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The references to the diagrams, e.g. (2/10), consist of the figure number and the item number, in that order.

Warning

Identifies working and operating procedures which must be strictly observed to prevent hazards to persons.

Caution

Indicates working and operating procedures which must be strictly observed to prevent damage to or destruction of the appliance.

We reserve the right to alter the design or any data given in these operating instructions.

The illustrations are approximations.

1 Description

Dogo

The TURBOVAC TW 70 H is a wide range turbomolecular pump designed to evacuate vacuum chambers down to pressure levels in the high vacuum range. It is suitable for pumping air and clean gases. The TURBO. DRIVE S frequency converter and a forevacuum pump are required for its operation.

These pumps are not suitable for

- pumping liquids or gases containing dust or particulates
- pumping corrosive or reactive gasses
- operation without a forevacuum pump.

If reactive gases in low concentrations must be pumped please consult with Leybold.

During operation the pressure inside the 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 110°C (230 °F). Ignition sparks could occur in case of damage to the pump and these could ignite explosive mixtures.

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

Warning



Never expose any parts of the body to the vacuum.



1.1 Design

The pumps comprise essentially the pump housing, a multi-stage rotor with the stator group, and the drive.

The first section of the rotor is a turbomolecular pump rotor while the second tile represents a Holweck stage. The Holweck pumping stage increases the permissible forevacuum pressure level markedly when compared with the classic turbomolecular pump.

The rotor shaft runs in two ceramic ball bearings, lubricated with grease.

The pump is driven by a split-cage DC motor. In this motor the rotor and stator windings are separated by a vacuum-tight can. Consequently the rotor runs inside the vacuum while the stator is outside the vacuum. This eliminates any need of vacuum feedthroughs.

The pump is equipped with a temperature sensor and a resistor code.

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

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

A plastic vacuum hose can be fitted directly to the forevacuum flange using a new high-vacuum tight port fitting, or a DN 16 KF flange is available. The pump connection cable is fixed and ready to connect to the TURBO.DRIVE S frequency converter.

1.2 Standard equipment

The components of the pump are given in the ordering matrix in Chapter 1.3.1 for each catalog number.

The pumps are shipped sealed in a PE bag with a desiccant to absorb moisture. The maximum useful life of the desiccant is one year.

The forevacuum flange is blank-flanged with centering ring with FPM sealing ring and a clamping yoke.

The high-vacuum connection elements and the splinter guard are not part of the standard equipment.

A suitable DC coupling for the power supply is included: In the case of pumps with integrated frequency converter it is supplied with the pump, in the case of pumps with a separate frequency converter it is supplied with the frequency converter.

PE = Polyethylene

FPM = Fluororubber, resistant to temperatures up to 150°C (302 °F)

1.3 Ordering data

1.3.1 Pumps





1.3.2 Frequency converter and accessories for the frequency converter

	1	1
Frequency converter TURBO.DRIVE S	Part No.	~ ~
Basic unit	800070V0001	
with RS 232 interface	800070V0002	
with RS 232 interface and mounted heat sink	800070V0005	
with RS 485 interface	800070V0003 ¹⁾	
with RS 485 interface and mounted heat sink	800070V0006	
with Profibus interface	800070V0004	
Connection line pump - frequency converter (TD Pump cable)		
1.0 m long 2.5 m long 3.0 m long 5.0 m long	152 47 864 49 864 40 864 50	
DC Cable		
3 m 5 m 10 m 20 m	200 12 732 200 12 733 200 12 735 200 12 735 200 12 734	
	200 12 701	
Power supply		
SITOP Power 10	152 50	
Other power supplies	on request	
Dive for connector DEMOTE with integrated		
ON/OFF switch for the pump		⊨
(Sub-D plug, 9 pole)	152 48	off
Heat sink for frequency converter	800110V0001	\sim
		\sim \sim
		•
		""

1) Previous Part No. 161 11, 136 31

1.3.3 Accessories for the pump

Splinter guard fine	Part No. 200 17 170	
Camozzi coupling	200 04 361	ECO
Water cooling with connection G 1/8" (for fitting to pumps without forced cooling) Adapter G 1/8" - 1/4" Swagelok Tube connector G 1/8" outer dia. 10 mm Tube connector G 1/8" outer dia. 8 mm Sealing ring 10x14x1	800135V0001 200 18 366 800 000 273 224 01 207	
Air cooling (for fitting to pumps without forced cooling)	800136V0001	
Flange heater (only for pumps with CF flange) DN 63 CF, 230 V DN 63 CF, 110 V DN 40 CF, 230 V	854 04 854 07 853 97	
Copper gasket rings for CF flange (Set of 10 pieces) DN 63 CF DN 40 CF	839 44 839 43	2777
Set of hex. screws with nuts, screws and washers for CF flange DN 63 CF DN 40 CF	838 81 839 01	
Centering ring (AI) with O-ring (FPM) DN 63 ISO-K	268 41	
Clamps (Set of 4 pieces)	267 01	
Centering ring with O-ring for DN 16 KF AI/CR AI/FPM Centering ring with O-ring for DN 40 KF AI/CR AI/FPM	183 26 182 06 183 28 182 08	
Clamping ring (AI) DN 16 KF Clamping ring (AI) DN 40 KF	183 41 183 43	

1.4 Technical data

1.4.1 TURBOVAC	TW 70 H	
High-vacuum connection	DN 63 ISO-K / DN 63 CF DN 40 KF / DN 40 CF	
Pumping speed (without splinter guar N ₂ He	d)for 65 I⋅s ⁻¹ 55 I⋅s ⁻¹	
Ultimate pressure with two-stage, oil-sealed rotary vane pump	< 10 ⁻⁹ mbar	
with diaphragm pump achieving ultimate pressure < 5 mbar	< 10 ⁻⁷ mbar	
Max. permissible forevacuum pressur	re 10 mbar	
Weight Pump Pump with TURBO.DRIVE S Pump with TURBO.DRIVE S and a Pump with TURBO.DRIVE S and w	2.3 kg 3.0 kg ir cooler 3.2 kg rater cooler 3.3 kg	
Recommended forevacuum pumps • TRIVAC	D 2.5 E	
Diaphragm pump DIVAC	0.8 T	
Operating speed	72,000 rpm	
Run-up time	1.5 min	
Forevacuum connection	DN 16 KF or Camozzi coupling	
Type of protection	IP 20	
Noise level	< 46 dB(A)	
Ambient temperature during operation storage	+ 15 - + 45 °C – 15 - + 70°C	
Max. rel. air humidity	approx. 95% ¹⁾ (non-condensing)	
Option pump with water cooling		
Cooling water connections	G 1/8"	

see Section 2.4

1) More details in Applied technical standard IEC 721-3-3 3K3/ 3Z1/ 3B1/ 3C1/ 3S2/ 3M1

Cooling water data



Fig. 3a Dimensional drawings for TW 70 H pumps; dimensions in mm



1.4.2 TURBO.DRIVE S

Supply voltage Residual ripple	24 V DC ± 5% < 2%
Max. power consumption	170 W
Max. continuous current Max. current	6 A 7 A
Max. length of the DC cable (shielded) at 3 x 1.5 mm ² at 3 x 2.5 mm ²	5 m 20 m
Load capability, relay output	42 V, 0.5 A
Ambient temperature during operation storage	10 - 45 °C - 15 - + 70 °C
Temp. of the heat transmission surface Only Part No. 800070V0004	10 - 55 °C 10 - 50 °C
Power loss	\leq 20 W
Relative air humidity acc. to DIN EN 6072	21 Class F
Type of protection	IP 20
Weight, approx.	0.7 kg
RS 232/485 interface	19 200 Baud
Address for RS 485	0 - 15
Parity	even
Response delay time Default	2 - 19 ms 10 ms

1.4.3 Power supply SITOP Power 10

AC input voltage	120/230 V, 50/60 Hz
Tolerance	93 - 132 V 187 - 264 V
Recommended circuit breaker (characteristic C)	16 A
Power consumption	270 W
DC output voltage	24 V ± 1%
DC output current	0 - 10 A
Weight, approx.	1 kg
Mounting	DIN rail
Screw-type terminals	0.5 - 2.5 mm ² 22 - 12 AWG
Ambient temperature during operation storage	0 - 60 °C -25 - + 85 °C
Cooling	air convection
Type of protection	IP 20
Safety to EN60950	SELV
RI suppression to EN 55022	limit curve B
Noise immunity to EN 50082-2	incl. Table A4
UL508 FILE	E143289



2 Connections

Caution

The pumps are **not suitable** for pumping aggressive or corrosive media or those which contain dust.

Install a micropore filter when pumping media which contains dust.

Observe the information on media compatibility at the beginning of these operating instructions.

Do not open the packaging until immediately before installation.

Do not remove the covers and blind flanges on the pump until just before attachment to the equipment to ensure that assembly is carried out under the cleanest possible conditions.

Caution

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

Warning



During operation the pump can become so hot that there is a danger of burns (up to approx. 80 $^\circ\text{C},\,176\ ^\circ\text{F}).$

Provide protection against contact with the hot components.

2.1 Operating environment

The maximum permissible ambient temperature is 45 °C (113 °F). Do not expose the pump or the frequency converter to dripping or spraying water

If the pump is used within a magnetic field, the magnetic induction at the surface of the pump housing may not exceed:

B = 5 mT if impinging radially and

B = 15 mT if impinging axially.

Install shielding equipment as appropriate if these values are exceeded.

The standard pump version without frequency converter is resistant to radiation up to 10^3 Gy.

Places of installation up to 1000 m above sea level (3300 ft) are possible without restrictions. At altitudes over 1000 m heat dissipation by the ambient air is impaired. Please consult us.

1 mT (milliTesla) = 10 G (Gauß) 1 Gy (Gray) = 100 rad



2.2 Attach the pump to the vacuum chamber

Warning



The high-vacuum flange must be solidly 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.

If the pump should suddenly seize, an ensuing deceleration torque of up to 470 Nm will have to be absorbed by the system. To accomplish this,

- 4 clamping bolts quality 12.9 or
- 6 clamping bolts quality 8.8

are required for securing an ISO-K type high-vacuum flange.

Clamping bolts made of steel must be torqued down to 35 Nm (26 ft-lb), those made of stainless steel to 50 Nm 37 ft-lb).

In most applications the pump is flanged to the highvacuum 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. A rubber foot must be removed from one of the boreholes.

Caution

If foreign objects could pass from the vacuum chamber into the pump, install a wire mesh splinter guard. Foreign objects which enter the pump through the intake would cause serious damage to the rotor. Damage resulting from foreign objects in the rotor section are excluded from guarantee coverage.

Insert the splinter guard so that the surface curvature is at the top and apply some pressure lightly at the rim so that the splinter guard engages.

If dust could pass from the vacuum chamber into the pump, then a micropore filter must be installed between the vacuum chamber and the pump.

The pump is precision balanced and is generally operated without a resonance damper. 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.

Detach the shipping flange from the high-vacuum flange and remove the desiccant. Pay attention to scrupulous cleanliness when making the connection.



Design with ISO-K clamp flange

Lay the O-ring on the centering ring.

The O-ring must be positioned so as to be smooth and flat; it must not be twisted. Then position the outer ring.

A collar flange with circlip and the appropriate gasket may be used to connect the pump.

A collar flange is required when using ultra-vacuum sealing gaskets.

The order numbers for the flange components are given in the Leybold Catalog.



Centering ring

O-ring (FPM)

ISO-K flange

ring

Clamp

Outer centering



2.3 Forevacuum connection

The high vacuum pressure level which can be achieved is a function of the volume of gas flow Q to be pumped and the forevacuum pressure.

We recommend using dry-running diaphragm vacuum pumps or TRIVAC rotary vane pump for this purpose.

For the forevacuum connection a vacuum hose \emptyset 10 x 8 mm will be needed. We recommend a polyamide hose.

Remove the shipping cap from the forevacuum connection. Pull the rear ring and push the forevacuum hose into the connector. Release the ring. The hose will be fixed.

Alternatively you may unscrew the hose connector and use the R $3/8^{\circ}$ screw connection for the forevacuum connection.

Warning



The forevacuum line must be tight. Hazardous gases can escape at leaks or the gases being pumped can react with air or humidity. Figure 13 is a schematic diagram of a pump system incorporating a turbomolecular pump and a TRIVAC forevacuum pump with an anti-suckback valve.

A separate safety valve must be provided for oil-sealed forevacuum pumps without an anti-suckback valve. The safety valve prevents oil flowing back from the forevacuum pump into the turbomolecular pump when the system is not running.

To ensure that the forevacuum space at the turbomolecular pump is kept largely free of oil vapors during operation, as well, we recommend installing an adsorption trap in the forevacuum line. Alternatively purge the forevacuum line with inert gas. In this case the pressure in the forevacuum line must be over 10^{-2} mbar.

Provide a roughing line to achieve the shortest cycle times.

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





Connections



2.4 Connect the cooling

When installing the pump into a housing, ensure that the flow of cooling air is not restricted; see Fig. 12.

Caution

The pump must be operated with the air cooling unless you have an agreement from Leybold for different operation.

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.

Cooling water specifications

Feed temperature	10 - 40 °C
Feed pressure	2 to 7 bar absolute
Cooling water requirement	See Fig. 10
Appearance	colourless, clear, free of oils and greases
Sediments	< 250 mg/l

Particle size	< 150 µm
pH value	7 to 8.5
Overall hardness (total alkaline earths)	max. 20 °
German	hardness scale
	(= 3.57 mmol/l)

Further information on request.

Connecting the cooling water

Screw on the cooling water lines; connections G 1/8".

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.









2.6 Electrical connection

The TURBO.DRIVE S frequency converter needed to operate the TURBOVAC TW 70 H has either been integrated in the pump or is a separate unit. For connection examples see Fig. 14.

Warning



The pump may be operated only with a suitable frequency converter and suitable connector cables.

Route all cables so as to protect them from damage.

Do not expose the pump, the frequency converter or the connections to water.



Unplug any connectors only when the mains voltage is switched off and the pump does no longer turn (the green LED is off).

Separating the connections while the mains power is still applied or while the pump is still turning may destroy the TURBO.DRIVE S.



2.6.1 Connecting pump and frequency converter

Only required in the case of a separate frequency converter.

Connect the pump to the frequency converter using a suitable connecting cable (15 way Sub-D plug X3). Connect the Sub-D-plugs with the hexagon threaded bolts UNC 4/40x6 which are provided with the cable.

Make sure that the frequency converter is adequately cooled; for this see Section 2.6.3 and also Fig. 17.



2.6.2 Connecting the power supply

Warning



The frequency converter must only be connected to power supplies which meet the requirements for functional extra low voltage with positive isolation in accordance with IEC 364 (VDE 0100, Part 410, or local regulations) (SELV).

The power supply must meet the requirements given in Section 1.4.3. Peak loads in the kHz range may be present on the DC side. The power supply should have a current limitation or control.

Connect the frequency converter to the 24 V DC power supply at the DC connector X4; see Fig. 19.

Caution

Ensure correct polarity. Pin 1 + 24 VDC Pin 2 0 V Pin 3 GND

Connect the power supply to the mains.



2.6.3 Mounting the frequency converter

The frequency converter can be mounted into a rack. The bottom side of the frequency converter must be cooled sufficiently.

If the frequency converter is installed without the optional cooling fins, adequate cooling must be ensured by other means.

The cooling surface of the frequency converter must not warm up to more than 55 °C (113 °F). When mounting the frequency converter on existing cooling surfaces ensure good surface contact.

For special requirements please contact Leybold.

The frequency converter has an internal SMD fuse T 10 A. It can only be changed by the Leybold Service.





Relay status

Input da	ta / status			Output d	ata			Operating mode	
Start/ stop signal	Pump rotating	Normal frequency ≥ 90% of setpoint frequency	Error is present	Motor drive	Relay NORMAL OPERATION	Relay ERROR	LED STATUS	LED ERROR	Other modes are not possible; they indicate a failure affecting the TURBO.DRIVE S.
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 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

2.6.4 Interface description

The frequency converter has an optional serial interface RS 485. It is operated with the standardized USS protocol. The frequency converter can be set to addresses 0 to 15. Addresses over 15 are not supported.

For more detailed information concerning the USS protocol please contact Leybold.

The RS 485 bus should be connected as shown in Fig. 22.

The frequency converter can be configured through the parameters shown in the parameter list.

As to the RS 232 and Profibus interfaces please enquire.



Connections



Parameter list

r = readable, w = writable

No.	Designation	Range	Unit	Default	Format	r/w	Description
0	Dummy parameter	-	-	-	U16		No function
1	Type of frequency converter	130 / 131	-	-	U16	r	TURBO.DRIVE S = 130 TURBO.DRIVE L = 131
2	Software version	2.x.x	-	-	U16	r	
3	Actual rotor frequency	01300	Hz	-	U16	r	The max. frequency depends on the pump type.
4	Actual converter supply voltage	1830	V	-	U16	r	Nominal value for TURBO.DRIVE S: 24V
5	Actual motor current	0 60	0,1A	-	U16	r	
7	Actual motor- temperature	0150	°C	-	U16	r	Measured coil temperature for the motor
8	Permanently save the changed parameter data in the EEPROM	-	-	-	U16	w	A write command will cause the data to be saved. The parameter value itself is not processed and saved.
11	Actual converter temperature	0150	°C	-	U16	r	Measured internal converter temperature
12	Operating mode for Start/Stop	02	-	0	U16	r/w	P12 = 0 (default): via REMOTE (X1); see Fig. 20 P12 = 1: via serial interface P12 = 2: Start: REMOTE (X1) at Start and serial interface sends Start signal Stop: REMOTE (X1) at Stop or serial interface sends Stop signal

No.	Designation	Range	Unit	Default	Format	r/w	Description
17	Max value setting for motor current	5 75	0,1 A	45	U16	r/w	Maximum permissible motor current
18	Nominal pump frequency	7501200	Hz	1200	U16	r	Highest permissible frequency
19	Minimum setpoint frequency for the pump	375600	Hz	600	U16	r	Lowest permissible frequency
20	Minimum frequency level	375 600	Hz		U16	r	When the pump is accelerating this frequency must be reached within the maximum passing time (P183)
23	Pump type	04	-	3	U16	r	
24	Setpoint frequency	P19 P18	Hz	1200	U16	r/w	Adjustable between P19 to P18
25	Frequency dependent normal operation level	0100	%	90	U16	r/w	If P29 = 0: Defines the normal operation level. Normal operation if P3 \ge P24 x P25
27	Motor current dependent normal operation level	t 575	0,1 A	20	U16	r/w	If P29 = 1: Defines the normal operation level. Normal operation if P5 \leq P27
29	Selection of the normal operation function	0 / 1	-	0	U16	r/w	Normal operation relay function: 0 = frequency dependent (see P25) 1 = current dependent (see P27)
32	Maximum run up time	302000	S	720	U16	r/w	Max. permissible acceleration time from starting the pump's drive until reaching the normal operation level (P24 * P25)
36	Start delay time	0255	0.1 min.	0	U16	r/w	Pause time after the Start command until the pump's drive is started
125	Current bearing temp.	0150	°C		U16	r	Measured bearing temperature (identical to P127)
127	Current bearing temp.	0150	°C	-	U16	r	Measured bearing temperature (identical to P125)
132	Bearing temperature shutdown level	30150	°C	67	U16	r	Max. permissible bearing temperature P125 > P132 causes the pump to be switched off
133	Motor temperature shutdown level	30150	°C	90	U16	r	Max. permissible motor temperature P7 > P133 causes the pump to be switched off
171	Error code memory for the last 8 error event Error codes see next table	s 08		0	Array 07 U16	r	Sequential permanent memory; the last error code which has occurred is saved at the memory location with the index 0, the oldest is at index 7
176	Error operating hours memory for the last 8 error events	019 years	0.01 h	-	Array 07 U32	r	Analogous to P171 (error code memory)
180	Response delay time	219	msec	10	U16	r/w	Pause time between received and trans- mitted USS protocol string of the frequency converter's serial interface. We recommend not to change the default setting (10 ms)
183	Max. passing time	102000	S	500	U16	r	During acceleration the pump must pass through the range of critical frequencies from 60 Hz to P20

Connections

No.	Designation	Range	Unit	Default	Format	r/w	Description
184	Converter operating hours counter	019 Years	0,01h	-	U32	r	Totals the operating hours for the converter when the pump's drive is active
303	Pump status word	-	-	-	U16	r	Meaning of the bits: Bit 0 Normal operation = 1 Bit 1 Ready for switch on = 2 Bit 2 Speed is increasing = 4 Bit 3 Speed is dropping = 8 In case of an error P303 has the value of 0 (not ready to be switched on)
312	Cat. No. code	0 65535	-	-	U16	r	
315	Serial No. code	1 231-1	-	-	U32	r	The 9 resp. 10 least significant bits of the original serial No.
316	Hardware identifier	0100	-	-	U16	r	Hardware version index of the converter

Error codes for parameter P171

Code	Type of error	Description of the error
0	No error	-
1	Overspeed error	Nominal speed of the pump (P 18) has been exceeded by over 10%
2	Pass through time error	Max. pass through time during run up has been exceeded: from 60 Hz to minimum frequency level; P3 < P20 after P183 has elapsed
3	Bearing temperature error	Maximum bearing temperature has been exceeded: P125 > P132; P127 > P132
4	Short circuit error	Short circuit in the pump's motor or the connecting cable
5	Converter temperature error	r Maximum temperature for the converter has been exceeded: P11 > 65°C
6	Run up time error	Maximum run up time during run up has been exceeded from starting to normal operation: P3 < P24 * P25 after P32 has elapsed
7	Motor temperature error	Maximum motor temperature has been exceeded: P7 > P133
8	Pump error	Pump could not be identified or no pump is connected.



3 Operation

Warning



The turbomolecular pump must only be operated in the proper condition and under the conditions described in the Operating Instructions.

3.1 Switching on

Switch on the 24 V DC power supply. The yellow LED at the frequency converter lights up.

The maximum starting pressure for the turbomolecular pump can be read from the graph in Figure 23.

Switch on the turbomolecular pump at the frequency converter

 by connecting contacts 7 and 8 at the REMOTE (X1) connector. (For example via a remote control or with the aid of the plug with integrated ON/OFF switch: see Section 1.3 Ordering data)

or

• by a start command via the interface; see Section 2.6.4.

For the power supply units offered or recommended by Leybold: If the contacts 7 and 8 at the REMOTE (X1) connector are closed the pump starts automatically when the DC voltage is switched on (provided parameter 12 is set to 0).

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.

Warning



During operation the pump can become so hot that there is a danger of burns (up to approx. 80°C, 176 °F).

Warning



After a mains power failure the pump can run up automatically once more.



3.2 Shutting down

Switch off the pump at the frequency converter.

- Disconnect contacts 7 and 8 at the REMOTE (X1) connector
- or
- apply a stop command via the interface

or

• for the power supply units offered or recommended by Leybold switch off the DC voltage.

Switch off the forevacuum pump.

When using oil-sealed forevacuum pumps, vent the turbomolecular pump before it comes to a stop; refer to Section 3.3.

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.

Warning



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

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.

3.3 Venting

When using oil-sealed forevacuum pumps, vent the pump each time it is shut down to prevent possible return diffusion of oil vapors from the forevacuum line to the high-vacuum side.

Use dry nitrogen, for example, for venting purposes.

The pump can be vented from the high-vacuum side.

When using a dry-running forevacuum pump, the pump can be vented via the forevacuum port.

When using oil-sealed forevacuum pumps **do not** vent the pump through the forevacuum port since oil vapors could enter the pump in this way.

The pump can be vented when it is running at full speed.

Caution

The values shown along the curve for pressure rise in Figure 24 must be maintained in all cases.

3.4 Bakeout

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.

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 $^{\circ}$ C (212 $^{\circ}$ F).

The forevacuum pump must be in operation so as to eliminate the vapors liberated at the sorption trap.

3.5 Removing the pump from the system

Shut down the pump and vent as described in Sections 3.2 and 3.3.

Warning



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



If necessary, use gloves, a respirator and/or protective clothing and work under an exhaust hood.



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

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 air-tight 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 4.2 if you forward the pump to Leybold.

4 Maintenance

The turbomolecular pump requires no routine maintenance.

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

The frequency converter is maintenance free.

4.1 Cleaning

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

4.2 Service by LEYBOLD

Whenever you send a pump to Leybold, indicate whether the pump 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; we will forward the form on request.

A copy of the form is printed at the end of these operating instructions: "Declaration of contamination of vacuum equipment and components".

Attach the form to the pump or enclose it with the pump.

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

Pumps which are not accompanied by a contamination statement will be returned to the sender.

5 Troubleshooting

Warning



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 V DC cable to the frequency converter,
- Connector cable between the frequency converter and the pump

Is the forevacuum pressure sufficient?

After having removed the cause for the error reset the error message at the TURBO.DRIVE S:

- In case of errors with error codes 1 to 7 by applying a STOP signal via the socket REMOTE (X1) or the serial interface or by switching the mains power off.
- In case of error code 8 by switching the mains power off.

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

Troubleshooting

Malfunction	Possible cause	Corrective action		
Red ERROR LED is on: Error code1: Overspeed error	EMC problems	Check connecting cable, insert it properly Switch the power supply voltage off and then on again		
	TURBO.DRIVE S faulty	Inform Leybold Service.		
Red ERROR LED is on: Error code 2 + 6: pass through	Forevacuum or high-vacuum pressure too high.	Check the forevacuum pump and use a different forevacuum pump if necessary.		
timer error and run up time error	Gas volume too great.	Seal leak; install a higher-capacity vacuum pump if necessary.		
Pump runs up too slowlyPump looses its speed	Power supply overloaded	Reduce the number of consumers or use a stronger power supply or switch on the consumers one after the other.		
	Bearing defective.	Have the pump repaired (may be done only by a Leybold service technician).		
Red ERROR LED is on: Error code 3 + 7: bearing tem-	Forevacuum pressure too high.	Check the forevacuum pump and use a different forevacuum pump if necessary.		
perature error and motor tem- perature error	Gas volume too great or leak in the system.	Seal leak; install a higher-capacity vacuum pump if necessary.		
	Fan defective.	Replace the fan (may be done only by a Leybold service technician).		
	Ambient temperature too high.	Feed cooler air to the pump or install water cooling.		
	Bearing defective.	Have the pump repaired (may be done only by a Leybold service technician).		
Red ERROR LED is on:	Short circuit in the pump's motor	Inform Leybold Service.		
Error code 4: Short circuit error	Short circuit in the connecting cable	Check to see if the connecting cable is undamaged, exchange it if required.		
Red ERROR LED is on: Error code 5: converter tempe- rature error	TURBO.DRIVE S integrated in the pump: Inadequate cooling of the pump operation at too high loads	See corrective action for error code 3 + 7.		
	Separate TURBO.DRIVE S: Ambient temperatures too high Inadequate cooling of the TURBO.DRIVE S	Improve the cooling situation: Install a fan Ensure better thermal linking to the cooling surface and ensure a lower temperature at the cooling surfaces Avoid exposure to the heat generated by other equipment.		
	Operation at too high loads	See corrective action for error code 3 + 7.		
Red ERROR LED is on:	Pump not connected to TURBO.DRIVE S	Check connecting cable		
Error code 8: pump error TURBO.DRIVE S can not detect the type of connected	Wrong connector cable pump - frequency converter.	Use standard cable; see Section 1.3) (ConeNect doesn't work)		
pump.	Power supply builds up the DC too slowly	Use power supply recommended by Leybold		
	Power supply overloaded	Reduce the number of consumers when swit- ching on or use a stronger power supply.		

Malfunction	Possible cause	Corrective action	
Yellow power LED is not on.	No DC power	Check cables and power supply.	
	Internal SMD fuse has blown Inform Leybold Service. The following cause a blown SMD fuse: • DC power miswired • Disconnection of the DC cable while was still rotating • Non-compliance with the note relate connecting several pump to a single supply.		
Turbomolecular pump does not	Operation mode set wrongly.	Change parameter 12.	
start, ERROR LED does not	Interface protocol error	Use USS protocol.	
iight.	No RS 485 communication.	Connect bus as shown in Section 2.6.	
	REMOTE connector (X1) connected wrongly.	Connect as shown in Fig. 20.	
Turbomolecular pump produ- ces loud running noises and	Rotor out of balance.	Have the rotor balanced (may be done only by a Leybold service technician).	
vibrations.	Bearing defective.	Have the bearing replaced (may be done only by a Leybold service technician).	
Turbomolecular pump does not	Measurement instrument defective.	Inspect the measurement sensor.	
reach ultimate pressure.	Measurement sensors soiled.	Clean or replace the sensors.	
	Leaks at the equipment, lines or the pump.	Check for leaks.	
	Pump soiled.	Have the pump cleaned (may be done only by a Leybold service technician).	
	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.	



EEC Manufacturer's Declaration

in the sense of EEC Directive on Machinery 89/392/EWG, Annex IIb

We - LEYBOLD Vacuum GmbH - herewith declare that operation of the incomplete machine defined below, is not permissible until it has been determined that the machine into which this incomplete machine is to be installed, meets the regulations of the EEC Directive on Machinery.

At the same time we herewith certify conformity with EEC Directive on Low-Voltages 73/23/EWG.

When using the appropriate Leybold accessories, e.g. connector lines, valves, or fans, the protection level prescribed in the EMC Guidelines will be attained.

Designation: Turbomolecular pump

Model: TW 70 H

Catalog numbers: 80000xVxxxx

"x": Variable 0 to 9

Applied harmonized standards:

Nov. 1991

• EN 1012 Part 2	1996
• EN 60 204	1993
• EN 61 010-1	1993

Applied national standards and technical specifications:

• DIN 31 001	Nov. 1984
- DIN 100 4040	Dec. 4000

• DIN ISO 1940	Dec. 1993

Cologne, Jan 24, 2001

Dr. Reinelt, Business Area Manager Turbomolecular pumps

2001 Cologne, Jan

Dr. Beyer, pesign Department Manager Turbomolecular pumps



as defined by the EMC guideline 89/336/EWG with revisions 91/263/EWG and 93/68/EWG

Product: TURBO.DRIVE S



RIR-TDS2-EMV 2000-12-07

We herewith declare sole responsibility for the product

 Product: Inverter
 Manufacturer: Indramat Refu GmbH Uracher Straße 91 72555 Metzingen / Germany
 Type: TURBO.DRIVE S, Cat. Nos.: 800070Vxxxx, 161 11, 136 31

4. including the following options: RS 232 interface, RS 485 interface, integrated Profibus DP, built on heat sink

5. from date of manufacture: 2000-12-01

6. Applied standards:

rds: EN 50081 Part 2: Electromagnetic compatibility (EMC) / Generic emission standard EN 50082 Part 2: Electromagnetic compatibility (EMC) / Generic immunity standard 06/93 meet the requirements outlined in the EG requirements on 89/336/ EWG (EMC guideline) with revisions 91/263/EWG and 93/68/EWG.

Explanation

Maintaining the EMC guideline assumes an EMC adapted installation of component within the plant or machine.

Test were run using a typical construction in a test assembly that conforms with the standards. The legal requirements made of resistance to interference and resistance to emission of interference limit values and standards are outlined in the above-referenced documentation.

This Indramat Refu product is intended for installation into an end product. The test results are not applicable to every installed state in every end product. This declaration does not therefore guarantee the EMC characteristics of the end product.

Metzingen, 2000-12-07

le. L'unich

Michael Kimmich Head of Quality Management

Stephan Scholze Head of Development

We reserve the right to make changes in the conformity declaration. Presently applicable edition can be obtained upon request.

Indramat Refu GmbH

Uracher Straße 91 • D-72555 Metzingen Phone +49 (0) 71 23 / 9 69-0 • Fax +49 (0) 71 23 / 9 69-120



Declaration of Conformity

as per EG Low-Voltage Guidelines 73/23/EWG, Attachment III B

Product: TURBO.DRIVE S



RIR-TDS2-NSR

2000-12-07

including the required accessories, as agreeing with EG guide-

This product is a component intended for further assembly.

Due to the features resulting therefrom, the product cannot

initially meet requirements made of finished products, machi-

nes or plants. It must thus be used for mounting/assembly only. An evaluation of electrical and mechanical safety, environ-

mental conditions (e.g., extrinsic objects and/or humidity) must be performed after mounting/assembly in the finished product.

The EMC characteristics of this product can change in a moun-

ted/ assembled state. An EMC check must thus be made for

the finished product (final unit, machine or plant) by the manu-

facturer of the finished unit, machine or plant.

lines 72/23/EWG, and 93/68/EWG.

Explanation

We herewith declare sole responsibility for the product

1. Product: Inverter

2. Manufacturer: Indramat Refu GmbH Uracher Straße 91 72555 Metzingen / Germany

3. Type: TURBO.DRIVE S, Cat. Nos.: 800070Vxxxx, 161 11, 136 31

4. including the following options: RS 232 interface, RS 485 interface, integrated Profibus DP, built on heat sink

- 5. from date of manufacture: 2000-12-01
- 6. Applicable standard: EN 61010 Part 1: Safety requirements for electrical equipment for measurement, control and laboratory use., 03/94

EN 60204 Part 1: Safety of machinery - Electrical equipment of machines, 06/93

Metzingen, 2000-12-07

le. L'unich

Michael Kimmich Head of Quality Management

Stephan Scholze Head of Development

We reserve the right to make changes in the conformity declaration. Presently applicable edition can be obtained upon request.

Indramat Refu GmbH

Uracher Straße 91 • D-72555 Metzingen Phone +49 (0) 71 23 / 9 69-0 • Fax +49 (0) 71 23 / 9 69-120







Declaration of Contamination of Vacuum Equipment and Components

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

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

1. Description of Vacu ponents	uum Equipment and C	com-	2. Rea	son for Return	
Equipment type/model: Code No.: Serial No.: Invoice No.: Delivery date:					
3. Condition of the Vac ponents	uum Equipment and Co	om-	4. Proc Equ	cess related Contami ipment and Compone	nation of Vacuum ents:
- Has the equipment be	en used?		- tox	ic	ves 🗇 no 🗇
yes	🗆 no 🗖		- co	rrosive	yes 🗆 no 🗖
 What type of pump oil, 	/liquid was used?		- ex	olosive*)	yes 🗆 no 🗖
 Is the equipment free to harmful substances? 	from potentially		- bic	logical hazard*)	yes 🗆 no 🗖
Ves	(ao to Section 5)		- rac	lioactive*)	yes 🗆 no 🗖
no	□ (go to Section 4)		- oth	er harmful substances	yes 🗆 no 🗖
*) Vacuum equipment and will not accepted withou Please list all substances, ga	I components which have be t written evidence of decont ases and by-products which	een cor aminati may ha	ntaminated on! ave come i	t by biological explosive	or radioactive substances,
Tede com	1	-			-
Product name Manufacturer	Chemical name (or Symbol)	Danger materia	ous I class	Measures if spillage	First aid in case of human contact
1.					
2.					
3.					
5.					
5. Legally Binding Dec	laration				
I hereby declare that th vacuum equipment and tation and Labelling of [I hereby declare that the information supplied on this form is complete and accurate. The despatch of the contaminat vacuum equipment and components will be in accordance with the appropriate regulations covering Packaging, Transportation and Labelling of Dangerous Substances.				espatch of the contaminated vering Packaging, Transport
Name of organisation o	Name of organisation or company:				
Address:			Post c	ode:	
Tel.:					
Fax:	Telex:				
Name:					
Job title:					
Date:			_ Compa	any stamp:	
Legally binding signatur	·e:				

Copies: Page 1 (white) to manufacturer or representative - Page 2 (yellow) attach to consignment packaging securely - Page 3 (blue) copy for file of sender



LEYBOLD VAKUUM GmbH

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