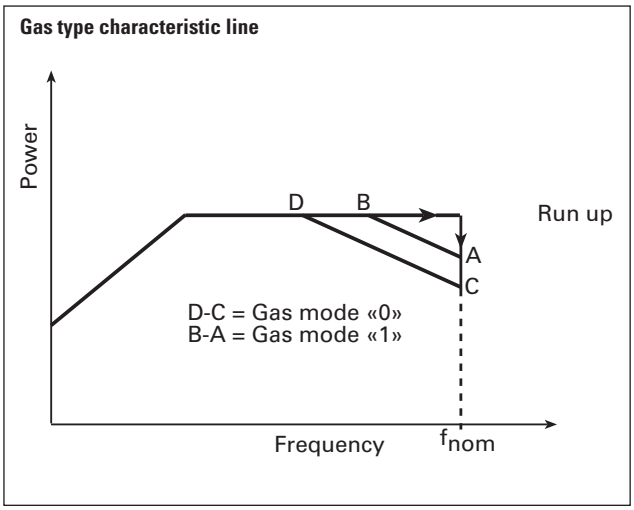
Pumping gases with molecular mass 40 with the incorrect gas mode can cause damage to the pump.

For the vertex of the power characteristic line please refer to Section 8. Technical Data.

Maximum power is applied when the pump starts in order to limit the time required. Once the set rotation speed is attained, switching to the selected power characteristic line is automatic.
If the gas dependent maximum power is exceeded, the rotation speed is reduced until equilibrium between the permissible power and gas friction is attained. The power limitation serves to protect the pump against thermal overloading. In order to avoid rotation speed fluctuations it is recommended to set, in rotation speed setting mode, the equilibrium frequency or a somewhat lower frequency.

PLEASE NOTE

There can be types of pump whereby there is no differentiation between the two "gas modes" settings.



4.5. TCK 100 – Operations With The DCU 001 / DCU 100

If the TCK 100 is operated with the DCU 001 or DCU 100 operations should be carried out in accordance with the relevant Operating Instructions
PM 0477 BN (DCU description) and
PM 0547 BN (operating the pump with the DCU).

4.6. Shutting Down For Longer Periods

WARNING

If aggressive or hazardous gases are pumped there is a danger of personal injury resulting from coming into contact with process gases. Before removing a turbopump from the system, first:

– Vent the turbopump with a neutral gas or dry air.
– Ensure that there is no residual process gas in the system nor in the feeder lines.

If the turbopump is to be shut down for more than a year:
➡ Remove turbopump from the system.
➡ Change the lubricant reservoir (see Section 6.1.).

PLEASE NOTE

Lubricant TL 011 should not be used when there have been no operations for **3 years.**

➡ Close the high vacuum flange and evacuate the turbopump via the fore-vacuum flange.
➡ Vent turbopump via the venting connection with nitrogen or dry air.
➡ Close fore-vacuum and venting connection by blank flanging.
➡ Place the pump vertically on its rubber feet.
➡ The pump must be stored in buildings within a temperature range of -25 °C to +55 °C.
➡ In rooms with moist or aggressive atmospheres, the turbopump must be air-sealed in a plastic bag together with a bag of dessicant.

PLEASE NOTE

If the pump has been shut down for **3 years**, the bearing must be changed (please contact Pfeiffer Vacuum Service).

4.7. Turbopump Temperature Management

Where impermissible motor temperatures are involved or the temperature of the casing is too high, the motor current is reduced.
This can lead to dipping below the set rotation speed switch-point and results in the turbomolecular pump being switched off.

5. What To Do In Case Of Breakdowns?

Problem	Possible Causes	Remedy
Pump doesn't start;	• Power supply interrupted	• Check fuse in the power supply or electronic drive unit • Check plug contacts on the turbopump, power supply or electronic drive unit • Check power supply feeder line • Check voltage on the power supply (24 V DC)
Pump doesn't attain nominal rotation speed within the set run-up time Pump cuts out during operations	• Fore-vacuum pressure too high • Leak or too much gas • Rotor sluggish caused by defective bearing • TC run-up time too short • Thermal overloading caused by – Water flow insufficient – Insufficient air supply – Fore-vacuum pressure too high – Ambient temperature too high	• Check backing pump function • Check seals • Seek leak and repair • Reduce supply of process gas • Check bearing (noises?): Inform Pfeiffer Vacuum Service • Set longer start-up time with the DCU, PC or electronic drive unit • Ensure free flow • Ensure adequate air supply • Reduce fore-vacuum pressure • Reduce ambient temperature
Pump doesn't attain final pressure	• Pump dirty • Leak in vacuum chamber, lines or pump	• Bake out pump • If seriously contaminated: Request Pfeiffer Vacuum Service to clean • Seek leak starting with vacuum chamber • Repair leak
Unusual operating noises	• Bearing damaged • Rotor damaged • Splinter shield (if fitted) not seated firmly	• Inform Pfeiffer Vacuum Service of need for repair • Inform Pfeiffer Vacuum Service of need for repair • Check seat of splinter shield (see Section 3.2.)

6. Maintenance / Replacement

PLEASE NOTE

No liability for personal injury nor material damage will be accepted for damages and operational interruptions which have been caused by improper maintenance; in addition, all guarantees become invalid.

The bearing should be changed every three years (request Pfeiffer Vacuum Service to change).
Where extreme operating conditions or unclean processes are involved, the replacement interval should be checked with your Pfeiffer Vacuum Service Center.

You can change the lubricant reservoir yourself. Please contact your Pfeiffer Vacuum Service for all other maintenance and service work.

6.1. Replacing The Lubricant Reservoir

The lubricant reservoir should be replaced at least every three years. Where extreme operating conditions or unclean processes are involved, the replacement interval should be checked with your Pfeiffer Vacuum Service Center.

- ➡ Switch off the turbopump, vent to atmospheric pressure (see Section 4.3.) and allow to cool as necessary.
- ➡ If necessary, remove the turbopump from the system.
- ➡ Unscrew rubber feet 6 from the underside of the pump.
- ➡ Unscrew locking cover 90 on the underside of the pump with installation tool E (order number N 5709 103).

- ➡ Lever out the lubricant reservoir 92 with the help of two screwdrivers.

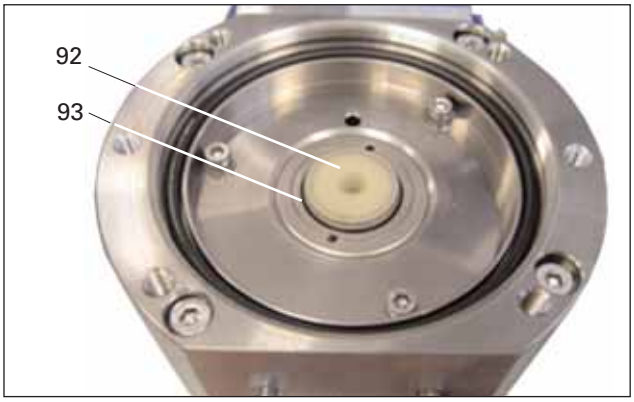
WARNING

Lubricants can contain toxic substances from the medium pumped. Lubricant must be disposed of in accordance with the respective regulations.
Safety instructions data sheet on request.

- ➡ Clean off any dirt on the pump and locking cover with a clean, fluff-free cloth.
- ➡ Insert new lubricant reservoir 92 **up to the O-ring 93** in the pump.

CAUTION

The lubricant reservoir is already filled with Lubricant TL 011; do not add additional lubricant.



- ➡ Screw in locking cover 90. The lubricant reservoir is brought into the correct axial position with the locking cover.
- ➡ Screw the rubber feet 6 back in.

7. Service

Do Make Use Of Our Service Facilities
In the event that repairs are necessary a number of options are available to you to ensure any system down time is kept to a minimum:
– Have the pump repaired on the spot by our Pfeiffer Vacuum Service Engineers;
– Return the pump to the manufacturer for repairs;
– Replace the pump.

Local Pfeiffer Vacuum representatives can provide full details.

Before Returning:
➡ Dismantle all accessories.
➡ Please attach a clearly visible notice "Free of harmful substances" (both on the unit and also on the delivery note and any accompanying letters).
"Harmful substances" are substances and preparations as defined in the current, local, dangerous substances regulations; in the U.S.A. as
"materials in accordance with the Code of Federal Regulations (CFR) 49 Part 173.240 Definition and Preparation".
We will carry out the decontamination and invoice this work to you if you have not attached this note. This also applies where the operator does not have the facilities to carry out the decontamination work. Units which are contaminated microbiologically, explosively or radioactively cannot be accepted as a matter of principle.

Fill Out The Declaration Of Contamination
➡ In every case the "Declaration of Contamination" must be completed diligently and truthfully.
➡A copy of the completed declaration must accompany the unit; any additional copies must be sent to your local Pfeiffer Vacuum Service Center.
Please get in touch with your local Pfeiffer Vacuum representatives if there are any questions regarding contamination.

Decontaminate units before returning or possible disposal. Do not return any units which are microbiologically, explosively or radioactively contaminated.

Returning Contaminated Units
If contaminated have to be returned for maintenance/repair, the following instructions concerning shipping must be followed:
➡ Neutralise the pump by flushing with nitrogen or dry air.
➡ Seal all openings to the air.
➡ Seal pump or unit in suitable protective foil.
➡ Return equipment only in suitable, rugged shipping containers and by complying with the currently valid shipping regulations.

Repair orders are carried out according to our general conditions of sale and supply.

If repairs are necessary, please send the pump together with a short damage description to your nearest Pfeiffer Vacuum Service Center.

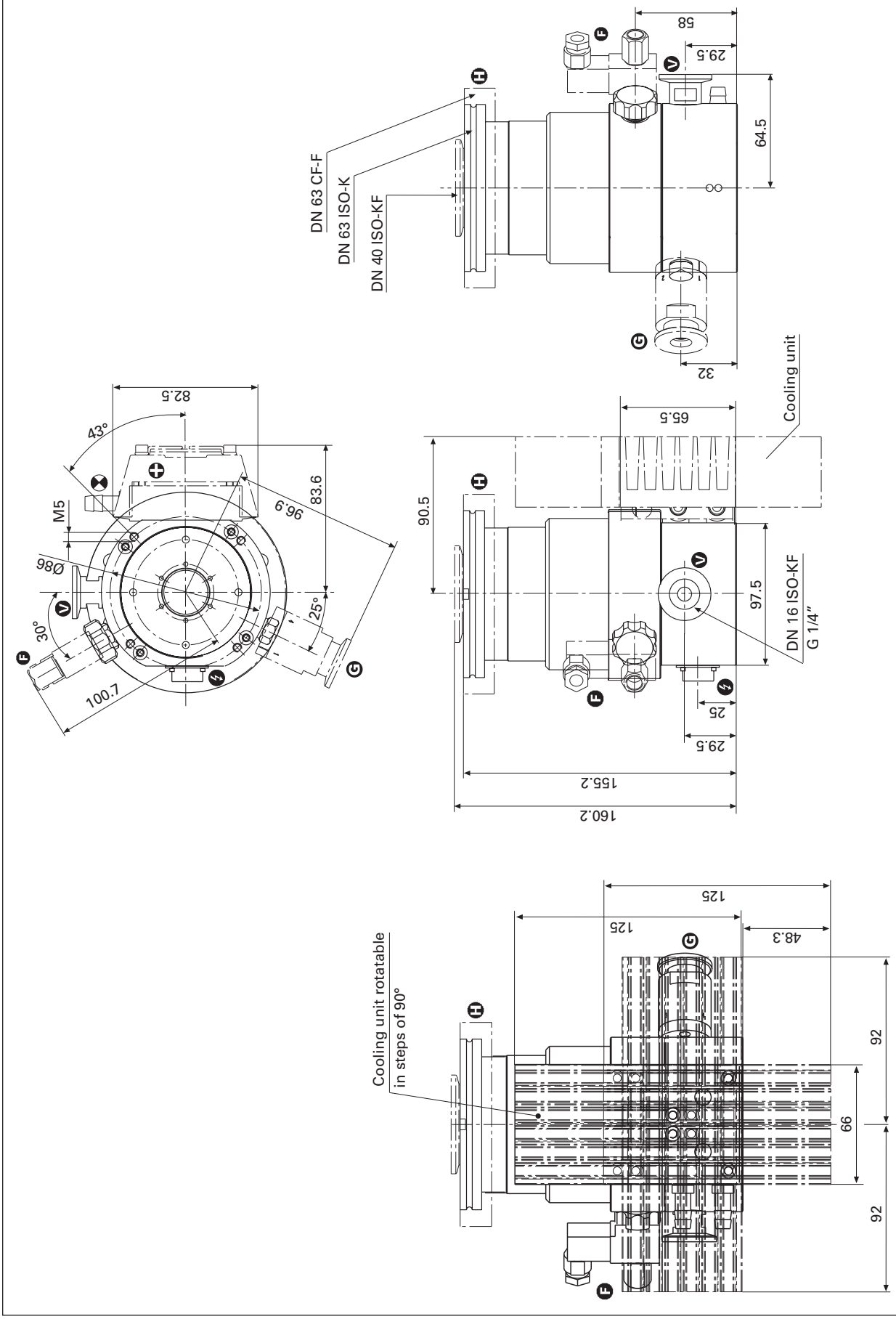
8. Technical Data

Feature	Unit	TMH 071 P	TMH 071 P	TMU 071 P
Connection nominal diameter				
Inlet		DN 40 ISO-KF	DN 63 ISO-K	DN 63 CF-F
Outlet		DN 16 ISO-KF/G 1/4"	DN 16 ISO-KF/G 1/4"	DN 16 ISO-KF/G 1/4"
Venting connection		G 1/8"	G 1/8"	G 1/8"
Nominal rotation speed	Hz (1/min)	1500 (90 000)	1500 (90 000)	1500 (90 000)
Standby rotation speed	Hz (1/min)	1000 (60 000)	1000 (60 000)	1000 (60 000)
Recommended rotation speed 50-100%	Hz (1/min)	750 (45 000)–1500 (90 000)	750 (45 000)–1500 (90 000)	750 (45 000)–1500 (90 000)
Start-up time				
TCK 100	min	2,5	2,5	2,5
TCP 350	min	3	3	3
Maximum noise level[1]	dB (A)	48	48	48
Final pressure, backing pump	mbar	< 10	< 10	< 10
Integral leak rate (He)[2]	mbar l/s	$< 2 \cdot 10^{-8}$	$< 2 \cdot 10^{-8}$	$< 2 \cdot 10^{-8}$
Maximum permissible rotor temperature	°C	80	80	80
Permissible heat radiation power	W	4	4	4
Volume flow rate for				
Nitrogen N_2	l/s	33	59	59
Helium He	l/s	39	50	50
Hydrogen H_2	l/s	32	42	42
Compression ratio for				
N_2		$> 10^{11}$	$> 10^{11}$	$> 10^{11}$
He		$6 \cdot 10^{6}$	$6 \cdot 10^{6}$	$6 \cdot 10^{6}$
H_2		$> 10^{5}$	$1 \cdot 10^{5}$	$1 \cdot 10^{5}$
Maximum fore-vacuum pressure for				
N_2	mbar	18	18	18
He	mbar	18	18	18
H_2	mbar	12	12	12
Maximum gas throughput[3]				
With water cooling N_2	mbar l/s	1.1	1.1	1.1
He	mbar l/s	2.5	2.5	2.5
Withe air cooling[4] N_2	mbar l/s	0.58	0.58	0.58
Maximum gas throughput at intake pressure of 0.1 mbar[5]				
N_2	mbar l/s	2	2	2
He	mbar l/s	3	3	3
H_2	mbar l/s	2	2	2
Vertex power characteristics line[6]				
A	W / Hz	80 / 1500	80 / 1500	80 / 1500
B	W / Hz	80 / 1500	80 / 1500	80 / 1500
C	W / Hz	60 / 1500	60 / 1500	60 / 1500
D	W / Hz	80 / 1300	80 / 1300	80 / 1300
Final pressure[7]				
With rotary vane pumps	mbar	$< 1 \cdot 10^{-7}$	$< 1 \cdot 10^{-7}$	$< 1 \cdot 10^{-10}$ [8]
With diaphragm pumps	mbar	$< 1 \cdot 10^{-7}$	$< 1 \cdot 10^{-7}$	$< 1 \cdot 10^{-8}$
Lubricant		TL 011	TL 011	TL 011
Maximum cooling water consumption with water at 15 °C[9]	l/h	100	100	100
Cooling water temperature	°C	5 - 25	5 - 25	5 - 25
Permissible ambient temperature with air cooling	°C	5 - 40	5 - 40	5 - 40
Heating power consumption	W	32	32	32
Weight	kg	2.0	2.1	3.4
Permissible magnetic field	mT	3	3	3
Operating voltage	VDC	24 ± 5%	24 ± 5%	24 ± 5%
Duration[9] - / max. current consumption	A	4.1 / 4.6	4.1 / 4.6	4.1 / 4.6
Duration[9] - / max. power	W	100 / 110	100 / 110	100 / 110
Protection class		IP 30	IP 30	IP 30
Shipping and storage temperature	°C	-25 to +55	-25 to +55	-25 to +55
Relative humidity	%	5-85 non-condensing	5-85 non-condensing	5-85 non-condensing

1) Distance from the pump 1 m
2) Measured at a helium concentration of 20%, 10 s measurement time
3) Until frequency fall-off; higher gas throughputs with reduced rotation speed.
4) Until ambient temperature 30 °C.
5) Rotation speed of pump may drop below the nominal rotation speed.
6) For gas characteristic lines please refer to Section 4.4.
7) In accordance with German Industrial Standard 28428 the final pressure which is attained in a measuring dome 48 hours after baking out.
8) Final pressure only attainable with metallic seal on the high vacuum flange.
9) At maximum gas throughput.

8.1. Dimensions Diagram

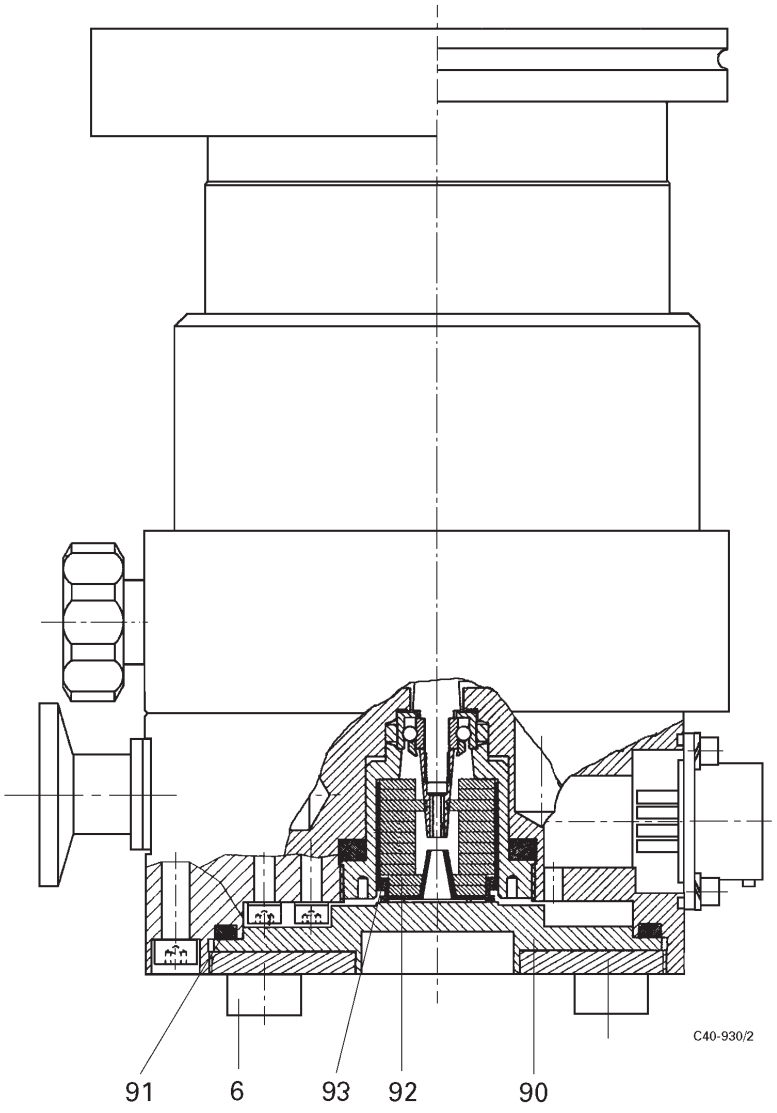
TMH 071 P / TMU 071 P



9. Spare Parts

Pos.	Description	Pieces	Size	Number	Comments	Ordering Quantity
	Spare parts TMH 071 P/TMU 071 P					
6	Rubber foot	4		P 3695 700 ZD		
90	Locking cover	1		PM 083 021 -X		
91	O-ring	1	68 x 3	P 4070 972 PV		
92	Lubricant reservoir (with o-ring 93)	1		PM 103 593 -T		

Spare parts



10. Accessories

Description	Size	Number	Comments/ Operating Instructions	Order Quantity
Components for cooling				
Dirt trap	R 3/8"	P 4161 300 2R		
Recycled Water Cooling Unit TZK 400	230 V, 50 Hz	PM Z01 245	PM 0369 BN	
Air cooling	24 VDC	PM Z01 253	PM 0543 BN	
Water cooling		PM 016 000 -T	PM 0546 BN	
Cooling unit for convection cooling		PM 039 237 -T		
Components for venting				
Venting Valve TVF 005, without current closed	24 VDC	PM Z01 135	PM 0507 BN	
Drying Unit TTV 001 (filled with zeolite)		PM Z00 121	PM 0022 BN	
Venting flange	DN 10 ISO-KF	PM 033 737 -T		
Components for heating				
Casing heating			Water cooling required / reasonable only with a metal seal and a stainless steel casing	
	230 V, Schuko plug	PM 041 900 -T	PM 0542 BN	
	208 V, UL-plug	PM 041 901 -T	PM 0542 BN	
	115 V, UL-plug	PM 041 902 -T	PM 0542 BN	
Components for mounting				
Coated centering ring, bracket screws	DN 63 ISO-K	PM 016 360-T	for mounting ISO-K/ISO-K	
Coated centering ring with protective screen, bracket screws	DN 63 ISO-K	PM 016 362-T	for mounting ISO-K/ISO-K	
Coated centering ring with splinter shield, bracket screws	DN 63 ISO-K	PM 016 361-T	for mounting ISO-K/ISO-K	
Coated centering ring, claw grips	DN 63 ISO-K	PM 016 510-T	for mounting ISO-K/ISO-F	
Coated centering ring with protective screen, claw grips	DN 63 ISO-K	PM 016 512-T	for mounting ISO-K/ISO-F	
Coated centering ring with splinter shield, claw grips	DN 63 ISO-K	PM 016 511-T	for mounting ISO-K/ISO-F	
Other accessories				
Electronic Drive Unit				
TCK 100		PM C01 693 A	PT 0055 BN	
TCP 350		PM C01 740	PT 0092 BN	
TCP 350 with Profibus interface		PM C01 741	PT 0138 BN	
TCP 350 with Devicenet interface		PM C01 742	PT 0149 BN	
Connecting cable TCK 100 – turbopump	1 m	PM 051 481 -T	Other lengths on request; protection class IP 30	
Connecting cable TCP 350 – turbopump	3 m	PM 051 803 -T	Other lengths on request; protection class IP 30	
Power supply (for TCK 100 only)				
– TPS 100; for fitting to walls or standard runners		PM 041 827 -T	PM 0521 BN	
– TPS 100; 19" insert unit		PM 041 828 -T	PM 0521 BN	
– DCU 100; 19" insert unit with Display And Operating Unit (DCU)		PM C01 694	PM 0477 BN	
Mains cable				
Schuko plug	230 V	P 4564 309 ZA		
UL plug	208 V	P 4564 309 ZF		
UL plug	115 V	P 4564 309 ZE		
Display And Operating Unit DCU 001		PM 041 816 -T	PM 0477 BN	
Display And Operating Unit HPU 001		PM 051 510 -T	PT 0101 BN	
Accessories for HPU (power supply, software, PC-cable)		PM 061 005 -T		
Relay box, backing pump				
	90 - 265 V (5 A)	PM 041 937 -AT	PM 0030 BN	
	90 - 265 V V	PM 041 938 -T	PM 0030 BN	
Connection cable relay box-TCP 350		PM 061 144 -X		
Level Converter RS 232/485		PM 051 054 -X	PM 0549 BN	
Profibus-DP gateway TIC 250		PM 051 257 -T	PM 0599 BN	
Vibration compensator, TMH	DN 63 ISO-K	PM 006 800 -X		
TMH	DN 40 ISO-KF	PM 006 799 -X		
TMU	DN 63 CF-F	PM 006 801 -X		
Coated centering ring	DN 63 ISO-K	PM 016 206 -U		
Splinter shield	DN 40 ISO-KF	PM 006 375 -X		
Coated centering ring with splinter shield	DN 63 ISO-K	PM 016 207 -U		
Coated centering ring with protective screen	DN 63 ISO-K	PM 016 208 -U		
Sealing gas valve		PM Z01 142	PM 0229 BN	
Hose nipple for the sealing gas valve	DN 16 ISO-KF-10	PF 144 020		

When ordering accessories and spare parts please be sure to state the full part number. When ordering spare parts please state additionally the unit type and unit number (see rating plate). Please use this list as an order form (by taking a copy).

Declaration of Contamination of Vacuum Equipment and Components

The repair and/or service of vacuum components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay.

The manufacturer could refuse to accept any equipment without a declaration.

This declaration can only be completed and signed by authorised and qualified staff:

1. Description of component:

- Equipment type/model: _____
- Code No.: _____
- Serial No.: _____
- Invoice No.: _____
- Delivery Date: _____

2. Reason for return:

_____

_____

_____

_____

_____

3. Equipment condition

- Has the equipment been used?

  yes ❒ no ❒

- What type of pump oil was used?

  _____

- Is the equipment free from potentially harmful substances?

  yes ❒ (go to section 5)
  no ❒ (go to section 4)

4. Process related contamination of equipment

- toxic yes ❒ no ❒
- corrosive yes ❒ no ❒
- microbiological hazard*) yes ❒ no ❒
- explosive*) yes ❒ no ❒
- radioactive*) yes ❒ no ❒
- other harmful substances yes ❒ no ❒

*) We will not accept delivery of any equipment that has been radioactively or microbiologically contaminated without written evidence of decontamination!

Please list all substances, gases and by-products which may have come into contact with the equipment:

Tradename Product name Manufacturer	Chemical name (or Symbol)	Danger class	Precautions associated with substance	Action if spillage or human contact
1.				
2.				
3.				
4.				
5.				

5. Legally Binding Declaration

I hereby declare that the information supplied on this form is complete and accurate. The despatch of equipment will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.

Name of Organisation: _____

Address: _____ Post code: _____

Tel.: _____

Fax: _____ Telex: _____

Name: _____

Job title: _____

Date: _____ Company stamp: _____

Legally binding signature: _____

Declaration of conformity

according to the EC directive:

- **Machinery 2006/42/EC (Annex II, no. 1 A)**

We hereby declare that the product cited below satisfies all relevant provisions of EC directive "Machinery" **2006/42/EC**.

In addition, the product cited below satisfies all relevant provisions of EC directive "Electromagnetic Compatibility" **2004/108/EC** .

The agent responsible for compiling the technical documentation is Mr. Jörg Stanzel, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Aßlar.

TMH 071 / TMU 071

Guidelines, harmonised standards and national standards and specifications which have been applied:

DIN EN ISO 12100-1 : 2004
DIN EN ISO 12100-2 : 2004
DIN EN ISO 14121-1 : 2007
DIN EN 1012-2 : 1996
DIN EN 61010-1 : 2002

Signatures:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(M.Bender)
Managing Director

(Dr. M. Wiemer)
Managing Director

CE/2010

PFEIFFER VACUUM

Vacuum is nothing, but everything to us!

Turbopumps

Rotary vane pumps

Roots pumps

Dry compressing pumps

Leak detectors

Valves

Components and feedthroughs

Vacuum measurement

Gas analysis

System engineering

Service

PFEIFFER VACUUM

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