

Betriebsanleitung • Operating Instructions

Translation of the Original Operating Instructions

Compact Turbo TurboDrag Pump



TMH 521
TMU 521

Inhalt

1	About this manual	3
1.1	Validity	3
1.2	Conventions	3
2	Safety	5
2.1	Safety precautions	5
2.2	Proper use	5
2.3	Improper use	6
3	Transport and storage	6
3.1	Transport	6
3.2	Storage	6
4	Product description	7
4.1	Product identification	7
4.2	Function	7
4.3	Range of application	8
5	Installation	9
5.1	Set-up	9
5.2	Preparatory work	9
5.3	Assembly	9
5.4	Connections to the turbopump	14
5.5	Connecting Pfeiffer Vacuum display and control units or PC	17
5.6	Connecting the remote control	18
5.7	Connections diagram TC	20
6	Operation	21
6.1	Commissioning	21
6.2	Operation modes	21
6.3	Function description	21
6.4	Monitoring of the operation conditions	24
6.5	Switching off and venting	25
7	Maintenance / replacement	26
7.1	Maintenance intervals and responsibilities	26
7.2	Replacing the operating fluid reservoir	26
7.3	Replacing the electronic drive unit	29
8	Decommissioning	30
8.1	Shutting down for longer periods	30
8.2	Re-starting	30
8.3	Disposal	30
9	Malfunctions	31
9.1	Rectifying malfunctions	31
10	Service	32
11	Spare parts TMH/U 521	33
12	Accessories	34
13	Technical data	35
13.1	Dimension diagrams	37
	Manufacturer's Declaration	39

1 About this manual

1.1 Validity

This operating manual is for customers of Pfeiffer Vacuum. It describes the functioning of the designated product and provides the most important information for safe use of the unit. The description follows applicable EU guidelines. All information provided in this operating manual refer to the current state of the product's development. The documentation remains valid as long as the customer does not make any changes to the product.

Up-to-date operating instructions can also be downloaded from www.pfeiffer-vacuum.net.

Applicable documents

TMH/U 521	Operating instructions
Safety information for vacuum pumps "Safety Guide"	PT 0300 BN*
Operating instructions "Pumping operations with DCU"	PM 0547 BN*
Operating instructions "Pfeiffer Vacuum protocol"	PM 0488 BN*
Manufacturer's declaration	Part of this document
Operating instructions for accessories	see section "accessories"*

*also available via www.pfeiffer-vacuum.net

1.2 Conventions

Safety instructions

The safety instructions in Pfeiffer Vacuum operating manuals are the result of risk evaluations and hazard analyses and are oriented on international certification standards as specified by UL, CSA, ANSI Z-535, Semi-S1, ISO 3864 and DIN 4844. In this document, the following hazard levels and information are considered:

DANGER
Immediate danger Death or very severe injuries occur.
WARNING
Possible danger Death or injuries may occur.
CAUTION
Possible danger Medium to slight injuries may occur.
NOTE
Command or note Command to perform an action or information about properties, the disregarding of which may result in damage to the product.

Piktograph definitions



Prohibition of an action or activity in connection with a source of danger, the disregarding of which may result in serious accidents.



Warning of a displayed source of danger in connection with operation of the unit or equipment.



Command to perform an action or task associated with a source of danger, the disregarding of which may result in serious accidents.

Instructions in the text

→ Work instruction: here you have to do something.

Abbreviations used

DCU:Display and operating unit

HPU:Handheld programming unit

TC:Electronic drive unit for turbopump

TPS:Power supply

Symbols used

The following symbols are used consistently throughout the diagrams:

- Ⓐ High vacuum flange
- Ⓑ Fore-vacuum flange
- Ⓕ Venting connection
- Ⓜ Cooling water connection
- ⊕ Air cooling
- ⚡ Electric connection
- Ⓖ Sealing gas connection

2 Safety

2.1 Safety precautions



NOTE

Duty to inform

Each person involved in the installation, operation or maintenance of the vacuum pump must read and observe the safety-related parts of these operating instructions.

- Absolute observe the safety information for vacuum pumps (PT 0300 BN) !
- The operator is obligated to make operating personnel aware of dangers originating from the vacuum pump, the pumped medium and the entire system.



NOTE

Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

- For information on the operating instructions of components, see "Accessories".
- Use original accessory parts only.

- Do not loosen any plug connection during operations.
- Wait for the rotor to reach standstill before performing work on the high vacuum flange.
- When using sealing gas, the pressure in the hose connection must be limited to 2 bar via an overpressure valve.
- Keep leads and cables well away from hot surfaces ($> 70^{\circ}\text{C}$).
- Always ensure a safe connection to the protective earthing conductor (PE, protection class I).
- Discrete operating of the turbopump and the electronic drive unit is only allowed after authorisation by Pfeiffer Vacuum. In this case the turbopump must be connected to the PE.
- The danger of an electrical shock in the case of ground leakage must be eliminated immediately (red LED flashes).
- Never fill or operate turbopump with cleaning agent.

2.2 Proper use



NOTE

CE conformity

The manufacturer's declaration becomes invalid if the operator modifies the original product or installs additional components!

- Following installation into a plant and before commissioning, the operator must check the entire system for compliance with the valid EU directives and reassess it accordingly.

- Only operate the turbopump with a proved backing pump.
- Only operate the turbopump with TC by a specified Pfeiffer Vacuum power supply. The use of other power units than the intended, is only permitted after consultation with Pfeiffer Vacuum.
- Only operate the turbopump with TC 600 in ambient conditions up to protection class IP 30.
- Only operate the turbopump together with a water cooling unit or in ambient conditions up to protection class IP 54 after installing a specified TC cover plate.

2.3 Improper use

Improper use will cause all claims for liability and guarantees to be forfeited. Improper use is deemed to be all use for purposes deviating from those mentioned above, especially:

- Pumping of corrosive or explosive media.
- Pumping of condensing vapors.
- Operation with improper high levels of gas loads.
- Operation with improper high fore-vacuum pressures.
- Operation with improper gas mode.
- Operation with improper high levels of insulated heat input.
- Venting with improper high venting rates.
- Operation of the pump in potentially radioactive areas.
- Installation in systems where the turbopumps are subjected to impact-like stress and vibrations or the effect of periodically occurring forces.
- The connection to a power supply with earthing of a direct voltage pole.
- The use of accessories, which are not named in this manual or not authorised by Pfeiffer Vacuum.

3 Transport and storage

3.1 Transport

- ➔ Reuse the transport container. Vacuum pumps should be transported or shipped in the original packing only.
- ➔ Only remove the protective covers from the high vacuum and the fore-vacuum side immediately before connection.
- ➔ Preserve the original protective covers.
- ➔ Always transport the turbopump uprightly.

3.2 Storage

- ➔ Close the flange openings by using the original protective covers.
- ➔ Close further connection ports by using the corresponding protective covers.
- ➔ Storage the pump only indoors with an ambient temperature between -25 °C and +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.

4 Product description

4.1 Product identification

Pump types

The product designations of Pfeiffer vacuum turbomolecular pumps are self-explanatory and permit conclusions about the different versions. The product designation consists of a family designation (1), the size (2), which is oriented on the pumping speed, and the properties (3) of the pump.

TMH⁽¹⁾ 521⁽²⁾ P⁽³⁾

1. Family designation	2. Model designation	3. Properties
T = Turbopump		U = Upside down version
P = Pure turbopump		P = Purge sealing gas system
M = Turbo with Holweck stage		M = Magnetic bearing
H = ISO-flange variants for high vacuum applications	521 = Model designation of the pump related to its pumping speed class	C = for corrosive gases
U = CF-flange variants for ultra-high vacuum applications		H = High throughput
D = "Drag" pump for the medium vacuum range		T = Temperature management
		Y = Installation in any orientation
		N = Integrated power supply

To correctly identify the product when communicating with Pfeiffer Vacuum, always have the information from the rating plate available.



Fig. 1: Example for a rating plate

Standard version

Turbopumps without a property, which concerns to the installation orientation will be characterized as standard version in the following (e.g. TMH 521 P).

Pump features

Characteristics	TMH 521	TMU 521
HV flange	DN 100 ISO-K DN 100 ISO-F DN 160 ISO-K DN 160 ISO-F	DN 100 CF-F DN 160 CF-F

Scope of delivery

- Turbopump
- Protective cover for the high vacuum and the fore-vacuum flange
- Operating instructions

4.2 Function

The turbopumps TMH/U 521 form a complete unit together with the electronic drive unit TC 600. For the voltage supply only Pfeiffer Vacuum power supplies may be used (e.g. TPS oder DCU). The use of other power units than the proper intended is only permitted after consultation with Pfeiffer Vacuum (specification of the power supplies on request).

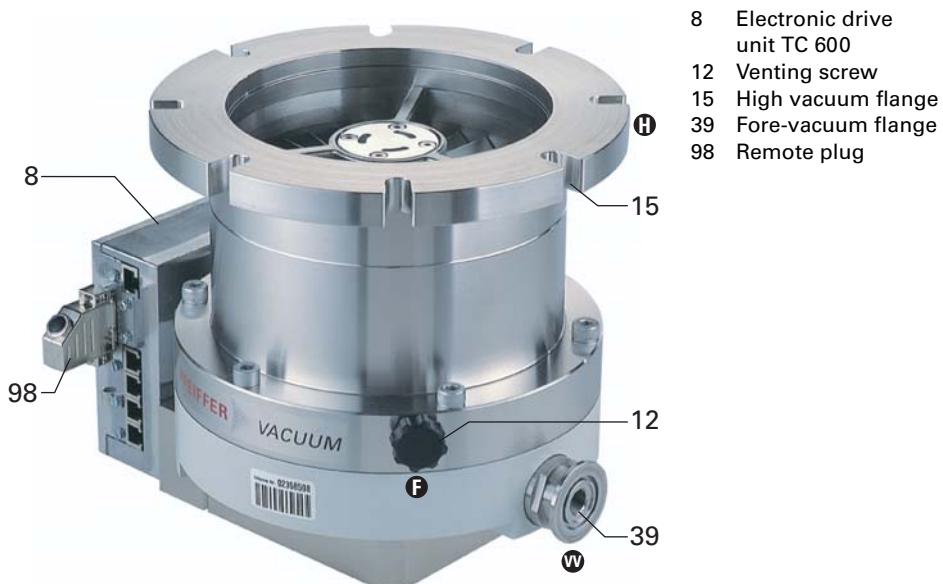


Fig. 2: View of CompactTurbo™ TMH 521 P

**NOTE****Observe the connection instructions!**

On delivery turbopumps with TC 600 are set up for operations with "Remote Control".

→ Before operating with DCU, HPU or PC the 15-pole D-Sub connector (remote plug) must be removed from the TC 600.

Cooling

- Air cooling
- Water cooling

In the case of excess temperature the electronic drive unit reduces the rotor rotation speed automatically. Depending on the application and the CompactTurbo™ different cooling variants are selectable.

Rotor bearings

- High vacuum side: maintenance-free permanent magnetic bearing.
- Fore-vacuum side: ceramic ball bearing.

4.3 Range of application

The pumps CompactTurbo™ TMH/U 521 must be installed and operated in the following ambient conditions.

Installation location	weather protected (indoors)
Temperature	+5 °C to +40 °C (up to +35 °C with air cooling)
Protection class	IP 30
Relative humidity	max. 80 %, at T ≤ 31 °C, up to max. 50% at T ≤ 40 °C
Atmospheric pressure:	77 kPa - 106 kPa
Installation altitude	2000 m max.
Degree of pollution	2
Permissible surrounding magnetic field	≤ 5 mT
Overvoltage category	II
Connection voltage TC	72 VDC ±5%

5 Installation



WARNING

Danger from the turbopump being ripped off.

If the rotor is suddenly blocked, torques of up to 6690 Nm can occur; if the turbopump is not properly fastened, it can be ripped off.

- Precisely follow installation instructions.
- Only use original components for the installation.



NOTE

Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

- For information on the operating instructions of components, see "Accessories".
- Use original accessory parts only.

5.1 Set-up

When installing the pump, observe the following conditions:

- The ambient conditions named for the area of use.
- The temperature of the high vacuum flange must not exceed 120 °C.
- The pump may be fastened to the floor only after consultation with Pfeiffer Vacuum.
- The pumps must not be installed in systems in which sporadic loads and vibrations or periodic forces have an effect on the pump.

5.2 Preparatory work

- Ensure sufficient cooling for the turbopump.
- Where magnetic fields > 5 mT are involved, a suitable shielding must be used. Check installation location and consult Pfeiffer Vacuum if needed!
- The maximum permissible rotor temperature for the turbopump is 90 °C. If high temperatures arise for process reasons, the radiated heat input must not exceed 8 W. Install suitable screening sheets, if necessary (design information on request).

5.3 Assembly

- Ensure the greatest possible cleanliness when installing any high vacuum parts. Unclean components prolong the pump-down time.
- All flange components must be grease-free, dust-free and dry at installation.
- The operating fluid reservoir is already installed and filled for the turbopumps TMH/U 521.

Splinter shield and protection screen

The installation of a Pfeiffer Vacuum centering ring with splinter shield or protection screen in the high vacuum flange protects the turbopump against foreign bodies coming from the recipient. The volume flow rate is reduced as follows.

	Reduced volume flow rate in %		
	H₂	He	N₂
Splinter shield DN 100	9	13	18
Splinter shield DN 160	5	7	14
Protection screen DN 100	2	3	5
Protection screen DN 160	1	2	4

Vibration compensator



CAUTION

Danger from the pump being ripped off

When a Pfeiffer Vacuum vibration compensator is used, suitable safety measures must be taken to compensate for the torques in case of sudden blocking.

- Definitely consult with Pfeiffer Vacuum.
- Do not exceed the maximum permitted temperature at the vibration compensator (100°C).

Mounting orientation



NOTE

Observe type-specific mounting orientations!

Pfeiffer Vacuum CompactTurbo™ pumps may only be installed in specific mounting orientations. Impermissible mounting orientations can result in contamination of the process vacuum or damage to the pump.

- Pay attention to the properties code after the model designation on the name plate!

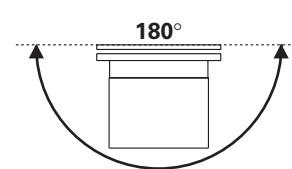


Fig. 3: Permissible installation orientations for standard versions

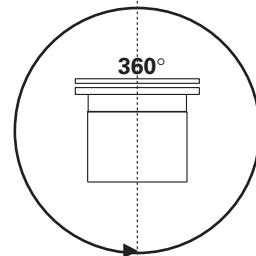
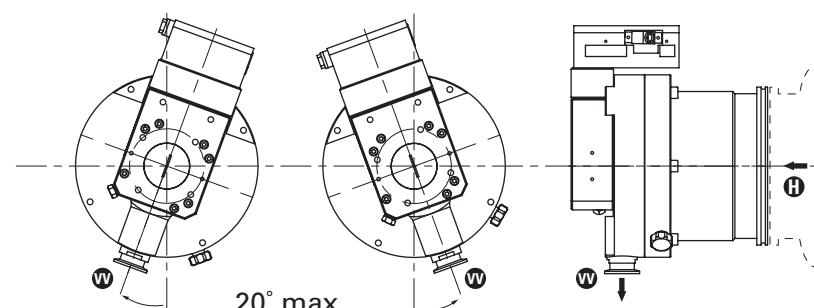


Fig. 4: Installation orientations for turbopumps with "Y" in their properties

Horizontal mounting orientation



- For horizontal installation, the fore-vacuum flange must point vertically downward ($\pm 20^\circ$), since otherwise the turbopump can be contaminated.
- Support pipes in front of the pump or remove them. No force from the pipe system may be exerted on the braced turbopump.

The maximum axial loading capacity of the high vacuum flange is 1000 N (equals 100 kg). A one-sided load on the high vacuum flange is not permitted.

Installing the high vacuum flange

In the case the rotor is suddenly blocked, the torques arising from the system and the high vacuum flange must be absorbed. Only the components listed in the following can be used to fasten the turbo pumps to the high vacuum flange. The components for installing the turbo pumps are special designs of Pfeiffer Vacuum. Observe the minimum strength of 170 N/mm² for the flange material.



DANGER

Danger to life - impermissible fastening

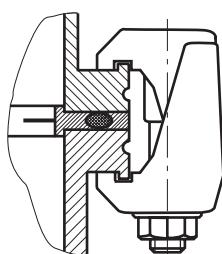
Twisting or tearing-off is possible in case the rotor is suddenly blocked due to the fastening of pumps on a vacuum chamber with different flange variants.

- Both flanges of the turbopump and the vacuum chamber must be always of the same type.
- The connection of different flange types is impermissible in any case.
- Pfeiffer Vacuum will not accept any liability for all damages resulting from impermissible fastening.

Installation of ISO-K with ISO-K flange

For the installation of the flange connections the following components are available:

Connection nominal diameter	Designation	Ordering No.
DN 100 ISO-K	Centering ring (coated)	PM 016 210-U
	Centering ring (coated) with splinter shield	PM 016 211-U
	Centering ring (coated) with protective screen	PM 016 212-U
	Bracket screw (use 16 pieces)	PF 300 110-T
DN 160 ISO-K	Centering ring (coated)	PM 016 216-U
	Centering ring (coated) with splinter shield	PM 016 217-U
	Centering ring (coated) with protective screen	PM 016 218-U
	Bracket screw (use 14 pieces)	PF 300 110-T



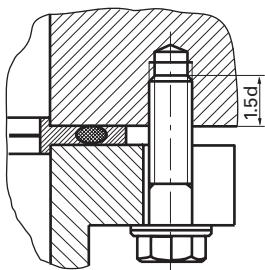
- Mind that the sealing surfaces are not damaged.
- Flange the turbopump according to the drawing and together with the component parts in the mounting material kit.
- Use the required number of bracket screws.
- Tighten the bracket screws crosswise in three steps.
- Tightening torque: 5, 15, 25 \pm 2 Nm

Installation of ISO-F with ISO-F flange

The connection types for installation of ISO-F to ISO-F flange are "hex screw and pocket hole", "stud screw and pocket hole" as well as "stud screw and through hole". The following elements are required:

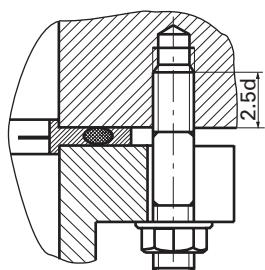
Connection nominal diameter	Designation	Ordering No.
DN 100 ISO-F	Centering ring (coated)	PM 016 210-U
	Centering ring (coated) with splinter shield	PM 016 211-U
	Centering ring (coated) with protective screen	PM 016 212-U
	Hexagon screw (use 8 pieces)	N 3024 428 1C
	Stud screw with nut (use 8 pieces each, for clearance hole use 16 nuts and washers)	N 3169 428 2C N 3433 047 8P
DN 160 ISO-F	Centering ring (coated)	PM 016 216-U
	Centering ring (coated) with splinter shield	PM 016 217-U
	Centering ring (coated) with protective screen	PM 016 218-U
	Hexagon screw (use 8 pieces)	N 3024 479 1C
	Stud screw with nut (use 8 pieces each, for clearance hole use 16 nuts)	N 3169 485 2C N 3433 051 8P

Hexagon screw and pocket hole



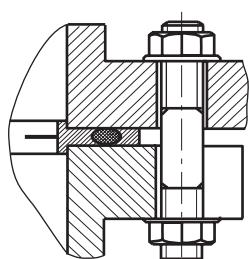
- Mind that the sealing surfaces are not damaged.
- Flange the turbopump according to the drawing and together with the component parts in the mounting material kit.
- Use the required number of hex screws.
- For a flange material with a strength of $> 270 \text{ N/mm}^2$ screw in the hex screw $1,5 \text{ d}$ into the blind hole.
- Tighten the hex screws crosswise in three steps.
- Tightening torque DN 100: 5, 12, $22 \pm 2 \text{ Nm}$
- Tightening torque DN 160: 10, 20, $38 \pm 3 \text{ Nm}$

Stud screw and pocket hole



- Mind that the sealing surfaces are not damaged.
- Flange the turbopump according to the drawing and together with the component parts in the mounting material kit.
- Use the required number of stud screws and nuts.
- For a flange material with a strength of $170 - 270 \text{ N/mm}^2$ screw in the hex screw $2,5 \text{ d}$ into the blind hole.
- Tighten the nuts crosswise in three steps.
- Tightening torque DN 100: 5, 12, $22 \pm 2 \text{ Nm}$
- Tightening torque DN 160: 10, 20, $38 \pm 3 \text{ Nm}$

Stud screw and through hole



- Mind that the sealing surfaces are not damaged.
- Flange the turbopump according to the drawing and together with the component parts in the mounting material kit.
- Use the required number of stud screws and nuts.
- Tighten the nuts crosswise in three steps.
- Tightening torque DN 100: 5, 12, $22 \pm 2 \text{ Nm}$
- Tightening torque DN 160: 10, 20, $38 \pm 3 \text{ Nm}$

Installation of CF-F flanges



NOTE

Preservation of sealing capacity

Observe the following to preserve sealing capacity:

- Touch seals only with gloves.
- Make sure sealing lips are undamaged.

The connection types for installation of CF-F to CF-F flange are "stud screw and pocket hole" as well as "hex screw and through hole". The following elements are required:

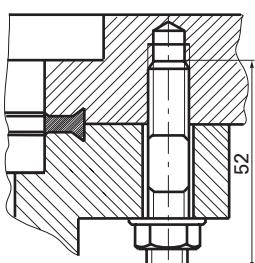
- A set of mounting material for the respective type of connection
- A copper seal
- A protective screen or splinter shield can optionally be used

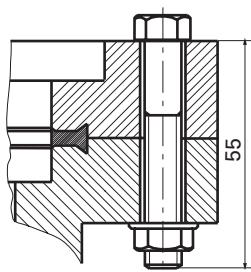
Connection nominal diameter	Designation	Ordering No.
DN 100 CF-F	Hexagon bolt M8 with washer and nut (25 pieces) ¹⁾	PF 505 003-T
	Stud screw M8 with washer and nut (25 pieces) ¹⁾	PF 507 003-T
	Copper seal (10 pieces) ¹⁾	PF 501 410-T
	Copper seal, silvered (10 pieces) ¹⁾	PF 501 510-T
	Splinter shield	PM 016 315
	Protective screen	PM 016 336
DN 160 CF-F	Hexagob bolt M8 with washer and nut (25 pieces) ¹⁾	PF 505 003-T
	Stud screw M8 with washer and nut (25 pieces) ¹⁾	PF 507 003-T
	Copper seal (10 pieces) ¹⁾	PF 501 416-T
	Copper seal, silvered (10 pieces) ¹⁾	PF 501 516-T
	Splinter shield	PM 016 318
	Protective screen	PM 016 339

¹⁾number of pieces in bracket is the delivery quantity

Stud screw and pocket hole

- If used: Insert protective screen or splinter shield with the clamping lugs downward into the high vacuum flange.
- Place the seal exactly in the hollow.
- Connect the flanges of nominal diameter DN 100 using **16** stud screws (M8) with washers and nuts.
- Connect the flanges of nominal diameter DN 160 using **20** stud screws (M8) with washers and nuts.
- Tighten the nuts circularly.
- Tightening torque: 22 ± 2 Nm
- After this, check the torque, since flowing of the sealing material may make it necessary to retighten the screws.



Hexagon screw and through hole

- If used: Insert protective screen or splinter shield with the clamping lugs downward into the high vacuum flange.
- Place the seal exactly in the hollow.
- Connect the flanges of nominal diameter DN 100 using **16** stud screws (M8) with washers and nuts.
- Connect the flanges of nominal diameter DN 160 using **20** stud screws (M8) with washers and nuts.
- Tighten the nuts circularly.
- Tightening torque: $22 \pm 2 \text{ Nm}$
- After this, check the torque, since flowing of the sealing material may make it necessary to retighten the screws.

5.4 Connections to the turbopump

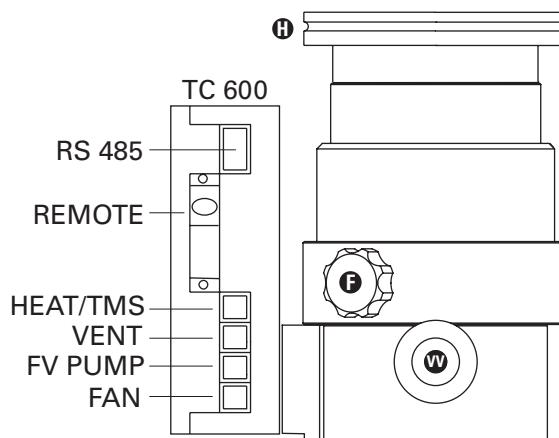


Fig. 5: Connection designations for turbopumps with electronic drive unit TC 600

Connecting the fore-vacuum side

Recommendation: As backing pump, use a dry-compressing diaphragm pump or rotary vane pumps from the Pfeiffer Vacuum programme. The backing pump must generate a vacuum pressure of $\leq 5 \text{ mbar}$.



WARNING

Damage to health due to poisonous gases

Process gases can damage health and contaminate the environment.

- Safely guide away the gas emission from the backing pump!
- Observe all safety recommendations of the gas producer.

- With rigid pipe connections: Install bellows for attenuation of vibrations in the connection line.
- Connect the fore-vacuum line with small-flange components or threaded hose couplings. Do not narrow the free cross section of the fore-vacuum flange!
- The backing pump is connected electrically via a relay box. Insert the control line of the relay box into the "FV PUMP" connection of the TC 600 .

Cooling

Pfeiffer Vacuum turbopumps must be cooled by means of air or water cooling.

- When operating the pump with more than 50 % of the maximum gas load, sealing gas must be used to ensure rotor cooling.
- In case of increased backing pressure ($> 0.1 \text{ mbar}$) and/or operation with gas loads, either air or water cooling may be used.
- Generally use water cooling if the ambient temperature is $> +35^\circ \text{C}$.

- ➔ Connect air cooling for the corresponding pump type in accordance with the accessory's operating manual.
- ➔ Connect water cooling for the corresponding pump type in accordance with the accessory's operating manual.

Venting valve

The TVF 005 venting valve is used for automatic flooding in case of shut-down or power failure. The maximum permissible pressure at the venting valve is 1.5 bar absolute.

Installation of the venting valve

- ➔ Unscrew the venting screw from the venting connection of the turbopump.
- ➔ Screw in the venting valve with seal ring.

Electrical connection

- ➔ Plug the control lead of the venting valve in accordance with the accessory's operating instructions.
- ➔ Select the venting mode of the venting valve via the DCU, HPU or serial interface RS485.

Casing heating unit

The turbopump and vacuum chamber can be heated to reach the final pressure more quickly. Use of a casing heating unit makes sense only for pumps with the high vacuum flange in stainless steel design. The heating duration depends on the degree of contamination as well as the final pressure to be reached and should be at least 4 hours.



CAUTION

Dangerous excess temperatures

Process-related high temperatures can result in impermissible excess temperatures and thus damage to the turbopump.

- ➔ Always use water cooling when a casing heating unit is used.



WARNING

Danger of burns

High temperatures arise when the turbopump or vacuum chamber are baked out. As a result, there is a danger of burns from touching hot parts, even after the housing heater is switched off!

- ➔ Thermally insulate heating sleeve, pump housing and vacuum chamber, if possible during installation.
- ➔ Do not touch heating sleeve, pump casing and vacuum chamber during bake out.
- ➔ Connect the casing heating for the corresponding pump type in accordance with the accessory's operating manual.

Sealing gas valve

Only pumps with the pump designation **P** (see rating plate) are equipped for connection of sealing gas. The turbopump must be operated with sealing gas to protect it, such as in the case of corrosive or dusty processes. The connection is made via a sealing gas valve.

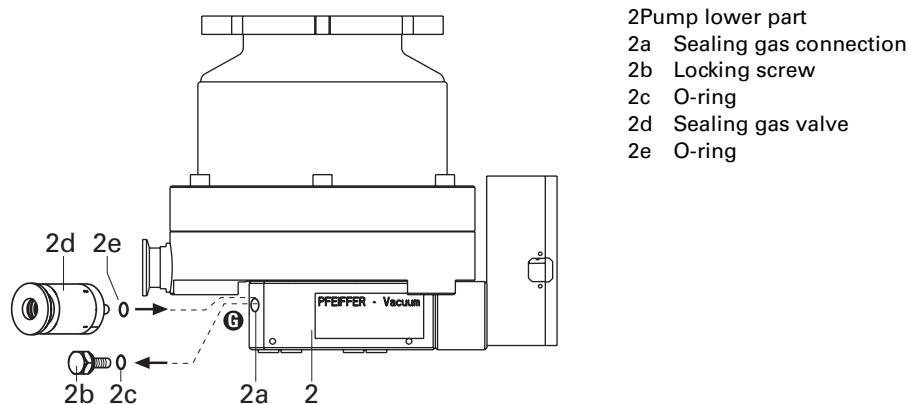


Fig. 6: Connecting the sealing gas valve

- Unscrew the screw plug with sealing ring out of the sealing gas connection of the turbopump.
- Screw the sealing gas valve with seal ring into the purge gas connection.
- Obtain details on adjusting the sealing gas quantity from the corresponding operating manual.
- When operating the pump with more than 50 % of the maximum gas load, sealing gas must be used to ensure rotor cooling.

Connecting the electronic drive unit to the power supply

The turbopumps CompactTurbo™ TMH/U 521 form a single unit with the electronic drive unit. For voltage supply, use only Pfeiffer Vacuum power supplies (e.g. TPS 300 or DCU 300). Use other power supplies only after consultation with Pfeiffer Vacuum and comparison with valid specifications (specifications of the power supplies on request).



WARNING

Danger of electric shock

In case of defect, the parts connected to the power supply are under voltage.

- Always keep the mains connection freely accessible so you can disconnect it at any time.

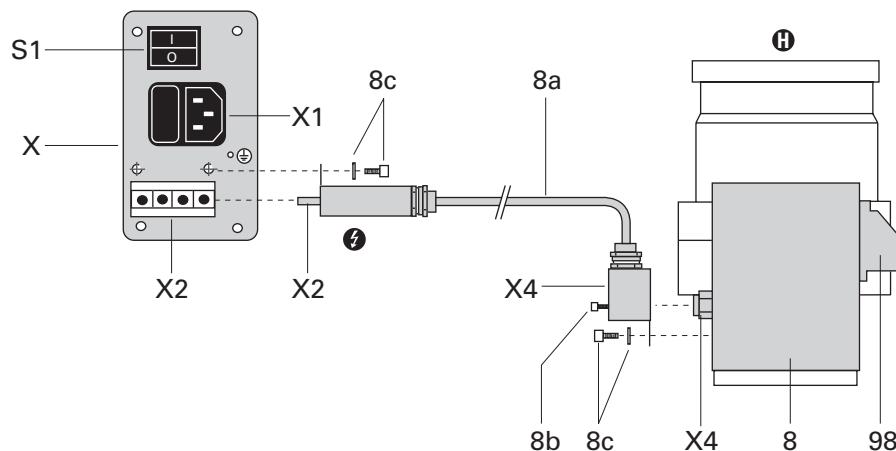


Fig. 7: TC 600 connection to power supply TPS or DCU, installation drawing for shielded cable

- 8Electronic drive unit
- 8a Connecting cable TC 600 - TPS/DCU
- 8b Screw
- 8c Screw with lock washer
- 98 Remote plug

- X Power supply unit TPS or DCU
- X1 Mains connection TPS/DCU
- X2 Connection connecting cable - TPS/DCU
- X4 Connection connecting cable - TC
- S1 Switch ON/OFF

- Unscrew the screw with lock washer 8c from the TC 600 (below connection X4).¹⁾
- Insert the X4 plug on the 8a connection cable into the X4 connection on the TC 600 and screw in the 8b screw.
- Fasten the X4 plug to the TC 600 with a screw and lock washer 8c.¹⁾
- Connect the X2 plug on the 8a connection cable to the TPS 300/DCU 300 power supply pack at the X2 connection.
- Fasten the X2 plug to the power supply with a screw and lock washer 8c (included with the cable).¹⁾

¹⁾ Only for PM 051 843 -T shielded connection cable (siehe S. 34, Kap. 12).

After operating voltage is applied, the TC 600 performs a self-test to check the supply voltage. The supply voltage for the turbopumps TMH/U 521 is 72 VDC \pm 5% in accordance with standard EN 60 742.

5.5 Connecting Pfeiffer Vacuum display and control units or PC



NOTE

Observe the connection instructions!

On delivery turbopumps with TC 600 are set up for operations with "Remote Control".

- Before operating with DCU, HPU or PC the 15-pole D-Sub connector (remote plug) must be removed from the TC 600.

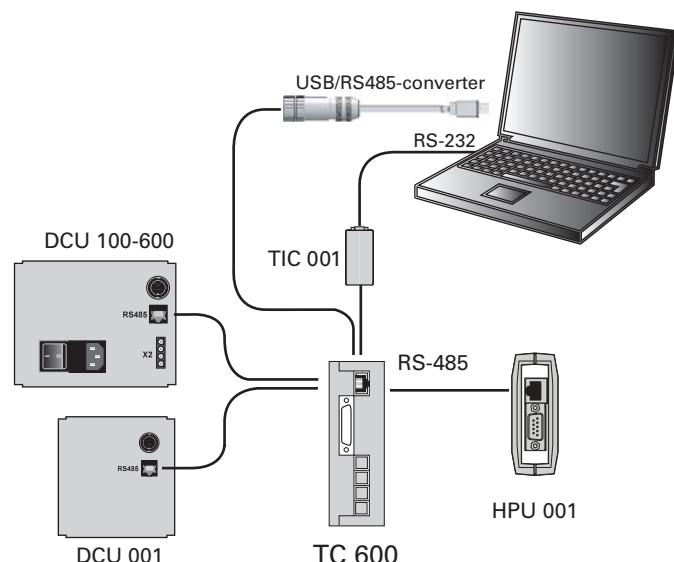


Fig. 8: Connecting the serial interface RS485

An external operating part (DCU **or** HPU 001) **or** an external computer can be connected via the connection with the designation "RS485" on the electronic drive unit. The interface is securely separated galvanically from the maximum occurring supply voltage of the TC 600. The electrical couplings are optically decoupled internally.

Connections

The connection of a RS232- oder USB-interface is possible via a TIC 001 or the USB/RS485-converter.

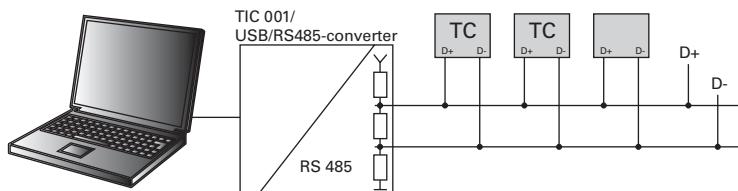
Designation	Value
Serial interface	RS485
Baud rate	9600 Baud
Data file word length	8 bit
Parity	keine (no parity)

Designation	Value
Start bits	1
Stop bits	1..2



Pin	Assignment
1	not connected
2	+24 V output loadable with ≤ 210 mA
3	not connected
4	not connected
5	RS485: D+
6	Gnd
7	RS485: D-
8	not connected

Cross-linking via the connection RS485



CAUTION

Danger of electric shock

The insulation measures of the bus system are designed only for use with safety extra-low voltage.

→ Connect only suitable devices to the bus system.

→ The connections must be made in accordance with the specification of the interface RS485.

→ Connect all units with D+ (pin 5 / RS485) and D- (pin 7 / RS485) to the bus.

- The group address of the TC 600 is 960.
- All units connected to the bus must have differing serial interface addresses (parameter 797).
- All switched on remote functions have priority over the serial interface functions.
- Refer to the component operating instructions for detailed information concerning operation procedures and electrical data of the interface RS485.

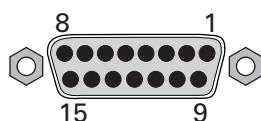


NOTE

Connection to an external bus system

The integration into an external bus system (e.g. Profibus DP, DeviceNet) is possible via connection gateway TIC 250 or TIC 260. Thus a synchronous use of interface RS485 on the TC 600 is not possible.

5.6 Connecting the remote control



Remote control options are provided via the 15-pole D-Sub connector with the designation "REMOTE" on the TC 600. The inputs 2 - 6 are activated by connecting them with +24 V at Pin 1 (active high) (see S. 20, Kap. 5.7). When connecting supply voltage the turbopump is started.

• **On delivery: Pin 1, Pin 2, Pin 3 and Pin 4 are bridged in the remote plug.**

→ Shielded cable must be used.

→ Connect the shielding on the plug side for the TC 600 to the TC housing.

Pin assignment and function of the remote plug

Reference voltage

Pin	Function		
1	+24 V	Reference voltage level for all remote in and outputs	
10	Ground	Ground potential for all remote in- and outputs	

Inputs

Pin	Function	Open (low)	Closed (high)
2	Venting release	Venting blocked	Venting released
3	Motor turbopump	Motor off	Motor on: the turbopump is driven, current flows through the motor coils
4	Pumping station	Pumpstand aus	Pumping station on: the turbopump is driven, backing pump control via relay box, the air cooling unit runs
5	Heating	Heizung aus	Heating on: the heating is switched on once the rotation switchpoint is attained. The heating is switched off, if the rotation switchpoint is not attained
	Option: Sealing gas connection control ¹⁾	Sealing gas valve closed	Sealing gas valve open
	Reset		Reset: by supplying a pulse ($T < 2s$) with an amplitude of 24V a malfunction acknowledgement can be processed
6	Standby	Standby off	The turbopump is controlled to 66% of its nominal rotation speed
7	Rotation speed setting mode	Rotation speed setting mode is off	The rotation speed can be modified by feeding a PWM signal to this pin or via RS485 ¹⁾

¹⁾The option must be set via serial interface RS485 (refer to operating instructions PM 0547 BN, Pumping Operation With DCU)

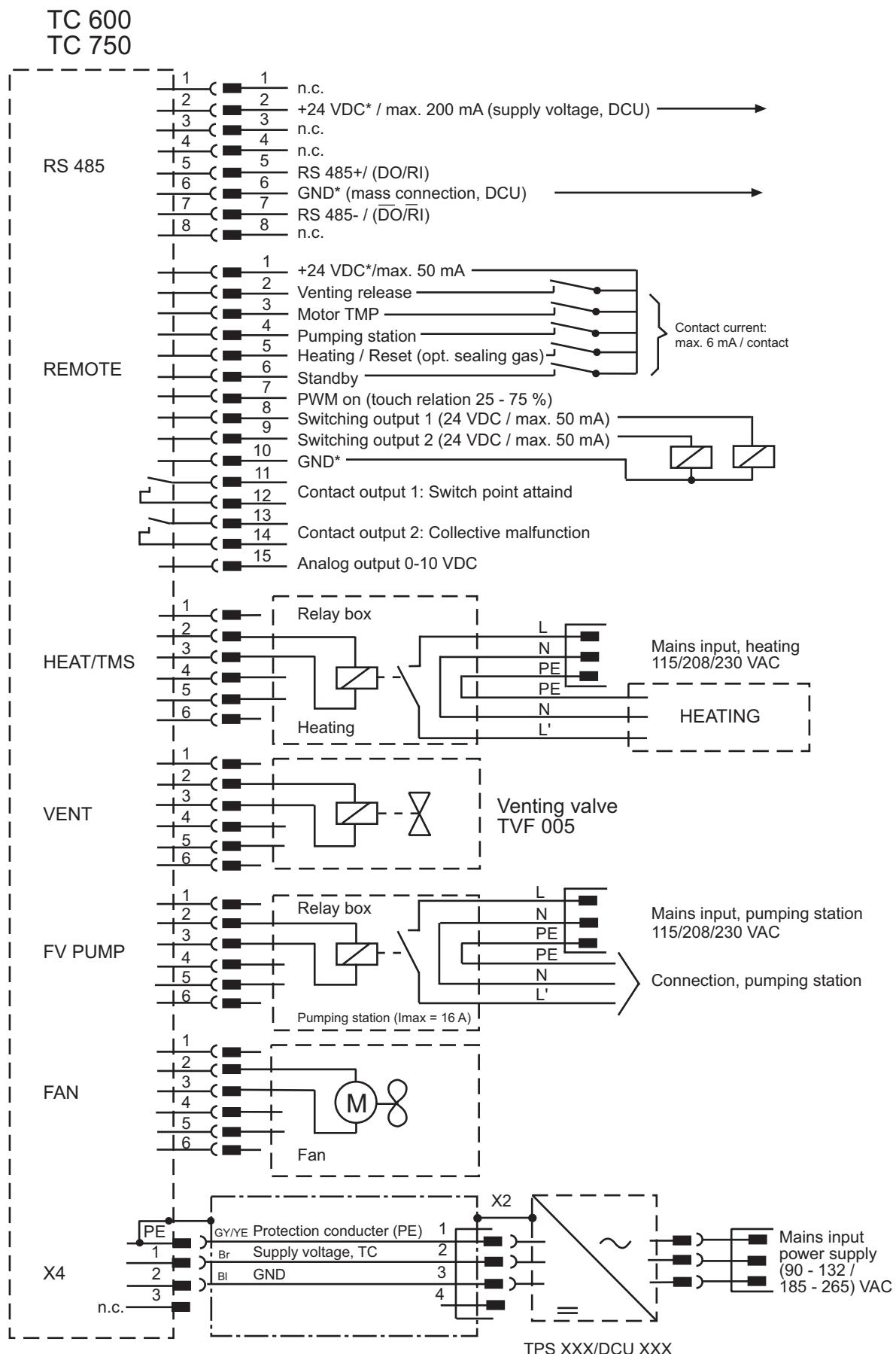
Outputs

Pin	Function	Open (low)	Closed (high)
8	Switching output 1	Rotation speed switchpoint not attained	Rotation speed switchpoint attained; output can be loaded with 24 V/50 mA
9	Switching output 2	Collective malfunction message	failure-free operation; output can be loaded with 24 V/50 mA
11	Contact output 1	Rotation speed switchpoint not attained	contact ²⁾ between Pin 11 and Pin 12 is closed, if the rotation switchpoint is exceeded
12	Contact output 1		
13	Contact output 2	Collective malfunction message	contact ²⁾ between Pin 13 and Pin 14 is closed at failure-free operation
14	Contact output 2		
15	Analog output	Output voltage is proportional to the rotation speed: 0 - 10 VDC = 0 - 100% *f _{end} / load R ≥ 10 kΩ (optional current/power) ¹⁾	

¹⁾The option must be set via serial interface RS485 (refer to operating instructions PM 0547 BN, Pumping Operation With DCU)

²⁾The following technical data are applicable for the contacts: U_{max} = 50 VDC, I_{max} = 1 A

5.7 Connections diagram TC



6 Operation

6.1 Commissioning

The following settings are permanently programmed in the TC 600 ex factory.

- Run-up time: 15 min
- Rotation speed switchpoint: 80%
- Automatic venting: 50%

→ Settings are possible via the RS485 on the TC 600 by using DCU, HPU or PC.
 → When water cooling is used: Open cooling water supply and check the flow.
 → Plug connecting cable between the TC 600 and the power supply.

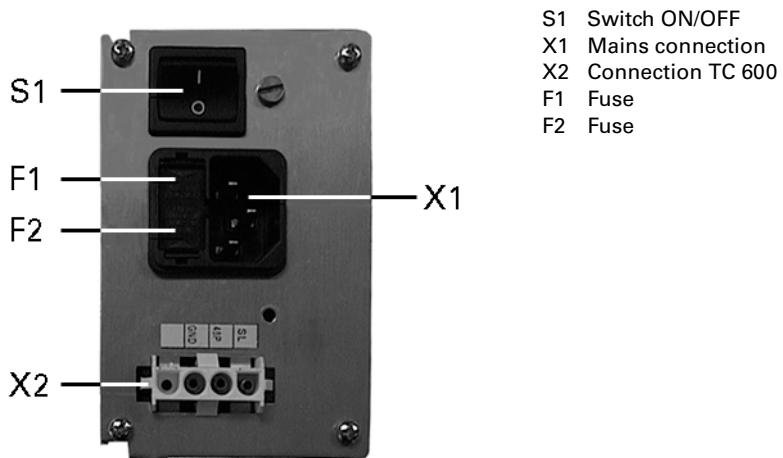


Fig. 9: Rear panel of power supply TPS

6.2 Operation modes

The following operation modes are available:

- Operation without operating panel
- Operation via remote control unit
- Operation via RS485 with Pfeiffer Vacuum display and control units or PC

6.3 Function description



NOTE

Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

→ For information on the operating instructions of components, see "Accessories".
 → Use original accessory parts only.



WARNING

Danger due to open high vacuum flange

The rotor of the turbopump turns at high speed. If the high vacuum flange is open, there is a danger of cut injuries and that the pump can be destroyed by objects falling into it.

→ Never operate the pump with an open high vacuum flange.

Operation without operating unit

- **On delivery: Pin 1, Pin 2, Pin 3 and Pin 4 are bridged in the remote plug.**
- For operation without the control unit, the 15-pole D-Sub plug must be in the "Remote" connection on the TC 600.

→ Switch on the supply voltage with switch S1 on the power supply.

When air cooling is used: the cooling fan is switched on automatically. Once the self test has been successfully completed on the TC 600 (approx. 10 seconds), the turbopump and the backing pump - if connected - begin to operate.

Operation with DCU or HPU

- Switch on the supply voltage with switch S1 on the power supply or on the DCU 300.
- Settings are possible via the RS485 on the TC 600 by using DCU, HPU or PC.
- Observe the following documents for operation with Pfeiffer Vacuum display and control units:
 - Operating instructions DCU
 - Operating instructions HPU 001
 - Pumping operations with DCU

**NOTE****Observe the connection instructions!**

On delivery turbopumps with TC 600 are set up for operations with "Remote Control".

→ Before operating with DCU, HPU or PC the 15-pole D-Sub connector (remote plug) must be removed from the TC 600.

Operation with remote control

Remote control options are provided via the 15-pole D-Sub connector with the designation "REMOTE" on the TC 600. The inputs 2 - 6 are activated by connecting them with +24 V at Pin 1 (active high) (*siehe S. 20, Kap. 5.7*). When connecting supply voltage the turbopump is started.

→ Remove the remote plug from the TC 600 and connect a remote control unit. Pin assignment of the connector according to table (*siehe S. 18, Kap. 5.6*).

Venting release (option)

Venting released (automatic venting)

Venting blocked (no venting)

- Settings are possible via the RS485 on the TC 600 by using DCU, HPU or PC.

Turbopump motor

After the pumping station is switched on and the self-test successfully completed (duration approx. 10 seconds), the turbopump is set into operation. During operation, the turbopump can be switched off and on again, while the pumping station remains switched on. The turbopump is not vented thereby.

Pumping station

Connected pumping station components (e.g. backing pump, venting valve, air cooling) are triggered and, with "turbopump motor" input simultaneously activated, the turbopump is set into operation after a successfully completed self-test (duration approx. 10 seconds).

Heating/Reset

Heating (Option)

After the rotation speed switchpoint is reached, the heating is switched on and switched off again when this point is fallen below. A purge gas valve can optionally be triggered here.

Reset

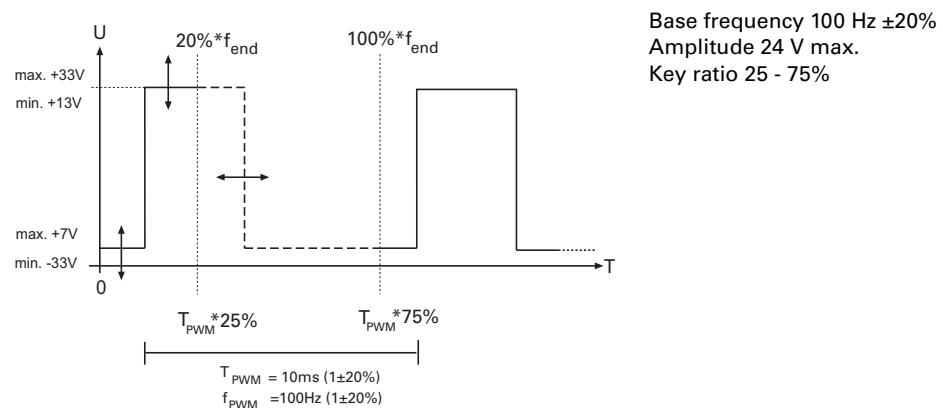
The heating input is assigned a dual function ((siehe S. 18, Kap. 5.6), Point 5 "Reset").

Standby

With the use of "Standby", the turbopump can be operated either at 66% of the nominal rotation speed (Standby ON) or at the nominal rotation speed (Standby OFF).

Speed actuation mode via PWM input

A pulse-width-modulated (PWM) signal permits setting the speed within the range of 20 - 100% of the nominal rotation speed.



If a signal is present, the pump runs up to the final rotation speed. Optionally, a PWM adapter box for turbopumps can be connected.

Switch outputs

The switch outputs 1 and 2 can be loaded with a maximum 24 V / 50 mA per output. The following functions are assigned to the switching outputs:

- Switching output 1: Active high after the rotation speed switchpoint is reached. The switch-point for the turbopump is set at 80% of the nominal rotation speed. It can, for example, be used for a "pump operational" message.
- Switching output 2: Active low in case of malfunction(common error message).

A relay is connected between Pin 10 (earth) and the respective switching output Pin 8 or Pin 9.

Contact outputs

- Relay contact 1: The contact between Pin 11 and Pin 12 is closed, if the rotation switchpoint is exceeded.
- Relay contact 2: The contact between Pin 13 and Pin 14 is closed at failure-free operation.

Analogue output

Over the analog output, a speed-proportional voltage (0-10 VDC equals 0 - 100 % $*f_{end}$) can be picked up (load $R \geq 10 \text{ k}\Omega$). Additional functions (optionally current/power) can be assigned to the analog output via DCU, HPU or PC.

Gas-type-dependent operation

With gas load and high rotation speed, the rotor heats up strongly. To avoid overheating, the TC 600 has implemented a power-rotation speed-characteristic, whereby the pump can be operated at every rotation speed with the maximum allowable gas load without danger of damage. The maximum power depends on the gas type. Two characteristics are available in order to completely exhaust the pump's capacity for each gas type.

- "Gas mode 0" (factory setting) for gases with the molecular mass ≥ 40 , e.g. Ar
- "Gas mode 1" for all lighter gases.



CAUTION

Danger of the pump being destroyed

Pumping of gases with the molecular mass ≥ 40 in the wrong gas mode can lead to destruction of the pump.

- ➔ Ensure the gas mode is correctly set.
- ➔ Contact Pfeiffer Vacuum before using gases with a greater molecular mass.

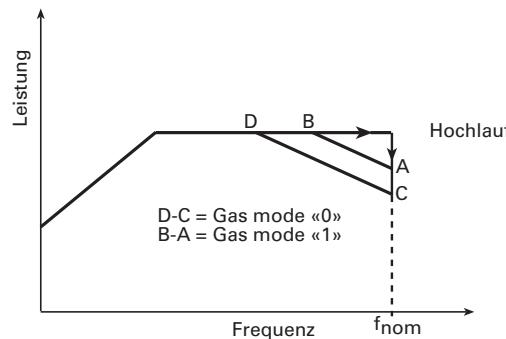


Fig. 10: Gas mode power characteristic

- Settings are possible via the RS485 on the TC 600 by using DCU, HPU or PC.
- Vertex of the power characteristic (siehe S. 35, Kap. 13)

The turbopump is always run up under maximum power in order to minimise the run-up time. When the set rotation speed is achieved, the chosen power characteristic is automatically switched over. When the gas-type-dependent maximum power is exceeded, the rotation speed of the turbopump is reduced until an equilibrium between permissible power and gas friction is attained.

- ➔ To avoid rotation-speed fluctuations, Pfeiffer Vacuum recommends setting the equilibrium frequency or a somewhat lower frequency in speed actuation operation.

6.4 Monitoring of the operation conditions

Operating mode display via LED

LEDs in the front panel of the TC 600 show basic operating conditions of the turbopump and TC. A differentiated malfunction and warning display is possible only for operation with DCU or HPU.

LED green	LED red	Cause
glows		power supply is o.k. function "pumping station on" is carried out
flashes short (1/12s active)		power supply is o.k. pumping station is off
blinks (1/2s active)		voltage drop; mains power failure
	glows	Collective malfunction, e.g. - run-up time failure - excess temperature of the pump - switching output 2 active (low)

LED green	LED red	Cause
	blinks (1/2s active)	Warning, e.g. – ground leak of the supply voltage – mains power failure

Temperature monitoring

The motor current is reduced in case of impermissible motor temperature or impermissibly high housing temperature. This can cause the motor to fall below the set rotation speed switchpoint and so result in switching off of the turbomolecular pump.

6.5 Switching off and venting

Switching off

After the turbopump is switched off, it must be vented to avoid contamination due to particles streaming back from the fore-vacuum side.

- ➔ Close the fore-vacuum line. Switch off the backing pump or close a fore-vacuum valve.
- ➔ Switch off the turbopump on the control unit or via remote control.
- ➔ Venting (possibilities, see below)
- ➔ For water cooling: Shut off the water supply.

Vent modes

Manually Venting

- ➔ Open the venting screw (included) in the venting connection of the pump about one turn.

Venting with TVF 005 venting valve

- ➔ Venting with venting valve on the "REMOTE" connection or release via RS485.
- ➔ Settings are possible via the RS485 on the TC 600 by using DCU, HPU or PC.

Venting frequency	Switch off the pumping station	Mains power failure ¹⁾
< 415 Hz (corresponds to 50 % of the final rotation speed)	venting valve opens for 3600 s (1 h, works setting)	Venting valve opens with achievement of the venting frequency and closes at approx. 15% of final rotation speed

¹⁾When mains power is restored the venting procedure is interrupted.

Basic information for the rapid venting

Venting of the vacuum chamber in two steps. Ask for details on individual solutions from Pfeiffer Vacuum.

- ➔ Vent for 20 seconds at a rate of pressure rise of max. 15 mbar/s.
 - The valve cross section for the venting rate of 15 mbar/s must be adapted to the size of the vacuum chamber.
 - For small vacuum chambers, use the Pfeiffer Vacuum TVF 005 venting valve.
- ➔ Then vent with an additional venting valve of any desired size.

7 Maintenance / replacement



WARNING

Contamination of parts and operating fluid by pumped media is possible.

Poisoning hazard through contact with materials that damage health.

- ➔ In the case of contamination, carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.
- ➔ Decontaminate affected parts before carrying out maintenance work.



NOTE

Disclaimer of liability

Pfeiffer Vacuum accepts no liability for personal injury or material damage, losses or operating malfunctions due to improperly performed maintenance. The liability and warranty entitlement expires.

7.1 Maintenance intervals and responsibilities

- Clean the turbopump externally with a lint-free cloth and little industrial alcohol.
- You can replace the operating fluid reservoir and electronic drive unit yourself.
- Change the operating fluid reservoir at least every 3 years.
 - Clarify shorter change intervals for extreme loads or impure processes with Pfeiffer Vacuum Service.
- Change the turbopump bearing at least every 3 years.
 - Contact Pfeiffer Vacuum Service.
 - Clarify shorter change intervals for extreme loads or impure processes.
- For all other cleaning, maintenance or repair work, please contact your Pfeiffer Vacuum service location.

7.2 Replacing the operating fluid reservoir



WARNING

Poisoning hazard through contact with materials that damage health.

The operating fluid reservoir and parts of the pump may contain toxic substances from the pumped media.

- ➔ Dispose of operating fluid reservoir in accordance with the applicable regulations. Safety data sheet on request or under www.pfeiffer-vacuum.net
- ➔ Prevent health hazards or environmental damage due to contamination by means of appropriate safety precautions.
- ➔ Decontaminate affected parts before carrying out maintenance work.



CAUTION

Pay attention to pump types

The procedure for changing the lubricant reservoir depends on the pump type. Incorrect execution can result in destruction of the pump.

- ➔ Pay attention to the properties code after the model designation on the name plate!



NOTE

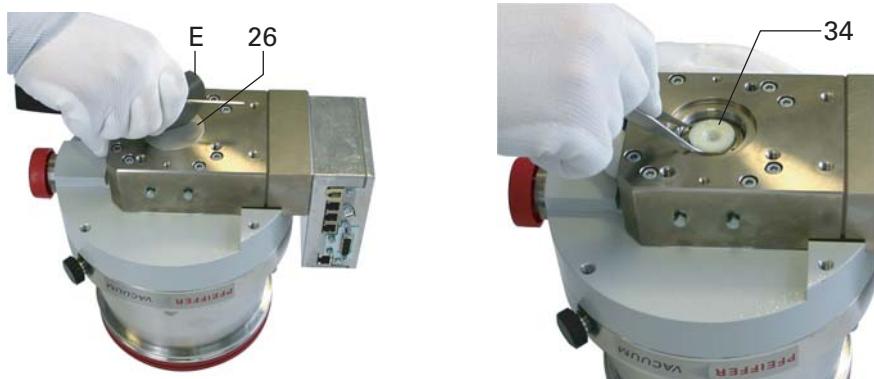
Lubricant filling

The lubricant reservoir is sufficiently filled with TL 011 lubricant.

- ➔ Do not add additional lubricant.

Standard version

- Turn off the vacuum pump, vent to atmospheric pressure and allow to cool, if necessary.
- Remove the vacuum pump from the system, if necessary.
- Close the flange openings by using the original protective covers.
- Turn the turbopump over onto the closed high vacuum flange.



- Screw out the end cover on the bottom of the turbopump with special tool E. Pay attention to O-ring.
- Using tweezers, lift out the lubricant reservoir.

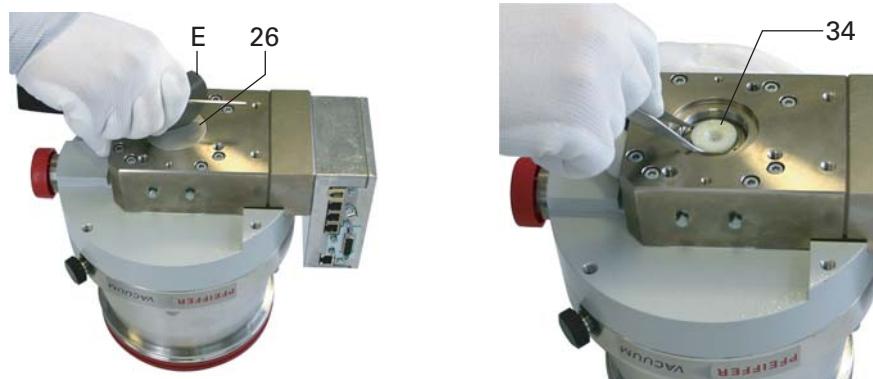


26 End cover
 34 Lubricant reservoir
 60 O-ring
 E Special tool
 PV M40 569

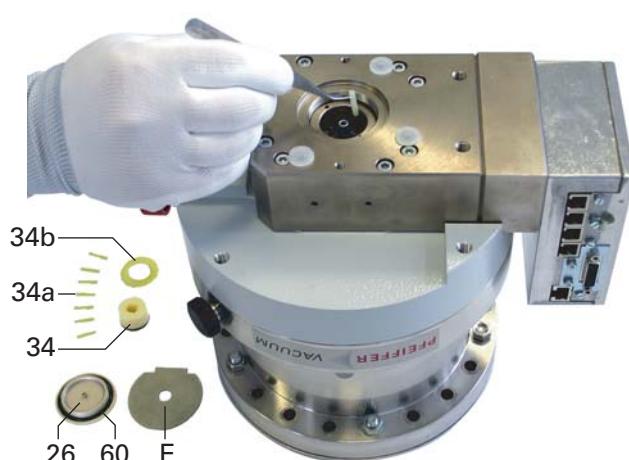
- Remove impurities from the turbopump and the end cover with a clean, lint-free cloth. **Do not use any cleaning fluids!**
- Push the new lubricant reservoir into the turbopump up to the O-ring.
- Screw in the end cover with O-ring. The operating fluid reservoir is brought into the correct axial position with the end cover.

Y Version

- ➔ Turn off the vacuum pump, vent to atmospheric pressure and allow to cool, if necessary.
- ➔ Remove the vacuum pump from the system, if necessary.
- ➔ Close the flange openings by using the original protective covers.
- ➔ Turn the turbopump over onto the closed high vacuum flange.



- ➔ Screw out the end cover on the bottom of the turbopump with special tool E. Pay attention to O-ring.
- ➔ Using tweezers, lift out the lubricant reservoir.
- ➔ Using tweezers, pull out Porex rods (8 pieces).



26 End cover
 34 Lubricant reservoir
 34a Porex rod
 34b Felt washer
 (only for service)
 60 O-ring
 E Special tool PV M40 569

**NOTE****Felt washer in the lubricant reservoir packet**

The felt washer in the operating fluid reservoir is necessary only for special service work and is replaced by Pfeiffer Vacuum Service.

- ➔ Remove impurities from the turbopump and the end cover with a clean, lint-free cloth. **Do not use any cleaning fluids!**
- ➔ Using tweezers, insert new Porex rods (8 pieces).
- ➔ Push the new lubricant reservoir into the turbopump up to the O-ring.
- ➔ Screw in the end cover with O-ring. The operating fluid reservoir is brought into the correct axial position with the end cover.

7.3 Replacing the electronic drive unit



WARNING

Danger of electric shock

Even after mains power is switched off, the subsequently running turbopump delivers voltages $> 50 \text{ V}_{\text{eff.}}$. There is a danger of electric shock when touching open contacts on conducting parts.

- Never separate the electronic drive unit from the pump when the mains power is connected or the rotor is running.
- Wait for the turbopump to reach complete standstill.
- Disconnect the electronic drive unit from the mains.



NOTE

Operating parameters of the electronic drive unit

The factory operating parameters are always preset with replacement shipments.

- The use of a HPU enables the storing and the reuse of an existing parameter record.
- Reset any individually changed application parameters.
- Refer to "Pump operation with DCU" (PM 0547 BN).

8 Electronic drive unit
9 Allen head screw

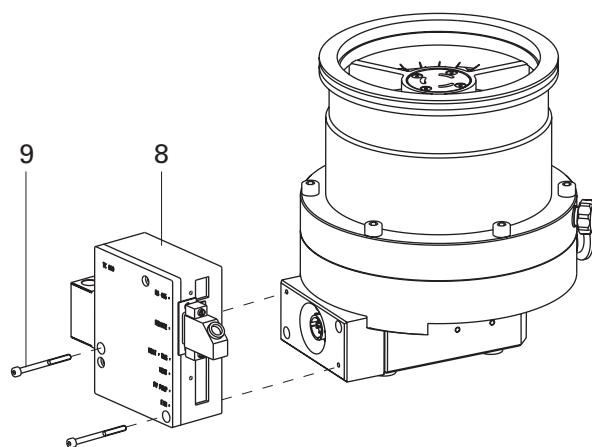


Fig. 11: Assembly / disassembly of the TC 600

- Do not exercise any mechanical load on the electronic drive unit.
- Turn off the vacuum pump, vent to atmospheric pressure and allow to cool, if necessary.
- Remove the vacuum pump from the system, if necessary.
- Unscrew Allen head screws (2 x) from the electronic drive unit.
- Pull the electronic drive unit off the pump.
- Screw on and connect new electronic drive unit to the turbopump.

8 Decommissioning

8.1 Shutting down for longer periods



WARNING

Contamination of parts and operating fluid by pumped media is possible.

Poisoning hazard through contact with materials that damage health.

- In the case of contamination, carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.
- Decontaminate affected parts before carrying out maintenance work.

If the turbopump should be shut down for longer than a year:

- Remove the vacuum pump from the system, if necessary.
- Change the operating fluid reservoir.
- Close the high vacuum flange of the turbopump.
- Evacuate turbopump via the fore-vacuum flange.
- Vent turbopump via the venting connection with dry air or inert gas.
- Close the flange openings by using the original protective covers.
- Close further connection ports by using the corresponding protective covers.
- Place pump upright on rubber feet.
- Storage the pump only indoors with an ambient temperature between -25 °C and +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.

8.2 Re-starting



CAUTION

Re-starting

The serviceability of the operating fluid without operation is a maximum of three years. Before restarting after a shut-down of **3 years or longer**, carry out the following work.

- Replace the operating fluid reservoir.
- Replace bearings.
- Follow the maintenance instructions and inform Pfeiffer Vacuum.
- Check turbopump for contamination and moisture.
- Clean the turbopump externally with a lint-free cloth and little industrial alcohol.
- If necessary, have Pfeiffer Vacuum Service clean the turbopump completely.
- If necessary, have the bearings replaced. Take into account the total running time.
- Change the operating fluid reservoir.
- Installation and commissioning in accordance with the operating instructions (see p. 9, chap. 5).

8.3 Disposal

Products or parts thereof (mechanical and electrical components, operating fluids, etc.) may cause environmental burden.

- Safely dispose of the materials according to the locally applicable regulations.

9 Malfunctions

If malfunctions on the pump occur, you will find possible causes and instructions for repair in the following table.

9.1 Rectifying malfunctions

Problem	Possible causes	Remedy
Pump will not start up; none of the built-in LEDs on the TC 600 lights up	<ul style="list-style-type: none"> • Electrical supply interrupted 	<ul style="list-style-type: none"> ⇒ Check fuses in the power supply ⇒ Check plug contacts on the power supply pack ⇒ Check supply lines of the power supply pack ⇒ Check output voltage (72 VDC) on the X2 of the power supply pack ⇒ Check plug contacts on the power supply pack
	<ul style="list-style-type: none"> • Operating voltage incorrect 	<ul style="list-style-type: none"> ⇒ Apply correct operating voltage ⇒ Observe name plate
	<ul style="list-style-type: none"> • No operating voltage applied 	<ul style="list-style-type: none"> ⇒ Supply the operating voltage
	<ul style="list-style-type: none"> • TC 600 defective 	<ul style="list-style-type: none"> ⇒ Exchange TC 600 . ⇒ Contact Pfeiffer Vacuum Service
Pump will not start up; green LED on the TC 600 is flashing	<ul style="list-style-type: none"> • Pin 1-3 and 1-4 on the remote plug not connected 	<ul style="list-style-type: none"> ⇒ Connect Pin 1-3 and 1-4 on the remote plug
	<ul style="list-style-type: none"> • Voltage drop in the cable 	<ul style="list-style-type: none"> ⇒ Use a suitable cable
Pump does not attain the nominal rotation speed within the specified starting time	<ul style="list-style-type: none"> • Backing pressure too high 	<ul style="list-style-type: none"> ⇒ Ensure function and suitability of the backing pump
	<ul style="list-style-type: none"> • Leak 	<ul style="list-style-type: none"> ⇒ Perform leak detection ⇒ Check gaskets and flange fasteners ⇒ Eliminate leaks
	<ul style="list-style-type: none"> • Gas load too high 	<ul style="list-style-type: none"> ⇒ Reduce process gas feed
	<ul style="list-style-type: none"> • Rotor runs hard, defective bearing 	<ul style="list-style-type: none"> ⇒ Check bearing for noise development ⇒ Contact Pfeiffer Vacuum Service
	<ul style="list-style-type: none"> • Starting time set too low 	<ul style="list-style-type: none"> ⇒ Extend starting time via DCU, HPU or PC
	<ul style="list-style-type: none"> • Thermal overload: <ul style="list-style-type: none"> – Lack of cooling – Backing pressure too high – Ambient air temperature too high 	<ul style="list-style-type: none"> ⇒ Reduce thermal load <ul style="list-style-type: none"> – Ensure adequate cooling – Lower backing pressure – Adjust ambient conditions
Pump not achieving the end pressure	<ul style="list-style-type: none"> • Pump is dirty 	<ul style="list-style-type: none"> ⇒ Bake out pump ⇒ Cleaning in case of heavy contamination – Contact Pfeiffer Vacuum Service
	<ul style="list-style-type: none"> • Vacuum chamber, pipes or pump leak 	<ul style="list-style-type: none"> ⇒ Leak detection starting from the vacuum chamber ⇒ Eliminate leaks
Unusual noises during operation	<ul style="list-style-type: none"> • Bearing damage 	<ul style="list-style-type: none"> ⇒ Contact Pfeiffer Vacuum Service
	<ul style="list-style-type: none"> • Rotor damaged 	<ul style="list-style-type: none"> ⇒ Contact Pfeiffer Vacuum Service
	<ul style="list-style-type: none"> • Splinter shield or protective screen loose 	<ul style="list-style-type: none"> ⇒ Correct seat of the splinter shield or protective screen ⇒ Observe installation notes
Red LED on the TC 600 lights up	<ul style="list-style-type: none"> • Common error 	<ul style="list-style-type: none"> ⇒ Reset through mains off/on switch ⇒ Reset via Pin 5 on the "REMOTE" connection ⇒ Differentiated malfunction display via DCU or HPU possible¹⁾ ⇒ Contact Pfeiffer Vacuum Service
Red LED on the TC 600 is flashing	<ul style="list-style-type: none"> • Warning: <ul style="list-style-type: none"> – Earthing of the supply voltage – Power failure 	<ul style="list-style-type: none"> ⇒ Differentiated malfunction display via DCU or HPU possible¹⁾ ⇒ Check partial mains voltage ⇒ Check partial mains voltage for earthing ⇒ Check mains power supply to the power adapter

¹⁾If no Pfeiffer Vacuum control panel is available, please contact Pfeiffer Vacuum Service

10 Service

Pfeiffer Vacuum offers first-class service!

- Operating fluid and bearing change on the spot by Pfeiffer Vacuum FieldService
- Maintenance / repair in the nearby ServiceCenter or ServicePoint
- Fast replacement with exchange products in mint condition
- Advice on the most cost-efficient and quickest solution

Detailed information, addresses and forms at: www.pfeiffer-vacuum.net (**Service**).

Maintenance and repair in the Pfeiffer Vacuum ServiceCenter

The following steps are necessary to ensure a fast, smooth servicing process:

- ➔ RMA form and declaration of contamination.¹⁾
- ➔ Fill out the RMA form and send it by fax or e-mail to your service address.
- ➔ Include the RMA confirmation from Pfeiffer Vacuum with your shipment.
- ➔ Fill out the contamination declaration and include it in the shipment (required!).
- ➔ Dismantle all accessories.
- ➔ Drain the operating fluid (applies for turbopumps in corrosive gas version or with suction performance > 550 l/s)
- ➔ Leave electronic drive on the pump.
- ➔ Close the flange openings by using the original protective covers.
- ➔ If possible, send pump in the original packaging.

Contaminated vacuum pumps

No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. "Hazardous substances" are substances and compounds in accordance with the hazardous goods directive (current version). If pumps are contaminated or the declaration of harmlessness is missing, Pfeiffer Vacuum performs decontamination at the shipper's expense.

Sending of contaminated pumps or devices

- ➔ Neutralise the pump by flushing it with nitrogen or dry air.
- ➔ Close all openings airtight.
- ➔ Seal the pump or unit in suitable protective film.
- ➔ Return the pump/unit only in a suitable and sturdy transport container and send it in while following applicable transport conditions.

Exchange unit

The factory operating parameters are always preset with exchange units. If you use changed parameters for your application, you have to set these again.

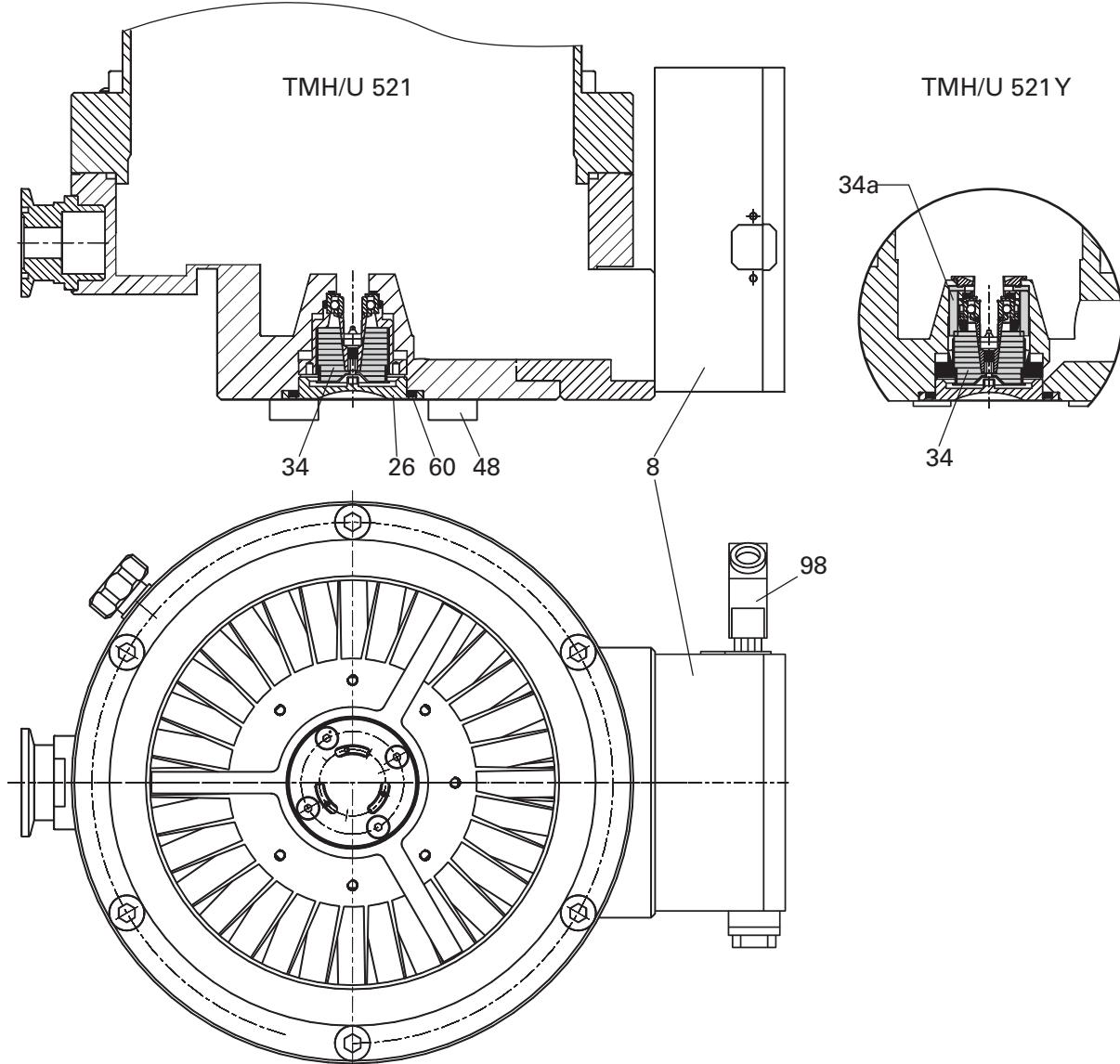
Service orders

All service orders are carried out exclusively according to our repair conditions for vacuum units and components.

¹⁾ Return material authorization under www.pfeiffer-vacuum.net

11 Spare parts TMH/U 521

Item	Designation	Size	Order Number	Notes	Pieces	Order Qty
8	Electronic drive unit TC 600		PM C01 720		1	
26	End cover	M40 x 1	PM 003 619 A		1	
34	Lubricant reservoir		PM 063 265 -T	incl. O-ring	1	
34	Lubricant reservoir ("Y")		PM 053 266 -T	incl. 8 x Porex rod (7a), O-ring, felt washer	1	
48	Sealing plugs		P 4098 582 FA		4	
60	O-ring	38 x 3	P 4070 621 PV		1	
98	Remote plug		PM 051 793 -X	Pin 1 to 4 bridged	1	



Please also specify model number of the rating plate when ordering accessories or spare parts.

12 Accessories

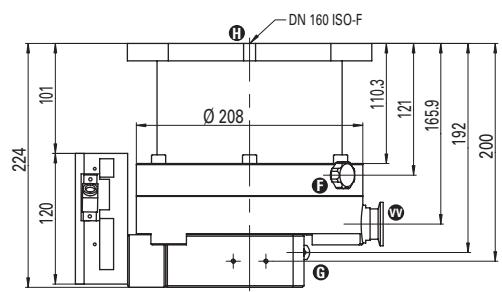
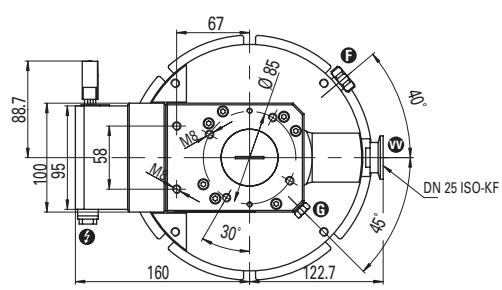
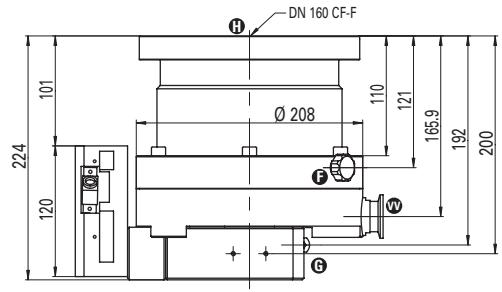
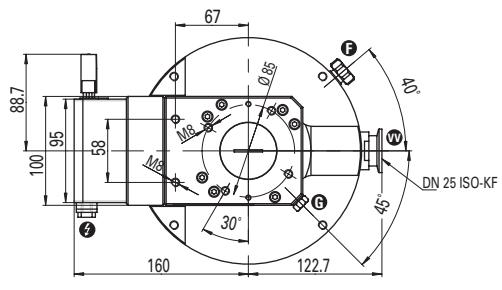
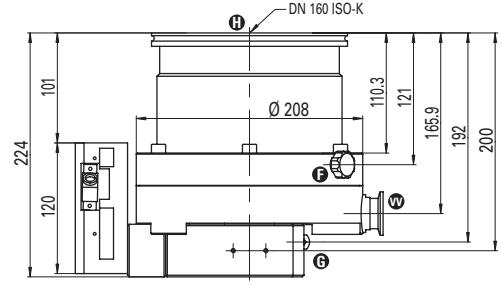
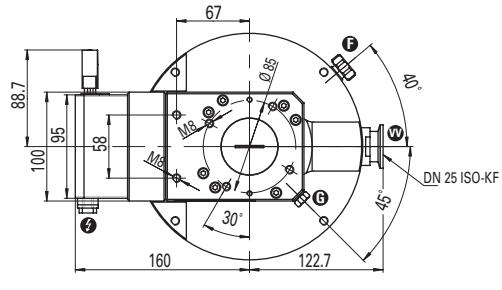
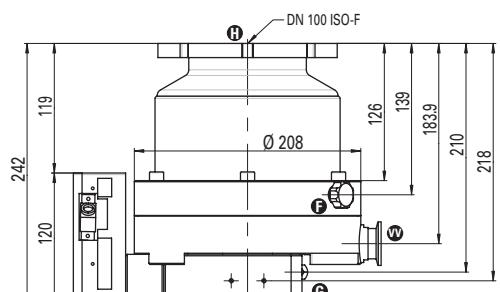
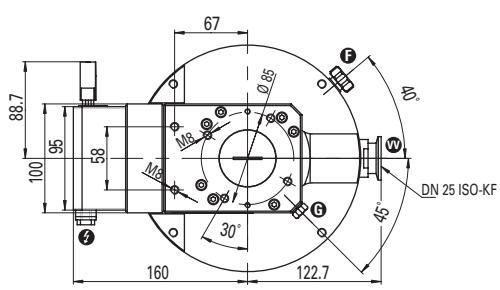
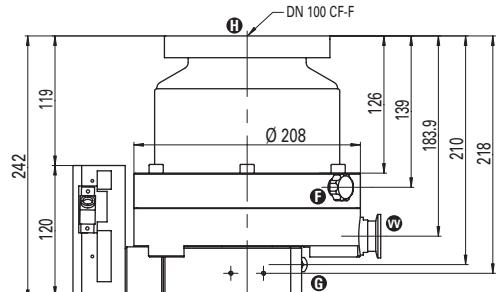
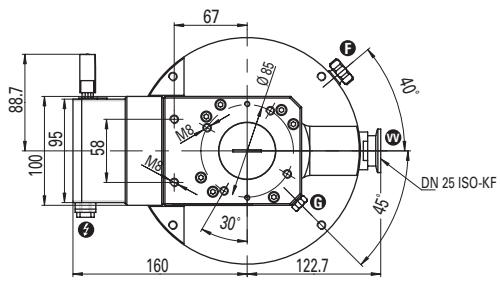
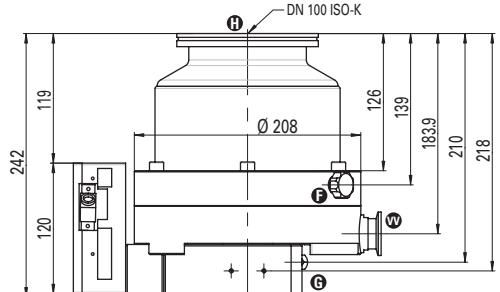
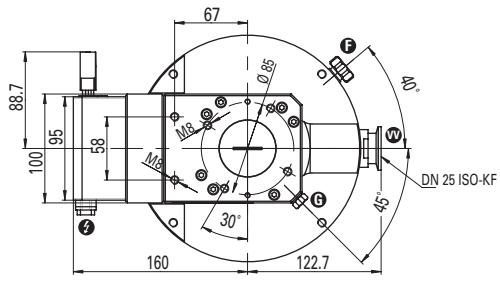
Designation	Size	Order Number	Operating instructions	Notes	Order Qty
Mains supply					
DCU 300 power supply with Display Control Unit	300 W	PM C01 696	PM 0477 BN PM 0547 BN		
TPS 300 power supply for wall/standard rail mounting	300 W	PM 041 814 -T	PM 0521 BN		
TPS 301 power supply 19" rack module 3HU	300 W	PM 041 820 -T	PM 0521 BN		
Mains cable with safety plug	230 V, 3 m	P 4564 309 ZA		Other lengths on request	
Mains cable with UL plug	115 V, 3 m	P 4564 309 ZE			
Mains cable with UL plug	208 V, 3 m	P 4564 309 ZF			
Connecting cable					
TC 600 - TPS / DCU	3 m	PM 051 103 -T		Other lengths on request	
TC 600 - TPS / DCU, shielded	3 m	PM 051 843 -T			
Control panel					
DCU 001 Display Control Unit		PM 041 816 -T	PM 0477 BN PM 0547 BN		
HPU 001 Handheld Programming Unit		PM 051 510 -T	PT 0101 BN		
Accessories package for HPU		PM 061 005 -T			
Components for venting					
TTV 001 Air drier		PM Z01 121	PM 0022 BN	incl. Zeolite filling	
TVF 005 Venting valve	24 V DC, G 1/8"	PM Z01 135	PM 0507 BN	closed without current	
Venting flange	DN 10 ISO-KF	PM 033 737 -T			
Circlip for venting flange	DN 10-15 ISO-KF	PF 102 016 -T			
Components for heating					
Heating jacket, safety plug	230 V	PM 051 096 -T	PM 0542 BN	Water cooling required	
Heating jacket, UL plug	208 V	PM 051 097 -T			
Heating jacket, UL plug	115 V	PM 051 098 -T			
Components for cooling					
Air cooling	24 V DC	PM Z01 251	PM 0543 BN		
Water cooling		PM 016 500 -T	PT 0152 BN		
TZK 400 Water cooling unit	230 V, 50 Hz	PM Z01 245	PM 0369 BN		
Dirt trap	G 3/8"	P 4161 300 2R			
Fore-vacuum triggering					
Relay box 1-phase	5 A	PM 041 937 -T	PT 0030 BN		
Relay box 1-phase	20 A	PM 041 938 -T			
TVV 001 Fore-vacuum valve	230 V, DN 16 ISO-KF	PM Z01 205	PM 0263 BN		
TVV 001 Fore-vacuum valve	115 V, DN 16 ISO-KF	PM Z01 206			
Accessories, general					
Sealing gas valve	M6 / DN 10 ISO-KF	PM Z01 142	PM 0229 BN		
Hose nipple, sealing gas valve	DN 16 ISO-KF-10	PF 144 020			
Vibration compensator	DN 100 ISO-K	PM 006 459 -X			
Vibration compensator	DN 100 CF-F	PM 006 488 -X			
Vibration compensator	DN 160 ISO-K	PM 006 492 -X			
Vibration compensator	DN 160 CF-F	PM 006 493 -X			
PWM box rot. speed control	15 - 30 V DC	PM 051 028 -U	PM 0563 BN		
Pfeiffer Vacuum protocol	RS232/RS485		PM 0488 BN	Interface protocol	
TIC 001 Interface converter	RS232 in RS485	PM 051 054 -T	PM 0549 BN		
TIC 250 Profibus-DP gateway		PM 051 257 -T	PM 0599 BN		
TIC 260 DeviceNet gateway		PM 061 166 -T	PT 0177 BN		
USB/RS485 converter	RS485/M12 in USB	PM 061 207 -T		incl. CD-ROM	
Connection cable	3 m	PM 051 726 -T			
TC 600 cover for IP 54		PM 051 327 -U	PT 0024 BN		
Installation material, accessories for flange fastening (siehe S. 9, Kap. 5.3).					

13 Technical data

DN 100	TMH 521 P TMH 521 YP	TMH 521 P TMH 521 YP	TMU 521 P TMU 521 YP
Flange (in)	DN 100 ISO-K	DN 100 ISO-F	DN 100 CF-F
Flange (out)	DN 25 ISO-KF / G 1/4"	DN 25 ISO-KF / G 1/4"	DN 25 ISO-KF / G 1/4"
Venting connection	G 1/8"	G 1/8"	G 1/8"
Rotational speed $\pm 2\%$	50000 rpm	50000 rpm	50000 rpm
Run-up time	4 min	4 min	4 min
Ultimate pressure with rotary vane pump	$< 5 \cdot 10^{-10}$ mbar	$< 5 \cdot 10^{-10}$ mbar	$< 5 \cdot 10^{-10}$ mbar
Ultimate pressure with diaphragm pump	$< 1 \cdot 10^{-8}$ mbar	$< 1 \cdot 10^{-8}$ mbar	$< 1 \cdot 10^{-8}$ mbar
Fore Vacuum max. for N ₂	13 mbar	13 mbar	13 mbar
Compression ratio for N ₂	$> 1 \cdot 10^{12}$	$> 1 \cdot 10^{12}$	$> 1 \cdot 10^{12}$
Compression ratio for He	$5 \cdot 10^7$	$5 \cdot 10^7$	$5 \cdot 10^7$
Compression ratio for H ₂	$6.5 \cdot 10^5$	$6.5 \cdot 10^5$	$6.5 \cdot 10^5$
Compression ratio for Ar	$> 1 \cdot 10^{12}$	$> 1 \cdot 10^{12}$	$> 1 \cdot 10^{12}$
Gas throughput at 0.1 mbar HV for N ₂	12 mbar l/s	12 mbar l/s	12 mbar l/s
Gas throughput at 0.1 mbar HV for He	12 mbar l/s	12 mbar l/s	12 mbar l/s
Gas throughput at 0.1 mbar HV for H ₂	8 mbar l/s	8 mbar l/s	8 mbar l/s
Gas throughput at 0.1 mbar HV for Ar	12 mbar l/s	12 mbar l/s	12 mbar l/s
Gas throughput at full rotational speed for N ₂	4 mbar l/s	4 mbar l/s	4 mbar l/s
Gas throughput at full rotational speed for He	8 mbar l/s	8 mbar l/s	8 mbar l/s
Gas throughput at full rotational speed for H ₂	9.5 mbar l/s	9.5 mbar l/s	9.5 mbar l/s
Gas throughput at full rotational speed for Ar	2 mbar l/s	2 mbar l/s	2 mbar l/s
Pumping speed backing pump for the listed gas throughputs at least	10 m ³ /h	10 m ³ /h	10 m ³ /h
Pumping speed for N ₂	290 l/s	290 l/s	290 l/s
Pumping speed for He	400 l/s	400 l/s	400 l/s
Pumping speed for H ₂	380 l/s	380 l/s	380 l/s
Pumping speed for Ar	260 l/s	260 l/s	260 l/s
Cooling method, standard	Water, Air	Water, Air	Water, air
Max. cooling water temperature	25 °C	25 °C	25 °C
Cooling water consumption	100 l/h	100 l/h	100 l/h
Weight	15.1 kg	15 kg	15.7 kg
Standby rotational speed	33000 rpm	33000 rpm	33000 rpm
Sound pressure level	50 db (A)	50 db (A)	50 db (A)
Required fore-vacuum pressure	<5 mbar	<5 mbar	<5 mbar
Integral leak rate	$< 1 \cdot 10^{-7}$ mbar l/s	$< 1 \cdot 10^{-7}$ mbar l/s	$< 1 \cdot 10^{-7}$ mbar l/s
Max. rotor temperature	90 °C	90 °C	90 °C
Max. input heat capacity	14 W	14 W	14 W
Max. surrounding magnetic field	5 mT	5 mT	5 mT
Fore vacuum max. for He	12,5 mbar	12,5 mbar	12,5 mbar
Fore vacuum max. for H ₂	9 mbar	9 mbar	9 mbar
Fore vacuum max. for Ar	11.0 mbar	11.0 mbar	11.0 mbar
Vertex of the power characteristics line:A	185/833 W/Hz	185/833 W/Hz	185/833 W/Hz
B	260/485 W/Hz	260/485 W/Hz	260/485 W/Hz
C	160/833 W/Hz	160/833 W/Hz	160/833 W/Hz
D	260/435 W/Hz	260/435 W/Hz	260/435 W/Hz
Lubricant	TL011	TL011	TL011
Max. ambient temperature with air cooling	35 °C	35 °C	35 °C
Power consumption housing heater	100 W	100 W	100 W
Operating voltage	72 \pm 5% VDC	72 \pm 5% VDC	72 \pm 5% VDC
Max. power consumption: pump	300 W	300 W	300 W
Power consumption, continuous operation	230 W	230 W	230 W
Max. current consumption: pump	4.2 A	4.2 A	4.2 A
Current consumption, continuous operation	3.2 A	3.2 A	3.2 A
Protection class	IP 30	IP 30	IP 30
Temperature: Storage	-25 to +55 °C	-25 to +55 °C	-25 to +55 °C
Relative humidity (non dewing)	5 to 85 %	5 to 85 %	5 to 85 %

DN 160	TMH 521 P TMH 521 YP	TMH 521 P TMH 521 YP	TMU 521 P TMU 521 YP
Flange (in)	DN 160 ISO-K	DN 160 ISO-F	DN 160 CF-F
Flange (out)	DN 25 ISO-KF / G 1/4"	DN 25 ISO-KF / G 1/4"	DN 25 ISO-KF / G 1/4"
Venting connection	G 1/8"	G 1/8"	G 1/8"
Rotational speed ±2%	50000 rpm	50000 rpm	50000 rpm
Run-up time	4 min	4 min	4 min
Ultimate pressure with rotary vane pump	< 5·10 ⁻¹⁰ mbar	< 5·10 ⁻¹⁰ mbar	< 5·10 ⁻¹⁰ mbar
Ultimate pressure with diaphragm pump	< 1·10 ⁻⁸ mbar	< 1·10 ⁻⁸ mbar	< 1·10 ⁻⁸ mbar
Fore Vacuum max. for N ₂	13 mbar	13 mbar	13 mbar
Compression ratio for N ₂	>1·10 ¹²	>1·10 ¹²	>1·10 ¹²
Compression ratio for He	5·10 ⁷	5·10 ⁷	5·10 ⁷
Compression ratio for H ₂	6.5·10 ⁵	6.5·10 ⁵	6.5·10 ⁵
Compression ratio for Ar	>1·10 ¹²	>1·10 ¹²	>1·10 ¹²
Gas throughput at 0.1 mbar HV for N ₂	12 mbar l/s	12 mbar l/s	12 mbar l/s
Gas throughput at 0.1 mbar HV for He	12 mbar l/s	12 mbar l/s	12 mbar l/s
Gas throughput at 0.1 mbar HV for H ₂	8 mbar l/s	8 mbar l/s	8 mbar l/s
Gas throughput at 0.1 mbar HV for Ar	12 mbar l/s	12 mbar l/s	12 mbar l/s
Gas throughput at full rotational speed for N ₂	4 mbar l/s	4 mbar l/s	4 mbar l/s
Gas throughput at full rotational speed for He	8 mbar l/s	8 mbar l/s	8 mbar l/s
Gas throughput at full rotational speed for H ₂	9.5 mbar l/s	9.5 mbar l/s	9.5 mbar l/s
Gas throughput at full rotational speed for Ar	2 mbar l/s	2 mbar l/s	2 mbar l/s
Pumping speed backing pump for the listed gas throughputs at least	10 m ³ /h	10 m ³ /h	10 m ³ /h
Pumping speed for N ₂	510 l/s	510 l/s	510 l/s
Pumping speed for He	520 l/s	520 l/s	520 l/s
Pumping speed for H ₂	450 l/s	450 l/s	450 l/s
Pumping speed for Ar	500 l/s	500 l/s	500 l/s
Cooling method, standard	Water, Air	Water, Air	Water, Air
Max. cooling water temperature	25 °C	25 °C	25 °C
Cooling water consumption	100 l/h	100 l/h	100 l/h
Weight	14.3 kg	15.7 kg	15.3 kg
Standby rotational speed	33000 rpm	33000 rpm	33000 rpm
Sound pressure level	50 db (A)	50 db (A)	50 db (A)
Required fore-vacuum pressure	<5 mbar	<5 mbar	<5 mbar
Integral leak rate	<1·10 ⁻⁷ mbar l/s	<1·10 ⁻⁷ mbar l/s	<1·10 ⁻⁷ mbar l/s
Max. rotor temperature	90 °C	90 °C	90 °C
Max. input heat capacity	14 W	14 W	14 W
Max. surrounding magnetic field	5 mT	5 mT	5 mT
Fore vacuum max. for He	12,5 mbar	12,5 mbar	12,5 mbar
Fore vacuum max. for H ₂	9 mbar	9 mbar	9 mbar
Fore vacuum max. for Ar	11.0 mbar	11.0 mbar	11.0 mbar
Vertex of the power characteristics line:A	185/833 W/Hz	185/833 W/Hz	185/833 W/Hz
B	260/485 W/Hz	260/485 W/Hz	260/485 W/Hz
C	160/833 W/Hz	160/833 W/Hz	160/833 W/Hz
D	260/435 W/Hz	260/435 W/Hz	260/435 W/Hz
Lubricant	TL011	TL011	TL011
Max. ambient temperature with air cooling	35 °C	35 °C	35 °C
Power consumption housing heater	100 W	100 W	100 W
Operating voltage	72 ± 5% VDC	72 ± 5% VDC	72 ± 5% VDC
Max. power consumption: pump	300 W	300 W	300 W
Power consumption, continous operation	230 W	230 W	230 W
Max. current consumption: pump	4.2 A	4.2 A	4.2 A
Current consumption, continous operation	3.2 A	3.2 A	3.2 A
Protection class	IP 30	IP 30	IP 30
Temperature: Storage	-25 to +55 °C	-25 to +55 °C	-25 to +55 °C
Relative humidity (non dewing)	5 to 85 %	5 to 85 %	5 to 85 %

13.1 Dimension diagrams





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 521 / TMU 521

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

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**

Pfeiffer Vacuum Technology AG · Headquarters/Germany
Tel. +49-(0) 64 41-8 02-0 · Fax +49-(0) 64 41-8 02-2 02 · info@pfeiffer-vacuum.de · www.pfeiffer-vacuum.net