

# TURBOVAC i(X)

TURBOVAC 90 i(X), (T) 250 i(X),  
(T) 350 i(X), (T) 450 i(X)

Turbomolecular Pumps with Integrated  
Frequency Converter (and Control Unit)

**Operating Instructions 300554863\_002\_A2**

Part Nos.

810030V1000 to 810089V9999

820050V1000 to 820089V9999

830050V1000 to 830089V9999



# Contents

|  | <b>Page</b> |
|--|-------------|
| <b>0 Important Safety Information</b>                                  | <b>5</b>    |
| 0.1 Mechanical hazards   | 5           |
| 0.2 Electrical hazards   | 6           |
| 0.3 Thermal hazards  | 7           |
| 0.4 Hazards caused by materials and substances                         | 7           |
| 0.5 Danger of ignition   | 8           |
| 0.6 Dangers in connection with safety-related measures and precautions | 8           |
| 0.7 Risk of damaging the pump  | 8           |
| <b>1 Description</b>   | <b>9</b>    |
| 1.1 Design   | 11          |
| 1.2 Standard equipment   | 11          |
| 1.3 Technical data   | 12          |
| 1.3.1 Technical data for the integrated drive electronics              | 20          |
| 1.4 Ordering data  | 33          |
| 1.5 Accessories  | 34          |
| <b>2 Transport and storing</b>   | <b>37</b>   |
| <b>3 Installation</b>  | <b>38</b>   |
| 3.1 Conforming utilization   | 38          |
| 3.1.1 Non-conforming utilization                                       | 38          |
| 3.2 Operating environment  | 39          |
| 3.3 Fitting accessories  | 40          |
| 3.4 Attach the pump to the vacuum chamber                              | 43          |
| 3.5 Forevacuum connection  | 48          |
| 3.6 Connect the cooling  | 50          |
| 3.6.1 Air cooling  | 50          |
| 3.6.2 Water cooling  | 51          |
| 3.6.3 Water Quality  | 51          |
| 3.7 Connect a power failure venting valve or a venting valve           | 54          |
| 3.8 Connect purge gas  | 55          |
| 3.9 Connect a flange heater  | 56          |
| 3.10 Connect a vacuum gauge head (only for TURBOVAC iX)                | 57          |
| 3.11 Electrical connection   | 58          |

|          |                                     |           |
|----------|-------------------------------------|-----------|
| <b>4</b> | <b>Operation</b>                    | <b>63</b> |
| 4.1      | Media compatibility / purge gas     | 63        |
| 4.2      | Interfaces                          | 63        |
| 4.3      | Switching on                        | 65        |
| 4.4      | Shutting down                       | 66        |
| 4.5      | Venting                             | 67        |
| 4.6      | Bakeout                             | 68        |
| 4.7      | Removing the pump from the system   | 69        |
| <b>5</b> | <b>Maintenance</b>                  | <b>70</b> |
| 5.1      | Cleaning                            | 70        |
| 5.2      | Oerlikon Leybold Vacuum Service     | 71        |
| <b>6</b> | <b>Troubleshooting</b>              | <b>72</b> |
| <b>7</b> | <b>Waste Disposal</b>               | <b>74</b> |
|          | <b>EC Incorporation Declaration</b> | <b>75</b> |
|          | <b>EC Declaration of Conformity</b> | <b>76</b> |

The TURBOVAC allows through both standard and optional interfaces controlling of the pump and setting up of some pump functions according to specific requirements. The Operating Instructions **300450826 Serial Interfaces for TURBOVAC i/iX** offers detailed information on the RS 232, RS 485, Profibus and USB interfaces of the TURBOVAC.

Original operating instructions.

# Safety Information

---

## NOTICE



### Obligation to Provide Information

Before installing and commissioning the pump, carefully read these Operating Instructions and follow the information so as to ensure optimum and safe working right from the start.

The Oerlikon Leybold Vacuum **TURBOVAC** has been designed for safe and efficient operation when used properly and in accordance with these Operating Instructions. It is the responsibility of the user to carefully read and strictly observe all safety precautions described in this section and throughout the Operating Instructions. The pump must only be operated in the proper condition and under the conditions described in the Operating Instructions. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

---

## DANGER



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

---

## WARNING



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

---

## CAUTION



CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

---

## NOTICE



NOTICE is used to notify users of installation, operation, programming or maintenance information that is important, but not hazard related.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are not binding.

Retain the Operating Instructions for further use.

## 0 Important Safety Information

### 0.1 Mechanical hazards

- 1 Avoid exposing any part of the human body to the vacuum.
- 2 The pressure in the pump must not exceed 1.4 bar (absolute).
- 3 The pump is intended for generating a vacuum only. If there is a risk of an overpressure within the system and the pump, then the pump must be protected against this, by way of an overpressure safety valve, for example.
- 4 Vent the pump only up to atmospheric pressure.
- 5 When using the pump with a purge gas valve, protect the purge gas supply such that in the event of a malfunction no overpressure can occur within the system.
- 6 The pump must be firmly mounted to the vacuum chamber. If the mounting is not sturdy enough, pump blockage could cause the pump to break loose; internal pump components could be thrown in all directions. Never operate the pump (in bench testing, for example) without proper flanging to the vacuum chamber. Observe the information in Section 3.4.

Due to high-speed and temperature, the service life of the rotor is limited. If the rotor is changed too late, it may be destroyed. Thus in the flange mounts high forces and torque conditions can occur. The mounting screws for the pump may be torn off. We recommend an exchange of the rotor unit after 80,000 operating hours at the latest. When using clamped flange connections at the housing or with components above the housing, sudden twisting of the entire pump can be experienced.

- 7 Turbopumps as described in the following operation manual contain a high portion of kinetic energy due to their high rotational speed in combination with the specific rotor mass. In case of a malfunction of the system, for example rotor/stator contact or even a rotor crash, the rotational energy is released.
- 8 To avoid the destruction of the equipment and to prevent injuries of the operating staff the leading European manufacturers of vacuum pumps strictly recommend to follow the installation instructions as given in this manual.

---

#### WARNING



# Safety Information

---

**DANGER**

## 0.2 Electrical hazards

- 1 The electrical connection must only be provided by a trained person. Please observe the national regulations in the country of use like EN 50110-1 for Europe, for example.
- 2 The pump must only be connected to power supplies which meet the requirements for functional extra-low voltages with positive isolation in accordance with IEC 60364-4-41 (or local regulations) (PELV). All interfaces must only be operated with PELV-fed components and devices.
- 3 Lethal voltages are present at the mains connections. Before starting with any maintenance and service work, de-energise (lockout/tagout) the product first.
- 4 Unplug any connectors only when the mains voltage is switched off and the pump does no longer turn.
- 5 Unauthorized device conversion and modifications are prohibited for safety reasons.
- 6 The outputs at the frequency converter are not free of voltage.
- 7 Lay connecting lines so that they cannot be damaged. Protect the lines against humidity and contact with water. Avoid any heat stress on the line due to unfavourable laying conditions.
- 8 Suitably support the connecting lines so that the pumps are not exposed to any major mechanical stress.
- 9 Do not expose the pump and the connections to dripping water. Note the information on the IP type of protection.
- 10 When storing the pump in a humid atmosphere, these can suffer corrosion. Corrosion gives rise to conductive deposits which in turn can cause short-circuits and reduce the insulation levels of electrical components
- 11 Transport the pump only in its original packaging so as to avoid any mechanical damage which in turn may reduce air gaps and creepage distances.
- 12 When applying external voltages above 42 V to the connection terminals, observe the applicable VDE safety regulations!
- 13 Make the electrical connections only after pump and accessories (e.g. air cooler) have been installed mechanically.
- 14 The slot for the Anybus interface must be blanked off during operation of the pump: either through a blank panel or by inserting an optional Anybus module.

## 0.3 Thermal hazards

- 1 Handle the equipment only while vented and cooled down.
- 2 During operation of the pump certain areas can get hot (65 °C max.). Protect hot parts against being touched.

---

### CAUTION



## 0.4 Hazards caused by materials and substances

- 1 The pump is not suited for pumping of reactive or corrosive media. If the rotor is attacked by process gases, it can suffer destruction. Thus in the flange mounts high forces and torque conditions can occur. The mounting screws for the pump may be torn off. When using clamped flange connections at the housing or with components above the housing, sudden twisting of the entire pump can be experienced.
- 2 When pumping dusty media, use a dust filter. The pollution degree II applies to the pump's inside, too.
- 3 If low concentration corrosive or reactive gases are being pumped, then operate the pump with purge gas.
- 4 Please consult us as to which types of pump are required for specific processes and applications.
- 5 The forevacuum line must be tight. Hazardous gases can escape at leaks or the gases being pumped can react with air or humidity. A leak search will always be required after having installed the pump and after service work on the vacuum system. Upon delivery the pump has an integral leak rate of  $< 1 \cdot 10^{-8}$  mbar·l/s. When pumping toxic gases we recommend a leak search on a regular basis.
- 6 If the pump has previously handled hazardous gases, implement the proper precautionary measures before opening the intake or exhaust connection. Before opening the pump, purge it for a longer period of time with an inert gas. If necessary, use gloves, a respirator and/or protective clothing and work under an exhaust hood. Firmly seal off the pump. When shipping the contaminated pump for servicing, please also state the type of hazard. For this you must use a form which we have prepared for you.
- 7 Contaminated parts can be detrimental to health and environment. Before beginning with any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.
- 8 The cooling water from the return is not of drinking water quality and should not be used for this purpose. After having operated the pump, the cooling water lines may suffer from microbiological contamination. Take appropriate safety precautions.

---

### DANGER



# Safety Information

---

## CAUTION



### 0.5 Danger of ignition

- 1 During operation the pressure inside the turbomolecular pump is so low that there is no danger of ignition (at pressures below about 100 mbar). A hazardous condition will be created if flammable mixtures enter the hot pump at pressures above 100 mbar. During operation the pump can reach temperatures as high as 140 °C internally, and at parts of the outside surfaces 65 °C. Sparks could occur in case of damage to the pump and these could ignite explosive mixtures. Also note the safety information provided by the gas supplier.

---

## CAUTION



### 0.6 Dangers in connection with safety-related measures and precautions

- 1 The frequency converter is not equipped with its own emergency shut down switch. Such a facility needs to be provided from the side of the system.

---

## NOTICE



### 0.7 Risk of damaging the pump

- 1 Never touch the rotor. Touching the rotor may cause injury and damage the rotor bearing.
  - 2 Foreign objects which enter the pump through the intake would cause serious damage to the rotor. That's why we recommend installing an inlet screen. Damages caused during operation without the inlet screen are excluded from warranty.
  - 3 The contact surfaces of pump housing, vacuum system and centering ring must be free of grease and dry so as to ensure sufficient stability in case the rotor seizes.
  - 4 Connect a purge gas or venting valve to the correct flange. Confusing the venting and purge gas flange can cause shock venting of the pump.
  - 5 The interface connectors have UNC 4-40 threads. Do not use connectors with M3 threads.
  - 6 Disconnect and connect the cable connections between pump and power supply only while the pump is turning no longer (green status LED off) **and** with the mains power switched off (yellow power LED off). Otherwise there is the risk of damaging the frequency converter.
  - 7 Exposure of the pump to accelerating forces must be avoided or reduced to such an extent that the rotor unit will not be excited by vibrations. In the case of critical applications you must consult our Applications Dept. first.
-



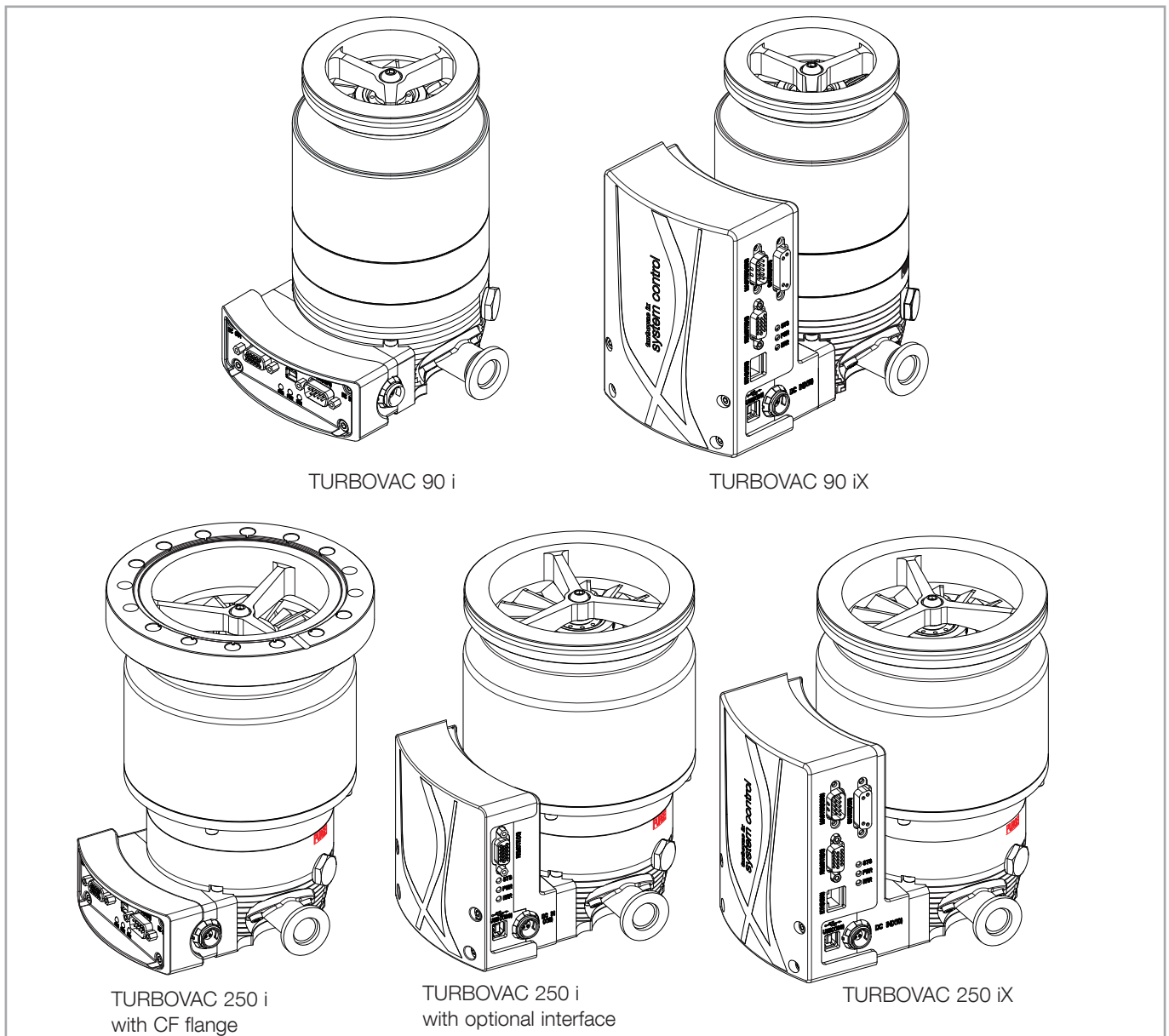


Fig. 1.1 TURBOVAC 90/250 i(X) models

## 1 Description

The TURBOVAC 90 i(X), (T) 250 i(X), (T) 350 i(X) and (T) 450 i(X) are turbomolecular pumps designed to evacuate vacuum chambers down to pressure levels in the high vacuum and ultra-high vacuum range.

They are suitable for pumping air and clean gases. A forevacuum pump and a power supply are required for their operation.

# Description

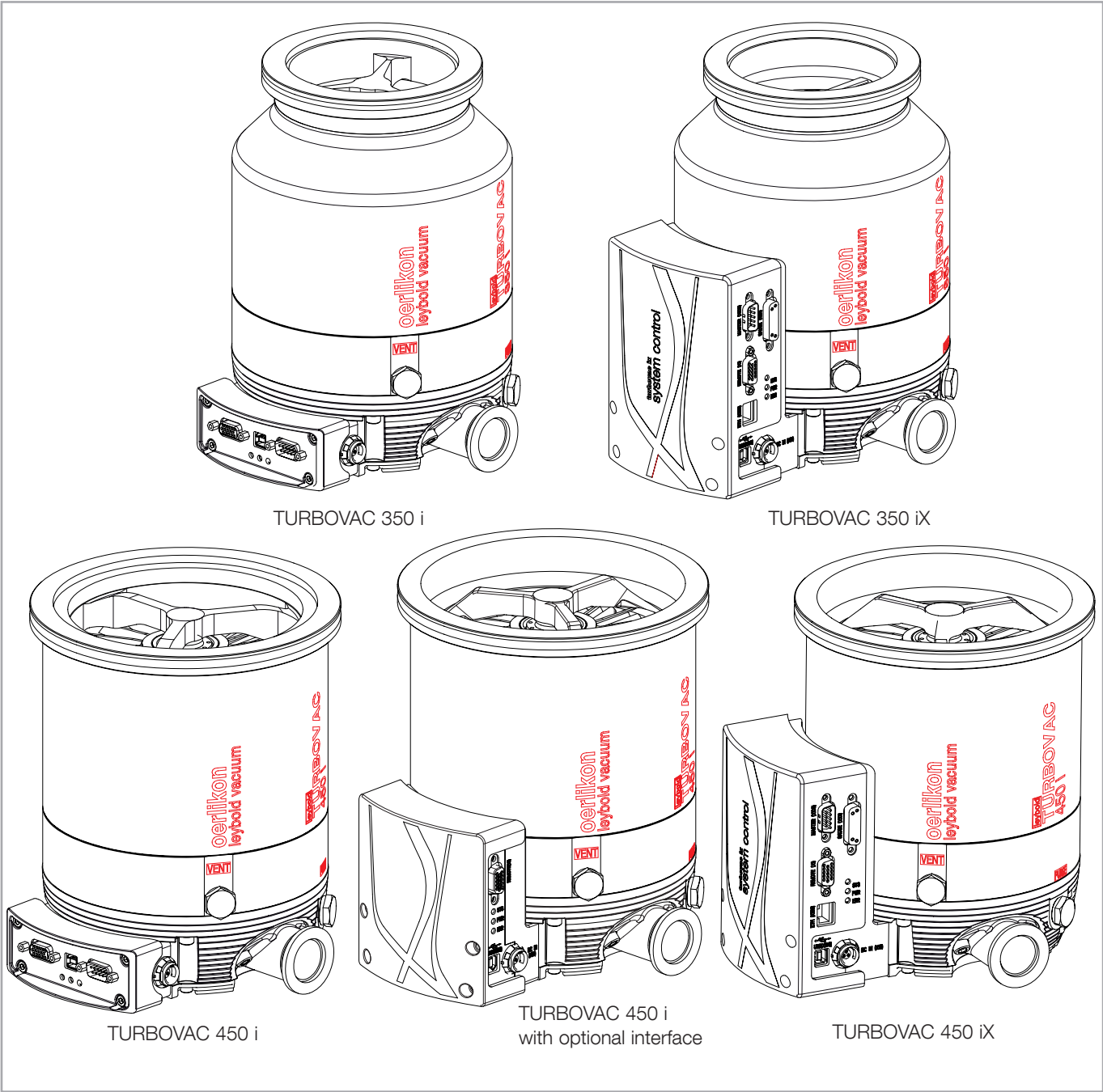


Fig. 1.2 TURBOVAC 350/450 i(X) models

## 1.1 Design

The pump models TURBOVAC **T** ... i(X) are of the standard TMP rotor type; the TURBOVAC ... i(X) models are wide-range TMPs equipped with an additional Holweck stage.

With the built-in frequency converter as the electronic drive the TURBOVAC i(X) forms one single unit. The electronic drive governs the pump's speed and serves as a monitor for all functions of the pump. Moreover, the TURBOVAC **iX** is equipped with an integrated vacuum system controller for connection and operation of various accessory components.

At the high vacuum side the bearing is of a non-wearing permanent magnetic bearing type, at the forevacuum side a lifetime lubricated oil-free ceramic ball bearing is used.

Water cooling or an air cooling fan is available as optional equipment.

The intake flange should be fitted with a wire mesh inlet screen to protect the pump against mechanical damage caused by foreign objects.

The pumps are equipped with a venting and a purge gas facility. The connections are blanked off by default with G1/8" closure screws.

Venting and purge gas valves, or a venting screw, or a pressure regulator can be connected directly to the pump.

## 1.2 Standard equipment

Turbomolecular pump with integrated electronic drive unit (and integrated vacuum system control unit for TURBOVAC iX)

High and fore-vacuum flanges are protective-capped.

Flange mounting elements, the DC In plug and the inlet screen are not enclosed, but are available as accessories, see Section 1.5.

### Only TURBOVAC iX

An USB stick with the LEYASSIST software is included.

# Description

## 1.3 Technical data

| <b>TURBOVAC</b>   |                             | <b>90 i(X)</b>    | <b>250 i(X)</b>          | <b>T 250 i(X)</b>   |
|---|-----------------------------|-------------------|--------------------------|---------------------|
| High-vacuum connection  | DN                          | 63 ISO-K<br>63 CF | 100 ISO-K<br>100 CF      | 100 ISO-K<br>100 CF |
| Forevacuum connection   | DN                          | 16 KF             | 16 KF                    | 16 KF               |
| Pumping speed*  | $l \cdot s^{-1}$            |                   |                          |                     |
| N <sub>2</sub>  |                             | 90                |                          |                     |
| Ar  |                             | 83                |                          |                     |
| He  |                             | 90                |                          |                     |
| H <sub>2</sub>  |                             | 78                |                          |                     |
| Gas throughput*   | $mbar \cdot l \cdot s^{-1}$ |                   |                          |                     |
| N <sub>2</sub>  |                             | 10                |                          |                     |
| Ar  |                             | 3                 |                          |                     |
| He  |                             | 11                |                          |                     |
| H <sub>2</sub>  |                             | 11                |                          |                     |
| Compression ratio*  |                             |                   |                          |                     |
| N <sub>2</sub>  |                             | $1 \cdot 10^{11}$ |                          |                     |
| Ar  |                             | $1 \cdot 10^{11}$ |                          |                     |
| He  |                             | —                 |                          |                     |
| H <sub>2</sub>  |                             | $5 \cdot 10^7$    |                          |                     |
| Ultimate pressure with 2-stage oil-sealed rotary vane pump ISO-K / CF | mbar                        |                   | $< 10^{-8} / < 10^{-10}$ |                     |
| Max. permissible forevacuum pressure for N <sub>2</sub>               | mbar                        | 14                |                          |                     |
| Operating speed   | min <sup>-1</sup>           |                   | 72 000                   |                     |
| Speed adaptation  |                             |                   | 50 to 100 %              |                     |
| Run-up time, approx.  | min                         |                   | 1.5                      |                     |
| Max. power consumption  | W                           |                   | 240                      |                     |
| Power consumption at ultimate pressure, approx.                       | W                           |                   |                          |                     |
| 24 V  |                             | 7                 |                          |                     |
| 48 V  |                             | 9.5               |                          |                     |
| Type of protection  | IP                          |                   | 40                       |                     |

\* Please contact us when using Argon or other “heavy” gases as process gas.

# Description

| <b>TURBOVAC</b>  |                                    | <b>90 i(X)</b>                        | <b>250 i(X)</b>   | <b>T 250 i(X)</b> |
|--|------------------------------------|---------------------------------------|---|-------------------|
| Ambient temperature<br>during operation<br>storage   | °C                                 |                                       | +5 to +45<br>-15 to +70   |                   |
| Cooling standard   |                                    |                                       | Convection  |                   |
| Cooling optional   |                                    |                                       | Air or water  |                   |
| Cooling water connection   |                                    |                                       | plug connection for 6x1 hose /<br>alternatively G 1/8-in. screw-in thread |                   |
| Cooling water consumption  | l/h                                |                                       | 30 to 60  |                   |
| Permissible cooling water pressure<br>(bar(g): bar (gauge) is overpressure,<br>i.e. atmospheric pressure = 0 bar(g)) | bar(g)                             |                                       | 3 - 6   |                   |
| Permissible cooling water temperature  | °C                                 |                                       | 15 to 35  |                   |
| Weight ISO-K / CF<br>TURBOVAC i<br>TURBOVAC iX   | kg                                 | 3.1 / 4.8<br>3.6 / 5.3                |   |                   |
| Recommended forevacuum pumps   | TRIVAC<br>SCROLLVAC<br>DIVAC       | D 2,5 E / D 4 B<br>SC 5 D<br>1,4 HV 3 |   |                   |
| Noise level<br>with convection cooling<br>with radial air cooler<br>with axial air cooler                            | dB(A)                              |                                       | < 41<br>< 44<br>< 49  |                   |
| Max. bake-out temperature of the CF version,<br>water cooled   | °C                                 |                                       | 100   |                   |
| Max. rel. air humidity   |                                    |                                       | approx. 85% (non-condensing)  |                   |
| Purge gas flow   | mbar · l · s <sup>-1</sup><br>sccm |                                       | 0.4<br>24   |                   |
| Purge gas connection   |                                    |                                       | G 1/8"  |                   |
| Venting connection   |                                    |                                       | G 1/8"  |                   |

# Description

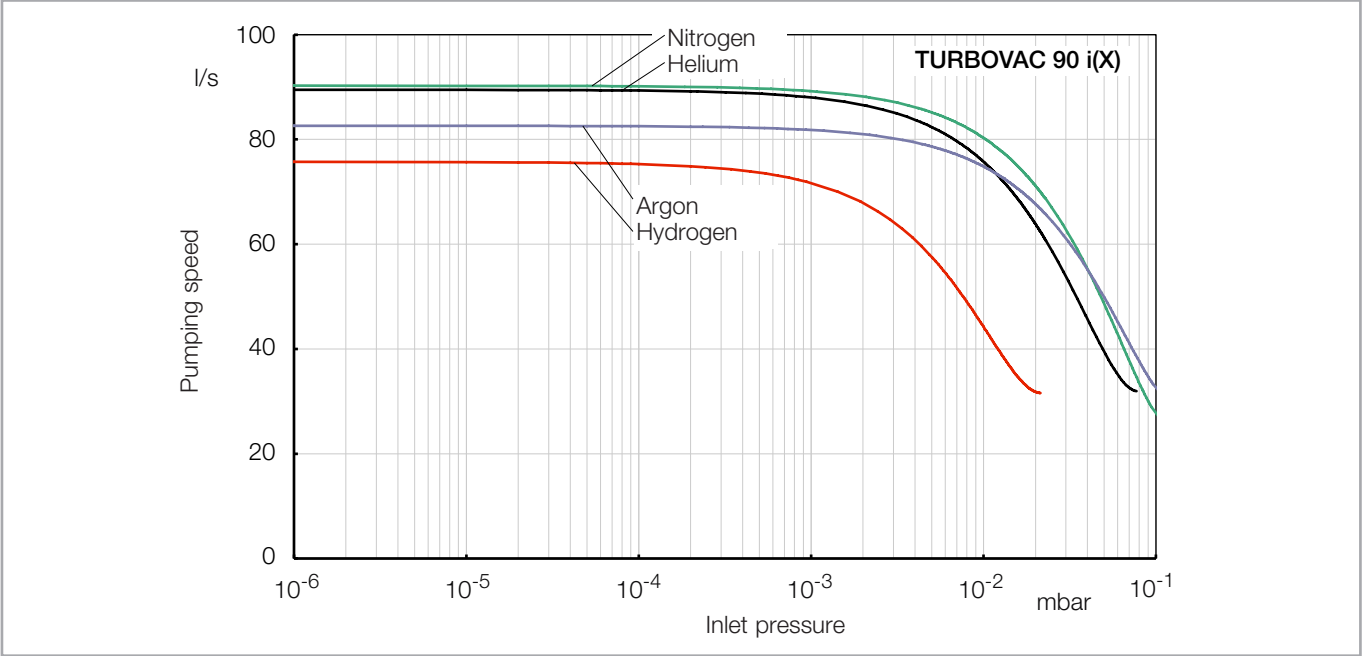


Fig. 1.3 Pumping speed curves for the TURBOVAC 90 i(X)

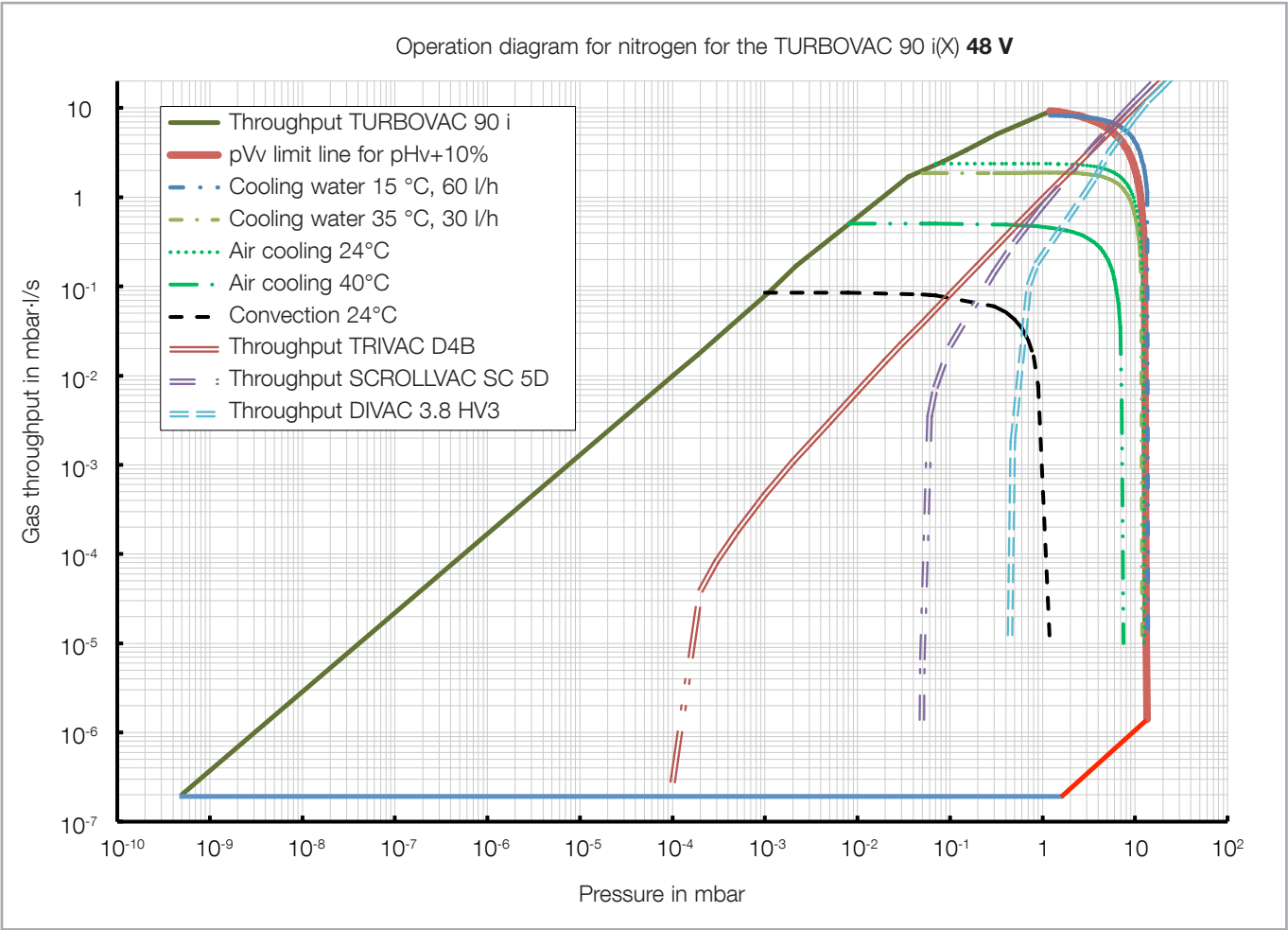


Fig. 1.4a Operation diagram for nitrogen for the TURBOVAC 90 i(X) 48 V

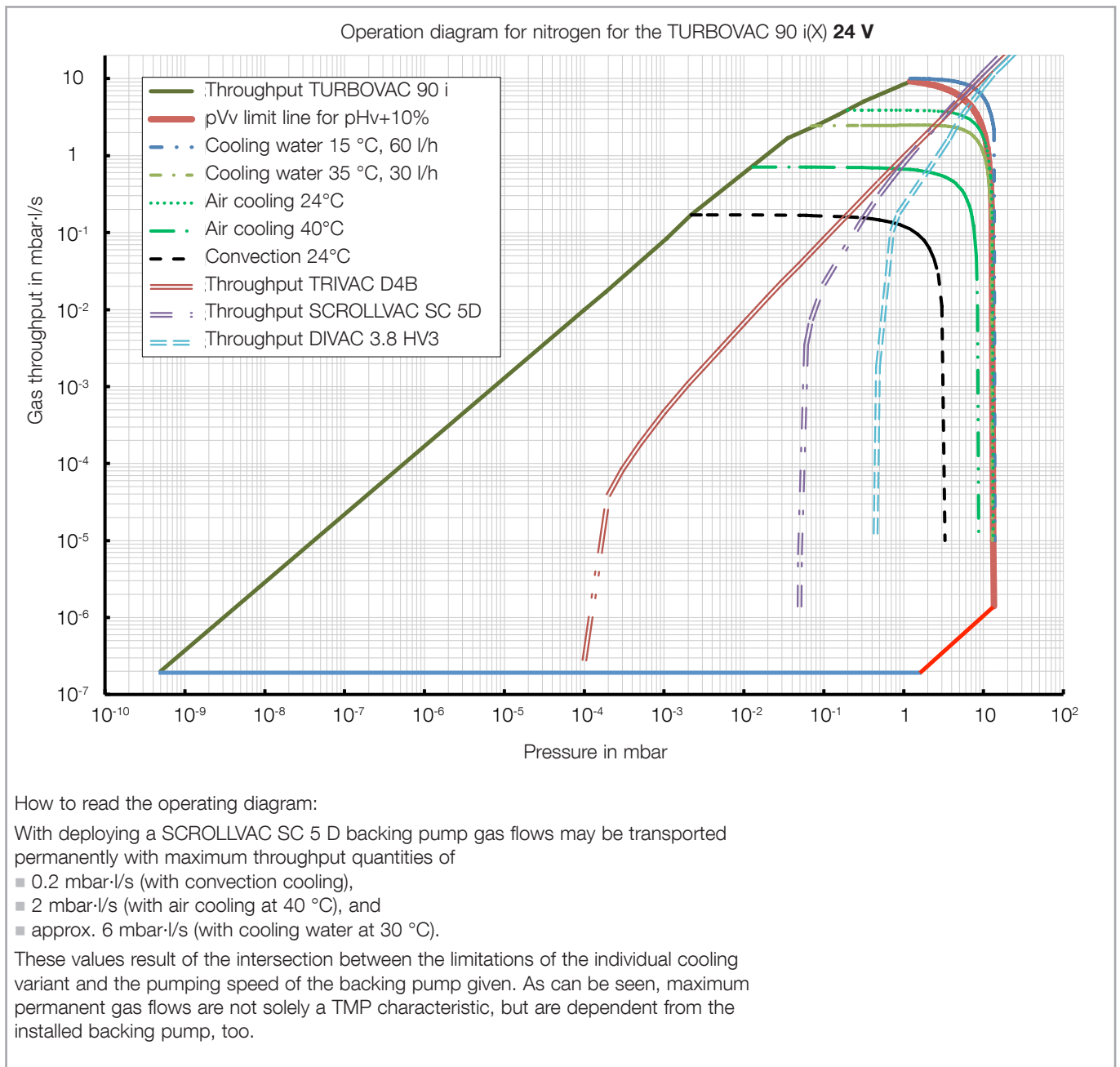


Fig. 1.4b Operation diagram for nitrogen for the TURBOVAC 90 i(X) 24 V

# Description

| <b>TURBOVAC</b>   |  | <b>350 i(X)</b>          | <b>T 350 i(X)</b>   | <b>450 i(X)</b>     | <b>T 450 i(X)</b>   |
|---|--|--------------------------|---------------------|---------------------|---------------------|
| High-vacuum connection  | DN   | 100 ISO-K<br>100 CF      | 100 ISO-K<br>100 CF | 160 ISO-K<br>160 CF | 160 ISO-K<br>160 CF |
| Forevacuum connection   | DN   | 25 KF                    | 25 KF               | 25 KF               | 25 KF               |
| Pumping speed for   | $\text{l} \cdot \text{s}^{-1}$                   |                          |                     |                     |                     |
| N <sub>2</sub>  |  | 290                      | 290                 | 430                 | 430                 |
| Ar  |  | 260                      | 260                 | 400                 | 400                 |
| He  |  | 360                      | 360                 | 440                 | 440                 |
| H <sub>2</sub>  |  | 350                      | 320                 | 420                 | 400                 |
| Gas throughput  | $\text{mbar} \cdot \text{l} \cdot \text{s}^{-1}$ |                          |                     |                     |                     |
| N <sub>2</sub>  |  | 4.5                      | 11.5                | 4.5                 | 11.5                |
| Ar  |  | 2.0                      | 6.0                 | 2.0                 | 6.0                 |
| He  |  | 8.0                      | 20.0                | 8.0                 | 20.0                |
| H <sub>2</sub>  |  | 8.0                      | 20.0                | 8.0                 | 20.0                |
| Compression ratio   |  |                          |                     |                     |                     |
| N <sub>2</sub>  |  | $1 \cdot 10^{11}$        | $1 \cdot 10^{10}$   | $1 \cdot 10^{11}$   | $1 \cdot 10^{10}$   |
| Ar  |  | $1 \cdot 10^{11}$        | $1 \cdot 10^{11}$   | $1 \cdot 10^{11}$   | $1 \cdot 10^{11}$   |
| He  |  | $1 \cdot 10^8$           | $1 \cdot 10^6$      | $1 \cdot 10^8$      | $1 \cdot 10^6$      |
| H <sub>2</sub>  |  | $1 \cdot 10^6$           | $1 \cdot 10^4$      | $1 \cdot 10^6$      | $1 \cdot 10^4$      |
| Ultimate pressure with 2-stage oil-sealed rotary vane pump ISO-K / CF | mbar   | $< 10^{-8} / < 10^{-10}$ |                     |                     |                     |
| Max. permissible forevacuum pressure for N <sub>2</sub>               | mbar   | 10                       | 0.5                 | 10                  | 0.5                 |
| Operating speed   | $\text{min}^{-1}$                                | 60 000                   |                     |                     |                     |
| Speed adaptation  |  | 50 to 100 %              |                     |                     |                     |
| Run-up time, approx.  | min  | 5.5                      | 3.5                 | 5.5                 | 3.5                 |
| Max. power consumption  | W  | 240                      |                     |                     |                     |
| Power consumption at ultimate pressure                                | W  | 20                       |                     |                     |                     |
| Type of protection  | IP   | 40                       |                     |                     |                     |



# Description

| TURBOVAC   |                                    | 350 i(X)  | T 350 i(X)                  | 450 i(X)                      | T 450 i(X)                  |
|--|------------------------------------|---|-----------------------------|-------------------------------|-----------------------------|
| Ambient temperature during operation storage   | °C                                 | +5 to +45<br>-15 to +70   |                             |                               |                             |
| Cooling standard   |                                    | Convection  |                             |                               |                             |
| Cooling optional   |                                    | Air or water  |                             |                               |                             |
| Cooling water connection   |                                    | plug connection for 6x1 hose /<br>alternatively G 1/8-in. screw-in thread |                             |                               |                             |
| Cooling water consumption  | l/h                                | 50 to 100   |                             |                               |                             |
| Permissible cooling water pressure (bar(g): bar (gauge) is overpressure, i.e. atmospheric pressure = 0 bar(g)) | bar(g)                             | 3 - 6   |                             |                               |                             |
| Permissible cooling water temperature  | °C                                 | 15 to 35  |                             |                               |                             |
| Weight ISO-K / CF<br>TURBOVAC i<br>TURBOVAC iX   | kg                                 | 7.5 / 11.5<br>8.0 / 12.0  | 7.0 / 11.0<br>7.5 / 11.5    | 7.7 / 12.5<br>8.2 / 13.0      | 7.2 / 12.0<br>7.7 / 12.5    |
| Recommended forevacuum pumps   | TRIVAC<br>SCROLLVAC<br>DIVAC       | D 4 B<br>SC 5/15 D<br>3.8 HV3   | D 16 B<br>SC 15D / 30D<br>– | D 4 B<br>SC 5/15 D<br>3.8 HV3 | D 16 B<br>SC 15D / 30D<br>– |
| Noise level<br>with convection cooling<br>with radial air cooler<br>with axial air cooler                      | dB(A)                              | < 44<br>< 47<br>< 49  |                             |                               |                             |
| Max. bake-out temperature of the CF version, water cooled  | °C                                 | 100   |                             |                               |                             |
| Max. rel. air humidity   |                                    | approx. 85% (non-condensing)  |                             |                               |                             |
| Purge gas flow   | mbar · l · s <sup>-1</sup><br>sccm | 0.4<br>24   |                             |                               |                             |
| Purge gas connection   |                                    | G 1/8"  |                             |                               |                             |
| Venting connection   |                                    | G 1/8"  |                             |                               |                             |

# Description

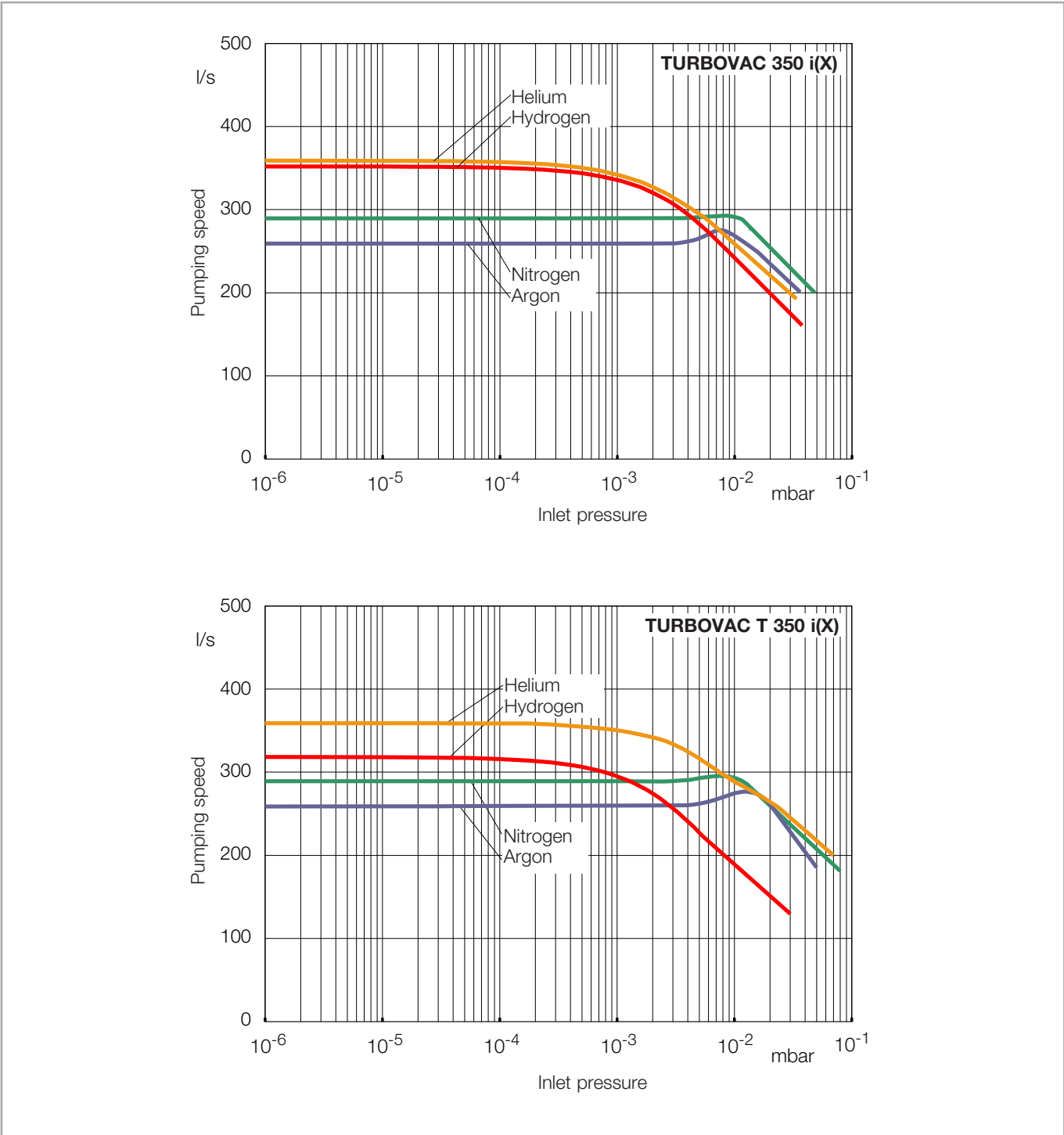


Fig. 1.5 Pumping speed curves for the TURBOVAC 350 i(X) and the TURBOVAC T 350 i(X)

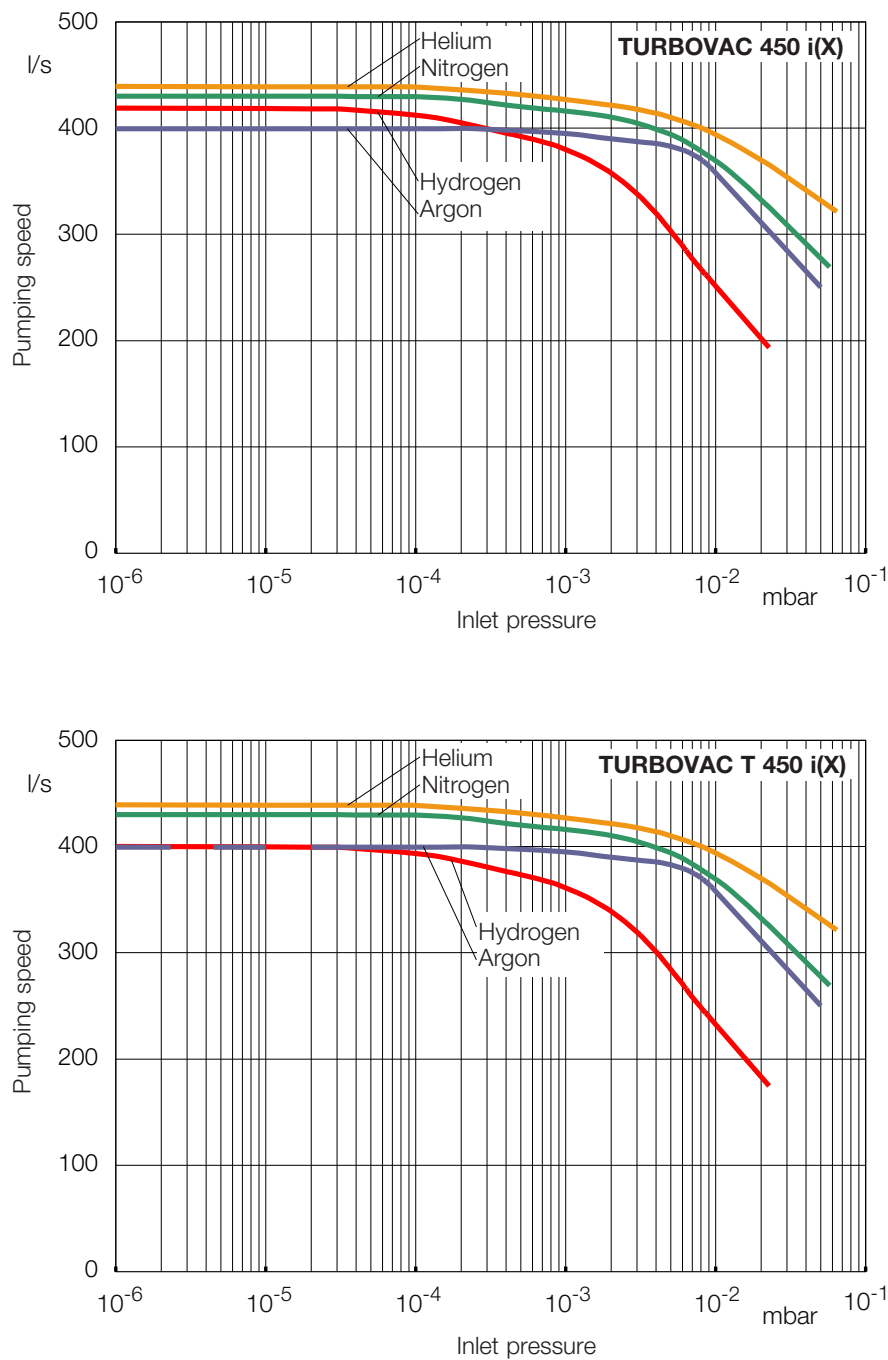


Fig. 1.6 Pumping speed curves for the TURBOVAC 450 i(X) and the TURBOVAC T 450 i(X)

# Description

## 1.3.1 Technical data for the integrated drive electronics

|  | <b>TURBOVAC i</b><br><b>Drive electronics</b> | <b>TURBOVAC iX</b><br><b>Drive electronics and vacuum<br/>system control unit</b> |
|--|---|---|
| Supply voltage   | 24/48 V DC $\pm$ 10 %                         | 24/48 V DC $\pm$ 10 %   |
| Max. current consumption   | 10 A at 24 V DC                               | 10 A at 24 V DC   |
| Max. power consumption   | 240 W   | 240 W   |
| Interfaces   | see ordering data                             | see ordering data   |
| Residual ripple  | < 3 %   | < 3 %   |
| Max. length of the DC cable<br>(for variants with removable front end)                             | 0,5 m   | –   |
| Max. contact rating of the relays  | 48 V, 0.5 A<br>24 V, 1.0 A                    | 48 V, 0.5 A<br>24 V, 1.0 A  |
| Overvoltage category   | II  | II  |
| Contamination grade  | 2   | 2   |
| Accessory connections  | 1 pc. M8 connector, 24 V DC                   | 3 pcs M8 connector, 24 V DC   |
| Maximum load rating for the 24 V DC outputs<br>(powering accessories, e.g. cooling unit or valves) | 24 V, max. 18 W                               | 24 V, 12 W  |
| Vacuum gauge head connection   | –   | 15 pin Sub-D  |

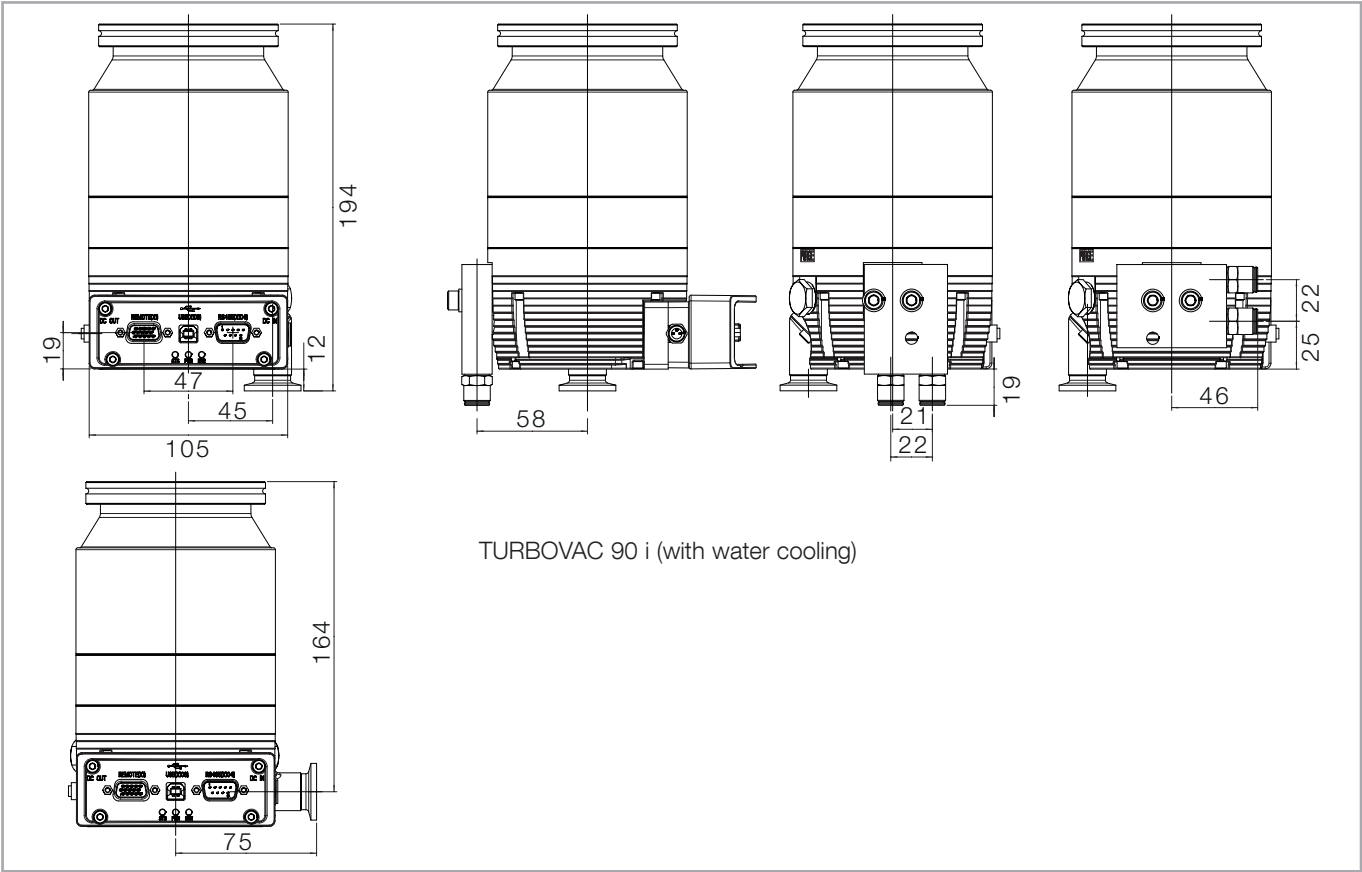


Fig. 1.7 Dimensional drawings, dimensions in mm

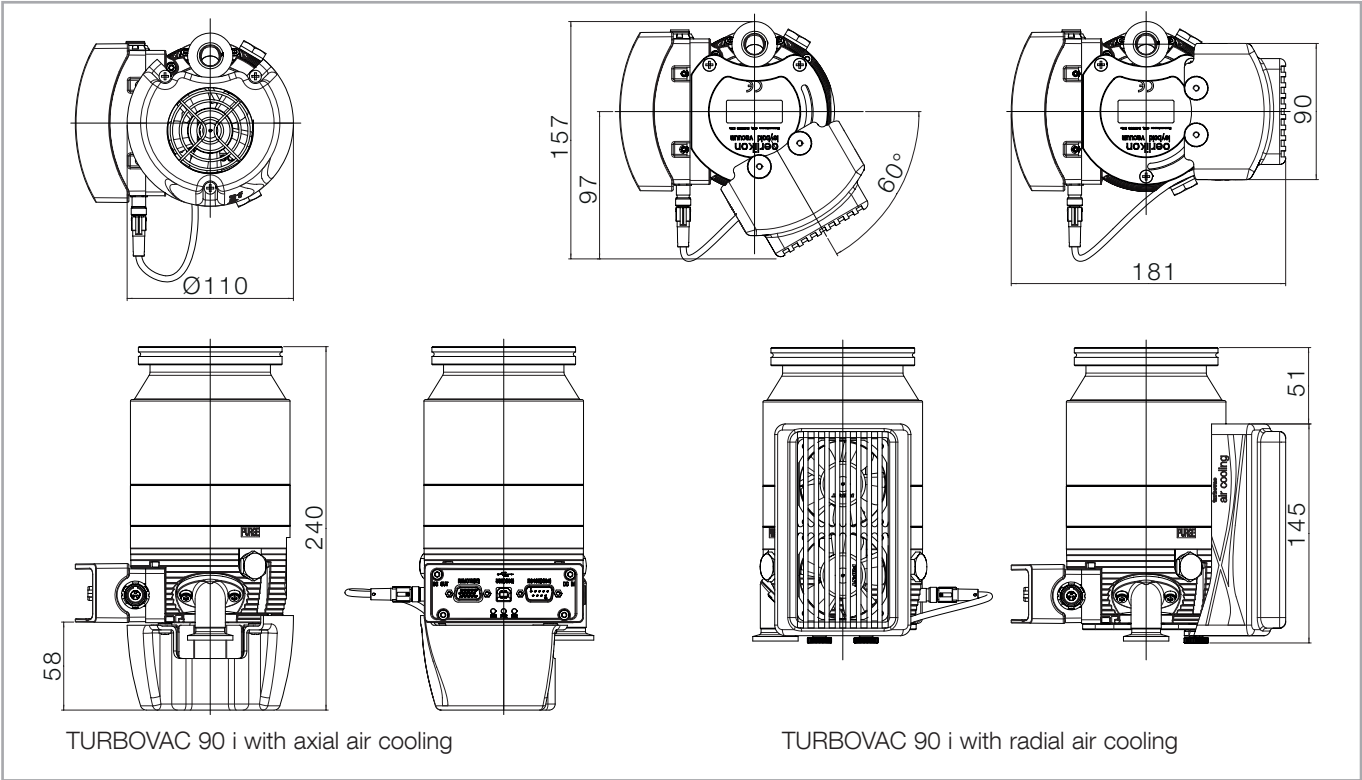


Fig. 1.8 Dimensional drawings, dimensions in mm

# Description

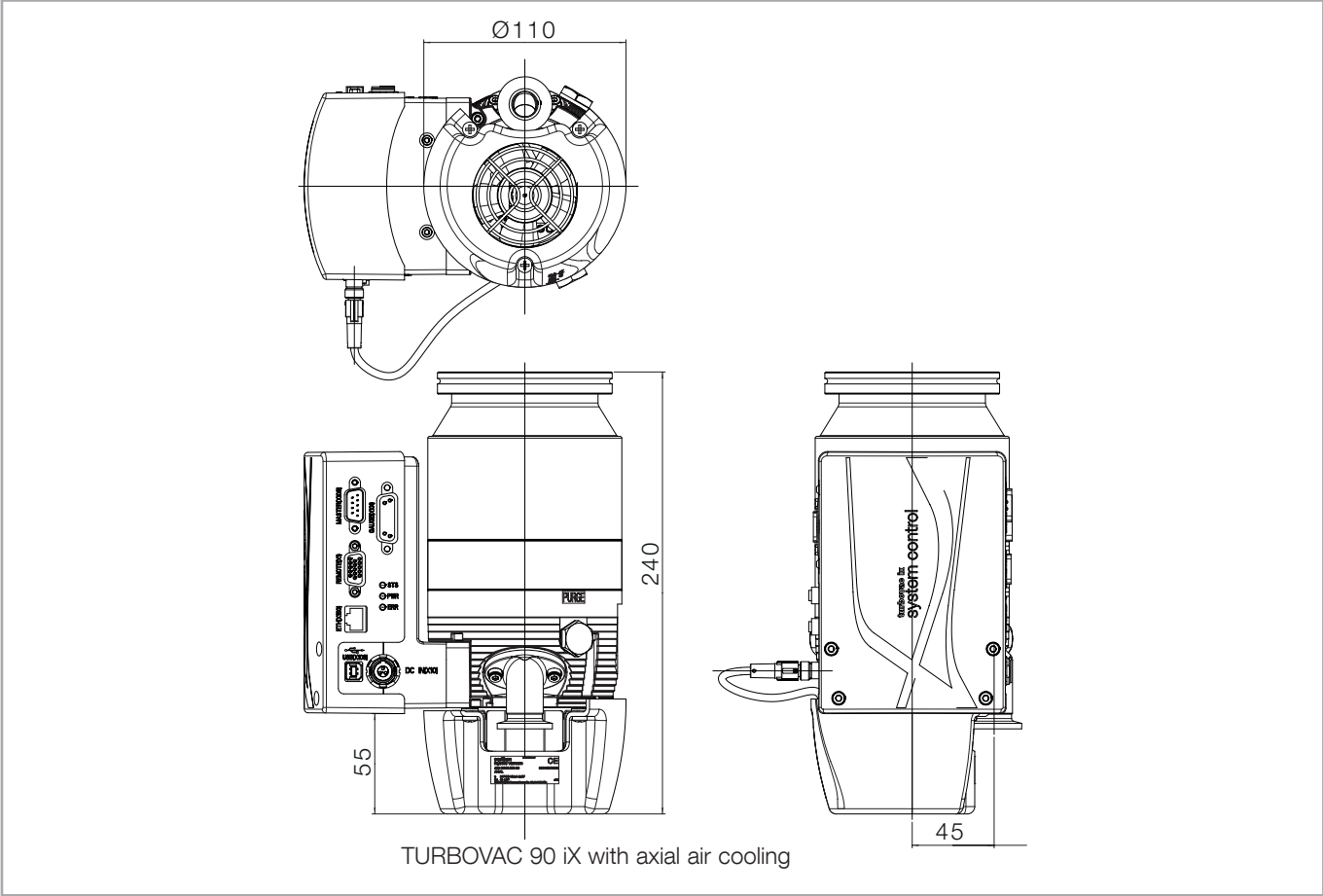
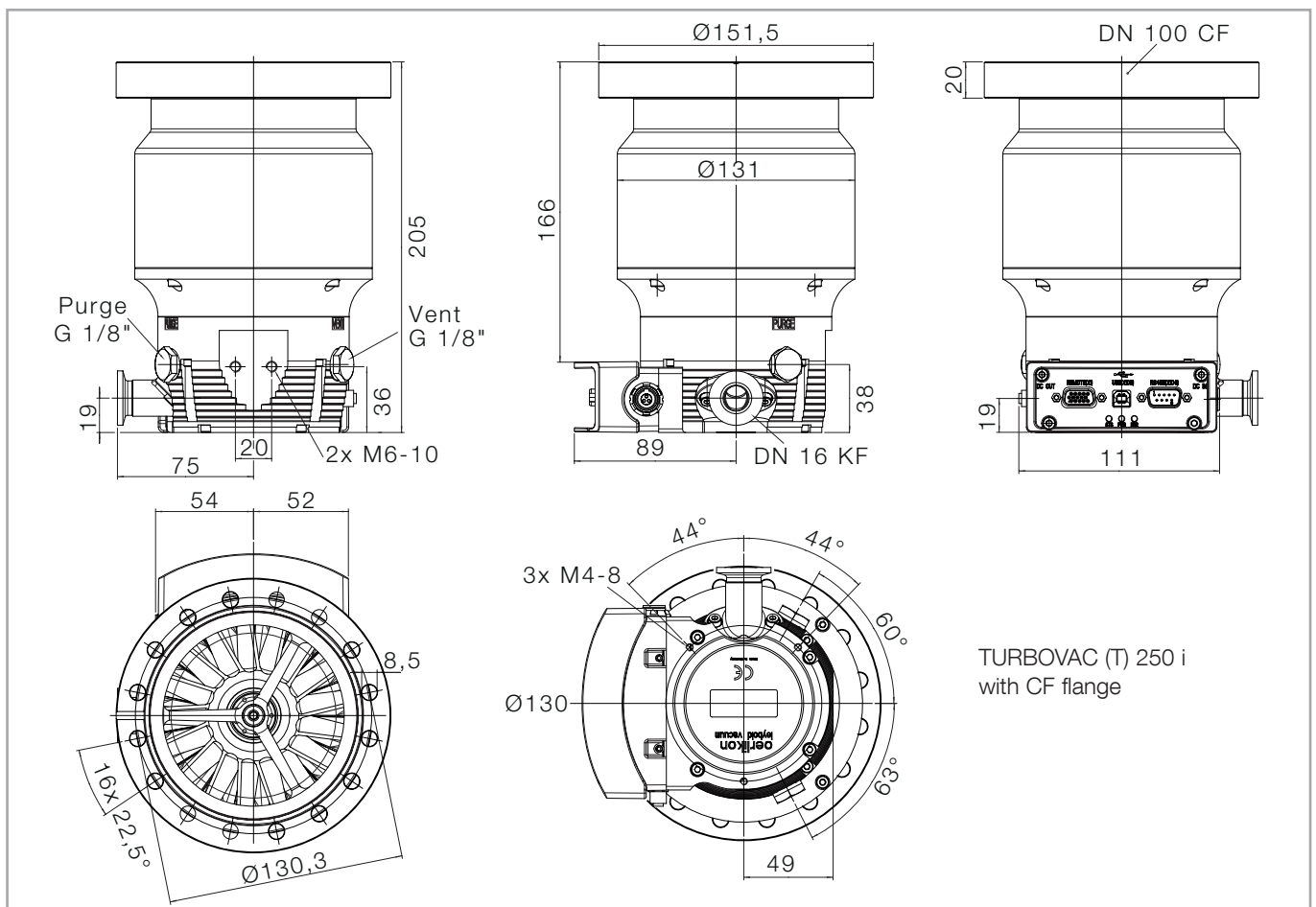
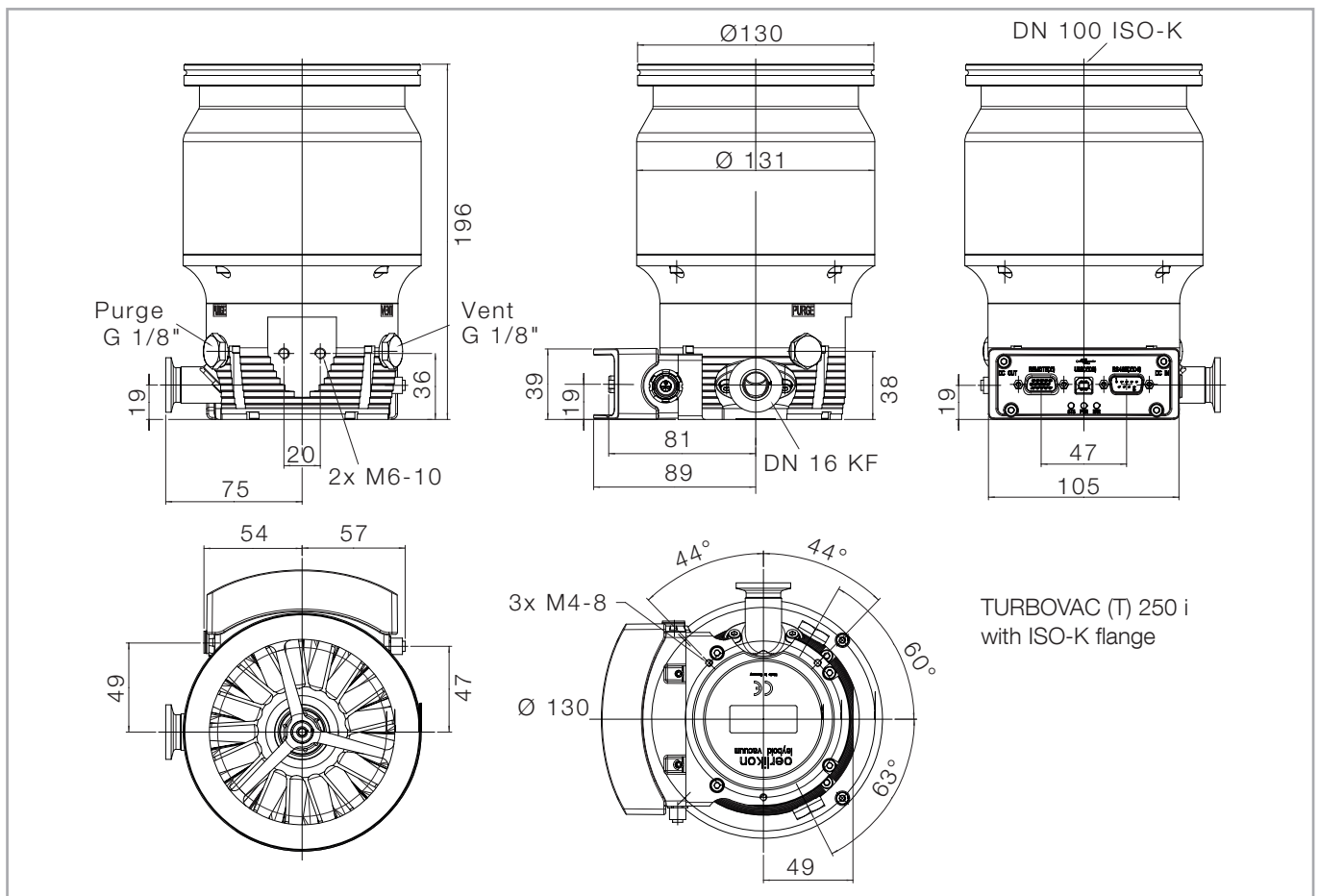


Fig. 1.9 Dimensional drawings, dimensions in mm

# Description



# Description

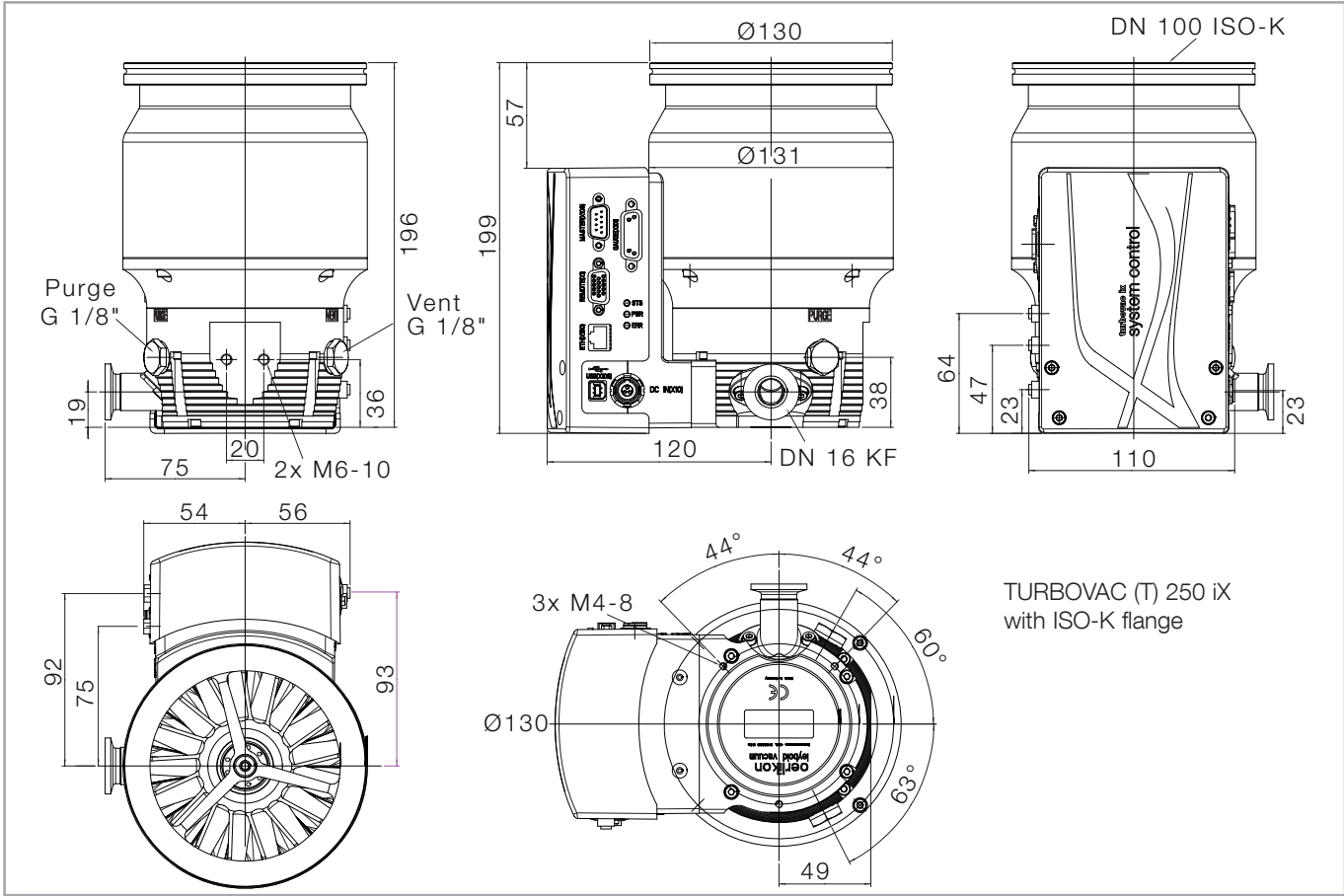


Fig. 1.12 Dimensional drawings, dimensions in mm

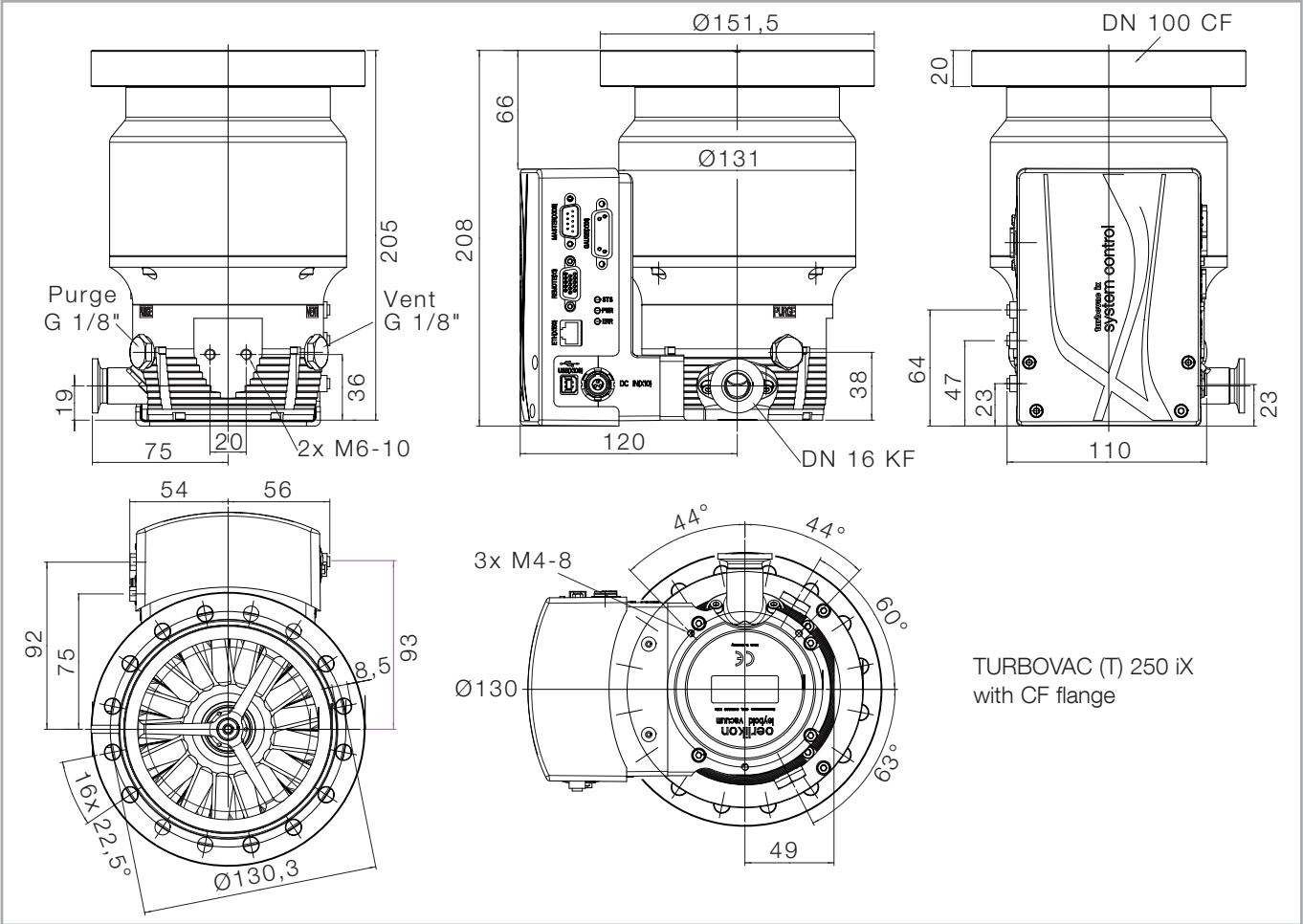


Fig. 1.13 Dimensional drawings, dimensions in mm



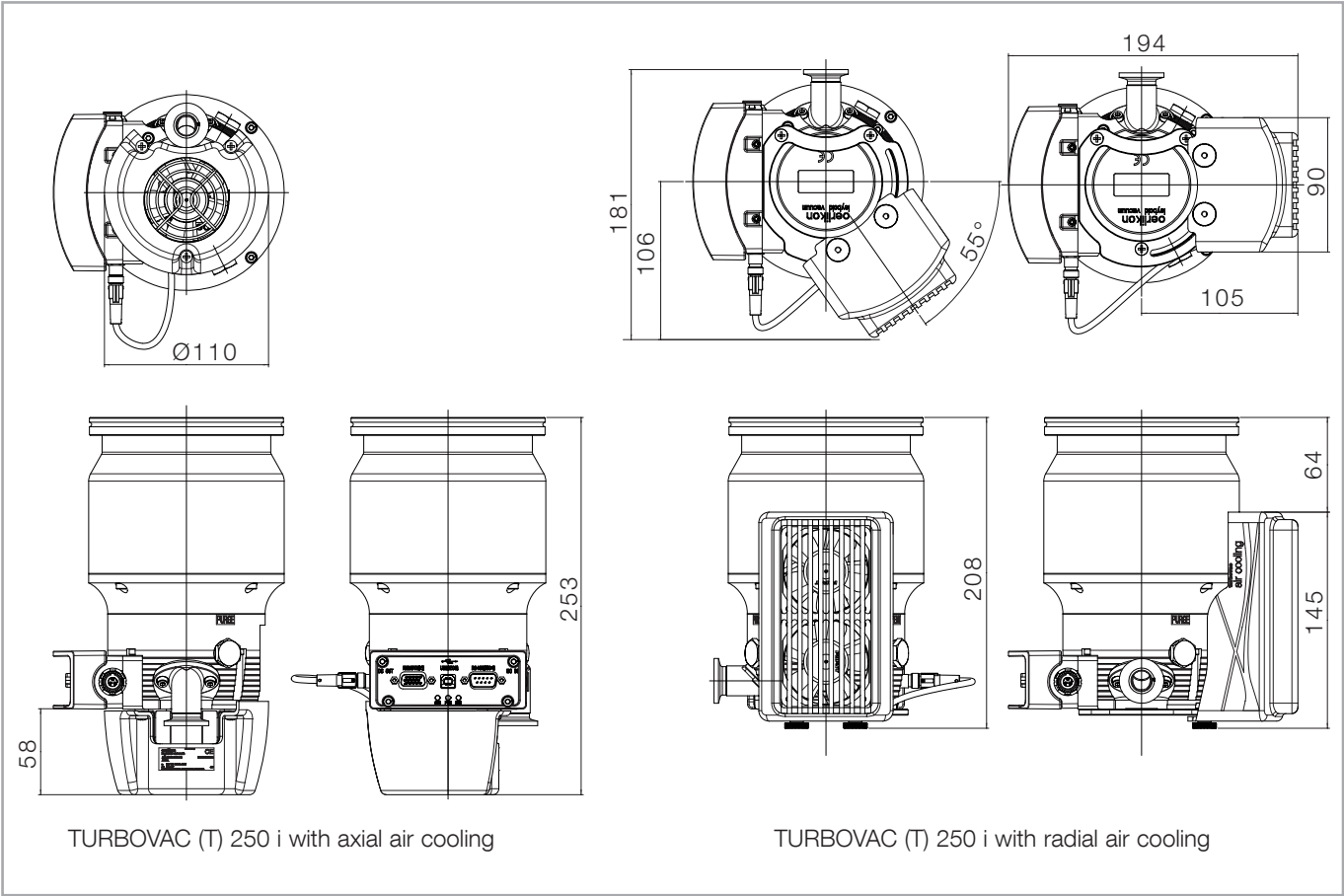


Fig. 1.14 Dimensional drawings, dimensions in mm

# Description

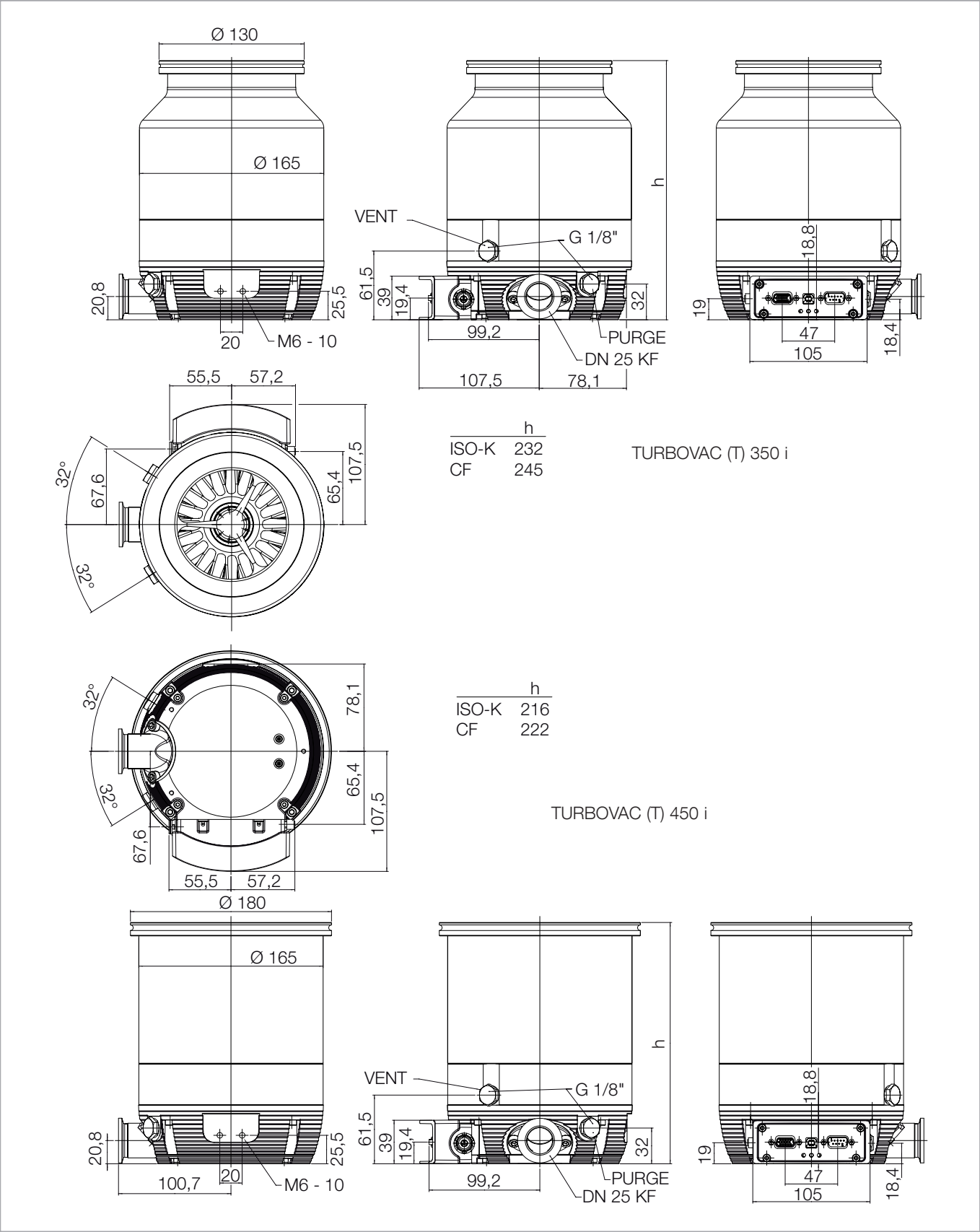


Fig. 1.15 Dimensional drawings, dimensions in mm

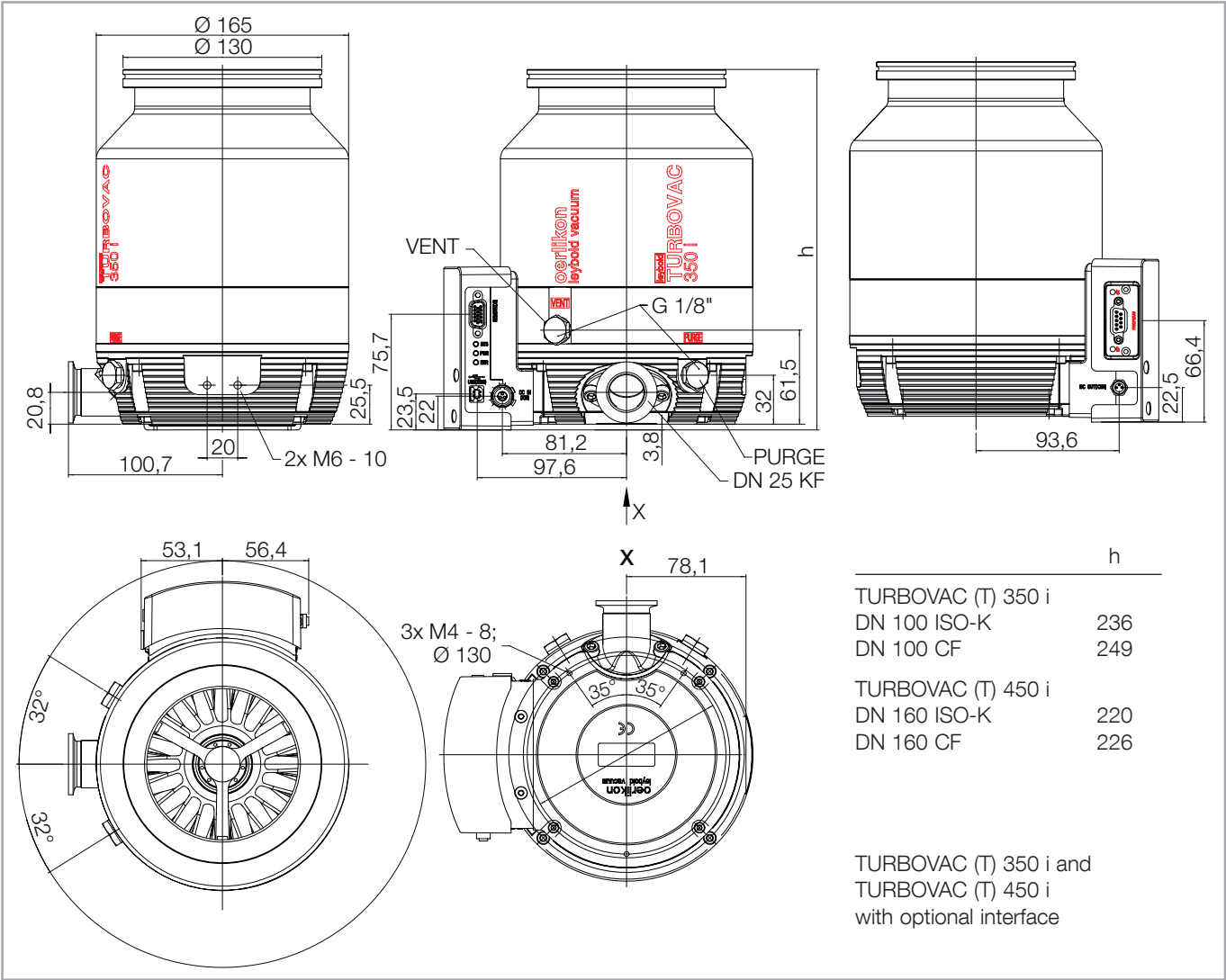


Fig. 1.16 Dimensional drawings, dimensions in mm

# Description

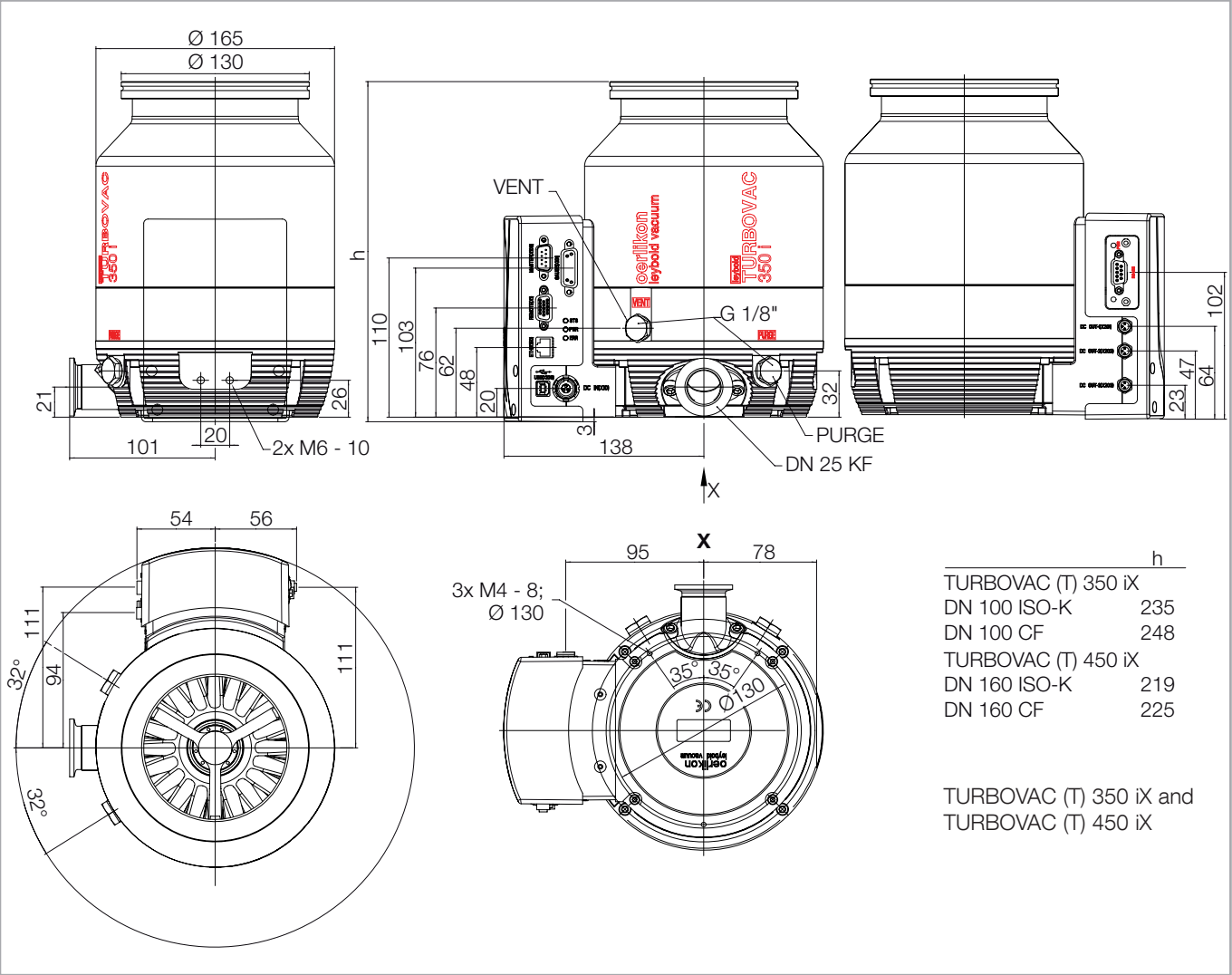


Fig. 1.17 Dimensional drawings, dimensions in mm

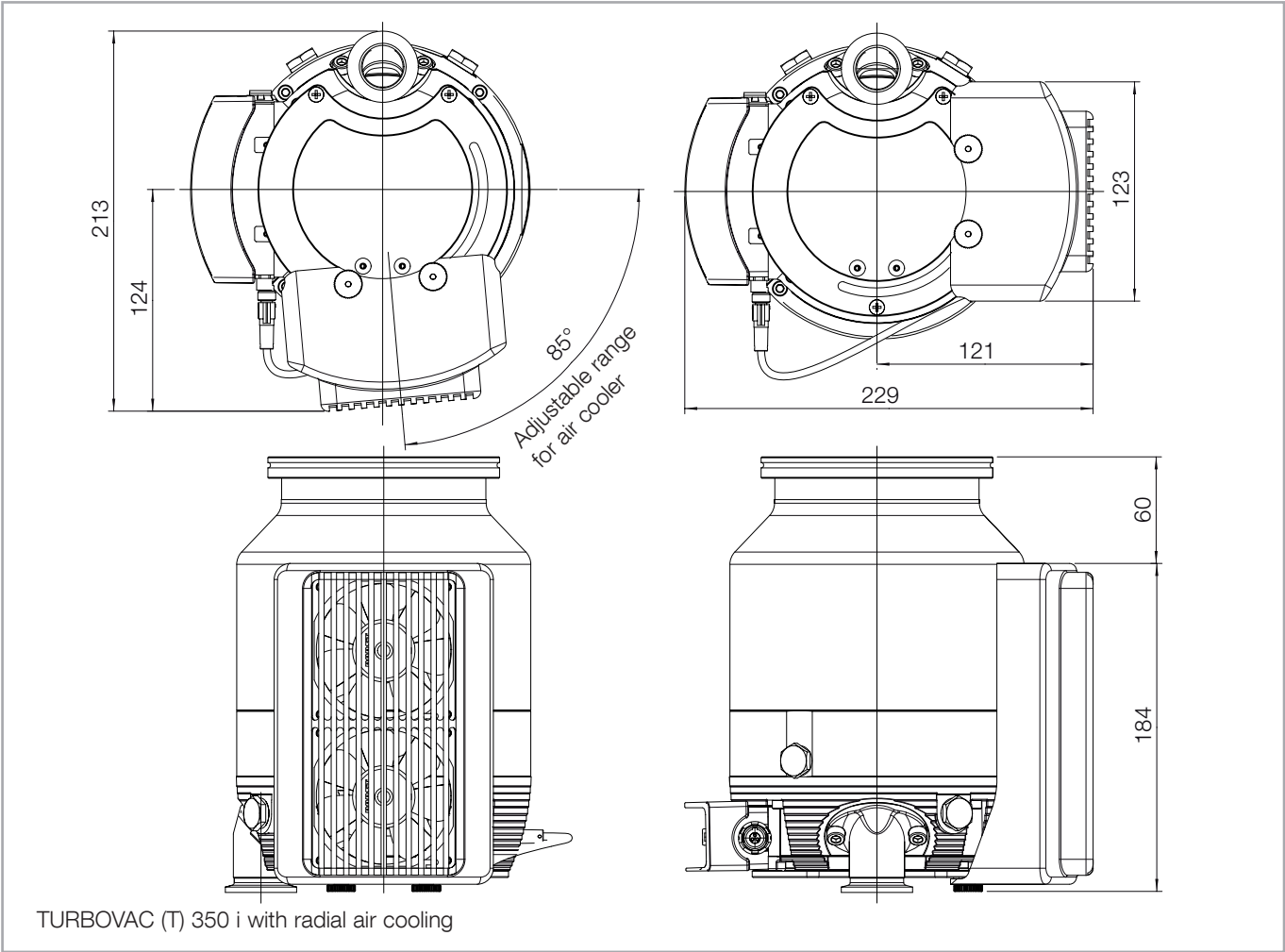


Fig. 1.18 Dimensional drawings

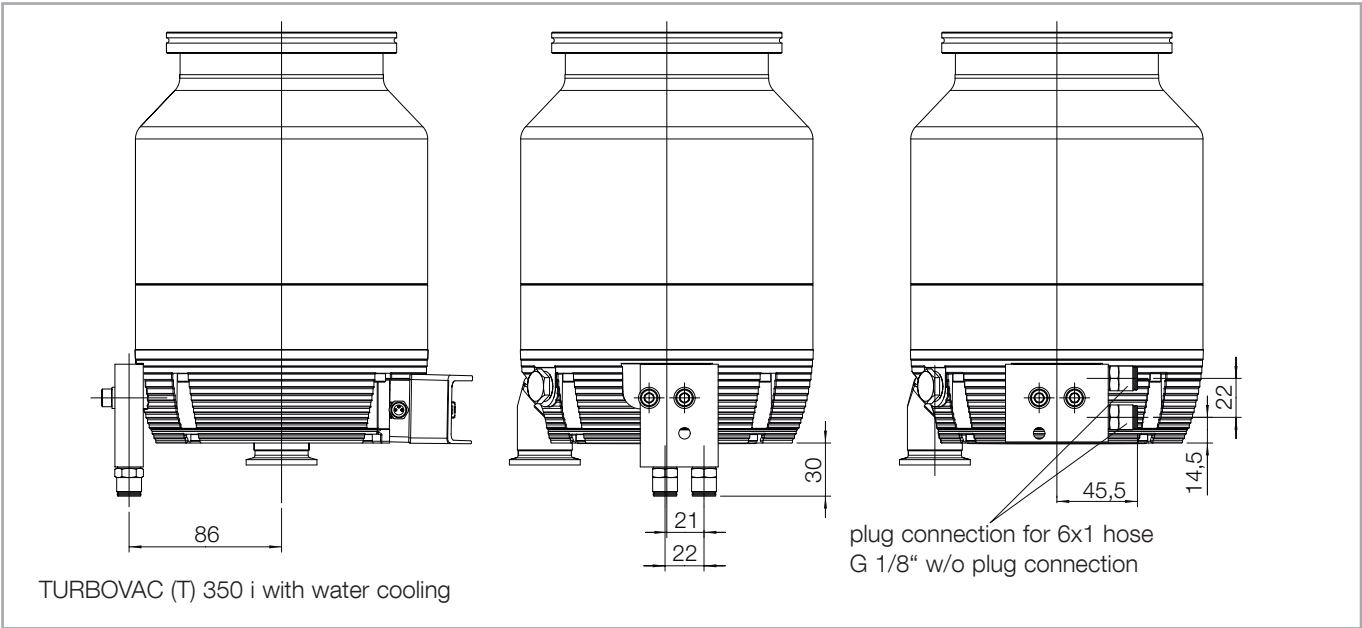


Fig. 1.19 Dimensional drawings

# Description

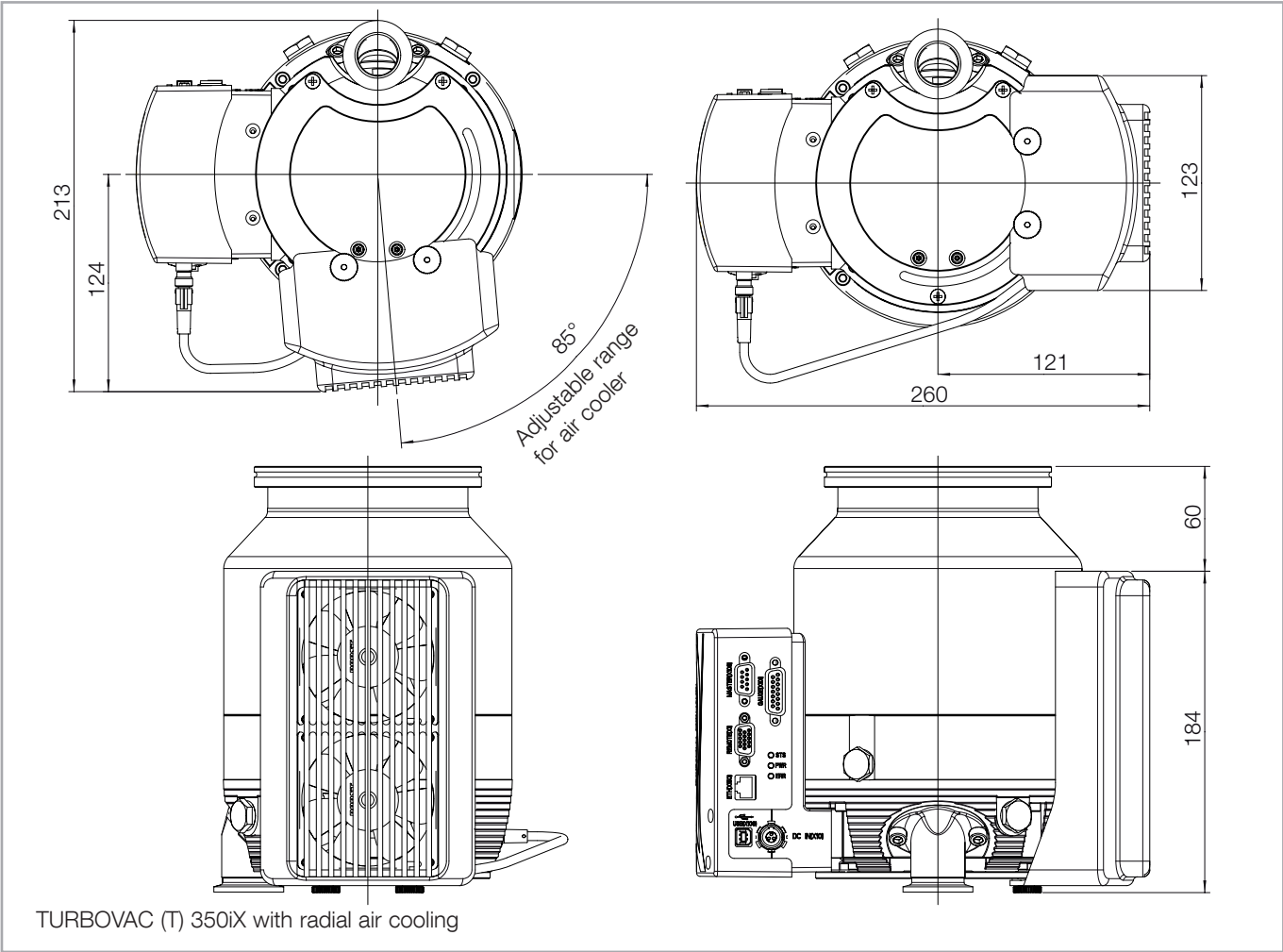


Fig. 1.20 Dimensional drawings

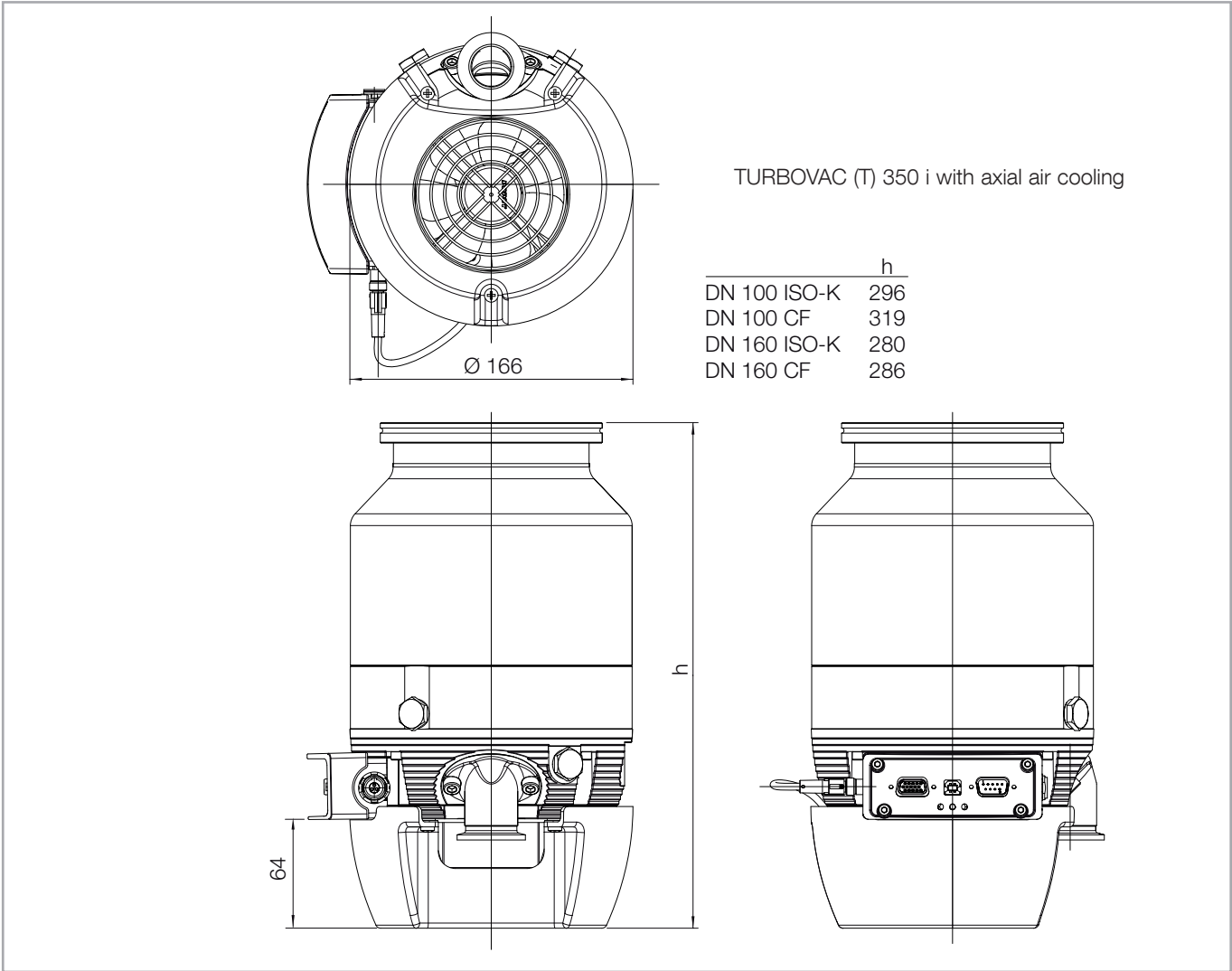


Fig. 1.21 Dimensional drawings

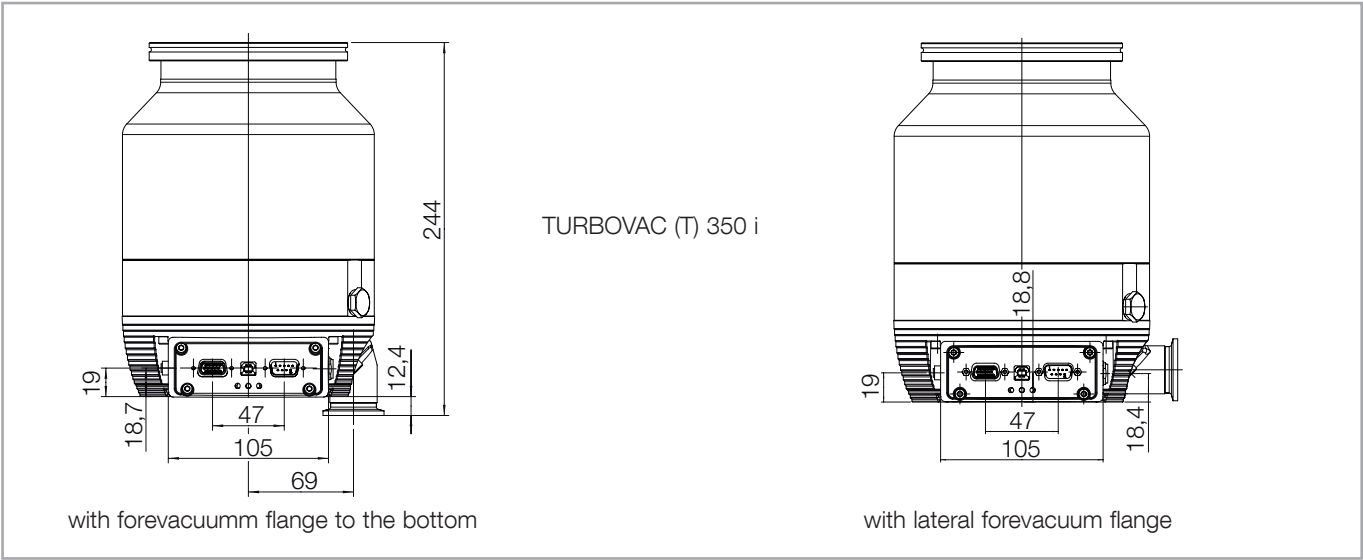


Fig. 1.22 Dimensional drawings

# Description

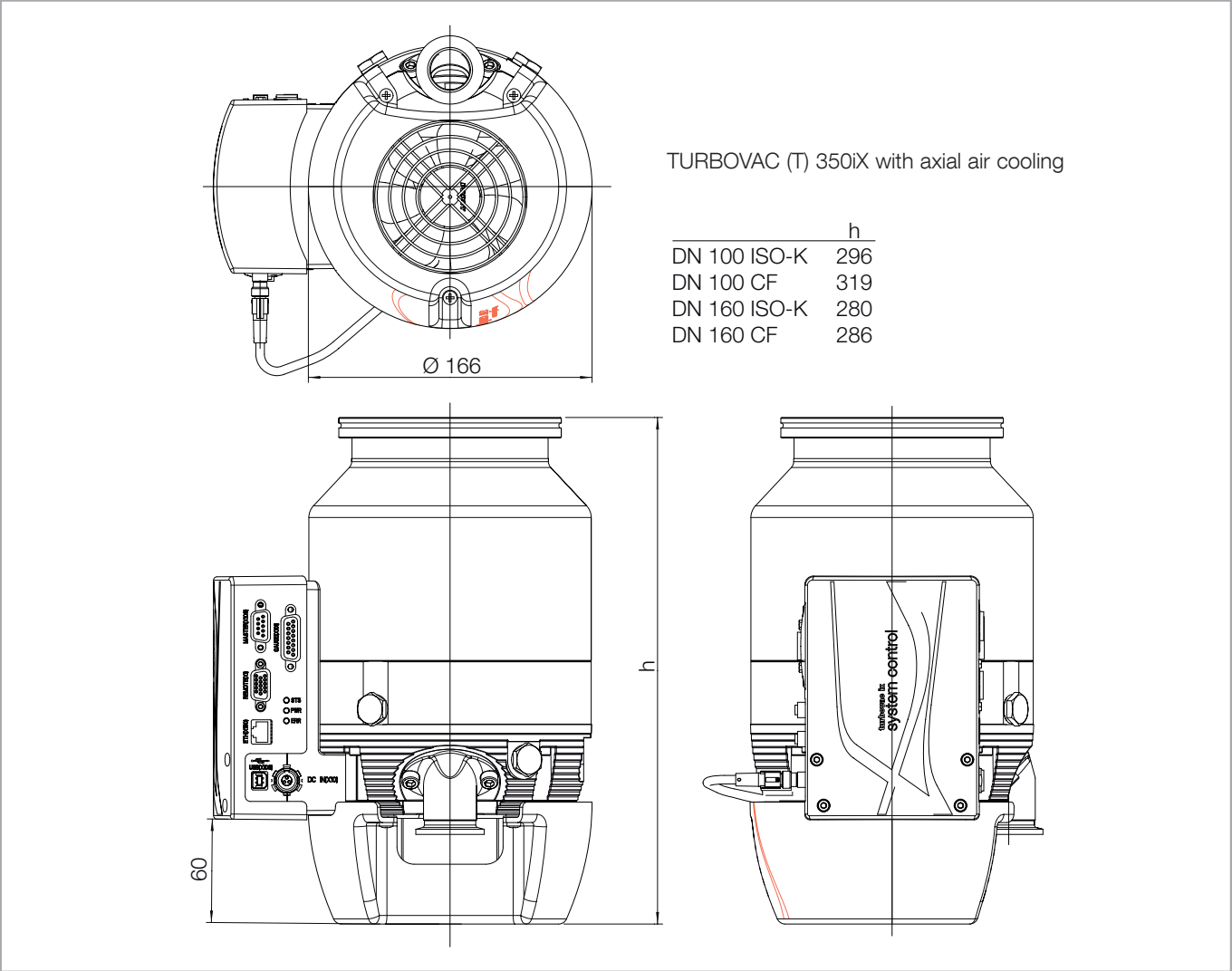


Fig. 1.23 Dimensional drawings

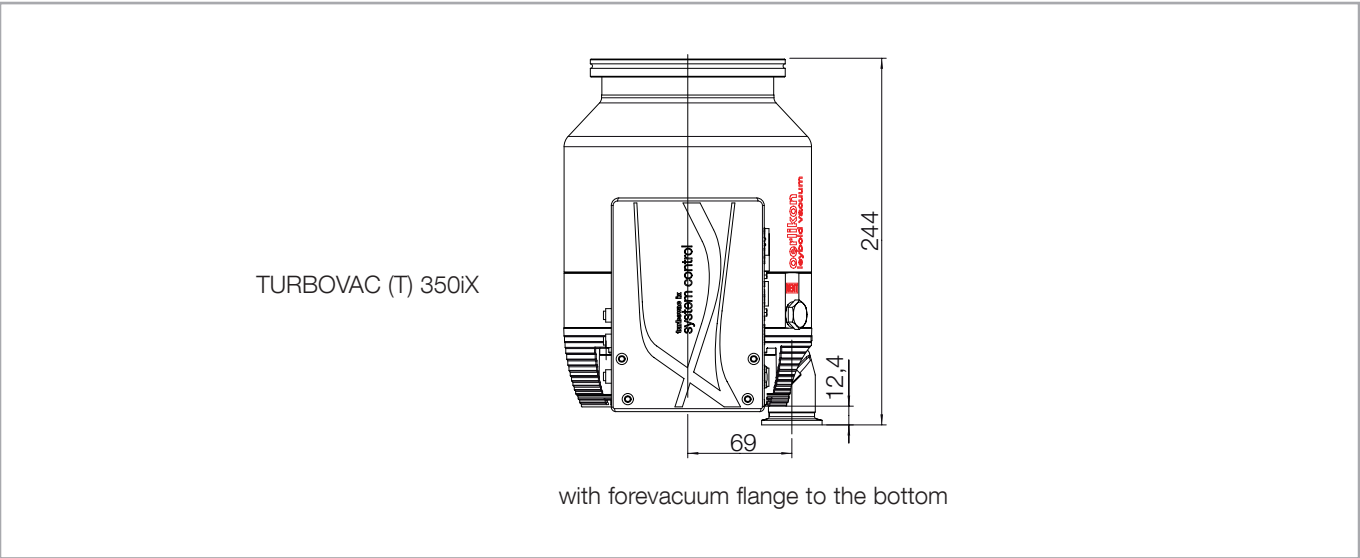


Fig. 1.24 Dimensional drawings



## 1.4 Ordering data

| <b>TURBOVAC</b>                            | <b>90 i</b> | <b>250 i</b> | <b>T 250 i</b> |
|--|-------------|--------------|----------------|
| RS 485, USB+, 15-pin digital I/O interface |             |              |                |
| High-vacuum flange                         | 63 ISO-K    | 100 ISO-K    | 100 ISO-K      |
| <b>Part No.</b>                            | 810031V1000 | 820051V1000  | 820050V1000    |
| High-vacuum flange                         | 63 CF       | 100 CF       | 100 CF         |
| <b>Part No.</b>                            | 810041V1000 | 820061V1000  | –              |

|  |             |             |           |
|--|-------------|-------------|-----------|
| RS 232, USB+, 15-pin digital I/O interface |             |             |           |
| High-vacuum flange                         | 63 ISO-K    | 100 ISO-K   | 100 ISO-K |
| <b>Part No.</b>                            | 810031V2100 | 820051V2100 | –         |

| <b>TURBOVAC</b>                            | <b>90 iX</b> | <b>250 iX</b> | <b>T 250 iX</b> |
|--|--------------|---------------|-----------------|
| RS 485, USB+, 15-pin digital I/O interface |              |               |                 |
| High-vacuum flange                         | 63 ISO-K     | 100 ISO-K     | 100 ISO-K       |
| <b>Part No.</b>                            | 810031V3300  | 820051V3300   | 820050V3300     |
| High-vacuum flange                         | 63 CF        | 100 CF        | 100 CF          |
| <b>Part No.</b>                            | 810041V3300  | 820061V3300   | –               |

| <b>TURBOVAC</b>                            | <b>350 i</b> | <b>T 350 i</b> | <b>450 i</b> | <b>T 450 i</b> |
|--|--------------|----------------|--------------|----------------|
| RS 485, USB+, 15-pin digital I/O interface |              |                |              |                |
| High-vacuum flange                         | 100 ISO-K    | 100 ISO-K      | 160 ISO-K    | 160 ISO-K      |
| <b>Part No.</b>                            | 830051V1000  | 830050V1000    | 830071V1000  | 830070V1000    |
| High-vacuum flange                         | 100 CF       | 100 CF         | 160 CF       | 160 CF         |
| <b>Part No.</b>                            | 830061V1000  | 830060V1000    | 830081V1000  | 830080V1000    |


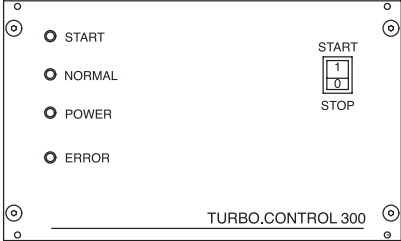

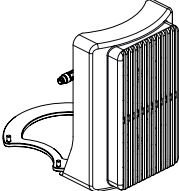
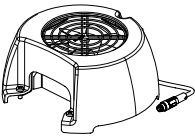
Optional interface (RS 232, Profibus), USB+, 15-pin digital I/O interface: on request

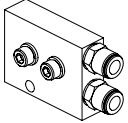
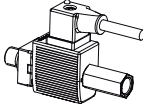

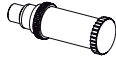
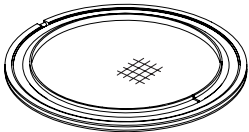
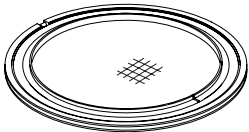
| <b>TURBOVAC</b>                    | <b>350 iX</b> | <b>T 350 iX</b> | <b>450 iX</b> | <b>T 450 iX</b> |
|------------------------------------|---------------|-----------------|---------------|-----------------|
| USB+, 15-pin digital I/O interface |               |                 |               |                 |
| High-vacuum flange                 | 100 ISO-K     | 100 ISO-K       | 160 ISO-K     | 160 ISO-K       |
| <b>Part No.</b>                    | 830051V3000   | 830050V3000     | 830071V3000   | 830070V3000     |
| High-vacuum flange                 | 100 CF        | 100 CF          | 160 CF        | 160 CF          |
| <b>Part No.</b>                    | 830061V3000   | 830060V3000     | 830081V3000   | 830080V3000     |

|  |             |             |             |             |
|--|-------------|-------------|-------------|-------------|
| RS 485, USB+, 15-pin digital I/O interface |             |             |             |             |
| High-vacuum flange                         | 100 ISO-K   | 100 ISO-K   | 160 ISO-K   | 160 ISO-K   |
| <b>Part No.</b>                            | 830051V3300 | 830050V3300 | 830071V3300 | 830070V3300 |
| High-vacuum flange                         | 100 CF      | 100 CF      | 160 CF      | 160 CF      |
| <b>Part No.</b>                            | 830061V3300 | 830060V3300 | 830081V3300 | 830080V3300 |

# Description

## 1.5 Accessories

|   | Part No.    |   |
|---|-------------|---|
| <b>Power supply TURBO.POWER integra</b> incl. 0.3 m cable                           | 800100V0003 |    |
| Cable TURBOVAC i/iX - TURBO.POWER integra, 1 m                                      | 800096V0100 |   |
| Cable TURBOVAC i/iX - TURBO.POWER integra, 3 m                                      | 800096V0300 |   |
| Cable TURBOVAC i/iX - TURBO.POWER integra, 5 m                                      | 800096V0500 |   |
| <b>Power supply and control unit TURBO.CONTROL 300</b>                              | 800100V0001 |    |
| Cable TURBOVAC - Turbo.Control 300, 1 m   | 800092V0100 |   |
| Cable TURBOVAC - Turbo.Control 300, 3 m   | 800092V0300 |   |
| Cable TURBOVAC - Turbo.Control 300, 5 m   | 800092V0500 |   |
| Cable TURBOVAC - Turbo.Control 300, 10 m extension                                  | 800092V1000 |   |
| Cable TURBOVAC - Turbo.Control 300, 20 m extension                                  | 800092V2000 |   |
| Mains cable for power supplies, 3 m long  |             |   |
| EC plug   | 800102V0002 |   |
| UK plug   | 800102V0003 |   |
| US plug   | 800102V1002 |   |
| 24/48 V DC In plug TURBOVAC   | 800090V0000 |   |
| TURBOVAC i DC cable with bare wire ends, 1 m  | 800095V0100 |   |
| TURBOVAC i DC cable with bare wire ends, 3 m  | 800095V0300 |   |
| TURBOVAC i DC cable with bare wire ends, 5 m  | 800095V0500 |   |
| Accessory cable TURBOVAC i, M8-M8, 2 m  | 800110V0016 |   |
| Y cable TURBOVAC i, M8  | 800110V0020 |   |
| Start stop switch for TMP   | 800110V0021 |   |
| USB cable 2.0 Type A/B, 1.8 m   | 800110V0108 |   |
| Relay box for forevacuum pump, 1-phase, 10A<br>incl. 2 m M8-M8 cable                | 800110V0030 |  |
| LEYASSIST software for TMPs<br>(included in the standard equipment for TURBOVAC iX) | 230439V01   |   |
| Air cooling radial  |             |   |
| TURBOVAC 90 i(X)  | 800136V0007 |  |
| TURBOVAC 250 i(X)   | 800136V0009 |   |
| TURBOVAC 350-450 i(X)   | 800136V0005 |   |
| Air cooling axial   |             |   |
| TURBOVAC 90 i(X) and 250 i(X)   | 800136V0008 |  |
| TURBOVAC 350-450 i(X)   | 800136V0006 |   |

|  | Part No.    |   |
|--|-------------|---|
| Water cooling TURBOVAC i(X)                          | 800135V0005 |    |
| Venting valve, 24 V DC, G 1/8"                       | 800120V0012 |    |
| Power failure venting valve 24 V DC, G 1/8"          | 800120V0022 |   |
| Purge gas valve, 24 V DC, G 1/8", 24 sccm            | 800120V0013 |   |
| Purge gas throttle 24 sccm                           | 800120V0014 |    |
| Air filter for TMP, G 1/8"                           | 800110V0022 |    |
| Air drier TURBOVAC                                   | auf Anfrage |   |
| Flange heater DN 63 CF, 230V                         | 800137V0003 |  |
| Flange heater DN 63 CF, 115V                         | 800137V0004 |   |
| Flange heater DN 100 CF, 230V                        | 800137V0005 |   |
| Flange heater DN 100 CF, 115V                        | 800137V0006 |   |
| Flange heater DN 160 CF, 230V                        | 800137V0007 |   |
| Flange heater DN 160 CF, 115V                        | 800137V0008 |   |
| Vibration absorber DN 100 ISO-K                      | 800131V1100 |   |
| for other flanges                                    | on request  |   |
| Centering ring with coarse inlet screen DN 63 ISO-K  | 800133V0011 |   |
| Centering ring with splinter guard DN 63 ISO-K       | 800133V0012 |   |
| Centering ring with coarse inlet screen DN 100 ISO-K | 800133V0021 |  |
| Centering ring with splinter guard DN 100 ISO-K      | 800133V0022 |   |
| Centering ring with coarse inlet screen DN 160 ISO-K | 800133V0031 |   |
| Centering ring with splinter guard DN 160 ISO-K      | 800133V0032 |   |
| Coarse inlet screen DN 63 CF (3.2 mm)                | 800132V0011 |   |
| Splinter guard DN 63 CF (0.8 mm)                     | 800132V0012 |   |
| Coarse inlet screen DN 100 CF (3.2 mm)               | 800132V0021 |   |
| Splinter guard DN 100 CF (0.8 mm)                    | 800132V0022 |   |
| Coarse inlet screen DN 160 CF (3.2 mm)               | 800132V0031 |   |
| Splinter guard DN 160 CF (0.8 mm)                    | 800132V0032 |   |

# Description

|                       | Part No.    |
|-----------------------|-------------|
| Mounting kit TURBOVAC |             |
| DN 63 ISO-K           | 800134V0010 |
| DN 63 CF              | 800134V0011 |
| DN 100 ISO-K          | 800134V0020 |
| DN 100 CF             | 800134V0021 |
| DN 100 ISO-K to ISO-F | 800134V0025 |
| DN 160 ISO-K          | 800134V0030 |
| DN 160 CF             | 800134V0031 |
| DN 160 ISO-K to ISO-F | 800134V0035 |

# Transport and storing

## 2 Transport and storing

Remove the equipment from the transportation box and keep the packaging. Make sure that the product has not been damaged during transportation. If this unit is damaged contact your carrier and inform Oerlikon Leybold Vacuum if necessary. For storage of the product, use the packaging provided.

Be careful not to damage the sockets and connections during transportation

Do not stand below the pump while connecting or removing the turbomolecular pump.

The turbomolecular pump is shipped in a sealed PE bag with desiccant. Do not open the sealed package until immediately before installing.

Do not remove the covers and blanking flanges until you are ready to make the connections, to ensure that the turbomolecular pump is installed under the cleanest possible conditions.

Do not store pump and accessories in a moist atmosphere so as to prevent these items from suffering corrosion.

---

### NOTICE



---

### WARNING



## 3 Installation

### 3.1 Conforming utilization

The turbomolecular pump is intended for generating a vacuum. It is suited for non-corrosive processes only.

The turbomolecular pump must be bolted to a rigid vacuum system and connected to a suitable backing pump.

It is intended for being operated within closed rooms.

The use of any accessories which have not been specified by Oerlikon Leybold Vacuum is only allowed after approval by Oerlikon Leybold Vacuum.

#### 3.1.1 Non-conforming utilization

Non-conforming utilizations for both pump and frequency converter are among others:

- Pumping of gases and vapours for which the materials of the pump are unsuitable.
- Operation in connection with processes in which GaAs (gallium arsenide) is being pumped.
- Pumping of gas mixtures with an oxygen content of > 21%.
- Pumping of corrosive gases and dust containing gases without reverting to purge gas operation.
- Pumping of condensable vapours without suitably controlling the temperature of the pump. Upon compression within the pump, these vapours may condense or form deposits.
- Pumping of dusts and solids without the use of suitable screens and filters.
- Operation at an inadmissibly high forevacuum pressure.
- Operation at inadmissibly high gas loads.
- Utilization of both pump and frequency converter in explosion hazard areas.
- Non-compliance of the specified maintenance and servicing intervals
- Operation of the pump and drive electronics in environments which demand protection type IP 40 or higher and where the installation site is over 4000 m the above sea level.
- Utilization in systems and pump systems in which the pressure may exceed 1.4 bar abs.
- Operation with an inadequately mounted pump
- Operation without having flanged the pump to the system or without having connected it to a suitable backing pump.
- Operation with additional heat sources involving thermal radiation, thermal conduction via the high vacuum or the forevacuum flange, strong magnetic fields or very hot process gases, for example. In environments with water cooling operation, CF flanges may be baked-out up to 100 °C.

- Use in systems in which impact stress and vibrations or periodically occurring forces affect pump, frequency converter and cables.
- Operation on moving system or system components (locks or movable pump systems, for example).
- Operation at vibration absorbers and vacuum components (gate valves, valves) which are not capable of sustaining the specified deceleration torque should the pump rotor seize.
- Stepping on pump, add-on parts, drive electronics, flanges and cables to climb onto the system.
- Fitting of add-on parts to the forevacuum flange which cause an inadmissible high load.
- Removing, covering or obstructing warning notices.
- Standstill or storing of the pump without suitable sealing-off and drying. Storing in a humid atmosphere can cause corrosion.
- Conversions, manipulations and maintenance work by personnel not authorised by Oerlikon Leybold Vacuum..

Any non-conforming utilisation of pump, frequency converter and accessories can result in severe injury or death and cause damage to components.

**WARNING**



### 3.2 Operating environment

|                                 |   |
|---------------------------------|---|
| Permissible ambient temperature | 5 to 45 °C<br>no dripping or spraying water, no explosive gas atmospheres                 |
| Installation altitude           | up to 4000 m<br>At altitudes over 2000 m heat dissipation by the ambient air is impaired. |

### 3.3 Fitting accessories

See also Section 1.5 accessories.

Various accessory components can be connected to the TURBOVAC i(X)

- Water cooling or air cooling, see Section 3.6.
- Purge gas valve, venting valve or power failure venting valve, see Sections 3.7 and 3.8
- Relay box for switching a forevacuum pump.

The accessory connections are pre-configured in the factory and are therefore ready for immediate operation when connecting the pre-configured accessory equipment.

Configurations may be modified via the interfaces. For this refer to the interface Operating Instructions.

#### Only for TURBOVAC i

Secondary devices are directly energised and activated via the accessory connection X201 (M8 plug); by means of a Y-cable 2 accessories can be connected at the same time.

In this case both devices will be switched parallelly (i.e. de-energised active / in-active). The factory-set accessories's interface features a plug-and-play mode, and is instantly ready for operation with the connected device (energised with pump switched on).

#### Only for TURBOVAC iX

Additional accessory components can be connected to the TURBOVAC iX

- Pressure gauge
- Further 24 V DC operated equipment which may be driven depending on the pump status.

The accessory components can be electrically powered and driven through three accessory connections. The following table shows the TURBOVAC iX configuration as delivered from the factory:

| Accessory connection | Pre-configured equipment      | Reaction   |
|----------------------|-------------------------------|--|
| X201                 | Air cooling                   | Air cooling unit is running when the TURBOVAC is running.  |
| X202                 | Relay box for forevacuum pump | Forevacuum pump is running when the TURBOVAC has received the start command.   |
| X203                 | Venting valve                 | The venting valve opens when the start command is revoked and the frequency drops below 999 Hz. At 5 Hz the valve is closed again (no power failure venting!). |



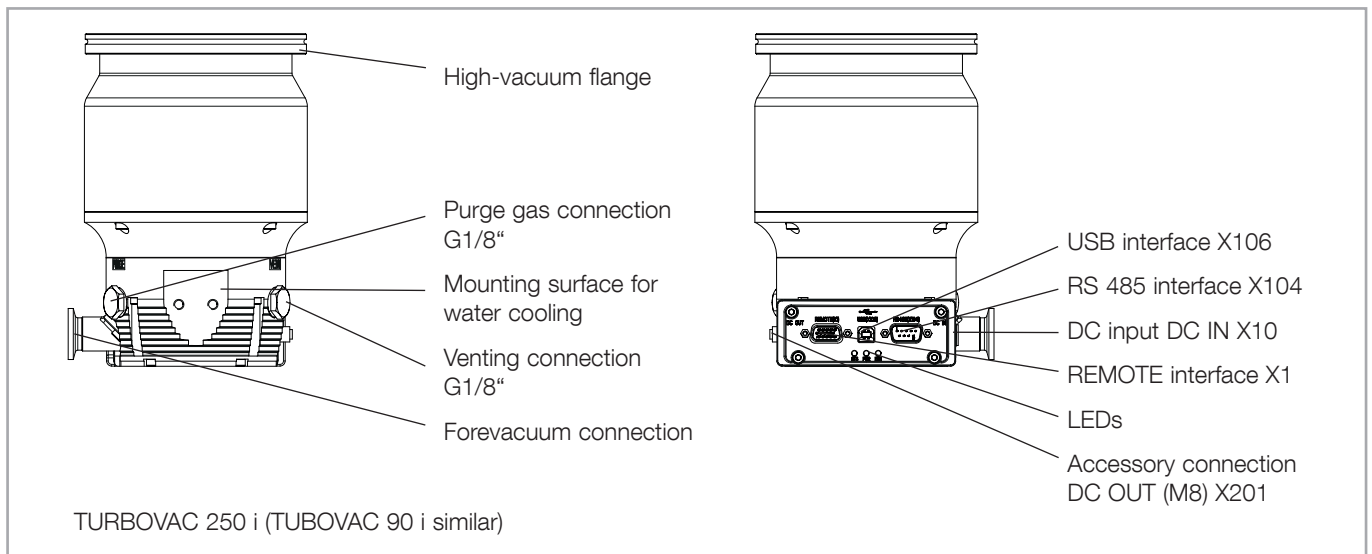


Fig. 3.1 Connections

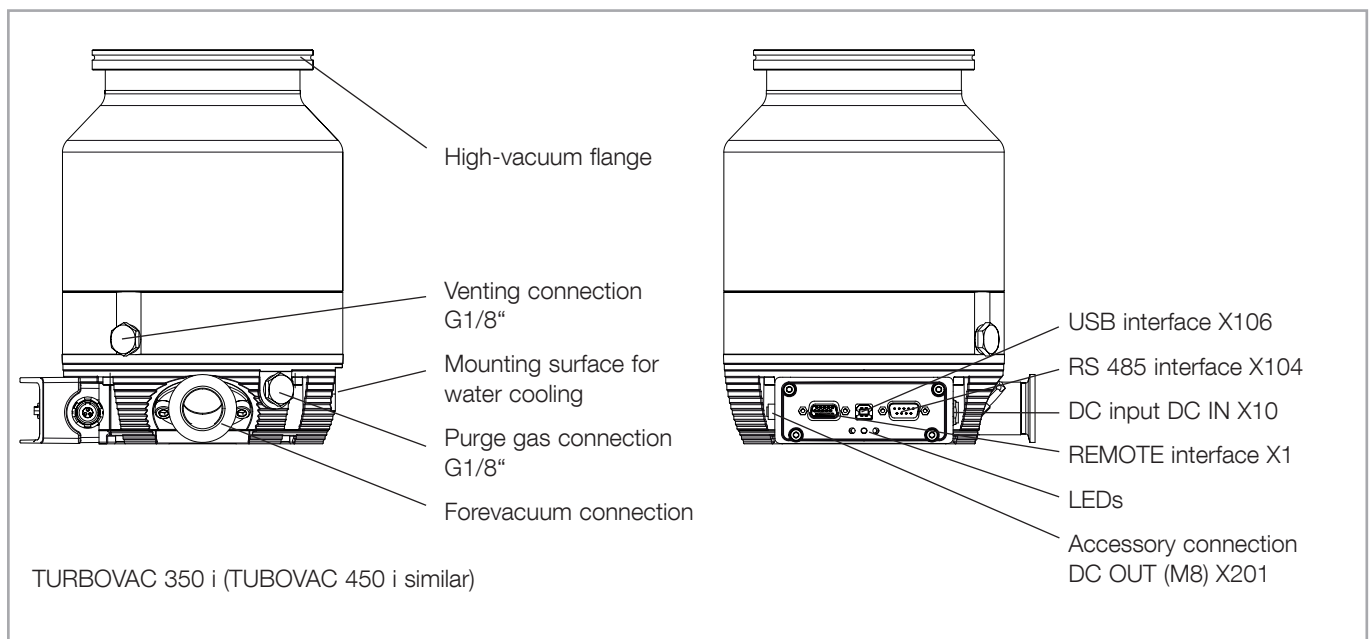


Fig. 3.2 Connections

# Installation

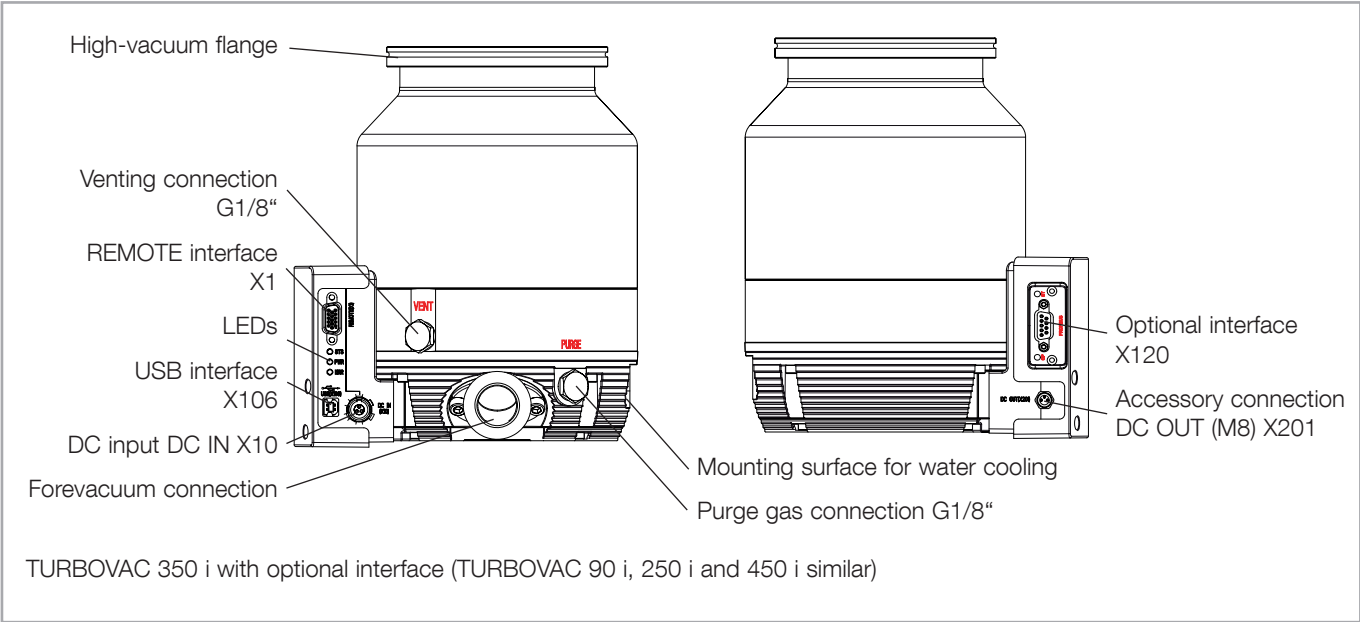


Fig. 3.3 Connections

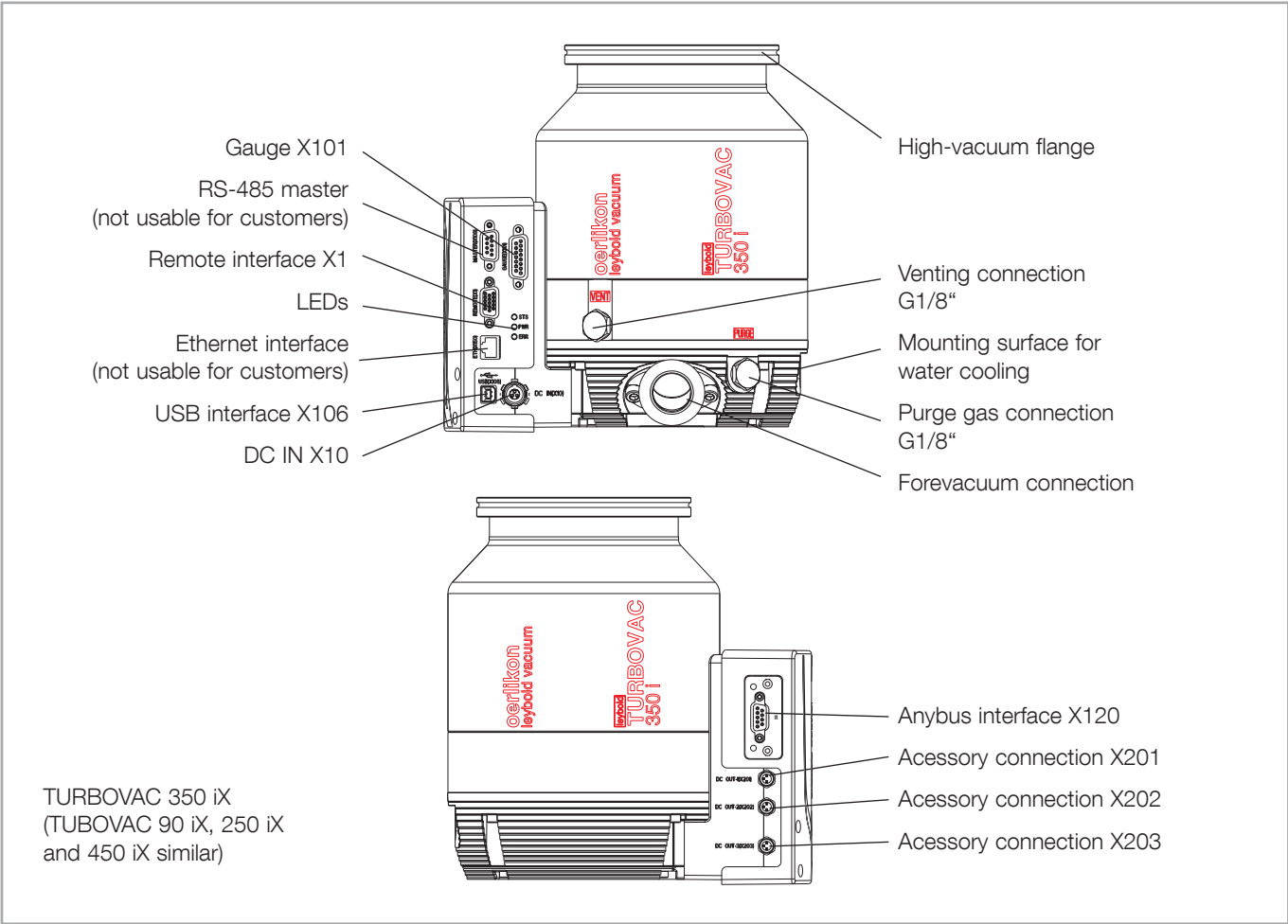


Fig. 3.4 Connections

## 3.4 Attach the pump to the vacuum chamber

Never touch the rotor. Touching the rotor may cause injury and damage the rotor bearing.

The high vacuum flange must be solidly mounted to the vacuum chamber. Observe Safety Information 0.1.6.

Remove the transport seal from the intake flange and remove the desiccant. Pay attention to maximum cleanliness when connecting.

In the case of a sudden rotor vane rupture or rotor-stator contact which may occur in practice (caused, for example, by solid objects from the process chamber entering the pump through the high vacuum flange), the following torques need to be absorbed by the system:

|                                     |             |
|-------------------------------------|-------------|
| TURBOVAC 90 i(X)                    | max. 250 Nm |
| TURBOVAC (T) 250 i(X)               | max. 850 Nm |
| TURBOVAC (T) 350 i(X), (T) 450 i(X) | max.1000 Nm |

In most applications the pump is flanged to the high vacuum flange at the apparatus. The pump can be mounted and operated in any desired attitude.

No support is required. If nonetheless an additional fastening is requested you can use the 3 boreholes in the pump's bottom.

Use exclusively flange connecting components which have been manufactured in accordance with DIN 28404, ISO 1609 (ISO-K flange connections) or ISO 3669 (CF flange connections).

The flange material to which the pump is bolted, must have at operating temperature a minimum strength specification of 150 N/mm<sup>2</sup>.

### Operation with vibration absorber

To decouple extremely sensitive equipment and to prevent transfer of external vibrations to the pump a special resonance damper is available for mounting at the high vacuum flange.

In this case mount the turbomolecular pump separately. A vibration absorber cannot reliably sustain the high deceleration torque in case of a rotor seizure.

If additional mounting is not possible, then the pump must be protected by a suitable shield during operation.

---

#### NOTICE



---

#### WARNING



---

#### Torque when the rotor seizes

# Installation

On the cooling surface it is possible to connect a vibration sensor: thread M6, 10 mm deep.

If several turbomolecular pumps are installed to the vacuum chamber of the same system, there is the risk of interference (vibration interference between the pumps). If such a risk exists please contact Oerlikon Leybold Vacuum Application Support.

The standard mounting arrangement for the pump is adequate to ensure earthquake protection. If required mount the system to the floor or the walls.

## Install a splinter guard or an inlet screen

To protect the TMP against foreign material from the vacuum vessel we recommend to mount a centering ring with a fine or coarse inlet screen at the high vacuum flange, though this will reduce the pumping speed at the chamber flange.

| Reduction of the pumping speed in % | H <sub>2</sub> | He | N <sub>2</sub> | Ar |
|-------------------------------------|----------------|----|----------------|----|
| Fine inlet screen DN 63             | on request     |    |                |    |
| Coarse inlet screen DN 63           | on request     |    |                |    |
| Fine inlet screen DN 100            | 5              | 7  | 24             | 24 |
| Coarse inlet screen DN 100          | 2              | 2  | 10             | 8  |
| Fine inlet screen DN 160            | 6              | 9  | 20             | 23 |
| Coarse inlet screen DN 160          | 1              | 2  | 6              | 7  |

Damages caused during operation without the inlet screen are excluded from warranty.

## Flange mounting for ISO-K flanges

When flanging on the high vacuum connecting flange, place the O-ring on the centering ring. The O-ring must remain in place smooth and untwisted. Thereafter put the outer ring (support ring) in place.

Mount the turbomolecular pump according to Fig. 3.5 and 3.6 and tighten the bolts crosswise step-by-step.

When using an ultra sealing ring, always use an outer support ring. The information on the number of bolts and clamps also applies to the ultra sealing rings.

Required for the installation:

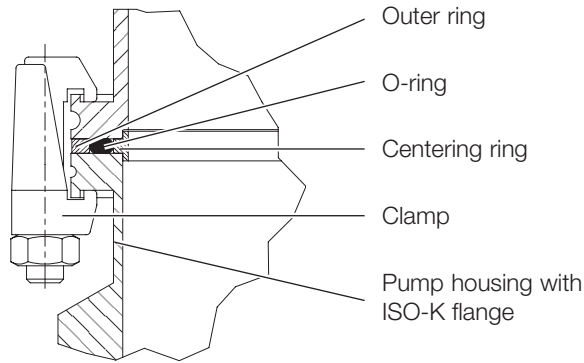
- mounting kit (accessories)
- coarse or fine inlet screens (accessories, optional)

### NOTICE



The contact surfaces of pump housing, vacuum system and centering ring must be free of grease and dry so as to ensure adequate strength in case the rotor should seize.

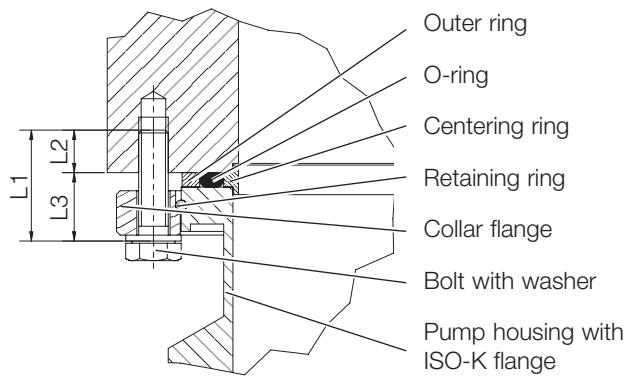
## ISO-K flange at ISO-K flange



| Flange                                 | DN 63 ISO-K                      | DN 100 ISO-K | DN 160 ISO-K |
|--|----------------------------------|--------------|--------------|
| Number of clamps                       | 4 x M10                          | 6 x M10      | 6 x M10      |
| Minimum clamp strength, yield strength | > 450 N/mm <sup>2</sup>          |              |              |
| Fastening torque                       | 20 <sup>+3</sup> <sub>0</sub> Nm |              |              |

The fastening torque levels apply to lubricated threads.

## ISO-K flange at ISO-F flange with collar flange



| Flange                                | DN 63 ISO-K                      | DN 100 ISO-K                     | DN 160 ISO-K                     |
|---------------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Number of bolts                       | 4 x M8                           | 8 x M8                           | 8 x M10                          |
| Minimum bolt strength, yield strength | > 450 N/mm <sup>2</sup>          | > 600 N/mm <sup>2</sup>          | > 600 N/mm <sup>2</sup>          |
| Minimum screw in depth L2             |                                  |                                  |                                  |
| for steel                             | 12 mm                            | 12 mm                            | 13 mm                            |
| for aluminium                         | 16 mm                            | 12 mm                            | 18 mm                            |
| L3                                    | 18.5 mm                          | 18.5 mm                          | 23 mm                            |
| Recommended bolts – ISO 4014          |                                  |                                  |                                  |
| for steel flanges                     | M8x30                            | M8x30                            | M10x40                           |
| for aluminium flanges                 | M8x35                            | M8x30                            | M10x45                           |
| Bolt quality                          |                                  |                                  |                                  |
| stainless steel bolts                 | 8.8 or A2(A4)-70                 | 8.8 or A2(A4)-80                 | 8.8 or A2(A4)-80                 |
| Fastening torque                      | 15 <sup>+2</sup> <sub>0</sub> Nm | 20 <sup>+3</sup> <sub>0</sub> Nm | 35 <sup>+5</sup> <sub>0</sub> Nm |

Fig. 3.5 Mounting high vacuum flange ISO-K

# Installation

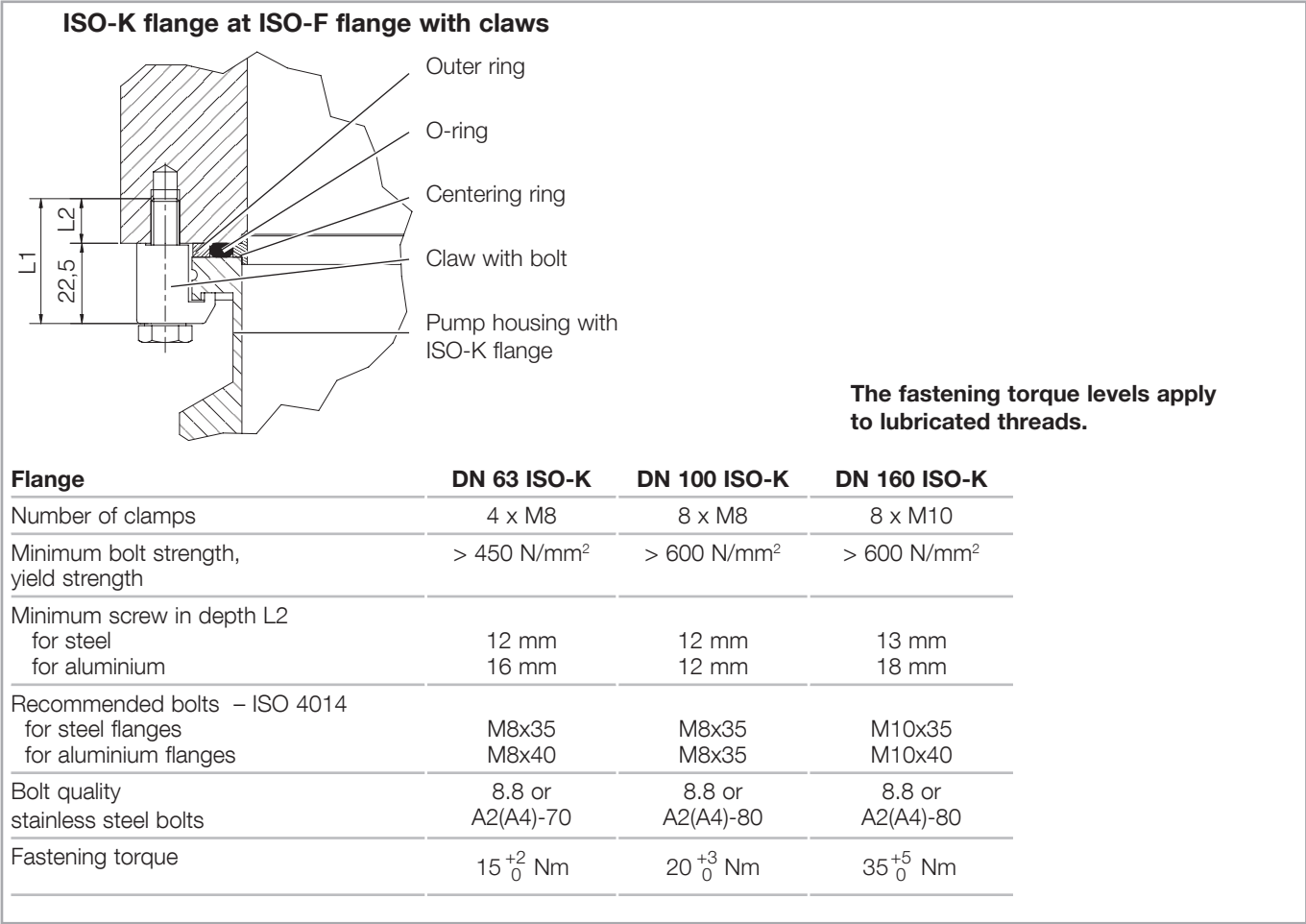
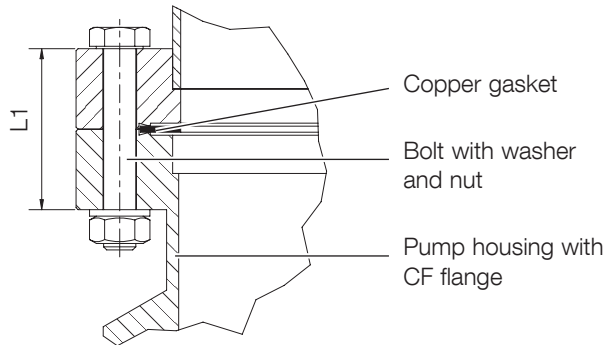


Fig. 3.6 Mounting high vacuum flange ISO-K

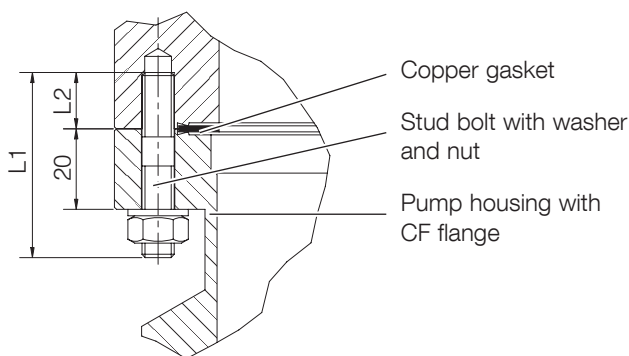
## CF flange connection with clearance hole



| Flange                                | DN 63 CF                         | DN 100 CF   | DN 160 CF   |
|---------------------------------------|----------------------------------|-------------|-------------|
| Number of bolts                       | 8 x M8                           | 16 x M8     | 20 x M8     |
| Minimum bolt strength, yield strength | > 450 N/mm <sup>2</sup>          |             |             |
| Recommended bolts – ISO 4014<br>L1 =  | M8x45<br>35                      | M8x50<br>40 | M8x55<br>44 |
| Bolt quality<br>stainless steel bolts | 8.8 or<br>A2(A4)-70              |             |             |
| Fastening torque                      | 15 <sup>+2</sup> <sub>0</sub> Nm |             |             |

The fastening torque levels apply to lubricated threads.

## CF flange connection with blind hole thread



| Flange  | DN 63 CF                         | DN 100 CF          | DN 160 CF |
|---|----------------------------------|--------------------|-----------|
| Number of bolts                                       | 8 x M8                           | 16 x M8            | 20 x M8   |
| Minimum bolt strength, yield strength                 | > 450 N/mm²                      |                    |           |
| Minimum screw-in depth for steel                      | 12 mm                            | 12 mm ≤ L2 < 16 mm |           |
| Recommended bolts for steel flanges – DIN 835<br>L1 = | M8x30<br>45                      |                    |           |
| Bolt quality stainless steel bolts                    | 8.8 or<br>A2(A4)-70              |                    |           |
| Fastening torque                                      | 15 <sup>+2</sup> <sub>0</sub> Nm |                    |           |

Fig. 3.7 Mounting the CF high vacuum flange

# Installation

### Flange mounting for CF flanges

Before fitting, check to ensure that the sealing edge is undamaged. Do not touch the copper gasket and the sealing edge with your bare hands.

**NOTICE**



The contact surfaces of pump housing, vacuum system and centering ring must be free of grease and dry so as to ensure adequate strength in case the rotor should seize.

Mount the turbomolecular pump according to Fig 3.7 and tighten the bolts step-by-step.

When the pump shall be baked out, the threads of the bolts should have been lubricated with a high temperature lubricant.

Owing to the deformation of the copper gasket, the fastening torque of all bolts must be checked once more after having completed the installation work.

Required for the installation:

- mounting kit (accessories)
- coarse or fine inlet screens (accessories, optional)

**CAUTION**



During operation the pump can get so hot that there is the risk of suffering burns (up to approximately 65 °C). Protect the hot parts against being touched.

### 3.5 Forevacuum connection

The forevacuum flange may be detached, turned by 180°, and refit, cf. the dimensional drawing of Fig. 1.22. Tightening torque for the screws is:

|                                     |                                 |
|-------------------------------------|---------------------------------|
| TURBOVAC 90 i(X), (T) 250 i(X)      | 3 ± 0,5 Nm                      |
| TURBOVAC (T) 350 i(X), (T) 450 i(X) | 5 <sup>+2</sup> <sub>0</sub> Nm |

Connect the clean forevacuum line with the small flange connectors or the hose couplings, and take care not to constrict the forevacuum flange's diameter.

Ensure that the pump is sufficiently isolated against vibrations generated by the forevacuum pump.

No forces from the piping system may be allowed to affect the turbomolecular pump. Support the piping correspondingly or decouple through flexible joints.

**DANGER**



The forevacuum line must be tight. Hazardous gases can escape at leaks or the gases being pumped can react with air or humidity. Observe Safety Information 0.4.5.



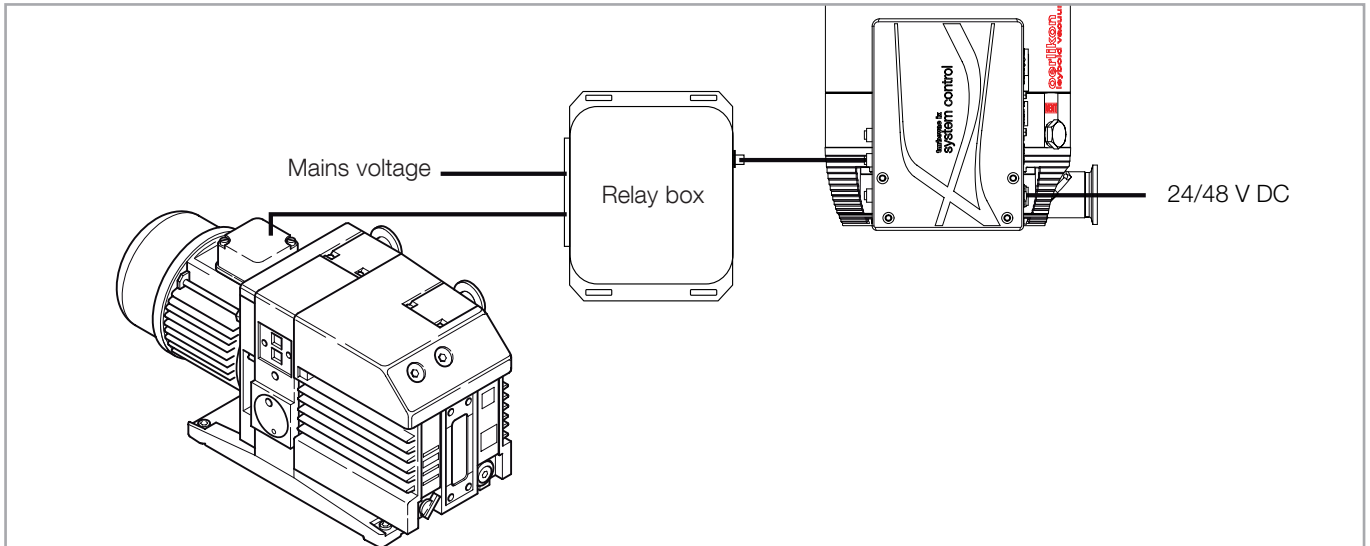


Fig. 3.8 Connecting the forevacuum pump via the relay box

### Only for TURBOVAC i

The forevacuum pump can be energised at the accessories connection of the TURBOVAC via the relay box.

### Only for TURBOVAC iX

A forevacuum pump may be electrically connected through the relay box to accessory connection X202 on the TURBOVAC iX.

The relay box switches the forevacuum pump on when a start command is present for the turbomolecular pump, and the relay box switches the forevacuum pump off when the start command is revoked.

Through parameter 643[1] the switch-on delay time and through parameter 644[1] a shutdown delay time in seconds can be set up (the default for both parameters is 0).

# Installation

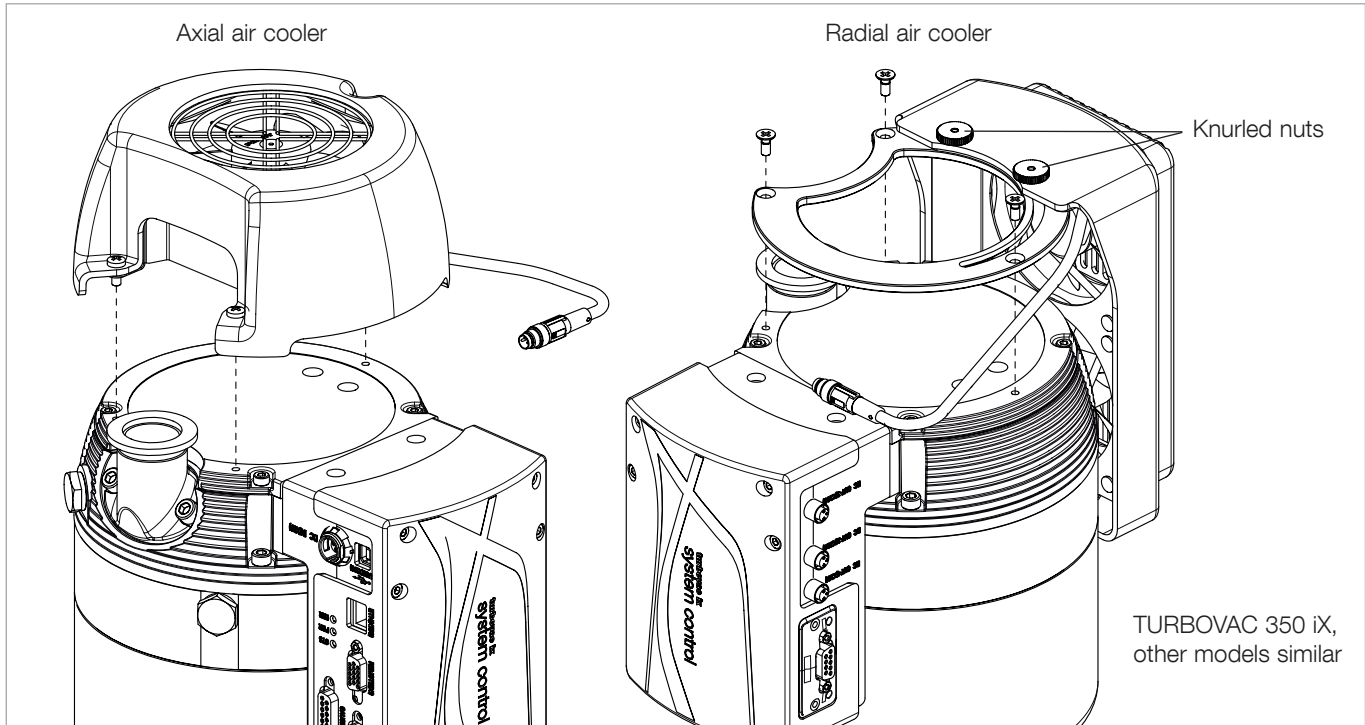


Fig. 3.9 Mounting air coolers

## 3.6 Connect the cooling

Cooling of the pump depends on the required pumping power and the ambient temperature. When the pump is insufficiently cooled it will shut down.

High gas throughputs, cyclic operation or high ambient temperatures will necessitate air or water cooling, refer to the operations diagram for the TURBOVAC 90 i (Fig. 1.4) or Fig. 3.13 for the TURBOVAC 350/450 i(X).

### 3.6.1 Air cooling

When installing air cooled pumps within a system ensure that sufficient quantities of fresh air are freely available. The air cooling facility is powered via the pump.

Use the 3 bolts which are included in the delivery to attach the air cooling unit at the bores provided on TURBOVAC, see also the resp. dimensional drawings. Plug in the control cable of the air cooler into the accessories connection (X201 for the TURBOVAC iX) and screw tightly. The accessory connection is so pre-configured that the air cooler will always be running when the pump is running. To change this setting, refer to the interface Operating Instructions.

The radial air cooler may be adjusted and turned after loosening the 2 knurled nuts, refer to the air cooler Operating Instructions.

## 3.6.2 Water cooling

Attach the cooling water block to the TURBOVAC with 2 M6 screws, tightening torque is  $8^{+2}_0$  Nm . Depending on the requirements the supply or the drainage may be arranged radially or axially, cf. the dimensional drawings. Connect the cooling water hoses.

The hose connections may be unscrewed and removed, to make use of the integrated G 1/8"-threads.

Adjust the cooling water temperature so that the formation of condensate is avoided. With pump downtimes the cooling water has to be turned off.

When switching the cooling water supply on and off by means of an electrically actuated valve, connect the valve so that it will be switched on and off together with the pump.

## 3.6.3 Water Quality

In order to ensure long trouble-free operation the cooling water must not contain any oils, greases and suspended solids. Moreover, we recommend compliance with the following limit values:

|  |                                 |
|--|---------------------------------|
| Appearance                             | Clear, free of oils and greases |
| Suspended matter                       | < 250 mg/l                      |
| Particle size                          | < 150 µm                        |
| Electrical conductivity                | < 700 µS/cm                     |
| pH value                               | 7.0 to 9.0                      |
| Total hardness (total alkaline earths) | < 8 °dH                         |
| Aggressive carbon dioxide              | None, not detectable            |
| Chloride                               | < 100 mg/l                      |
| Sulphates                              | < 150 mg/l                      |
| Nitrate                                | ≤ 50 mg/l                       |
| Iron                                   | < 0.2 mg/l                      |
| Manganese                              | < 0.1 mg/l                      |
| Ammonium                               | < 1.0 mg/l                      |
| Free chlorine                          | < 0.2 mg/l                      |

8 °dH (degrees German hardness) = 1.4mmol/l  
 = 10 °e (degrees English hardness)  
 = 14 °f (degrees French hardness)

If there is the danger of frost, you may use a water glycol mixture of up to 30 %.

DS water (softened or fully desalinated water) can be used for cooling the pump, if the pH value corresponds to the range indicated above.

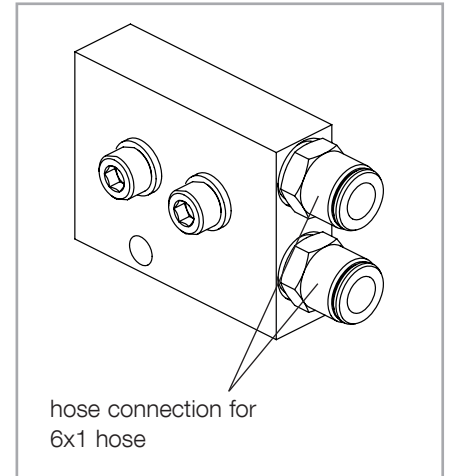


Fig. 3.10 Cooling water block

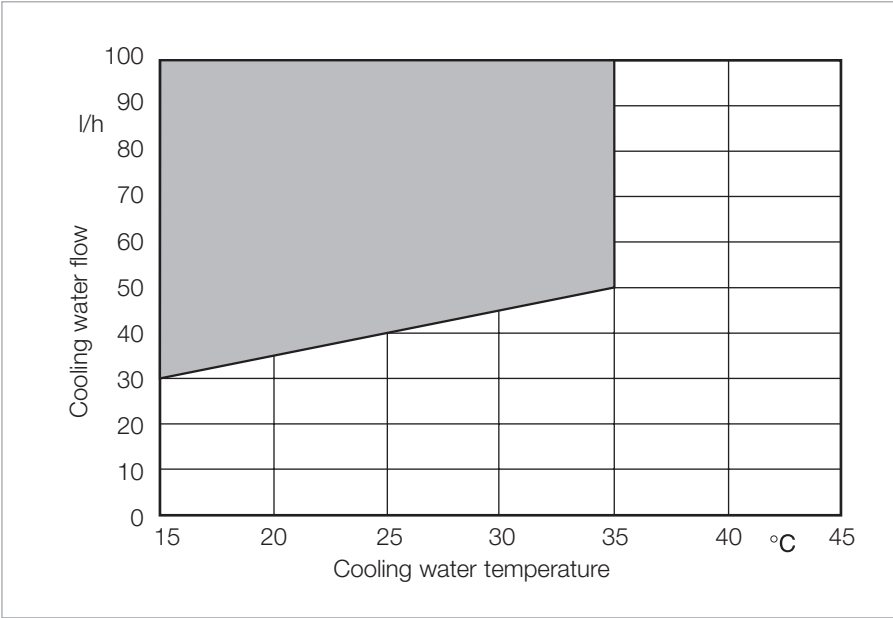


Fig. 3.11 Cooling water requirements

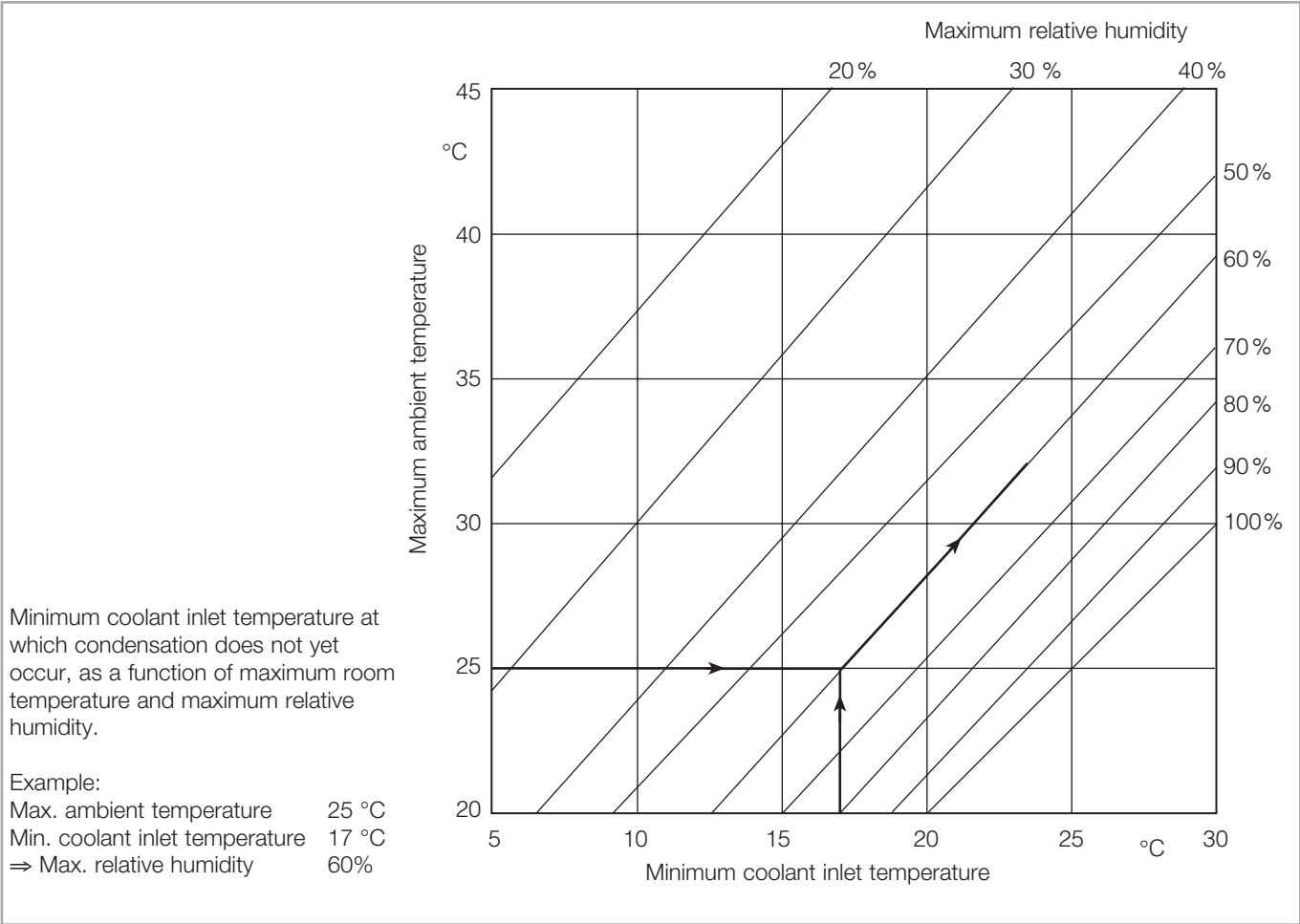


Abb. 3.12 Dewpoint diagram

## Cooling conditions for pumps with an ISO-K flange and aluminium housing

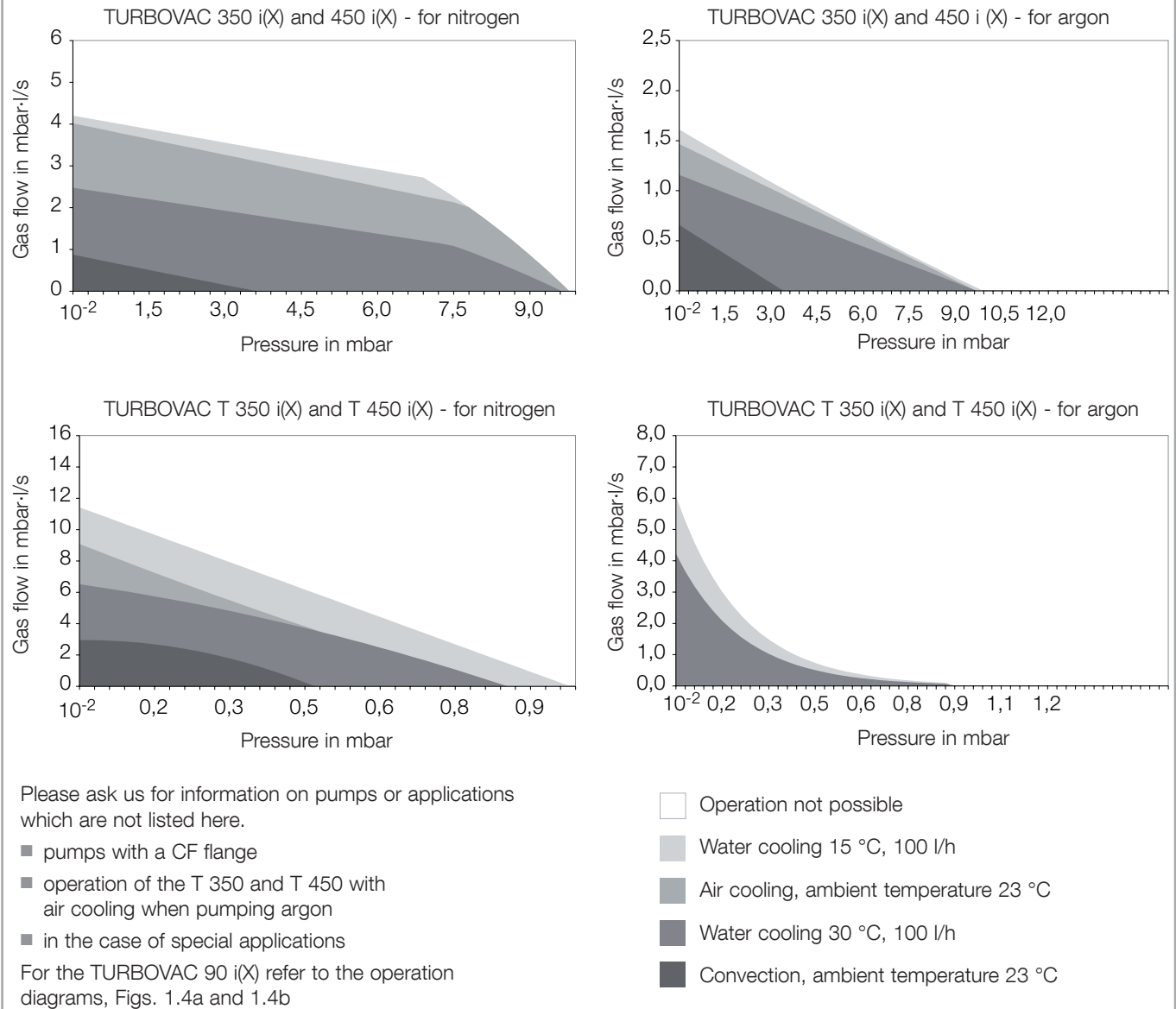


Fig. 3.13 Cooling conditions

# Installation

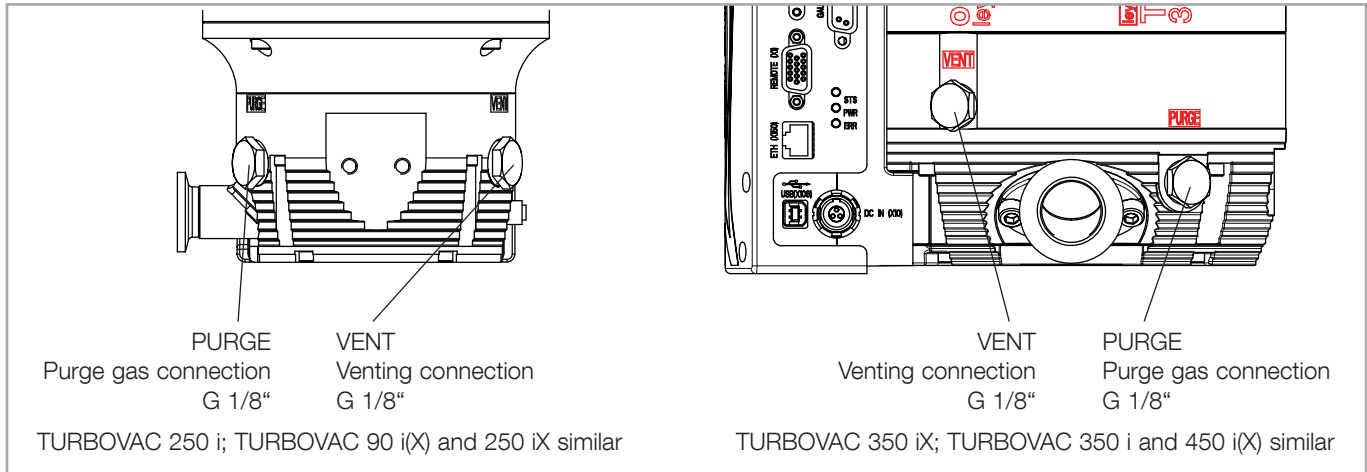


Fig. 3.14 Venting and purge gas connections

### 3.7 Connect a power failure venting valve or a venting valve

The power failure venting valve (normally open) or venting valve (normally closed) vents the pump and the forevacuum line when the pump is switched off and thus keeps oil vapor from diffusing back from the forevacuum line. A choke nozzle in the vent port ensures that the pump is not vented too fast.

The max. permissible pressure in the pump must not exceed 1.4 bar (abs.).

Unscrew and remove the locking screw and the gasket from the venting connection of the TURBOVAC.

Screw in the venting valve and the gasket into the venting connection.

If applicable connect the venting gas supply at the valve's inlet (G1/8").

#### WARNING



The pressure in the pump must not exceed 1400 mbar (0.4 bar over-pressure). Observe Safety Information 0.1.2 to 0.1.5.

#### NOTICE



Connect a purge gas or venting valve to the correct flange. Confusing the venting and purge gas flange can cause shock venting of the pump.

#### Only for TURBOVAC i

Plug in the corresponding control cable into the accessories connection.

For the electronic drive unit change the venting valve settings to venting operation (via the interfaces).

#### Only for TURBOVAC iX

Plug in the corresponding control cable into the accessories connection X203. Accessory connection X203 is so pre-configured that the venting valve opens when the start command is revoked and the frequency drops below 999 Hz. At 5 Hz this valve is closed again. This is no power failure venting! The limits can be changed through parameter 28[2] (upper switching threshold) and parameter 647[2] (lower switching threshold). For this refer to the

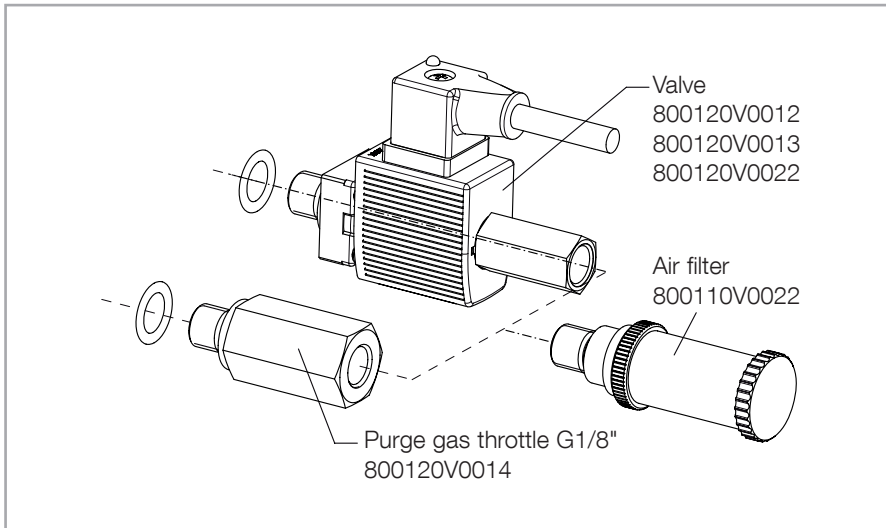


Fig. 3.15 Fitting valve

interface Operating Instructions.

Either connect a power failure venting valve electrically separately or connect it to X201, X202 or X203 and thereafter change the function for the accessory connection. For this refer to the interface Operating Instructions.

### 3.8 Connect purge gas

When having to decide which gases need or not need to be pumped with purge gas we are available to provide assistance.

Refer to Section 4.1 for suited gases.

Consider the additional purge gas flow when selecting a suitable backing pump.

We recommend a purge gas flow of 0.4 mbar·l/s (24 sccm) with Nitrogen.

The pressure in the pump must not exceed 1400 mbar (0.4 bar over-pressure). Observe Safety Information 0.1.2 to 0.1.5.

#### WARNING



The purge gas is fed either through an activated valve or a manually operated throttle.

#### Purge gas connection with purge gas valve

Unscrew and remove the locking screw and the gasket from the purge gas connection of the TURBOVAC.

Screw in the purge gas valve and the gasket into the thread.

Connect the purge gas supply at the valve's inlet (G1/8").

Either connect the purge gas valve electrically separately or connect it to an accessory connection and thereafter change the function for the accessory connection. For this refer to the interface Operating Instructions.

# Installation

## **Purge gas connection with purge gas throttle**

Unscrew and remove the locking screw and the gasket from the purge gas connection of the pump.

Then screw in the throttle and the gasket into the thread.

## **3.9 Connect a flange heater**

Only for TURBOVACs with CF flange

If pressures in the range of  $10^{-8}$  mbar or below are to be developed, the vacuum chamber and the components installed therein will have to be baked out. In addition, the TURBOVAC can be baked out using the flange heater provided for this purpose.

With the aid of the relay box the heating jacket can be driven directly via the turbopump. For this connect the heating jacket to the relay box and insert the connection cable of the relay box at the accessory connection (X201 for the TURBOVAC iX) and screw it down.

The accessory connection has been so pre-configured that the heating jacket will heat as long as the turbomolecular pump is running. To change this setting, refer to the interface Operating Instructions.

Alternatively the heating jacket may be connected through the corresponding mains power cable to the power supply.

Information on baking out is also given in Section 4.6.



## 3.10 Connect a vacuum gauge head (only for TURBOVAC iX)

One of the listed vacuum gauge heads may be connected to connection X101.

Connect the vacuum gauge head only after having switched off the pump first.

| Vacuum gauge head   | Connection cable | Pressure range   |
|---|------------------|--|
| TTR 101, TTR 101 S2,<br>TTR 101 N, TTR 101 N(S2)                      | Type F           | $5 \times 10^{-4} \dots 1500$ mbar   |
| ITR 200 S, ITR 200 SL,<br>ITR 200 SP, ITR 200 SD                      | Type C           | $5 \times 10^{-10} \dots 1000$ mbar  |
| PTR 225, PTR 225 S,<br>PTR 237, PTR 225 N,<br>PTR 225 N(S), PTR 237 N | Type F           | $1 \times 10^{-9} \dots 1 \times 10^{-2}$ mbar                             |
| CTR 100/101,<br>CTR 100 N, CTR 101 N                                  | Type C           | $1 \times 10^{-1} \dots 1000$ torr to<br>$1 \times 10^{-5} \dots 0,1$ torr |
| TTR 91, TTR 91 S,<br>TTR 96 S, TTR 91 N,<br>TTR 91 N(S), TTR 96 N(S)  | Type F           | $5 \times 10^{-4} \dots 1000$ mbar   |
| PTR 90, PTR 90 N  | Type F           | $5 \times 10^{-9} \dots 1000$ mbar   |
| ITR 90, ITR 90 P  | Type C           | $5 \times 10^{-10} \dots 1000$ mbar  |

The type of connected vacuum gauge head is detected automatically.

The measured value can be read out in millibar, Torr and Pascal through parameter as real value.

P616: measured value in millibar

P617: measured value in Torr

P618: measured value in Pascal

Further parameters (like filter time, CTR vacuum gauge head subtype, gas type correction factor etc., for example) may be set up for the respective vacuum gauge head.

For this refer to the interface Operating Instructions.

# Installation

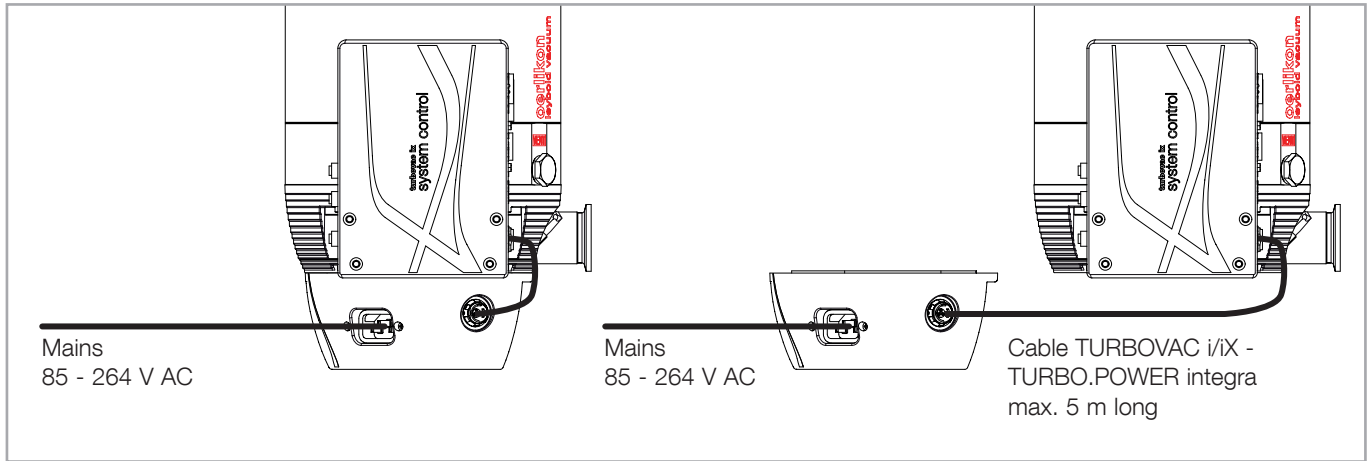


Fig. 3.16 TURBOVAC iX with power supply

## 3.11 Electrical connection

### DANGER



Observe Safety Information 0.2

Unplug any connectors only when the mains voltage is switched off **and** the pump does no longer turn.

During run down the pump may still turn without a LED being on, observe the information on emergency shut down given in Section 4.4.

The power supply must meet the requirements given in Section 1.3.1. Peak loads in the kHz range may be present on the DC side. The power supply should have a current limitation or control.

When connecting several frequency converters to a single power supply, then each frequency converter must be fused separately.

Use the 24/48 V DC cable to connect the frequency converter to the power supply unit.

### NOTICE



Ensure correct polarity

Pin 1 24/48 V

Pin 2 GND

Pin 3 0 V

When pulling the DC-IN connector first retract the retaining sleeve

Connect the power supply to the mains.

Emergency shut down: By shutting down the power supply voltage. Please note the information on shutting down and emergency shut down provided in Section 4.4.

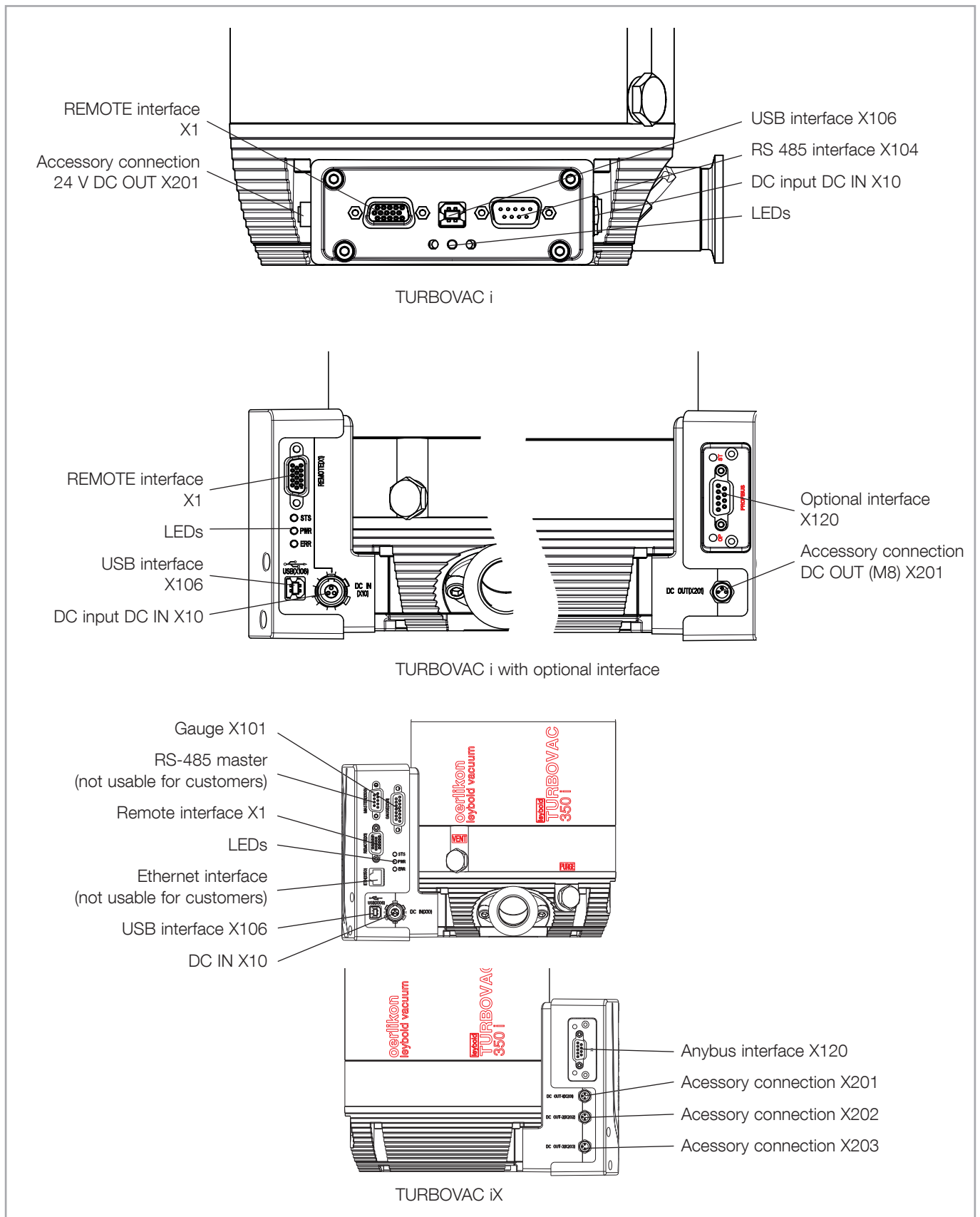


Fig. 3.17 Interfaces

# Installation

|   |                         |  |
|---|-------------------------|--|
| <div> <div>● STS</div> <div>● PWR</div> <div>● ERR</div> </div> | <b>green LED STATUS</b> |  |
|   | off:                    | Pump at standstill (< 3 Hz)  |
|   | flashes slowly 1/s:     | Start command is present (about 10 s after start)                        |
|   | flashes fast 3/s:       | Running up or running down   |
|   | on:                     | Normal operation   |
|   | <b>yellow LED POWER</b> |  |
|   | off:                    | No supply voltage  |
|   | flashes:                | Supply voltage too low or too high                                       |
|   | on:                     | Supply voltage is present  |
|   | <b>red LED ERROR</b>    |  |
|   | off:                    | No error, no warning   |
|   | flashes:                | Warning is present, pump can be operated possibly with some restrictions |
|   | on:                     | Fault is present, pump stopped or can not be operated                    |

Fig. 3.18 LEDs

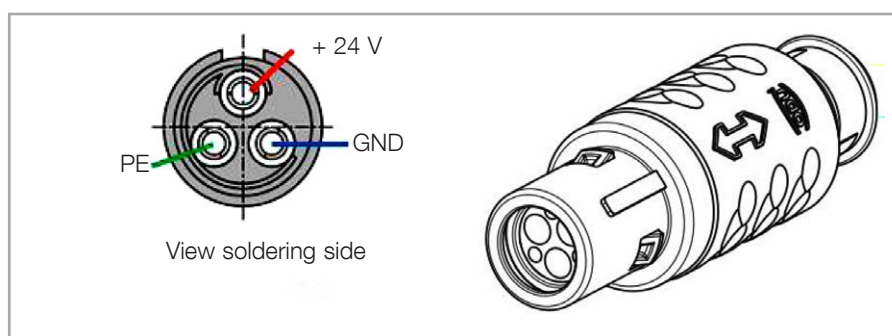
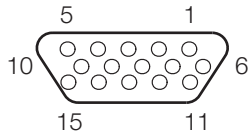


Fig. 3.19 Power supply connector DC IN (X4)

## REMOTE X1

15-pole Sub-D female  
High Density

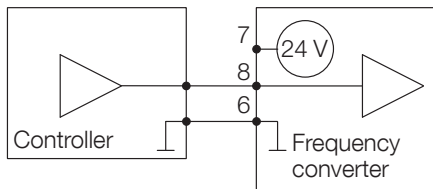


Maintain pin 6 Signal GND and pin 13 Analog GND separate so as to avoid equalisation currents.

| Pin    | Name                                    | Description   |
|--------|---|---|
| 1      | Error relay                             | (com)   |
| 2      | Error relay                             | (n.c.)  |
| 3      | Normal operation relay                  | (n.o.)  |
| 4      | Normal operation relay                  | (com)   |
| 5      | Normal operation relay                  | (n.c.)  |
| 6      | Signal GND                              |   |
| 7      | High level output                       | 24 V, 100 mA, Tolerance acc. to device supply voltage |
| 8      | Start input (High)<br>Reset input (Low) | High > 10 V $\pm$ 0,5 V<br>Low < 7.5 V $\pm$ 0,5 V    |
| 9      | Error relay                             | (n.o.)  |
| 10     | Standby input                           | High > 10 V $\pm$ 0.5 V<br>Low < 7.5 V $\pm$ 0.5 V    |
| 11     | Cooling/Venting valve input (Low)       | High > 10 V $\pm$ 0.5 V<br>Low < 7.5 V $\pm$ 0.5 V    |
| 12     | Analog output (Default: Frequency)      | 0 ... 10 V, 2 mA                                      |
| 13     | Analog GND                              |   |
| 14     | Warning relay                           | (n.o.)  |
| 15     | Warning relay                           | (com)   |
| Shield | Connected with pump housing             |   |

## Start/Stop input

0V = STOP/Error reset  
24 V = START



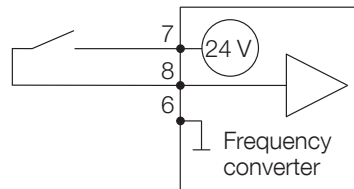
### Pin 10

0 V = no Standby operation  
24 V = Standby operation

### Pin 11

0 V = no function  
24 V = Cooling or valve is activated

Contact open = STOP/Error reset  
Contact closed = START



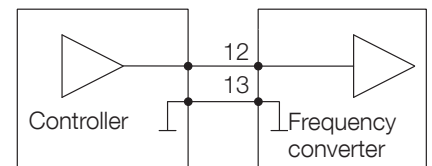
### Pin 10

Contact open: no Standby operation  
Contact closed: Standby operation

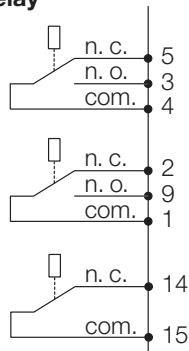
### Pin 11

Contact open: no function  
Contact closed: Cooling or valve is activated

## Analog output



## Relay



### Normal operation relay

4 and 5 connected (normal position) Run-down, run-up, stop  
4 and 3 connected Normal operation

### Error relay

1 and 2 connected (normal position) No error  
1 and 9 connected Error

### Warning relay

14 and 15 connected (normal position) No warning  
14 and 15 open Warning

Fig. 3.20 REMOTE interface X1

# Installation

## Relay status

| Input data / status      |                  |  |                     | Output data    |                              |                |                          | Operating mode        |  |
|--------------------------|------------------|--|---------------------|----------------|------------------------------|----------------|--------------------------|-----------------------|--|
| Start/<br>stop<br>signal | Pump<br>rotating | Normal<br>frequency<br>≥ 90% of<br>setpoint<br>frequency | Error is<br>present | Motor<br>drive | Relay<br>NORMAL<br>OPERATION | Relay<br>ERROR | LED<br>STATUS<br>(green) | LED<br>ERROR<br>(red) | Other modes are not possible;<br>they indicate a failure affecting<br>the frequency converter. |
| Stop                     | no               | no   | no                  | off            | passive                      | passive        | off                      | off                   | Pump not operating   |
| Stop                     | yes              | no   | no                  | off            | passive                      | passive        | flashes                  | off                   | Pump is decelerating   |
| Stop                     | yes              | yes  | no                  | off            | passive                      | passive        | flashes                  | off                   | Just after stop; pump was in the normal<br>operating mode before that                          |
| Start                    | no               | no   | no                  | on             | passive                      | passive        | off                      | off                   | Just after start   |
| Start                    | yes              | no   | no                  | on             | passive                      | passive        | flashes                  | off                   | Pump is accelerating   |
| Start                    | yes              | yes  | no                  | on             | active                       | passive        | green                    | off                   | Pump is in the normal operating mode   |
| Stop                     | no               | no   | yes                 | off            | passive                      | active         | off                      | red                   | Error is present; pump is at standstill  |
| Stop                     | yes              | no   | yes                 | off            | passive                      | active         | flashes                  | red                   | Error is present; pump is decelerating   |
| Stop                     | yes              | yes  | yes                 | off            | passive                      | active         | flashes                  | red                   | Error has just occurred  |
| Start                    | no               | no   | yes                 | off            | passive                      | active         | off                      | red                   | Error is present; pump is at standstill  |
| Start                    | yes              | no   | yes                 | off            | passive                      | active         | flashes                  | red                   | Error is present; pump is decelerating   |
| Start                    | yes              | yes  | yes                 | off            | passive                      | active         | flashes                  | red                   | Error has just occurred  |

## 4 Operation

### 4.1 Media compatibility / purge gas

The TURBOVAC integra is suitable for pumping air and clean gases.

If reactive gases in low concentrations must be pumped operate the pump with purge gas.

We would be glad to consult with you as regards the media which can safely be handled with this unit.

Install a micropore filter when pumping media which contains dust.

Suited for venting or purging are all gases,

- which will not cause corrosion or pitting in aluminium and steel and
- which in connection with process deposits in the pump will not cause corrosion or sticking.

For venting and as the purge gas we recommend inert gases like nitrogen or argon. The temperature of these gases should be between 5 °C and 80 °C, max. relative humidity should not exceed 10 ppm.

The gas must be clean.

In individual cases and after consultation also dry, filtered, oil-free air or filtered ambient air may be used (filter mesh < 1 µm).

Change the filters after some time, at least annually.

### 4.2 Interfaces

The TURBOVAC i(X) is always equipped with the following interfaces for customers:

- USB (COM port) (X106)
- REMOTE (X1)

Moreover, some models are equipped with an Anybus interface which in turn may be equipped with different interfaces like a RS 485, for example.

The control hierarchy is as follows: Anybus interface → USB → REMOTE (X1). See also parameter 179.

The frequency converter is configured through the parameters according to the parameter list. Pxxx denotes parameter value xxx.

The PC software LeyAssist allows convenient access by the user to the parameters of the frequency converter.

Operating Instructions 300450826 Serial Interfaces for TURBOVAC i/IX offer a detailed description of the interfaces RS 232, RS 485, Profibus and USB of the TURBOVAC.

# Operation

## Applications which can be implemented with the aid of the serial interface:

| Application  | Benefits to the customer   | How to do it   |
|--|--|--|
| Networking of several pumps and other equipment  | Savings relating to the costs for signalling cables  | With Field Bus systems   |
| Automation   | Savings related to repetitive manual work  | For example by a control computer  |
| Avoidance of warnings and warnings before overload operation and early detection of a failing pump                 | <ul style="list-style-type: none"> <li>■ Precise planning for maintenance</li> <li>■ Improved reliability of sensitive production processes in a vacuum</li> </ul> | Monitoring of: <ul style="list-style-type: none"> <li>■ Motor current P5</li> <li>■ Motor temperature P7</li> <li>■ Frequency converter temperature P11</li> </ul>                           |
| Standby operation  | <ul style="list-style-type: none"> <li>■ Cutting process gas consumption</li> <li>■ Cutting energy consumption</li> </ul>  | Reducing the rotor's frequency through P24   |
| Troubleshooting  | Quick analysis of problems   | Reading of error memories P171, P174 and P176: error code, speed, operating hours for error<br>Read out warning messages through P227  |
| Slow pressure control by changing the pumping speed  | Dispensing with a flow controller  | Changing the rotor frequency through parameter 24  |
| Limit the maximum current uptake   | Cost savings through smaller power supply units if peak loads can be reduced   | With P 185, maximum DC current uptake<br><br>Do not set up values exceeding 7 A since at full load of all peripheral equipment outputs 3 A are needed by the vacuum system controller        |
| Starting the pump with a delay if several consumers are connected to the same PSU                                  | Cost savings through smaller power supply units if peak loads can be reduced   | With P36, delay  |
| Lowering the normal operation threshold  | Normal operating mode is attained faster, processes can be started faster  | Reduce frequency threshold through P25   |
| Only for TURBOVAC iX: Switch the fan depending on temperature or frequency   | Saving of electricity, reduce noise, optimise the pump temperature for the process   | Configure accessory connection (X201, for example) correspondingly, for example, enter function code 30 in parameter 134[0] and set up the temperature limits in parameter 122[0] and 26[0]. |
| Only for TURBOVAC iX: Individually adapt venting and purge gas (active venting, adaptation of the delay time etc.) | Save gas, process speed-up   | Correspondingly configure the function code for an accessory connection (X203, for example)  |
| Control cooling water flow   | Avoid condensation during cooling water operation  | Connect cooling water valve at accessory connection (X201, for example)  |
| Enable generator operation (power backup mode)   | The power produced by the pump when running in the generator mode may be used for other electrical consumers and the pump is also decelerated faster.              | With P249<br><br>This function is only changed after de-energising the pump and then restarting it.  |
| Only for TURBOVAC iX: Changing the function of the accessory outputs   | Different applications for connected accessories   | Configure the accessory connection, see interface Operating Instructions   |



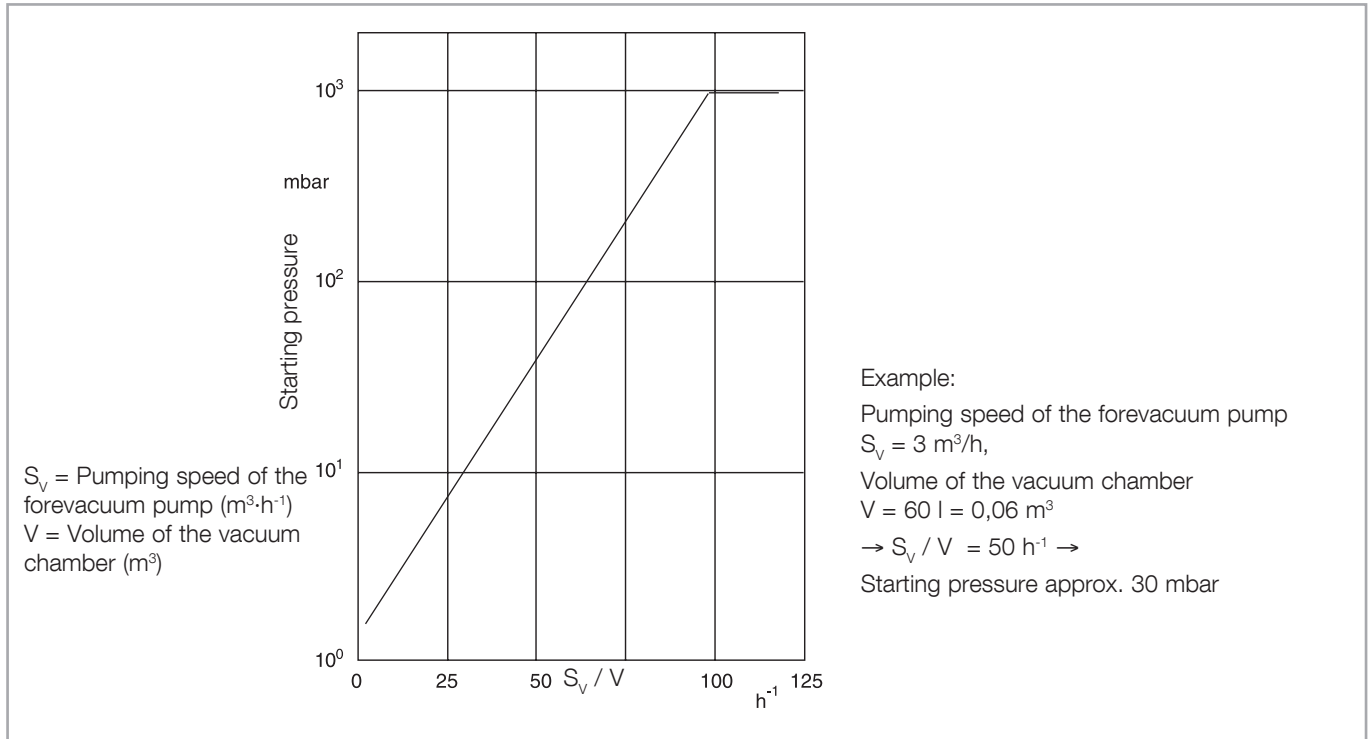


Fig. 4.1 Determining the starting pressure of a turbomolecular pump when evacuating large volumes

### 4.3 Switching on

Switch on the power supply. All LEDs come on one after the other (sequential light), drive electronics (and vacuum system controller) are running up (for approximately 35 seconds).

The maximum starting pressure for the turbomolecular pump can be read from the graph in Fig. 4.1.

Switch on the turbomolecular pump

- via pins 7 and 8 of the socket REMOTE (X1) (For example via a remote control or with the aid of the plug with integrated ON/OFF switch.
- by a start command via the interface.

The turbomolecular pump accelerates. The green LED flashes. When the pump reaches normal operation the green LED lights up permanently.

Avoid the influences of shock and vibration when the pump is running.

Exposure of the pump to accelerating forces must be avoided or reduced to such an extent that the rotor unit will not be excited by vibrations. In the case of critical applications you must consult our Applications Dept. first.

After a mains power failure the pump can run up automatically once more if a start command is present.

### Starting pressure

### NOTICE



## 4.4 Shutting down

Switch off the pump.

- via contacts 7 and 8 of the socket REMOTE (X1)
- apply a stop command via the interface
- for the power supply units offered or recommended by Oerlikon Leybold Vacuum switch off the DC voltage.

### Generator operation

After switching off, the green status LED will flash until the rotor of the turbomolecular pump is at standstill. This may take several minutes. With the DC power supply off, the turbomolecular pump will act as a generator supplying the frequency converter and the control unit with the connected devices with energy as indicated by the yellow power LED. When the generator mode is enabled, the turbomolecular pump supplies power back in to the DC power grid.

Switch off the forevacuum pump.

### Venting

When using oil-sealed forevacuum pumps, vent the turbomolecular pump before it comes to a stop; refer to Section 4.5.

When using TRIVAC pumps the built-in anti-suckback valve will close automatically, shutting off the forevacuum line. In forevacuum pumps without a vacuum retention valve, close the valve in the forevacuum line.

When the system is not operating, ensure that neither ambient air nor cleaning media can enter the pump.

If a failure occurs the turbomolecular pump will be shut down automatically. The red LED at the frequency converter lights up.

### Emergency shut down

In the case of an emergency shut down, the pump is switched off as described above. The rotor of the turbomolecular pump may be stopped faster by venting the pump.

Under vacuum conditions the pump may take up to one hour to run down, when venting to atmospheric pressure it may take up to one minute. During the time the pump is running down, the green LED will flash, indicating that the rotor has not yet arrived at standstill.

When shutting down by **switching off the power supply voltage**, there will be only enough power for the LEDs down to a speed of the pump of approximately 200 Hz. Thus the pump may still turn without a LED being on. For this reason, when switching off without venting, wait for approximately 15 minutes after the LEDs have turned off until the pump has arrived at standstill.

### CAUTION



Unplug any connectors only when the mains voltage is switched off **and** the pump does no longer turn.

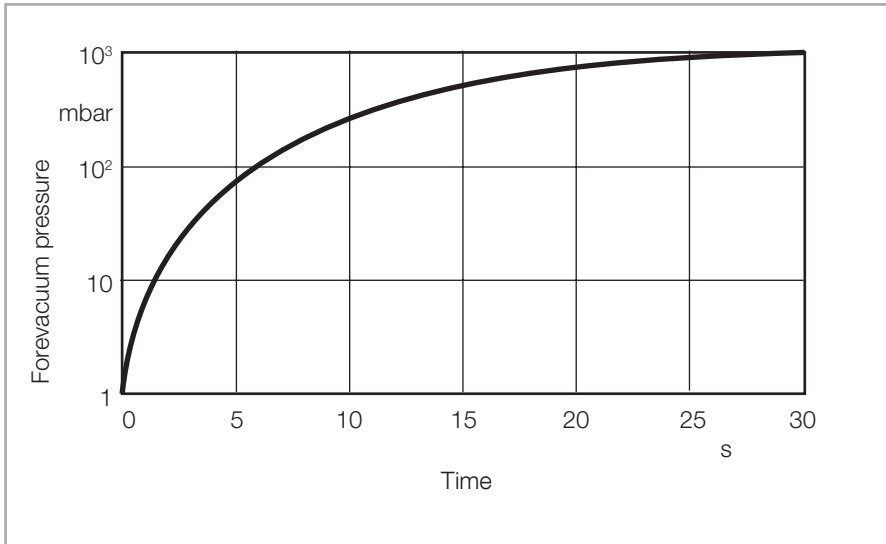


Fig. 4.2 Maximum rise in pressure

## 4.5 Venting

Refer to Section 4.1 for suited gases.

### Venting Methods

There are three different methods of venting the turbomolecular pump.

The pump can be vented via the **venting connection** (VENT), by means of a venting valve, a power failure venting valve, or a venting screw.

Cautious venting of the pump is possible from the **high vacuum side**, since here the bearing forces will be lowest. When doing so, no free jet of gas must be allowed to form on the rotor so as to avoid exposing the rotor to additional forces.

When venting the pump through its **foreline connection**, neither oil nor particles may be entrained in the gas flow from the forevacuum side into the pump.

### Speed of the Pressure Rise

All turbomolecular pumps may be vented at full speed. However, the pressure must not increase faster than specified through the pressure rise curve, see Fig. 4.2..

The pump must be vented significantly slower when there is the risk of particles entering into the pump from the process. During venting, the flow must be of the laminar type in both the vacuum chamber and the turbomolecular pump.

The pump must not be vented to pressures above atmospheric pressure.

**Speed**

**Pressure rise curve**

**Particles**

## **4.6 Bakeout**

Only for TURBOVACs with CF flange, see also Section 3.9.

If pressures in the range of  $10^{-8}$  mbar or below are to be developed, the vacuum chamber and the components installed therein will have to be baked out. In addition, the TURBOVAC can be baked out using the flange heater provided for this purpose.

Protect the rotor against intensive, direct heat radiation. When baking out at the forevacuum side – at a sorption trap, for example – ensure that the components attached direct are not heated to more than 100 °C (212 °F).

Operate the pump with water cooling when baking out.

## 4.7 Removing the pump from the system

Shut down the pump and vent as described in Sections 4.4 and 4.5.

If the pump has previously handled hazardous gases, implement the proper precautionary measures before opening the intake or exhaust connection.

Observe Safety Information 0.4.6.

Disconnect the pump only when it has come to a full stop. The green LED must have gone out.

During run down the pump may still turn without a LED being on, observe the information on emergency shut down given in Section 4.4.

Then switch the mains power off and wait until the yellow power LED is off. Then only disconnect any cable connections.

The pumps may be contaminated with process gases. These gases may be toxic and hazardous to health. In addition, deposits with similarly dangerous properties may have formed. Many of these gases and deposits form acids when they come into contact with humid air. This will result in serious corrosion damage to the pump.

To avoid health hazards and corrosion damage when the pumps are detached from the system, fasten a container of desiccant under the transport cover of the high vacuum connection and then close the pump immediately at all flange connections. Store the pump, with a desiccant, in an airtight PE bag.

Corrosion damage due to faulty packing will nullify the guarantee.

Pack the pump so that it cannot be damaged during shipping and storage. Pay particular attention to protection for the flanges and the electrical plug.

Observe the instructions in Section 5.2 if you forward the pump to Oerlikon Leybold Vacuum.

---

### DANGER



### Hazardous gases Deposits

### Desiccant

## 5 Maintenance

### Rotor exchange

We recommend an exchange of the rotor unit after 80,000 operating hours at the latest.

Such maintenance work can only be done by the Oerlikon Leybold Vacuum Service. If required contact the Oerlikon Leybold Vacuum service center nearest to your location. You can find the address on our internet page [www.oerlikon.com](http://www.oerlikon.com).

At high pump loads - for example during cyclic operation, at high gas throughputs or at high ambient temperatures - the aforementioned maintenance work should be carried forward. Please consult Oerlikon Leybold Vacuum for recommendations.

---

#### WARNING



Observe Safety information 0.1.7.

### Bearing replacement

If required, the bearings may be changed on site by our after sales service or in the nearest Oerlikon Leybold Vacuum Service Center. For such work please ask us for a quotation.

### Purge gas filter

Depending on the degree of contamination of the purge gas used the filter will clog and will have to be exchanged (our experience indicates that this will become necessary after 1 to 6 months).

### Adsorption trap

When an adsorption trap is used, regenerate or renew the adsorption agent regularly; refer to the operating instructions provided with the trap.

## 5.1 Cleaning

If required clean the turbomolecular pump of dust with a dry cloth.

### Cleaning the frequency converter internally

The converter essentially requires no servicing since it contains no components which could be adjusted.

Depending on the installation particulars and the ambient conditions, the converter may collect grime (dust, moisture) on the inside. Such contamination can lead to malfunctions, overheating or short circuits and will have to be avoided to the maximum extent possible. The Oerlikon Leybold Vacuum Service Department can clean the converter.

## 5.2 Oerlikon Leybold Vacuum Service

Whenever you send us in equipment, indicate whether the equipment is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose.

A copy of the form has been reproduced at the end of these Operating Instructions: "Declaration of Contamination for Compressors, Vacuum Pumps and Components". Another suitable form is available from [www.oerlikon.com/leyboldvacuum](http://www.oerlikon.com/leyboldvacuum) → Documents → Download Documents.

Attach the form to each pump.

This statement detailing the type of contamination is required to satisfy legal requirements and for the protection of our employees.

We must return to the sender any equipment which is not accompanied by a contamination statement.

### Contamination

### Form

# Troubleshooting

## CAUTION



## 6 Troubleshooting

When the connector cable is attached, the outputs at the frequency converter are not free of voltage.

Before you start searching for the source of the problem, you should carry out a few simple checks:

Are the connections in good working order?

- Mains connection,
- 24/48 V DC cable to the frequency converter.

Observe the polarity.

Is the forevacuum pressure sufficient?

After having removed the cause for the error reset the error message: By applying a STOP signal via the socket REMOTE (X1), or by a reset sequence via the serial interface or by switching the mains power off.

The error codes can only be read if a serial interface is present.

The following table has been provided as a guide when determining the causes of errors.

| Malfunction  | Possible cause   | Remedy   | Shut down |
|--|--|--|-----------|
| Yellow power LED is not on                                       | No DC power<br>DC power miswired<br>Frequency converter defective  | Check cables and power supply<br>Ensure correct polarity of the DC cable.<br>Have the pump repaired. The following may damage the freq. converter:<br>- Disconnection of the DC cable while the pump was still rotating<br>- Non-compliance with the note related to connecting several pump to a single power supply. | —         |
| Red LED flashes  | Warning message.   | The pump can continue to run, as long as operation limits are only exceeded for a short time. In case of longer exceeding send pump and frequency converter to the OLV service.  | no        |
| Turbomolecular pump does not start, ERROR LED does not light.    | Interface protocol error<br>No communication via the serial interface.<br>REMOTE connector (X1) connected wrongly. | Use USS protocol.<br>Connect bus as shown in the interface instructions<br>Observe Fig. 3.20.  | —         |
| Turbomolecular pump produces loud running noises and vibrations. | Rotor out of balance<br>Bearing defective  | Balance the rotor<br>Replace the bearing   | no        |



# Troubleshooting

| Malfunction   | Possible cause  | Remedy  | Shut down |
|---|---|---|-----------|
| Pump overload, pump cannot keep up its speed.<br><br>When the speed drops below 900 Hz* the red LED flashes. When this continues for more than 12 min* the pump shuts down. | Forevacuum pressure too high.   | Check the ultimate pressure of the backing pump and install a bigger backing pump if req.   | yes       |
|   | Gas flow too high   | Seal leak, check process  |           |
|   | Fan defective   | Replace fan   |           |
|   | Water cooling switched off  | Switch on water cooling   |           |
| Turbomolecular pump does not reach ultimate pressure.   | Measurement instrument defective  | Inspect the measurement sensor  | no        |
|   | Measurement sensors soiled  | Clean or replace the sensors  |           |
|   | Leaks at the equipment, lines or the pump   | Check for leaks   |           |
|   | Pump soiled   | Clean the pump  |           |
|   | Forevacuum pump provides insufficient pumping speed or ultimate pressure which is too high.   | Check the ultimate pressure of the forevacuum pump and install a higher-capacity vacuum pump if necessary   |           |
|   | Frequency parameters programmed wrongly   | Check parameters.   |           |
| Running pump can not be stopped via X1  | Pump has been started via the serial interface, the interface controls the pump   | Disconnect the DC supply or connect serial interface and stop via bus   | no        |
| Connected accessories do not operate as intended  | Accessories incorrectly connected or wrong function code has been set up or function code dependent parameters have not been properly set up. | Check the settings for the function codes and the corresponding parameters OR check to ensure that the accessories have been connected to the correct accessory connection. | no        |

\* Default values for normal operation threshold (P25) and max. run-up time (P32), can be changed via serial interface.

## Contamination



## 7 Waste Disposal

The equipment may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices.

Contaminated parts can be detrimental to health and environment. Before beginning with any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Separate clean components according to their materials, and dispose of these accordingly. We offer this service. Further details are available on request.

When sending us any equipment, observe the regulations given in Section "5.2 Oerlikon Leybold Vacuum service".

## EC Incorporation Declaration

The manufacturer: Oerlikon Leybold Vacuum GmbH  
Bonner Straße 498  
D-50968 Cologne  
Tel.: +49(0)221 347-0  
info.vacuum@oerlikon.com

herewith declares that the following product:

Product designation: **turbo-molecular pump with integrated controller**

| Type designation:                                    | P/N         |
|--|-------------|
| TURBOVAC a1/a2/.../an I, TURBOVAC T a1/a2/.../an I   | 8xxxxxVxxxx |
| TURBOVAC a1/a2/.../an iX, TURBOVAC T a1/a2/.../an iX | 8xxxxxVxxxx |
| TURBOVAC a1/a2/.../an iC, TURBOVAC T a1/a2/.../an iC | 8xxxxxVxxxx |

(a1/a2 = 30 bis 450; an = 1 to 300)  
Indices greater 1 are optional  
n= 1 to 10

x= 0 to 9

complies with the following fundamental requirements of the **Machinery Directive (2006/42/EG)**:  
Annex I, Paragraph 1.1.2, 1.1.3, 1.1.5, 1.2.1, 1.2.3, 1.2.4.1, 1.2.4.2, 1.2.6, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.13, 1.6.1 and 1.7.1

With respect to potential electrical hazards as stated in appendix I No. 1.5.1 of the machine guide lines 2006/42/EG all safety protection goals are met according to the low voltage guide lines 2006/95/EG.

The following harmonised standard has been applied:

|                          |   |
|--------------------------|---|
| EN 1012-2: 1996+A1: 2009 | Compressors and vacuum pumps - Safety requirements - Part 2: Vacuum pumps   |
| EN 61010-1: 2010         | Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements |

The incomplete machine may only be put into operation after it has been determined that the machine into which the incomplete machine shall be installed complies with the regulations laid down in the EC Machinery Directive (2006/42/EG).

The manufacturer commits himself to make the special documentation on the incomplete machine electronically available to national authorities upon request.

The special engineering documentation belonging to the machine was compiled in accordance with Annex VII Part B.

Documentation Officer

Herbert Etges  
Tel.: +49(0)221 347-0  
Fax: + 49(0)221 347 1250  
Documentation.vacuum@oerlikon.com  
Oerlikon Leybold Vacuum GmbH  
Bonner Straße 498 , D-50968 Cologne

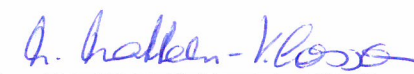
Cologne, dated

15-09-15

  
ppa. Harald Udelhoven  
Head of Produktlinie Hochvakuum

Cologne, dated

15-09-15

  
ppa. Dr. Monika Mattern-Klosson  
Head of Quality & Business Process Management

## EC Declaration of Conformity

The manufacturer: Oerlikon Leybold Vacuum GmbH  
Bonner Straße 498  
D-50968 Cologne  
Tel.: +49(0)221 347-0  
info.vacuum@oerlikon.com

herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EC Council Directives. This declaration becomes invalid if modifications are made to the product without agreement of Oerlikon Leybold Vacuum GmbH. Compliance with the EMC Directives requires that the components are installed within a system or machine in a manner adapted to EMC requirements.

Product designation: **turbo-molecular pump with integrated controller**

| Type designation:                                    | P/N         |
|--|-------------|
| TURBOVAC a1/a2/.../an I, TURBOVAC T a1/a2/.../an I   | 8xxxxxVxxxx |
| TURBOVAC a1/a2/.../an iX, TURBOVAC T a1/a2/.../an iX | 8xxxxxVxxxx |
| TURBOVAC a1/a2/.../an iC, TURBOVAC T a1/a2/.../an iC | 8xxxxxVxxxx |

(a1/a2 = 30 bis 450; an = 1 to 300)  
Indices greater 1 are optional  
n= 1 to 10

x= 0 to 9

### The product complies with the following European Council Directives:

Directive on Electromagnetic Compatibility (2004/108/EG)

The following harmonised standards have been applied:

|                  |   |
|------------------|---|
| EN 61326-1: 2013 | Electrical equipment for measurement, control and laboratory use -:<br>EMC requirements - Part1: General requirements |
|                  | emission EN 61326-1 2013 Class B  |
|                  | immunity EN 61326-1 2013 (industrial environment)   |

Documentation Officer

Herbert Etges  
Tel.: +49(0)221 347-0  
Fax: + 49(0)221 347 1250  
Documentation.vacuum@oerlikon.com  
Oerlikon Leybold Vacuum GmbH  
Bonner Straße 498 , D-50968 Cologne

Cologne, dated **15-09-15**

Cologne, dated **15-09-15**



ppa. Harald Udelhoven  
Head of Produktlinie Hochvakuum



ppa. Dr. Monika Mattern-Klosson  
Head of Quality & Business Process Management

## Declaration of Contamination of Compressors, Vacuum Pumps and Components

The repair and / or servicing of compressors, vacuum pumps and components will be carried out only if a correctly completed declaration has been submitted. Non-completion will result in delay. The manufacturer can refuse to accept any equipment without a declaration.

**A separate declaration has to be completed for each single component.**

This declaration may be completed and signed only by authorized and qualified staff.

|   |  |
|---|--|
| Customer/Dep./Institute : _____<br>Address : _____<br>_____<br>Person to contact: _____<br>Phone : _____ Fax: _____<br>End user : _____ | Reason for return: <input checked="" type="checkbox"/> applicable please mark<br><b>Repair:</b> <input type="checkbox"/> chargeable <input type="checkbox"/> warranty<br><b>Exchange:</b> <input type="checkbox"/> chargeable <input type="checkbox"/> warranty<br><input type="checkbox"/> Exchange already arranged / received<br><b>Return only:</b> <input type="checkbox"/> rent <input type="checkbox"/> loan <input type="checkbox"/> for credit<br><b>Calibration:</b> <input type="checkbox"/> DKD <input type="checkbox"/> Factory-calibr.<br><input type="checkbox"/> Quality test certificate DIN 55350-18-4.2.1 |
|---|--|

|  |   |
|--|---|
| <b>A. Description of the product:</b><br>Material description : _____<br>Catalog number: _____<br>Serial number: _____<br>Type of oil (ForeVacuum-Pumps) : _____ | <b>Failure description:</b> _____<br><b>Additional parts:</b> _____<br><b>Application-Tool:</b> _____<br><b>Application- Process:</b> _____ |
|--|---|

| <b>B. Condition of the equipment</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;"></th> <th style="width: 10%; text-align: center;">No<sup>1)</sup></th> <th style="width: 10%; text-align: center;">Yes</th> <th style="width: 10%; text-align: center;">No</th> </tr> <tr> <td>1. Has the equipment been used</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>2. Drained (Product/service fluid)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>3. All openings sealed airtight</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>4. Purged</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table> If yes, which cleaning agent _____<br>and which method of cleaning _____<br><sup>1)</sup> If answered with "No", go to D. |                          | No <sup>1)</sup>         | Yes                      | No | 1. Has the equipment been used | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 2. Drained (Product/service fluid) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 3. All openings sealed airtight | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 4. Purged | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <b>Contamination :</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;"></th> <th style="width: 10%; text-align: center;">No<sup>1)</sup></th> <th style="width: 10%; text-align: center;">Yes</th> </tr> <tr> <td>toxic</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>corrosive</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>flammable</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>explosive <sup>2)</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>radioactive <sup>2)</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>microbiological <sup>2)</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>other harmful substances</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table> |  | No <sup>1)</sup> | Yes | toxic | <input type="checkbox"/> | <input type="checkbox"/> | corrosive | <input type="checkbox"/> | <input type="checkbox"/> | flammable | <input type="checkbox"/> | <input type="checkbox"/> | explosive <sup>2)</sup> | <input type="checkbox"/> | <input type="checkbox"/> | radioactive <sup>2)</sup> | <input type="checkbox"/> | <input type="checkbox"/> | microbiological <sup>2)</sup> | <input type="checkbox"/> | <input type="checkbox"/> | other harmful substances | <input type="checkbox"/> | <input type="checkbox"/> |
|--|--------------------------|--------------------------|--------------------------|----|--------------------------------|--------------------------|--------------------------|--------------------------|------------------------------------|--------------------------|--------------------------|--------------------------|---------------------------------|--------------------------|--------------------------|--------------------------|-----------|--------------------------|--------------------------|--------------------------|---|--|------------------|-----|-------|--------------------------|--------------------------|-----------|--------------------------|--------------------------|-----------|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|  | No <sup>1)</sup>         | Yes                      | No                       |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| 1. Has the equipment been used   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| 2. Drained (Product/service fluid)   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| 3. All openings sealed airtight  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| 4. Purged  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
|  | No <sup>1)</sup>         | Yes                      |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| toxic  | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| corrosive  | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| flammable  | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| explosive <sup>2)</sup>  | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| radioactive <sup>2)</sup>  | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| microbiological <sup>2)</sup>  | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |
| other harmful substances   | <input type="checkbox"/> | <input type="checkbox"/> |                          |    |                                |                          |                          |                          |                                    |                          |                          |                          |                                 |                          |                          |                          |           |                          |                          |                          |   |  |                  |     |       |                          |                          |           |                          |                          |           |                          |                          |                         |                          |                          |                           |                          |                          |                               |                          |                          |                          |                          |                          |

| <b>C. Description of processed substances (Please fill in absolutely)</b>  |                          |                          |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
|--|--------------------------|--------------------------|----------------|--|--------------------------|--------------------------|--|--------------------------|--------------------------|----|--|--|----|--|--|
| <b>1. What substances have come into contact with the equipment ?</b><br>Trade name and / or chemical term of service fluids and substances processed, properties of the substances<br>According to safety data sheet (e.g. toxic, inflammable, corrosive, radioactive)  |                          |                          |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; text-align: center;">X</th> <th style="width: 40%;">Tradename:</th> <th style="width: 50%;">Chemical name:</th> </tr> <tr> <td style="text-align: center;">a)</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">b)</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">c)</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">d)</td> <td></td> <td></td> </tr> </table>   | X                        | Tradename:               | Chemical name: | a)                                       |                          |                          | b)   |                          |                          | c) |  |  | d) |  |  |
| X  | Tradename:               | Chemical name:           |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| a)   |                          |                          |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| b)   |                          |                          |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| c)   |                          |                          |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| d)   |                          |                          |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 40%;"></th> <th style="width: 10%; text-align: center;">No</th> <th style="width: 10%; text-align: center;">Yes</th> </tr> <tr> <td><b>2. Are these substances harmful ?</b></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td><b>3. Dangerous decomposition products when heated ?</b></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table> If yes, which ? _____ |                          | No                       | Yes            | <b>2. Are these substances harmful ?</b> | <input type="checkbox"/> | <input type="checkbox"/> | <b>3. Dangerous decomposition products when heated ?</b> | <input type="checkbox"/> | <input type="checkbox"/> |    |  |  |    |  |  |
|  | No                       | Yes                      |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| <b>2. Are these substances harmful ?</b>   | <input type="checkbox"/> | <input type="checkbox"/> |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |
| <b>3. Dangerous decomposition products when heated ?</b>   | <input type="checkbox"/> | <input type="checkbox"/> |                |  |                          |                          |  |                          |                          |    |  |  |    |  |  |

<sup>2)</sup> Components contaminated by microbiological, explosive or radioactive products/substances will not be accepted without written evidence of decontamination.

### D. Legally binding declaration

I / we hereby declare that the information supplied on this form is accurate and sufficient to judge any contamination level.

Name of authorized person (block letters) : \_\_\_\_\_

\_\_\_\_\_ Date

\_\_\_\_\_ signature of authorized person

\_\_\_\_\_ firm stamp



# Sales and Service

## Germany

**Oerlikon Leybold Vacuum GmbH**  
Sales, Service, Support Center (3SC)  
Bonner Strasse 498  
D-50968 Cologne  
Phone: +49-(0)221-347 1234  
Fax: +49-(0)221-347 31234  
sales.vacuum@oerlikon.com  
www.oerlikon.com/leyboldvacuum

**Oerlikon Leybold Vacuum GmbH**  
**Sales Area North**  
Branch Office Berlin  
Industriestrasse 10b  
D-12099 Berlin  
Phone: +49-(0)30-435 609 0  
Fax: +49-(0)30-435 609 10  
sales.vacuum.bn@oerlikon.com

**Oerlikon Leybold Vacuum GmbH**  
**Sales Office South**  
Branch Office Munich  
Karl-Hammerschmidt-Strasse 34  
D-85609 Aschheim-Dornach  
Phone: +49-(0)89-357 33 9-10  
Fax: +49-(0)89-357 33 9-33  
sales.vacuum.mn@oerlikon.com  
service.vacuum.mn@oerlikon.com

**Oerlikon Leybold Vacuum**  
**Dresden GmbH**  
**Service Competence Center**  
Zur Wetterwarte 50, Haus 304  
D-01109 Dresden  
Service:  
Phone: +49-(0)351-88 55 00  
Fax: +49-(0)351-88 55 041  
info.vacuum.dr@oerlikon.com

## Europe

### Belgium

**Oerlikon Leybold Vacuum**  
**Nederland B.V.**  
**Belgisch bijkantoor**  
Leuvensesteenweg 542-9A  
B-1930 Zaventem  
Sales:  
Phone: +32-2-711 00 83  
Fax: +32-2-720 83 38  
sales.vacuum.zv@oerlikon.com  
Service:  
Phone: +32-2-711 00 82  
Fax: +32-2-720 83 38  
service.vacuum.zv@oerlikon.com

### France

**Oerlikon Leybold Vacuum**  
**France S.A.S.**  
Parc du Technopolis, Bâtiment Beta  
3, Avenue du Canada  
F-91940 Les Ulis cedex  
Sales and Service:  
Phone: +33-1-69 82 48 00  
Fax: +33-1-69 07 57 38  
info.vacuum.ctb@oerlikon.com  
sales.vacuum.ctb@oerlikon.com

**Oerlikon Leybold Vacuum**  
**France S.A.S.**  
Valence Factory  
640, Rue A. Bergès  
B.P. 107  
F-26501 Bourg-lès-Valence Cedex  
Phone: +33-4-75 82 33 00  
Fax: +33-4-75 82 92 69  
marketing.vacuum.vc@oerlikon.com

## Great Britain

**Oerlikon Leybold Vacuum**  
**UK LTD.**  
Unit 9  
Silverglade Business Park  
Leatherhead Road  
Chessington  
Surrey (London)  
KT9 2QL  
Sales:  
Phone: +44-13-7273 7300  
Fax: +44-13-7273 7301  
sales.vacuum.ln@oerlikon.com  
Service:  
Phone: +44-13-7273 7320  
Fax: +44-13-7273 7303  
service.vacuum.ln@oerlikon.com

## Italy

**Oerlikon Leybold Vacuum**  
**Italia S.r.l.**  
Via Trasimeno 8  
I-20128 Mailand  
Sales:  
Phone: +39-02-27 22 31  
Fax: +39-02-27 20 96 41  
sales.vacuum.mi@oerlikon.com  
Service:  
Phone: +39-02-27 22 31  
Fax: +39-02-27 22 32 17  
service.vacuum.mi@oerlikon.com

## Netherlands

**Oerlikon Leybold Vacuum**  
**Nederland B.V.**  
Floridadreef 102  
NL-3565 AM Utrecht  
Sales and Service:  
Phone: +31-(30) 242 63 30  
Fax: +31-(30) 242 63 31  
sales.vacuum.ut@oerlikon.com  
service.vacuum.ut@oerlikon.com

## Switzerland

**Oerlikon Leybold Vacuum**  
**Schweiz AG, Pfäffikon**  
Churerstrasse 120  
CH-8808 Pfäffikon  
Warehouse and shipping address:  
Riedthofstrasse 214  
CH-8105 Regensdorf  
Sales:  
Phone: +41-44-308 40 50  
Fax: +41-44-302 43 73  
sales.vacuum.zh@oerlikon.com  
Service:  
Phone: +41-44-308 40 62  
Fax: +41-44-308 40 60  
service.vacuum.zh@oerlikon.com

## Spain

**Oerlikon Leybold Vacuum**  
**Spain, S.A.**  
C/. Huelva, 7  
E-08940 Cornellà de Llobregat  
(Barcelona)  
Sales:  
Phone: +34-93-666 43 11  
Fax: +34-93-666 43 70  
sales.vacuum.ba@oerlikon.com  
Service:  
Phone: +34-93-666 46 11  
Fax: +34-93-685 43 70  
service.vacuum.ba@oerlikon.com

## America

### USA

**Oerlikon Leybold Vacuum**  
**USA Inc.**  
5700 Mellon Road  
USA-Export, PA 15632  
Phone: +1-724-327-5700  
Fax: +1-724-325-3577  
info.vacuum.ex@oerlikon.com  
Sales:  
Phone: +1-724-327-5700  
Fax: +1-724-333-1217  
Service:  
Phone: +1-724-327-5700  
Fax: +1-724-325-3577

### Brazil

**Oerlikon Leybold Vacuum**  
**Brasil**  
Rod. Vice-Prefeito Hermenegildo Tonolli,  
nº. 4413 - 6B  
Distrito Industrial  
Jundiá - SP  
CEP 13.212-315  
Sales and Service:  
Phone: +55 11 2152 0499  
Fax: +55 11 99467 5934  
sales.vacuum.ju@oerlikon.com  
service.vacuum.ju@oerlikon.com

## Asia

### P. R. China

**Oerlikon Leybold Vacuum (Tianjin)**  
**International Trade Co. Ltd.**  
Beichen Economic  
Development Area (BEDA),  
No. 8 Western Shuangchen Road  
Tianjin 300400  
China  
Sales and Service:  
Phone: +86-22-2697 0808  
Fax: +86-22-2697 4061  
Fax: +86-22-2697 2017  
sales.vacuum.tj@oerlikon.com  
service.vacuum.tj@oerlikon.com

### India

**Oerlikon Leybold Vacuum**  
**India Pvt Ltd.**  
No. 82(P), 4th Phase  
K.I.A.D.B. Plot  
Bommasandra Industrial Area  
Bangalore - 560 099  
Indien  
Sales and Service:  
Phone: +91-80-2783 9925  
Fax: +91-80-2783 9926  
sales.vacuum.bgl@oerlikon.com  
service.vacuum.bgl@oerlikon.com

### Japan

**Oerlikon Leybold Vacuum**  
**Japan Co., Ltd.**  
Headquarters  
Shin-Yokohama A.K.Bldg., 4th floor  
3-23-3, Shin-Yokohama  
Kohoku-ku, Yokohama-shi  
Kanawaga 222-0033  
Japan  
Sales:  
Phone: +81-45-471-3330  
Fax: +81-45-471-3323  
sales.vacuum.yh@oerlikon.com

## Oerlikon Leybold Vacuum

**Japan Co., Ltd.**  
Tsukuba Technical Service Center  
1959, Kami-yokoba  
Tsukuba-shi, Ibaraki-shi 305-0854  
Japan  
Service:  
Phone: +81-29 839 5480  
Fax: +81-29 839 5485  
service.vacuum.iik@oerlikon.com

## Malaysia

**Oerlikon Leybold Malaysia**  
**Oerlikon Leybold Vacuum**  
**Singapore Pte Ltd.**  
No. 1 Jalan Hi-Tech 2/6  
Kulim Hi-Tech Park  
Kulim, Kedah Darul  
Aman 09000  
Malaysia  
Sales and Service:  
Phone: +604 4020 222  
Fax: +604 4020 221  
sales.vacuum.ku@oerlikon.com  
service.vacuum.ku@oerlikon.com

## South Korea

**Oerlikon Leybold Vacuum**  
**Korea Ltd.**  
3F. Jellzone 2 Tower  
Jeongja-dong 159-4  
Bundang-gu Sungnam-si  
Gyeonggi-do  
Bundang 463-384, Korea  
Sales:  
Phone: +82-31 785 1367  
Fax: +82-31 785 1359  
sales.vacuum.bd@oerlikon.com  
Service:  
623-7, Ulsung-Dong  
Cheonan-Si  
Chungcheongnam-Do  
Korea 330-290  
Phone: +82-41 589 3035  
Fax: +82-41 588 0166  
service.vacuum.cn@oerlikon.com

## Singapore

**Oerlikon Leybold Vacuum**  
**Singapore Pte Ltd.**  
8 Commonwealth Lane #01-01  
Singapore 149555  
Singapore  
Sales and Service:  
Phone: +65-6303 7030  
Fax: +65-6773 0039  
sales.vacuum.sg@oerlikon.com  
service.vacuum.sg@oerlikon.com

## Taiwan

**Oerlikon Leybold Vacuum**  
**Taiwan Ltd.**  
No 416-1, Sec. 3  
Chunghsin Rd., Chutung  
Hsinchu County 310  
Taiwan, R.O.C.  
Sales and Service:  
Phone: +886-3-500 1688  
Fax: +886-3-583 3999  
sales.vacuum.hc@oerlikon.com  
service.vacuum.hc@oerlikon.com

**Oerlikon**  
**Leybold Vacuum GmbH**  
Bonner Strasse 498  
D-50968 Cologne  
Phone: +49-(0)221-347 0  
Fax: +49-(0)221-347 1250  
info.vacuum@oerlikon.com

**oerlikon**  
leybold vacuum

**www.oerlikon.com /**  
**leyboldvacuum**