GA 04.106/6.02

Oil diffusion pumps

DIP 3 000
DIP 8 000
DIP 12 000
DIP 20 000
DIP 30 000
DIP 50 000

Part No.
222 10 /20 /25 /30 /35 /40

Operating instructions

Contents

Illustrations

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

Warning

This indicates procedures and operations which must be strictly observed to prevent hazard to persons.

Caution

This indicates procedures and operations which must be strictly observed to prevent damage to or destruction of the unit.

LEYBOLD service

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. LEYBOLD must return to the sender any pumps which are not accompanied by a contamination statement.

Legend for Fig. 1

1 Forevacuum connection flange
2 Centering ring with forevacuum baffle
3 Nozzle assembly
4 Coolant line
5 High-vacuum connection flange
6 Outer ring with O-ring and centering ring
7 Cold cap baffle
8 Pump housing
9 Electrical junction box
10 Sheet metal cladding for heating

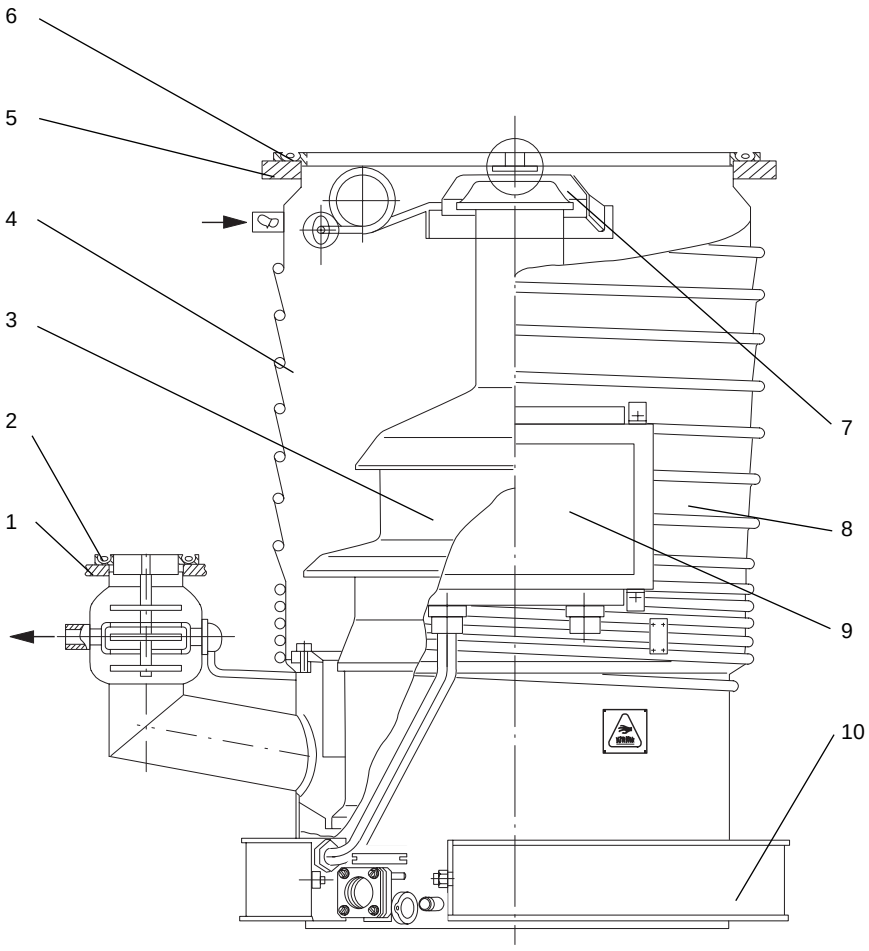


Fig. 1 Section through a model DIP 20 000 diffusion pump; other models are similar

1 Description

The pumps in the DIP series are high-vacuum pumps. They are always operated in conjunction with forevacuum pumps.

The DIP series pumps are water cooled and utilize the oil diffusion principle in their operation. They are employed in high-vacuum technology to evacuate vacuum chambers.

Above and beyond this, they can also achieve high pumping speeds in pressure ranges of from 10^{-3} to 10^{-2} mbar.

Caution

The pump is not suitable for handling oxygen above normal atmospheric concentration.
Kindly contact the manufacturer whenever gases with high hydrogen content are to be pumped.

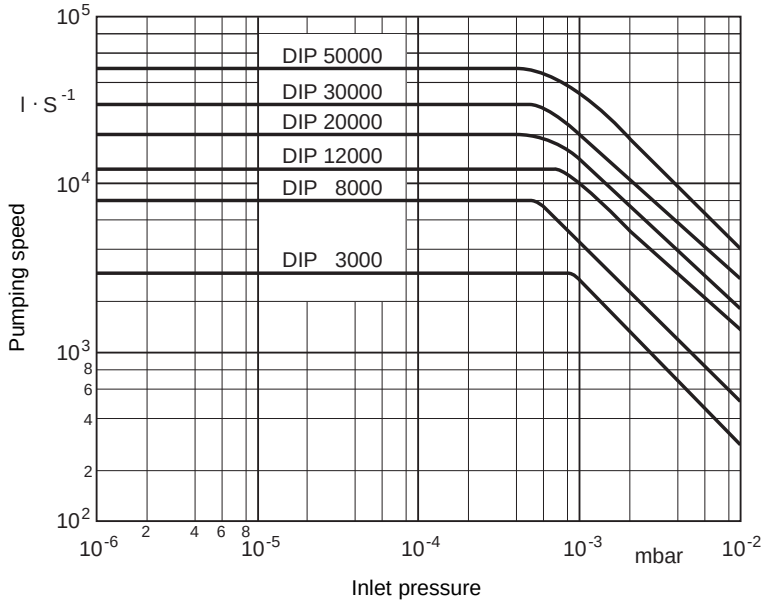


Fig. 2 Pumping speed chart

1.1 Design

The diffusion pumps in the DIP series comprise the following component assemblies:

– Water-cooled pump housing with high-vacuum and forevacuum connection flange

– Nozzle assembly

– Vaporization chamber with heating elements

– Cold cap baffle

– Forevacuum baffle

The DIP pumps are fitted with a four-stage nozzle system made of light-alloy metal and with an internal heating system comprising heating cartridges and mounting wells to which heat diffusion fins are soldered. The mounting wells are made of stainless steel and are welded vacuum-tight in the pump body, in a horizontal position.

The housing for the DIP pump is made of standard grade steel; the high-vacuum connection flange and the forevacuum connection are made of stainless steel (alloy 1.4301), the cooling coils of copper, and the cold cap baffle of nickel-plated copper.

The heat diffusion fins are made of copper and are only partially immersed in the pump fluid in the vaporization chamber.

The section of the heat diffusion fins immersed in the pump fluid is dimensioned so that that intense but surge-free vaporization of the pump fluid is achieved.

The sections of the heat dissipation fins located above the level of the pump fluid apply additional energy to the pumping vapor.

To protect the heating element, a thermostat is attached to a part of the heat diffusion fin which protrudes from the fluid; this will switch off the pump's heaters as soon as the temperature set at the thermostat is exceeded.

The heating cartridges can be easily replaced when required. It is not necessary to dismantle the pump to do so.

To prevent fluid from flowing back into the vacuum vessel, the DIP series pumps are fitted with a water-cooled cold cap baffle in the area of the intake port.

A water-cooled forevacuum baffle located on the forevacuum side effectively prevents fluid being swept into the forevacuum unit.

1.2 Standard equipment

All DIP pumps are shipped from the factory without pump fluid installed.

Included as standard equipment with the pump are

- centering ring with centering star, O-ring and outer ring for the high-vacuum flange,
- centering ring with insert for forevacuum baffle, O-ring and outer ring for the forevacuum flange.

The high-vacuum and forevacuum flanges are closed with shipping flanges and claws. The insides of the pumps have been cleaned; they are evacuated prior to shipment.

Warning

Shipping flanges (blank flanges) and claws are suitable only for shipping purposes; they may **not** be used to mount the pumps in systems.

1.3 Technical specifications

		DIP 3 000	DIP 8 000	DIP 12 000	DIP 20 000	DIP 30 000	DIP 50 000
High-vacuum/forevacuum connection	**Nom. diam.**	250 ISO-K/63 ISO-K	400 ISO-K/63 ISO-K	500 ISO-K/100 ISO-K	630 ISO-F/100 ISO-K	800 ISO-F/160 ISO-K	1000 ISO-F/160 ISO-K
Pumping speed for air [1]							
below 1 · 10^{-4} mbar	**l · s^{-1}**	3 000	8 000	12 000	20 000	30 000	50 000
Working range	**mbar**	< 10^{-2} - 10^{-7}	< 10^{-2} - 10^{-7}	< 10^{-2} - 10^{-7}	< 10^{-2} - 10^{-7}	< 10^{-2} - 10^{-7}	< 10^{-2} -10^{-7}
Ultimate total pressure [2]	**mbar**	< 5 · 10^{-7}	< 5 · 10^{-7}	< 5 · 10^{-7}	< 5 · 10^{-7}	< 5 · 10^{-7}	< 5 · 10^{-7}
Max. permissible forevacuum pressure	**mbar**	6 · 10^{-1}	6 · 10^{-1}	6 · 10^{-1}	6 · 10^{-1}	6 · 10^{-1}	6 · 10^{-1}
Pump fluid fill, min./max.	**l**	1.0 / 1.4	2 / 3.5	3 / 5.5	6 / 9	10 / 15	15 / 25
Line power supply							
Standard, 50/60 Hz	**V**	230 ~ 1 Ph	230/400 ~ 3 Ph Δ/Y	400 ~ 3 Ph Y	230/400 ~ 3 Ph Δ/Y	230/400 ~ 3 Ph Δ/Y	230/400 ~ 3 Ph Δ/Y
Special, 50/60 Hz	**V**		460 ~ 3 Ph Δ		460 ~ 3 Ph Δ	460 ~ 3 Ph Δ	460 ~ 3 Ph Δ
Heating power	**kW**	2.4	4.8	7.2	12	18	24
Number of heating cartridges		2	6	9	12	18	24
Warm-up period	**min**	< 25	< 25	< 25	< 25	< 30	< 30
Coolant (minimum)							
for the pump [3]	**l · h^{-1}**	160	290	500	600	900	1500
for the cold cap baffle	**l · h^{-1}**	20	40	50	80	80	150
Number of cooling circuits (including cold cap baffle)		2	2	2	2	3	3
Coolant connection							
Pump	**G**	3/8"	1/2"	1/2"	1/2"	1/2"	1/2"
Cold cap baffle	**G**	1/4"	3/8"	3/8"	3/8"	3/8"	3/8"
Weight, approx.	**kg**	29	70	102	172	296	560
Recommended forevacuum pumps [4]							
at working pressures > 10^{-4} mbar		DK 100 + W 151	DK 100 + W 251	DK 200 + W 501	SV 200 + W 501	SV 300 + W 1001	SV 630 + W 2001
at working pressures < 10^{-4} mbar		TRIVAC D 25 B	TRIVAC D 65 B + W 251	TRIVAC D 65 B + W 251	DK 100 + W 251	DK 200 + W 251	DK 200 + W 501

1) Measured as per DIN 28 427 using **DIFFELEN normal** as the pump fluid.
2) Measured as per DIN 28 427 using **DIFFELEN normal** as the pump fluid. When using the DC 705 pump fluid and FPM (fluoroelastomer) gaskets, the DIP pumps with water-cooled baffles will achieve pressures below 1·10^{-8} mbar following suitable bake-out procedures.
3) The coolant water volume is referenced to ΔT = 10 K. The discharge temperature should not exceed 30°C.
4) Single- and two-stage rotary vane pumps (TRIVAC; SV) or rotary piston pumps (E/DK) from our line of forevacuum pumps in conjunction with roots pumps (RUVAC) in pumping systems.

1.4 Order data

	DIP 3 000	DIP 8 000	DIP 12 000	DIP 20 000	DIP 30 000	DIP 50 000
Oil diffusion pump	**Part No. 222 10**	**Part No. 222 20**	**Part No. 222 25**	**Part No. 222 30**	**Part No. 222 35**	**Part No. 222 40**
Astrotorus vapor baffle	Part No. 227 50	Part No. 227 60	Part No. 227 65	Part No. 227 70	Part No. 227 75	Part No. 227 80
Water-flow monitor,						
LR 10	Part No. 122 82	Part No. 122 82	–	–	–	–
LR 20	–	–	Part No. 122 83	Part No. 122 83	Part No. 122 83	Part No. 122 83
"Never Seez"	Part No. 060 25 124	Part No. 060 25 124	Part No. 060 25 124	Part No. 060 25 124	Part No. 060 25 124	Part No. 060 25 124
Thermostatic safety switch	Part No. 122 84	Part No. 122 84	Part No. 122 84	Part No. 122 84	Part No. 122 84	Part No. 122 84
Contact thermometer	Part No. 218 81	Part No. 218 81	Part No. 218 81	Part No. 218 81	Part No. 218 81	Part No. 218 81
Thermoelement						
Pt 100 sensor	Part No. 200 02 958	Part No. 200 02 958	Part No. 200 02 958	Part No. 200 02 958	Part No. 200 02 958	Part No. 200 02 958
Pump fluid (see below)						

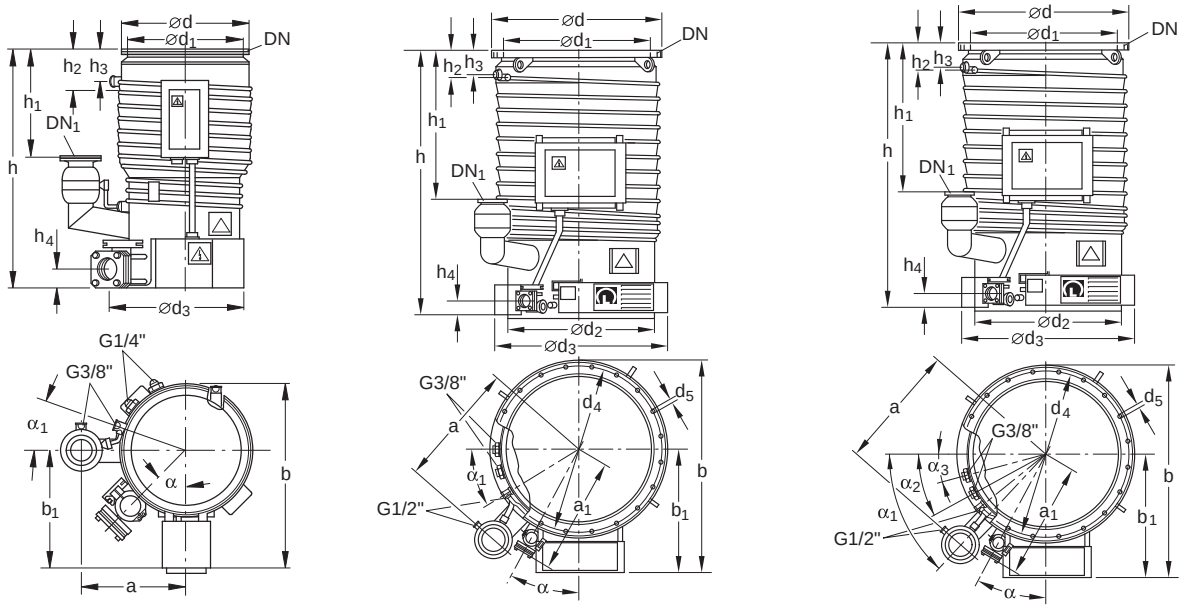
1.5 Survey of pump fluids

Technical data		Petroleum-based oils/DIFFELEN			Silicone-based oils	
		Light	**Standard**	**Ultra**	**DC 704**	**DC 705**
Vapor pressure at 20 °C	**mbar**	$1 \cdot 10^{-8}$	$1.5 \cdot 10^{-9}$	$2.7 \cdot 10^{-11}$	$2.6 \cdot 10^{-8}$	$4 \cdot 10^{-10}$
Relative molecular mass	**g · mol^{-1}**	500	570	600	484	546
Flash point (DIN ISO 2592)	**°C**	> 240	> 255	> 270	221	243
Viscosity at 25 °C	**mm^2 · s^{-1}**	115	165	200	39	175
Density at 20 °C	**g · cm^{-3}**	0.862	0.862	0.864	1.07 [1)]	1.09 [1)]

[1)] At 25 °C

Order data		Petroleum-based oils/DIFFELEN			Silicone-based oils	
		Light	**Standard**	**Ultra**	**DC 704**	**DC 705**
Pump fluid / oils	**5 kg**	**–**	**–**	**–**	**Part No. 500 600**	**–**
	5 l	**Part No. 176 68**	**Part No. 176 72**	**–**	**–**	**–**
	0,5 l	**Part No. 176 69**	**Part No. 176 73**	**Part No. 176 71**	**Part No. 176 94**	**Part No. 176 96**

1.6 Dimensions



DIP	3 000	8 000	12 000	20 000	30 000	50 000
DN	250 ISO-K	400 ISO-K	500 ISO-K	630 ISO-F	800 ISO-F	1000 ISO-F
DN_1	63 ISO-K	63 ISO-K	100 ISO-K	100 ISO-K	160 ISO-K	160 ISO-K
d	290	450	550	750	920	1120
d_1	261	400	501	651	800	1000
d_2	–	405	506	636	716	916
d_3	278	530	630	760	840	1040
d_4	–	–	–	720	890	1090
d_5	–	–	–	14	14	14
Number (d_5)	–	–	–	20	24	32
a	240	350	420	540	600	800
a_1	250,5	375,5	432	496	536	636
b	443	643	775	920	1090	1290
b_1	276	373	460	540	630	730
h	560	785	940	1130	1450	1880
h_1	250	400	470	620	870	1275
h_3	68	88	92	97	102	102
h_2	75	102	106	110	116	116
h_4	45	68	68	74	70	70
α	45 °	30 °	30 °	30 °	20 °	25 °
α_1	20 °	30 °	30 °	30 °	30 °	45 °
α_2	–	–	–	–	–	25 °
α_3	–	–	–	–	–	15 °

Fig. 3 Dimensional drawing for the DIP 3000 (left), the DIP 8000 to 30 000 (middle) and the DIP 50 000 models (right)

Legend for Fig. 4
1 Stabilizing cross
2 Tightening straps
3 Hex-head bolts
4 Brackets
5 Pocket for shipping papers
6 Hex-head bolts

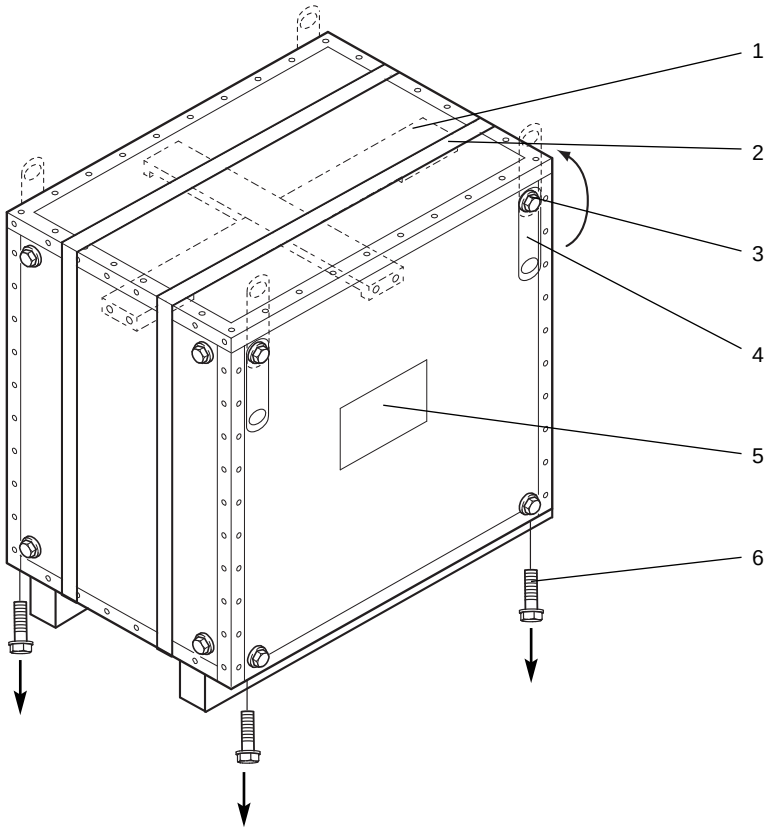


Fig. 4 DIP pump in the shipping case

2 Connections

2.1 Unpacking and moving

The DIP pump is shipped upright on a pallet and packed in a wooden crate. Proceed as follows to unpack the unit; see Figure 4.

1) Remove the shipping papers from the pocket (4/4)
2) Position the pallet on a flat and level surface.
3) Unscrew the 4 bolts (4/6) from under the wooden box and/or remove the tightening straps (4/2).
4) Loosen the 4 bolts at the upper part of the wooden crate and turn the brackets (4/4) up. Then tighten the bolts once more. Affix the lifting gear at the brackets and lift the wooden crate up and away.

Warning

Lift the wooden crate up slowly and with care so that it passes the pump without causing it to topple over.

5) Remove the plastic wrapper.
6) The DIP pump is now freely accessible on the pallet on the floor.
7) Remove the linen bag containing the desiccant.

The DIP pump may be moved only when it is standing upright on a pallet or suspended from the lifting eyes. After unpacking the unit, examine the shipment for completeness and any possible shipping damage (see Section 1.2, “Standard equipment”).

Warning

Protect the pump against tipping when moving it on the pallet.

The pumps are shipped evacuated (corrosion protection). Do not air the pumps until immediately before installation.

To vent the pump, pull the closure plug out of the hose nozzle in the forevacuum shipping flange (5/5).

Legend for Fig. 5

1 Oil level sight glass with pump fluid inlet and outlet ports
2 Coolant outlet from pump
3 Forevacuum connection flange
4 Outer ring with O-ring
5 Forevacuum shipping flange with hose nozzle and closure plug
6 Coolant inlet and outlet for cold cap baffle
7 Coolant inlet for pump
8 High-vacuum connection flange
9 Sealing plate with O-ring
10 High-vacuum shipping flange
11 Electrical terminal box with circuit breakers for heating cartridges and thermostat switching devices
12 Contact plate for thermal safety switch
13 PG style threads for electrical connection
14 Sheet metal cladding, heating

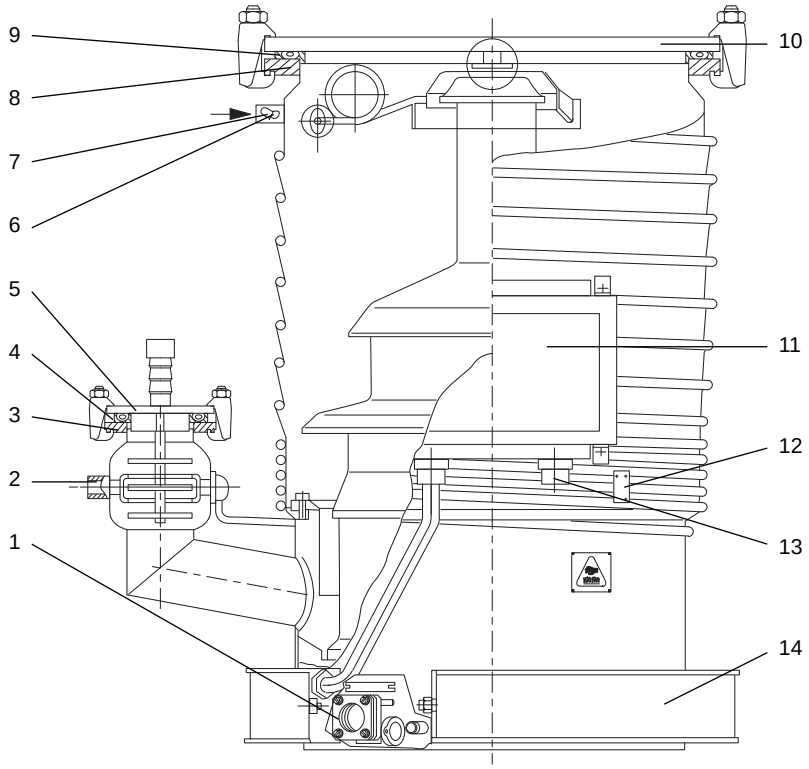


Fig. 5 Connection elements

2.2 High-vacuum connection

The DIP pumps are shipped evacuated. Do not air the pump until immediately before it is installed; to do so, open the closure plug at the forevacuum shipping flange.

Remove the high-vacuum shipping flange (5/10).

The pump must be standing flat and level or suspended from the high-vacuum connection flange when installed in the system.

We recommend maintaining a clearance of 500 mm between the sheet metal cladding at the heating unit (5/14) and other system components. This facilitates maintenance work on the pump's heating unit with the pump left in place in the system.

Check to ensure that the centering ring (14/16), together with the O-ring (14/17) and the outer ring (14/18) are seated securely in the high-vacuum flange (14/15).

DIP 3000, 8000, 12000: Use clips to join the ISO-K flange.

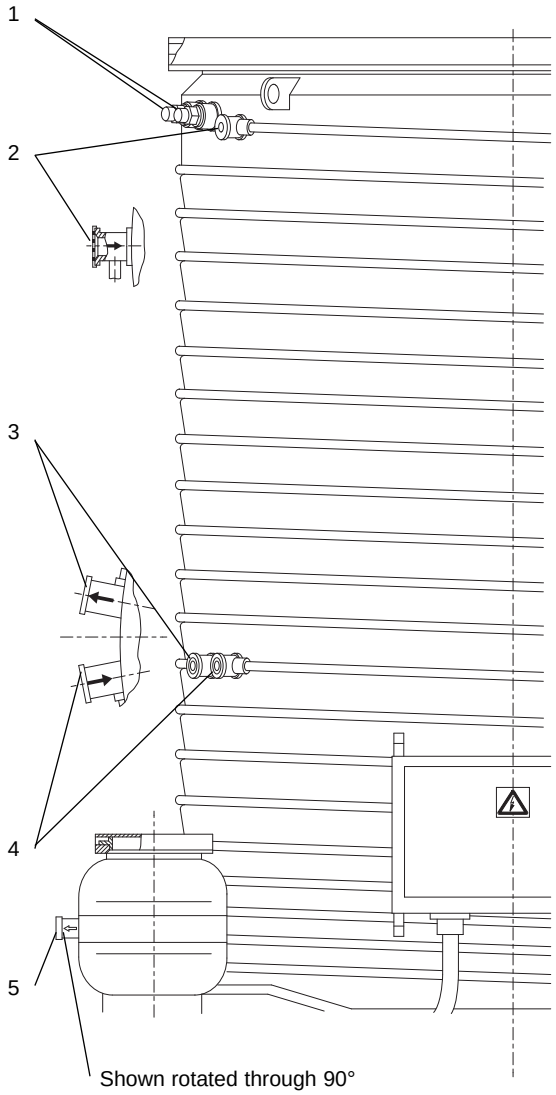
DIP 20 000, 30 000, 50 000: Use M12x60 bolts and matching nuts to join the ISO-F flange; see Section 1.6 for the number required.

Warning

The shipping flange (blank flange) and claws may be used only for shipping purposes; they are **not** suitable for mounting the pumps in systems.

Where maintaining uniform pressure is of special importance, and particularly when working in pressure ranges of less than 10^{-6} mbar, we recommend using at all flange connections at the high-vacuum side the "ultra" sealing plate instead of the centering ring with an O-ring.

Necessary to achieve maximum conductance at the high-vacuum line is that it exhibit the largest possible nominal diameter and be as short as possible. The DIP pump must be suspended vertically.



1 Coolant inlet and outlet for cold cap baffle
2 Coolant inlet for pump, upper coolant circuit
3 Coolant outlet for pump, upper coolant circuit
4 Coolant inlet for pump, lower coolant circuit
5 Coolant outlet for pump, lower coolant circuit

Fig. 6 Coolant connections at the DIP 30 000 and 50 000

2.3 Forevacuum connection

A forevacuum system is required for operating the DIP pumps. We recommend our TRIVAC or SOGEVAC pumps in conjunction with roots booster pumps.

Remove the forevacuum shipping flange (5/5).

Connect the forevacuum line with the centering ring, O-ring and outer ring (5/4) at the forevacuum port (5/3).

The centering ring also serves at the same time as the attachment point for the water-cooled baffle (14/3) in the forevacuum port.

Warning

The shipping flange (blank flange) and claws may be used only for shipping purposes; they are **not** suitable for mounting the pumps in systems.

The diameter of the forevacuum line should be at least as large as the forevacuum flange nominal diameter; the line should be as short as possible in order to achieve the maximum conductance value.

2.4 Coolant connections

The coolant should exhibit the following qualities:

pH value	7.0 to 8.5
Chloride content (Cl^-)	≤ 75 mg/l = 2.1 mmol/l
Sulfate content (SO_4^{--})	≤ 70 mg/l = 2.1 mmol/l
Calcium ions	> 1.0 mmol/l = 5.6°dH
	≤ 2.7 mmol/l = 5.6°dH
Hydrogen carbonate hardness	7 to 10°dH
Particle size	≤ 150 µm

Coolant pressure should not exceed 6 bar.

Significant deviations from the recommended values can result in premature corrosion or deposit build-up. Kindly consult the manufacturer if there are any questions.

It is necessary to connect the coolant system prior to operating the DIP pump.

The DIP 3000 to 20 000 have two coolant circuits which can be connected in series.

1. Cold cap baffle: coolant inlet and outlet: (5/6)
2. Pump: coolant inlet: (5/7)
   Coolant outlet: (5/2)

Important is that the coolant flow first into the cold cap baffle.

We recommend coolant feed temperatures of between 15°C and 20°C.

Coolant return temperature should not exceed 30°C at the outlet. It is important to pay attention to this in particular where the DIP pump is connected to a closed coolant circuit. We recommend using conditioned water to avoid the formation of scale deposits (which would impair cooling performance).

The DIP 30 000 and 50 000 have three coolant circuits:

1. Cold cap baffle: coolant inlet and outlet: (6/1)
2. Pump: upper coolant circuit: (6/2) and (6/3)
3. Pump: lower coolant circuit: (6/4) and (6/5)

The pump's upper and lower coolant circuits may be joined one with the other: connect the outlet (6/3) to the inlet (6/4). In this operating mode the discharge temperature at the outlet (6/5) should not exceed 30°C. If the coolant return temperature should rise above 30°C, then we recommend operating the pump with separate coolant circuits.

2.5 Electrical connections

Please also refer to the wiring diagrams in Section 7.

2.5.1 Connecting the heaters

Warning

The electrical connection is to be made by a licensed electrician in compliance with VDE regulations and in accordance with the harmonized or national codes and regulations for the country in which the unit is being operated.
High fault currents may appear at the insulation for the heating elements due to exceptional amounts of moisture absorption.

Warning

The DIP pump will get hot in the marked area during operation:
Burn hazard!
Be sure to observe the cool-down time after the system is shut off.

Warning

Do not use any easily flammable materials near the hot area of the pump.

General installation notes

Information on the internal wiring of the DIP pump will be found in the schematic diagrams.

In all the DIP pumps, with the exception of DIP 3000, the heating cartridges are normally wired in a "star" (Y) circuit; this means that they are prepared for connection to a 400 V, 3-phase, 50/60 Hz, power source.

If the DIP pumps are to be operated on a network in which the current deviates from 400 V, 3-phase, 50/60 Hz (e.g. 230 V, 3-phase or 460 V, 3-phase), then the pump will have to be rewired internally. Kindly inquire at the factory for details.

A supply cable sized to correspond to the amount of power drawn or the connected load is to be used when making the connection. The parameters which affect dimensioning include current load, ambient temperature, how the cable is laid and type of cable and conductors. Local codes shall be observed when sizing the connection cable.

The power consumption figures required to make this selection are given in the following table. The appropriate circuit breakers shall be installed during installation; their specifications are also given in the following table.

Legend for Fig. 7

1 Electrical terminal box with circuit breakers for heating cartridges and thermostat switching devices

2 Contact plate for thermal safety switch

3 PG type threaded fitting for electrical connection

4 Connection for dial-type thermometer (optional)

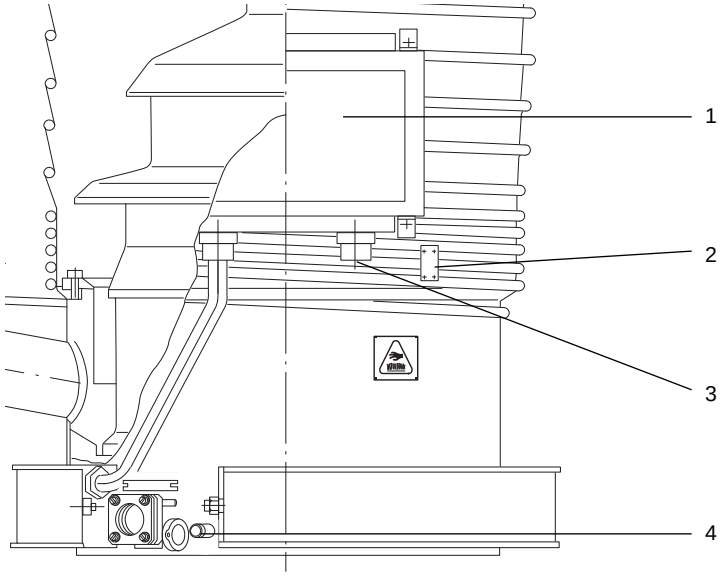


Fig. 7 Electrical connections

DIP	Connection voltage	Main fuse	Individual fuses Size	Number
3000	**230 V, single-phase**	**16 A**	**6 A**	**2**
8000	230 V, 3-phase	16 A	10 A	6
	400 V, 3-phase	**16 A**	**6 A**	**6**
	460 V, 3-phase	16 A	10 A	3
12000	230 V, 3-phase	25 A	10 A	9
	400 V, 3-phase	**16 A**	**6 A**	**9**
	460 V, 3-phase	16 A	6 A	9
20000	230 V, 3-phase	40 A	10 A	12
	400 V, 3-phase	**25 A**	**6 A**	**12**
	460 V, 3-phase	25 A	10 A	6
30000	230 V, 3-phase	63 A	10 A	18
	400 V, 3-phase	**40 A**	**6 A**	**18**
	460 V, 3-phase	32 A	10 A	9
50000	230 V, 3-phase	100 A	10 A	24
	400 V, 3-phase	**50 A**	**6 A**	**24**
	460 V, 3-phase	40 A	10 A	12

The insulation for the lines from the junction boxes to the fuse boxes shall be resistant to temperatures of up to 200 °C.

Safety interlock

Operation of the pump heaters at the DIP type pump is monitored with a thermostat. Where there is a loss of pump liquid and an unacceptable temperature rise in the vaporization chamber, the heating will be switched off, keeping the cartridges from being overheated.

The thermostat is engineered as a fail-safe temperature monitoring unit which means that if the connection line between the measurement sensor (14/44) and the switching device (14/21) is broken the built-in contact will open, reporting a “fault” as would be the case for unacceptable temperature rise.

DIP	Number of thermostats	Temperature setting
3000	1	320 °C
8000	1	320 °C
12000	1	320 °C
20000	1	360 °C
30000	2	360 °C
50000	2	360 °C

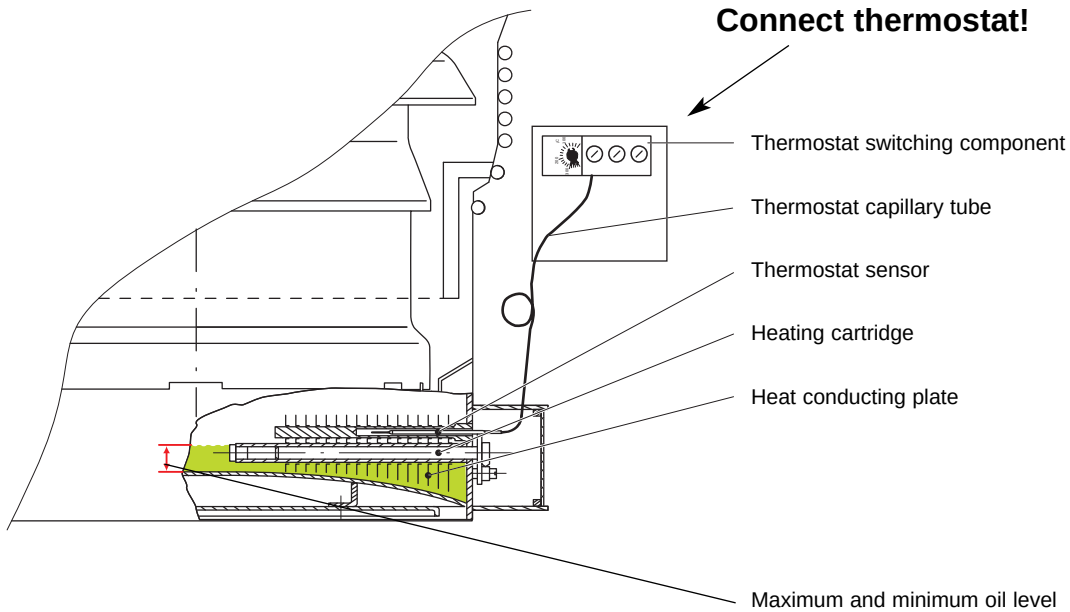


Fig 8 Connecting the thermostat to protect the pump against overheating

Caution

Switching the heating cartridge on and off repeatedly will result in its premature failure.

The connection for the DIP pump must be via a power relay of appropriate capacity (not included as standard equipment). The control circuit for the relay coil is to interface with the switching contact for the thermostat in such a way that **the relay will separate the pump from the power supply if unacceptably high temperatures are detected**. Use terminals 1 and 2 at the thermostat for this purpose; see the schematic diagram for details.

Caution

Connect the thermostat in such a way that, after the thermostat has disabled the system, the pump cannot start again spontaneously once the system has cooled down again.

Electrical connection at the thermostat

To set up the protective interlock system connect the switching contact for the thermostat with the appropriate power circuit to control the relay coil.

Remove the cover at the electrical junction box. Pass the end of the supply line through the type PG threaded fitting and connect the conductors with the connector contacts at the thermostat (see the schematic for the wiring scheme). Attach the ground conductor in the supply lead to the central grounding point on the backing plate (PE bus). Then connect the supply line with the system control unit in order to ensure that this protective interlock is set up properly.

Caution

Missing or wrong connections for the thermostat can cause the pump to overheat.

Connect the supply line with the electrical junction box

Pass the end of the supply lead through the type PG threaded fitting.

Attach the ground and neutral conductors at the appropriate PE and N buses inside the fuse box. Connect the neutral conductor only after determining that it can carry a load.

Then connect the hot conductor(s) (L1 in the DIP 1000; L1, L2 and L3 in the other models) at the appropriate connection strips for the fuse groups. Tighten down the PG threaded fitting to activate the strain relief feature and then reinstall the cover on the electrical junction box.

2.5.2 Connect monitoring components (options)

Overheating switch

We recommend installing a thermostatic safety switch. This switch monitors the coolant temperature and is located in the immediate vicinity of the coolant pipe (7/2). The contacts are closed at temperatures below 50°C during normal operations. If the temperature at the sensor rises above 50°C (in case the coolant circulation should fail, for example), then the contacts will open and shut down the DIP pump heating by way of a relay (to be provided by owner).

Route one phase of the relay in the power supply through the overheating protection switch.

Caution

Connect the pump in such a way that it will not start again spontaneously once a monitoring component (thermostat, overheating protection switch, coolant flow monitor) has been tripped and the operating parameters have returned from the unacceptable to the normal status.

Use four cap screws, M 3 x 6 to mount the thermal protection switch (7/2).

Coolant flow monitor

The coolant flow monitor is installed in the outlet port of the coolant circuit for the series DIP pump.

If coolant circulation fails the flow monitor can, for example, be used to drive a relay which will switch off the pump heating, activate an alarm system or carry out another suitable switching function. The minimum coolant volumes are given in Section 1.3, “Technical Data”.

Dial-type thermometer

The dial-type thermometer is inserted at the base of the vaporization chamber, in the opening (7/4) provided for this purpose. Remove the threaded plug to do so.

The dial thermometer has two switching points which can be set independent one of another.

We recommend setting the lower switching point at < 100°C (pump can be aired) and the upper switching point at > 200°C (pump is ready for operation).

The contacts for the switching points are connected to leads which terminate outside the thermometer. The signals can be interpreted by an external pump system control unit.

Alternatively also a Pt 100 temperature sensor may be inserted into the bore (7/4).

2.6 Pump fluid

The series DIP pumps are shipped without pump fluid installed.

We recommend using either our DIFFELEN pump fluid or silicone oil. These compounds are particularly suitable because of their high thermal and chemical stability.

Use DIFFELEN LEICHT where great throughput is to be achieved in a range of 10^{-3} to 10^{-2} mbar.

We recommend using DIFFELEN NORMAL for pressure reaching down to 10^{-7} mbar.

DIFFELEN ULTRA is used to achieve extremely low pressures (ultra-high vacuum).

Silicone oils are distinguished by their very low vapor pressure and great resistance to oxidation and decomposition. We recommend using type DC 704 silicone oil.

We recommend using type DC 705 silicone oil where particularly low ultimate pressures are to be attained.

Caution

All the pump's interior surfaces must be carefully cleaned before filling the pump with a different oil compound (e.g. from mineral oil DIFFELEN to silicone oil).

Install the pump fluid through the pump fluid filler port (11/1).

The quantities of fluid required will be found in Section 1.3, "Technical Data".

Use a litre gauge to measure the quantity of pump fluid and fill the pump fluid into the pump. When filling the pump for the first time or when filling it after cleaning, we recommend to fill the pump up to its maximum.

After having filled in the pump fluid, wait a few minutes for the pump fluid to spread and then read off the oil level at the oil level sight glass. In order to correctly determine the oil level, read off the filling level at eye level.

Disposing of spent fluid

The owners of used fluid are responsible for its proper disposal.

Spent fluid from vacuum pumps may not be mixed with other substances.

Spent fluids from vacuum pumps (Leybold's petroleum-based oils) which are contaminated only as a result of normal wear and tear due to the effects of atmospheric oxygen, elevated temperature and mechanical strain can be disposed of in the same way as used motor oils.

Spent oils from vacuum pumps which were contaminated with other substances will have to be marked to identify the contaminant and stored and disposed of as toxic wastes.

European, national and local regulations concerning the disposal of waste need to be observed. The waste must only be handled and disposed of through an approved waste disposal vendor.

Legend for Fig. 9

1	Rotary vane vacuum pump
2	Forevacuum valve
3	Rough vacuum valve
4	High-vacuum valve
5	Vapor baffle
6	Oil diffusion pump with cold cap baffle
7	Sorption trap
BV	Airing valve
HM	High-vacuum measurement point
VM1	Forevacuum measurement point (diffusion pump)
VM2	Forevacuum measurement point (roughing line)

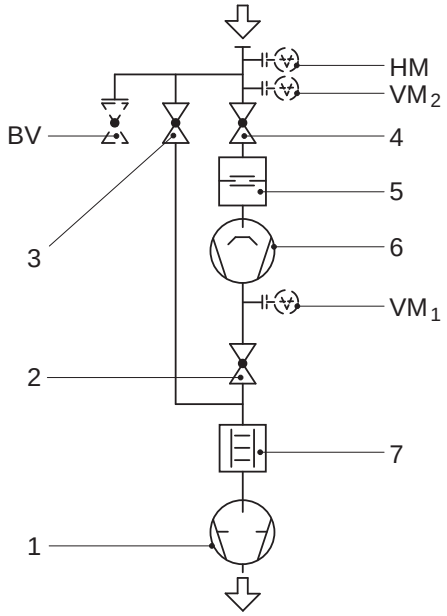


Fig. 9 Schematic for a diffusion-type vacuum pump system

3 Operation

The pumping speed attained by diffusion pumps is constant between about 10^{-3} mbar and very low pressure since in this pressure range the stream of vapor will not be affected by the pressure level prevailing in the vacuum chamber.

We recommend joining the vacuum chamber direct to the forevacuum pump via a valve (9/3) and a roughing line. A high-vacuum valve (9/4) and a forevacuum valve (9/2) are required for proper functioning of the roughing line.

The vacuum chamber is evacuated down to the transfer pressure via the roughing line. The diffusion pump and pump fluid are protected when the high-vacuum valve (9/4) is opened. Close the forevacuum valve (9/2) and the high-vacuum valve (9/4) prior to venting the vacuum chamber; the diffusion pump will remain in a state of operational readiness.

3.1 Switching on

All the connections and preparations for operation have been made properly and in accordance with Sections 2.2 to 2.6.

Switch on the roughing pump and evacuate the DIP pump down to forevacuum pressure < $5 \cdot 10^{-1}$ mbar; open the coolant supply valve and then switch on the pump heaters.

The DIP pump will begin functioning after a certain period of time (see Section 1.3, “Technical Data”).

If a high-vacuum valve has been installed between the diffusion pump and the vacuum chamber, then this should be opened when the DIP pump is hot only if the pressure in the vacuum chamber is below $1 \cdot 10^{-1}$ mbar.

3.2 Running the pump

Warning

Operating the DIP pump with the high-vacuum and forevacuum sections closed off and with the coolant supply shut down at the same time represents a hazardous situation and is to be reliably excluded (e.g. by way of interlock circuitry).

Warning

Do not use any easily flammable materials near the hot pump section.

When inlet and forevacuum temperatures are above the maximum permissible levels as specified in the tables at “Technical Data” (see Section 1.3) it is possible for pump fluid to pass into other parts of the vacuum system.

Unrestricted coolant flow and satisfactory temperature and the quantity and temperature of the pump fluid have to be monitored while the DIP pump is in operation.

For this refer to Sections 3.5 Regular checks and 4 Maintenance.

Where there is an unacceptable rise in temperature caused, for instance, by failure of the coolant circuit, the built-in thermostat will switch off the heating cartridges at the DIP pump; see Section 2.5 “Electrical connection at the thermostat”. If you have installed a thermostatic safety switch and/or a coolant flow monitor unit these will also switch off.

3.3 Shutting down

Close the high-vacuum valve (9/4).

Switch off the pump heating and wait until the DIP pump has cooled down sufficiently.

Warning

Danger of scalding by the pump fluid vapor when the hot DIP pump is opened.

Close the forevacuum valve (9/2).

Shut off the coolant supply.

Caution

The DIP may be vented only after the pump fluid temperature has fallen to below 100°C. With the optionally built-in pointer thermometer (see Section 2.5.2) the temperature may be checked. At 100 °C the lower switching threshold is tripped.
Ventilation should preferably be from the high-vacuum side, into the cool pump.

Switch off and vent the forevacuum pump.

Shut off coolant supply only after the DIP pump has cooled down to below 100°C.

3.4 Air inrush

Brief, intermittent ingress of air will not affect functioning of the DIP pump since the pump fluid is self-cleaning.

We recommend using a silicone-based oil if air inrush is to be expected more frequently, since such compounds exhibit greater resistance to oxidation and de-composition.

3.5 Regular checks

In order to ensure trouble-free operation of the DIP pump we recommend in the case of normal operation the following regular checks:

Check	Interval	Action	Chapter
Filling level of the pump fluid	1 week	If required top up oil, be sure to use the same grade of oil	4.1, 4.2
Condition of the pump fluid	1 month	If required change the oil	4.3
Cleaning of the nozzle assembly	1 year	Use suitable solvents, for example, petroleum ether or acetone	4.4
Cleaning the heat conducting plates of the heater cartridges	1 year	Use a commercial high-pressure cleaner, 2 bar overpressure max.	4.4
Cooling water flow	1 year	If required clean the cooling coils	4.4.5

3.6 Detaching the pump from the system

Switch off and vent the DIP pump in a planned fashion and as described in Section 3.3.

Isolate the DIP pump from the power supply and detach at the electrical connection terminals.

Disconnect the coolant system and use compressed air to blow out the piping network.

Lift the DIP pump only at the lifting eyes.

Warning

If the pump had previously handled hazardous gases or if toxic products of pump fluid decomposition generated due to overheating might be present, then all the appropriate precautionary measures will have to be undertaken.

Use gloves, a respirator and protective clothing as required and work under a suitable fume extraction hood.

Open the pump fluid outlet ports (11/5) and drain the pump fluid into a suitable container.

Caution

Dispose of the pump fluid properly (may possibly have to be handled as toxic waste).

Separate the pump's forevacuum and high-vacuum flanges from the system and remove the DIP pump.

Pack the pump so that it cannot be damaged during shipment.

Protect the flanges and the coolant connections in particular.

Please observe the precautions set forth in Section 4.5 if you send a pump to Leybold.

Maintaining in stock

Maintain the pump in stock so that it is dry and not exposed to frost. The cooling coils need to be blown out and must be dry.

Keep the pump in stock standing upright.

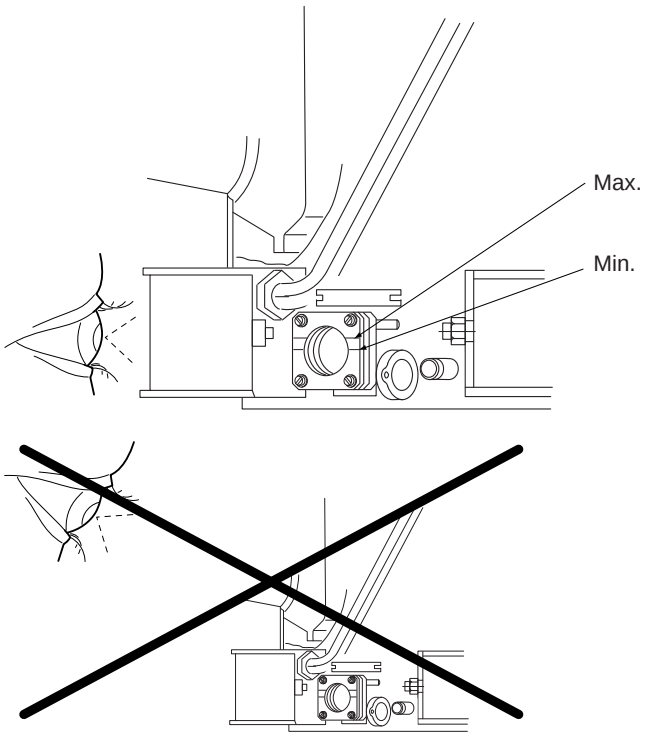


Fig. 10 Checking the level of the pump fluid

4 Maintenance

Warning

If the pump had previously handled hazardous gases or if toxic products of pump fluid decomposition generated due to overheating might be present, then all the appropriate precautionary measures will have to be undertaken.
Use gloves, a respirator and protective clothing as required and work under a suitable fume extraction hood.

4.1 Checking the pump fluid level

The fluid fill level can be read at the sight glass on the DIP pump. There are markings for the minimum and maximum levels at the sight glass. When the DIP pump is running the fill level should be at the center of the sight glass.

The oil fill level can be checked exactly only when the pump is cold and vented. In order to correctly determine the oil level, read off the filling level at eye level.

The fill level will fluctuate hardly at all during normal operation. If the DIP pump has to be aired frequently (batch operation), then we recommend keeping the fluid level at the maximum level.

Legend for Fig. 11
1 Pump fluid inlet port
2 Oil fill level sight glass
3 “Maximum” mark
4 “Minimum” mark
5 Pump fluid outlet port

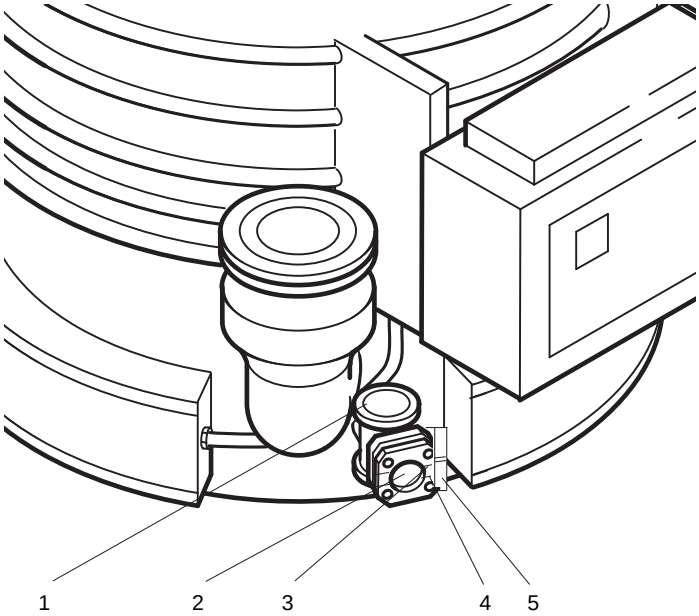


Fig. 11 Oil level sight glass with pump fluid inlet and outlet ports

4.2 Topping up pump fluid

The level of the pump fluid must not be allowed to drop below the minimum mark. Top up as required.

Caution

Open the inlet port for the pump fluid only after having vented the pump and while cold.

- Switch the pump off, wait for it to cool down and vent it.
- Read off the filling level at eye level. Be sure to use the same grade of pump fluid.

  Open the inlet port (11/1) and fill in the pump fluid ensuring that the maximum mark is not exceeded.
- We recommend that you replace the gasket at the inlet port (14/43).
- Close the inlet port.

4.3 Exchanging the pump fluid

Normally the pump fluid (mineral oil and silicone oil) is as clear as water. When it changes its colour to “honey yellow” it will have to be exchanged.

Caution

Open the pump fluid drain port or the inlet port only after the pump has been vented and while cold.

- Switch the pump off, wait for it to cool down and vent.
- Open the drain port and drain the pump fluid into a suitable vessel. Leave the drain port open for at least 30 minutes so that as much pump fluid as possible can drain out.
- Each time when exchanging the pump fluid we recommend that you replace the two gaskets at the filling port (14/43) and the drain port (14/42).
- Close the drain port.
- Open the inlet port and fill in the pump fluid ensuring that the maximum mark is not exceeded. Read off the filling level at eye level.
- Close the inlet port.

For disposing of waste oil refer to Section 2.6.

4.4 Cleaning the pump

The inner surfaces of the pump should be cleaned at least once a year. Moreover, they must be cleaned when filling in a different grade of pump fluid.

The pump will have to be dismantled to do so.

4.4.1 Dismantle pump

Disconnect the power supply and coolant circuit (see Section 3.6, “Detaching the pump from the system”).

Open the pump fluid outlet port (14/42) and allow the pump fluid to drain.

Separate the pump’s forevacuum and high-vacuum flanges from the system.

Remove the cold cap baffle (14/19).

Unscrew the nut (14/31) and remove the washer (14/32). Unscrew the mounting bolt (14/35).

Carefully lift the cold cap baffle and pull it out of the pump housing.

Loosen the connection ports (14/30) with by tapping lightly with a rubber hammer or wooden mallet if necessary.

When removing the baffle carefully remove the two insulating washers (14/34) and the spacer (14/36).

DIP 3000 to 20 000: Grasp the nozzle assembly at the first stage (12/6) and lift it out of the pump housing.

DIP 30 000 and 50 000: Lift out the nozzle assembly using the lifting eyes at the second stage.

4.4.2 Cleaning the pump

The nozzle assembly and the inner parts of the pump may be cleaned with a commercial steam cleaner.

Caution The pressure of the steam cleaner may
- only **amount to 2 bar** when cleaning the heat conducting panels of the heater inserts (risk of breaking the copper lamellae)
- only **amount to 10 bar** for the remainder of the pump.

Stubborn dirt (burnt-in residues of the pump fluid) may be removed with a suitable solvent or with fine grain detergents or fine emery paper.

Place the pump at a slight angle (ensure that it can not topple over) so that the cleaning fluid can run out. At the end of the cleaning process clean all inner surfaces with a commercial hot air fan.

4.4.3 Oil level sight glass

Remove the screws at the flange mount (14/39) to clean the oil level sight glass (14/41) in the assembly (14/29).

We recommend replacing the two O-rings (14/38) in front of and behind the sight glass during assembly.

Pay attention to correct positioning of the marking at the sight glass cover. The marking line indicating the upper level for the pump fluid must be located above the middle of the oil level sight glass.

If arrows are present on the cover frame, these must point downwards.

4.4.4 Assembling the pump

When assembling the pump ensure that the individual components are again mounted in the correct order (see Fig. 14).

Caution

The nozzle assembly may not be dismantled. It will be necessary to change out the complete nozzle assembly if the dimensions at the gaps (see Fig. 12) deviate from the specified values. Deformations at the nozzle assembly are an indicator for serious air ingress during pump operation.

Install the nozzle assembly centered in the pump housing. Check to ensure that it is seated in the center of the high-vacuum flange (14/15).

Mount the cold cap baffle (14/19), paying particular attention to correct seating of the gasket rings (14/33) for the coolant liquid port.

Close the pump fluid outlet port (14/42) and reinstall the DIP pump in the system, being sure that it is vacuum-tight.

Caution

Pay attention to correct positioning, properties and cleanliness for all gaskets; use new gaskets if appropriate.

Install new pump fluid at the pump fluid filling port (14/43). See Section 1.3, “Technical Data”, for specifications on the amount of pump fluid required.

4.4.5 Cleaning the cooling coils

Clean the cooling coils with a commercial decalcifier based on formic acid or ethanoic acid.

Caution

Do not use any chlorine based decalcifier since this will damage the cooling coils due to crevice corrosion.

4.5 Service by LEYBOLD

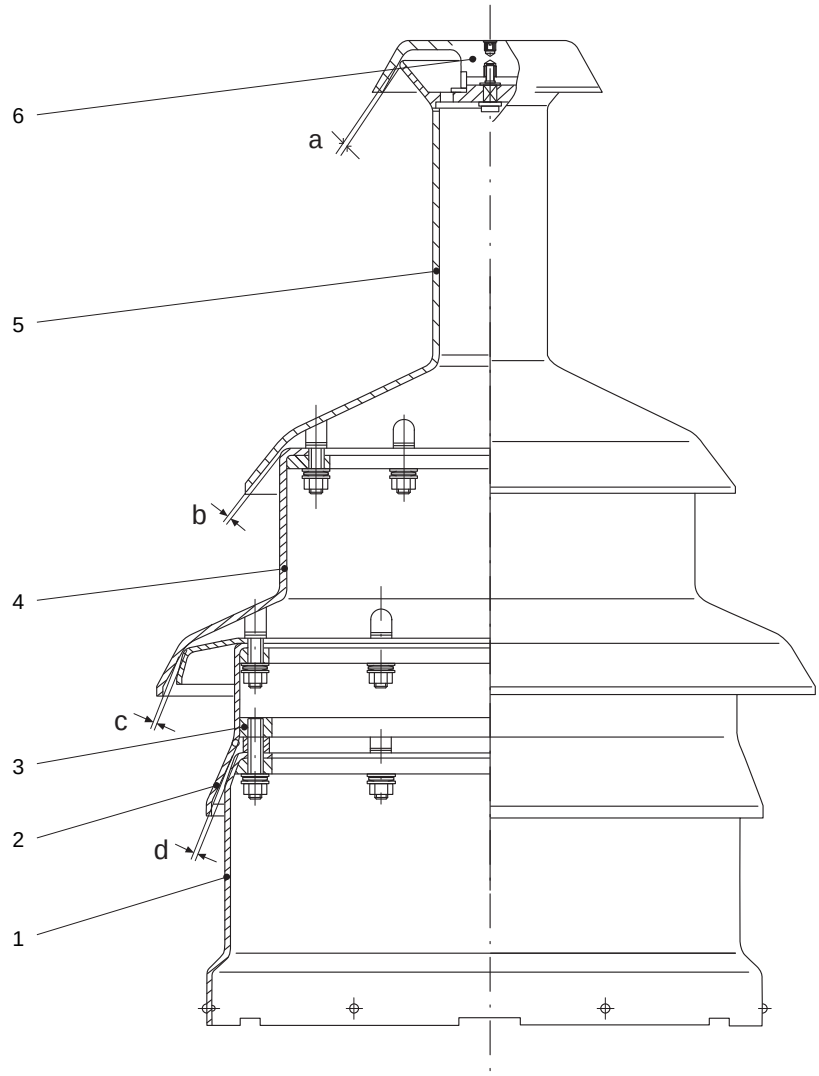
Whenever you send a pump to Leybold, indicate whether the pump is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose; we will forward the form on request.

A copy of the form is printed at the end of these operating instructions: „Declaration of contamination of vacuum equipment and components“. Another suitable form is available from the Leybold homepage:
http://www.leyboldvac.de under the headline “customer service”.

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.



Legend for Fig. 12

1 Nozzle assembly housing
2 4th stage
3 Spacer bushing
4 3rd stage
5 2nd stage
6 1st stage

Specified dimensions for nozzle gap

	a (1st stage)	b (2nd stage)	c (3rd stage)	d (4th stage)
DIP 3000	1.5 ± 0.1	1.2 ± 0.2	1.3 ± 0.2	3.5 ± 0.2
DIP 8000	0.8 ± 0.1	1.2 ± 0.2	2.0 ± 0.2	2.5 ± 0.2
DIP 12000	1.0 ± 0.1	1.2 ± 0.2	2.5 ± 0.2	3.0 ± 0.2
DIP 20000	1.3 ± 0.1	1.1 ± 0.2	2.5 ± 0.2	3.0 ± 0.2
DIP 30000	1.2 ± 0.1	2.0 ± 0.2	3.0 ± 0.2	3.5 ± 0.2
DIP 50000	1.2 ± 0.1	1.5 ± 0.2	2.5 ± 0.2	3.5 ± 0.2

Fig. 12 Nozzle assembly for the DIP 20 000;
other models are similar

5 Troubleshooting

The ultimate total pressure specified in Section 1.3, “Technical Data”, will be attained under the following conditions:

The chamber must be leak-tight and bake-out procedures should be possible, if this is at all feasible. The interior surfaces must be clean.

The gases liberated by the sealing elements used in the unit are to be kept to a minimum, which means that FPM gaskets are to be used instead of NBR or silicone sealing rings. If very low working pressures are required, then metal seals will preferably be installed.

If the ultimate pressure is obviously not attained although the conditions given here are all satisfied, then the following defects may be present:

Insufficient pump fluid

Cause: Heating units switch off and on at insufficient pump fluid level.

Remedy: Top up with pump fluid.

Pump fluid contaminated

Cause: Pump fluid has decomposed as a result of frequent air ingress or there are contaminants originating from the apparatus.

Remedy: Clean the DIP pump; replace the pump fluid.

Insufficient heater output

Warning

Have these repairs carried out (in accordance with VDE and local codes) only by a qualified, licensed electrician.

Cause: Line voltage too low; heating cartridge defective.

Remedy: Check the heating units; replace the defective heating cartridge.

The heating cartridges contain magnesium oxide (MgO) and thus attract humidity. For this reason keep the replacement heater cartridges in dry rooms only or in plastic bags which are sealed air-tight. If the heater cartridges have attracted humidity, they may be dried in a drying oven for 8 hours at 180 °C.

Caution

Only install heater cartridges which are dry.

Switch off the DIP pump in preparation for replacing the heating cartridge; remove the sheet metal cladding at the base of the pump (14/27) by loosening the fixing screws. Disconnect the leads for the defective heating cartridge (14/45) and pull the heating cartridge straight out of the heater well, **without** rotating it.

If the heater cartridge can not be pulled out manually, use the withdrawal sleeve; see Fig. 13.

For this remove the clamp holding the heater cartridge (13/4) and cut off the electric cables.

Drill a hole (5 mm dia.) into the side of the heater cartridge.

Fit the withdrawal sleeve and affix it with the pin.

Screw the withdrawing hammer in and pull the heater cartridge out.

Before installing the heater cartridge widen the heating pipe by 20^{H7} mm with a reamer and then clean it.

The replacement heating cartridge will have to be sprayed with a temperature-resistant lubricating substance (“Never Seez” brand; see Section 6, “Replacement Parts”).

Caution

In order to avoid any danger of electrical problems, **do not** apply the spray to a 20 mm length of the cylindrical section of the cartridge at the connection end.

The spray film which is applied must be distributed evenly and should fill the entire air gap between the cartridge and the inside of the heater well. The lubrication substance enhances protection against the cartridge seizing during installation and removal and promotes heat transfer from the heating cartridge to the heater well.

Rotate and slide the heating cartridge (13/5) to insert it into the heater tube. When inserting the heater cartridge there must be no mechanical resistance. If necessary once more widen the heating pipe by 20^{H7} mm with a reamer and then clean it. Finally provide the electrical connections.

Subsequent assembly is in the reverse order to that described above. The inside of the heater well must not be damaged. Notify our Customer Service Department if the heater well should suffer serious damage.

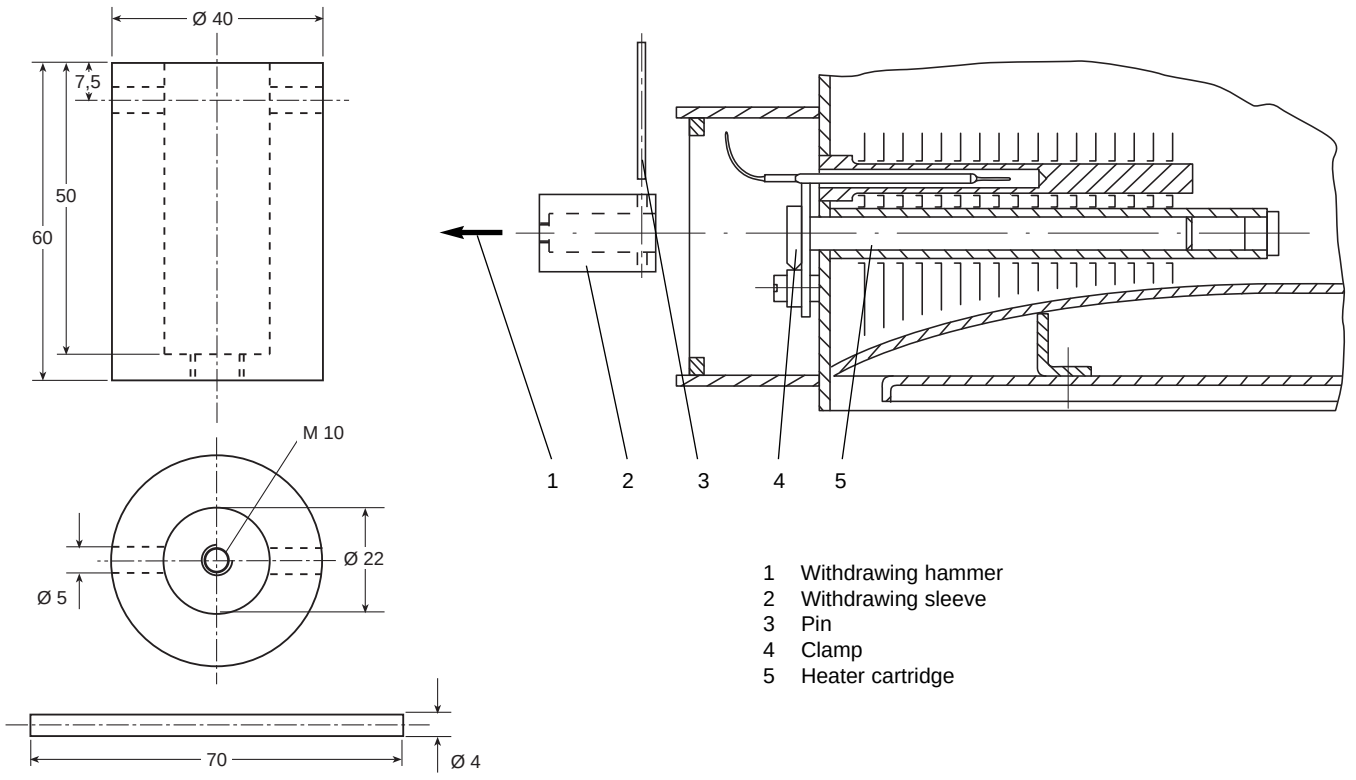


Fig. 13 Withdrawing sleeve for heater cartridges; left dimensional drawing; right schematic indicating usage

Insufficient cooling; pump runs too hot

Cause: Coolant circuits connected incorrectly, insufficient coolant pressure, clogged lines, scale deposits.

Remedy: Connect the coolant circuits as described in Section 2.3. Raise the coolant pressure to a maximum of 6 bar, clean the lines, run water through the system in the reverse direction.

Do not use any de-scaling products containing chlorine compounds; use commercially available products based on formic or acetic acid.

Pump achieves neither full pumping speed nor satisfactory ultimate pressure

Possible causes:

a) Nozzle assembly assembly improperly mounted.

b) Insufficient forevacuum.

c) Device leaking or soiled.

d) Oil contaminated or aged.

Remedy:

a) Remove and clean the nozzle assembly and then carefully reinstall (see Section 4.4). Ensure that the nozzle assembly is centered in the DIP pump.

b) Examine the forevacuum line for potential leaks and seal where needed. The required forevacuum pressure upline from the diffusion pump must be ensured.

c) Use a leak tester to examine the apparatus; clean thoroughly, dry and bake out if indicated.

d) Change the oil.

6 Replacement parts

Item in Fig. 14	Quantity DIP 3.000	DIP 8.000	DIP 12.000	DIP 20.000	DIP 30.000	DIP 50.000	Designation	Dimensions (mm) Material	Order N0.	Comments
8	1	1					O-ring	70 x 5; FPM	239 70 509	DN 63 ISO-K
8			1	1			O-ring	100 x 5; FPM	239 70 139	DN 100 ISO-K
8					1	1	O-ring	150 x 5; FPM	239 70 526	DN 160 ISO-K
9	1						Forevacuum baffle	ø68 x 97	200 05 491	Centering ring DN63ISO-K
9		1					Forevacuum baffle	ø68 x 124	200 05 492	Centering ring DN63ISO-K
9			1				Forevacuum baffle	ø98 x 154	200 05 493	Centering ring DN100ISO-K
9				1			Forevacuum baffle	ø96 x 162	200 05 494	Centering ring DN100ISO-K
9					1	1	Forevacuum baffle	ø150 x 228	200 05 495	Centering ring DN160ISO-K
10	1						Nozzle assembly, complete	ø237x442; Al	200 05 438	
10		1					Nozzle assembly, complete	ø365x620; Al	200 05 441	
10			1				Nozzle assembly, complete	ø472x790; Al	200 05 442	
10				1			Nozzle assembly, complete	ø554x965; Al	200 05 440	
10					1		Nozzle assembly, complete	ø796x1290; Al	200 05 443	
10						1	Nozzle assembly, complete	ø985x1706; Al	200 05 444	
17	1						Centering ring with O-ring	Al/FPM	268 45	DN 250 ISO-K
17		1					Centering ring with O-ring	Al/FPM	268 47	DN 400 ISO-K
17			1				Centering ring with O-ring	Al/FPM	268 48	DN 500 ISO-K
17				1			Vacuum sealing disc, compl.	Al/CR (Neoprene)	171 16	DN 630 ISO-F
17					1		Vacuum sealing disc, compl.	Al/CR (Neoprene)	171 17	DN 800 ISO-F
17						1	Vacuum sealing disc, compl.	Al/CR (Neoprene)	171 18	DN 1000 ISO-F
19,20	1						Cold cap baffle	ø123 x 54	200 05 460	
19,20		1					Cold cap baffle	ø187 x 70	200 05 461	
19,20			1				Cold cap baffle	ø258 x 86	200 05 462	
19,20				1			Cold cap baffle	ø285 x 102	200 05 466	Serial No. ≥ Z95 00012
19,20					1		Cold cap baffle	ø330 x 116	200 05 464	
19,20						1	Cold cap baffle	ø374 x 113	200 05 465	
33	2	2	2	2	2	2	Gasket for cold cap baffle	25x2,5; NBR	239 50 105	Pump body coolant port
34	2						Insulating washers	15x5; PTFE	200 05 471	Thermal insulation
34		2	2				Insulating washers	15x5; PTFE	200 05 425	Nozzle assembly
34				2			Insulating washers	15x5; PTFE	200 05 472	
34					2	2	Insulating washers	ø20x8; PTFE	200 05 433	
38	2	2	2	2	2	2	O-ring	65 x 5; FPM	239 70 129	For fill level sight glass
38,40,41	1	1	1	1	1	1	Fill level sight glass	ø80 x 10	200 05 470	Incl. 4 spacer sleeves
							– Mounting set			and 2 O-rings (Item 38)
42	1	1	1	1	1	1	O-ring	18 x 5; FPM	239 70 176	Fluid outlet port DN 16
43	1						O-ring	25 x 5; FPM	239 70 125	Fluid inlet port DN 25
43		1	1	1	1	1	O-ring	42 x 5; FPM	239 70 516	Fluid inlet port DN 40
44 (in21)	1	1	1				Built-in thermostat incl.	ø9 x 30	200 05 416	Serial No. ≥
							measurement sensor	(Measurement		Z97 00062(3.000+8.000)
							and switching device	sensor)		Z97 00093(DIP12.000)
							Switching temp. 320°C			
44 (in21)				1	2	2	Built-in thermostat incl.	ø9 x 30	200 12 573	
							measurement sensor	(Measurement		
							and switching device	sensor)		
							Switching temp. 360°C			

Item in Fig. 14	Quantity DIP 3.000	DIP 8.000	DIP 12.000	DIP 20.000	DIP 30.000	DIP 50.000	Designation	Dimensions (mm) Material	Order No.	Comments
45	2						Heating cartridge	ø20 x 200	200 05 457	1250W, 230V
45		6					Heating cartridge	ø20 x 200	200 05 458	800W, 230V
45			9				Heating cartridge	ø20 x 200	200 05 458	800W, 230V
45				12			Heating cartridge	ø20 x 200	200 05 459	1000W, 230V
										Serial No. ≥ Z95 00012
45					18		Heating cartridge	ø20 x 200	200 05 459	1000W, 230V
45						24	Heating cartridge	ø20 x 200	200 05 459	1000W, 230V
---	1	1	1	1	1		Spray can, “Never Seeze”	450 cm^3	060 25 124	Temperature-resistant lubricant

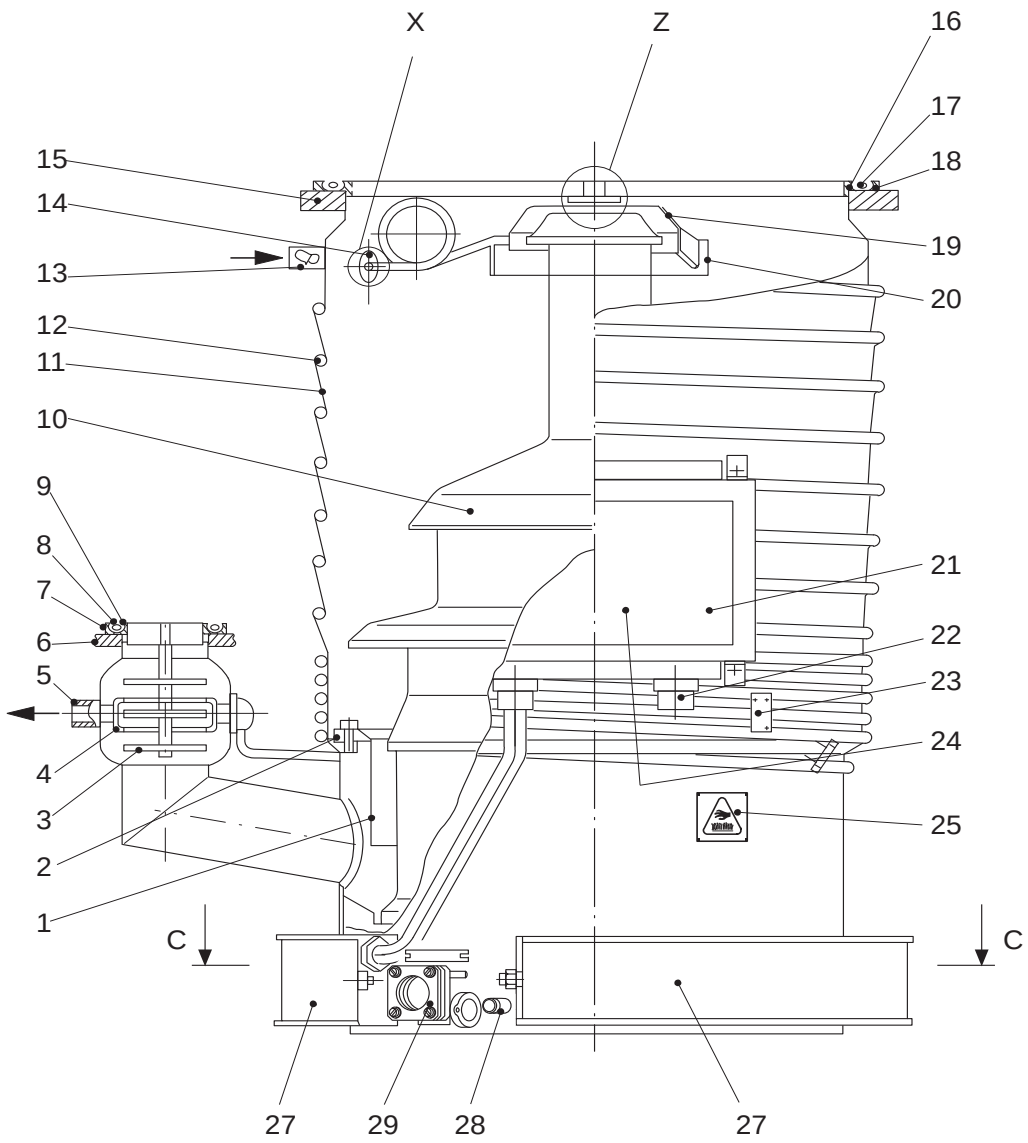


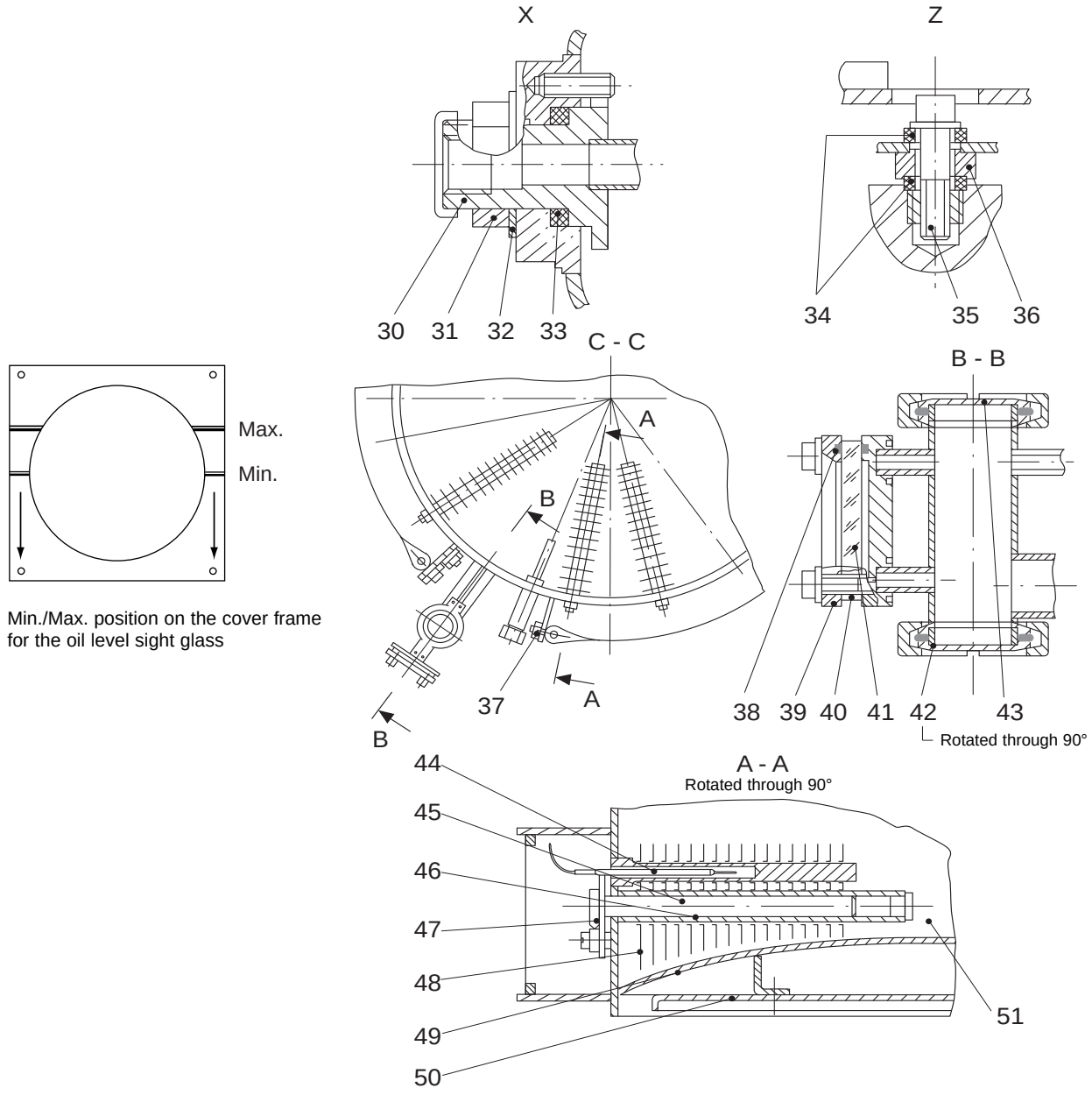
Fig. 14a Overall view of the DIP 20 000; other models are similar

Legend for Fig. 14

1 Shielding plate, ring insert
2 Fixing pins, ring insert
3 Insert, forevacuum baffle
4 Cooling, forevacuum baffle
5 Coolant outlet, pump
6 Forevacuum connection flange
7 Outer ring
8 O-ring
9 Centering ring with baffle insert
10 Nozzle assembly, 4-stage

11 Pump housing
12 Coolant line
13 Coolant inlet, pump
14 Coolant connection, cold cap baffle
15 High-vacuum connection flange
16 Centering ring with centering star
17 O-ring
18 Outer ring
19 Cold cap baffle

20 Outer ring for cold cap baffle
21 Electrical junction box with circuit breakers for heating cartridges and switching devices for thermostats
22 Threaded fitting (PG) for electrical connection
23 Contact plate for thermostatic safety switch
24 Switching device, thermostat
25 Warning label
27 Sheet metal cladding, heating
28 Installation location for dial-type thermometer
29 Fluid fill level sight glass with pump fluid inlet and outlet ports



Min./Max. position on the cover frame for the oil level sight glass

Fig. 14b Overall view of the DIP 20 000; other models are similar

30 Connection ports, water cooling, cold cap baffle
31 Nut
32 Washer
33 Gasket ring

34 Ceramic washer
35 Bolt
36 Centering ring

37 Tightening screw

38 O-ring
39 Flange
40 Spacer sleeve
41 Fluid fill level sight glass
42 Pump fluid outlet port
43 Pump fluid inlet port

44 Capillary tube, thermostat
45 Heating cartridge
46 Mounting well for heating cartridge
47 Fixing clamp
48 Heat diffusion fin
49 Pump base
50 Thermal protection jacket
51 Vaporization chamber

Section A-A Heater well with heating rod
Section B-B Fluid fill level sight glass with pump fluid inlet and outlet ports
Section C-C Arrangement of the heating rods
Section X Connection port, water cooling, cold cap baffle
Section Z Attachment, cold cap baffle

7 Terminal diagrams

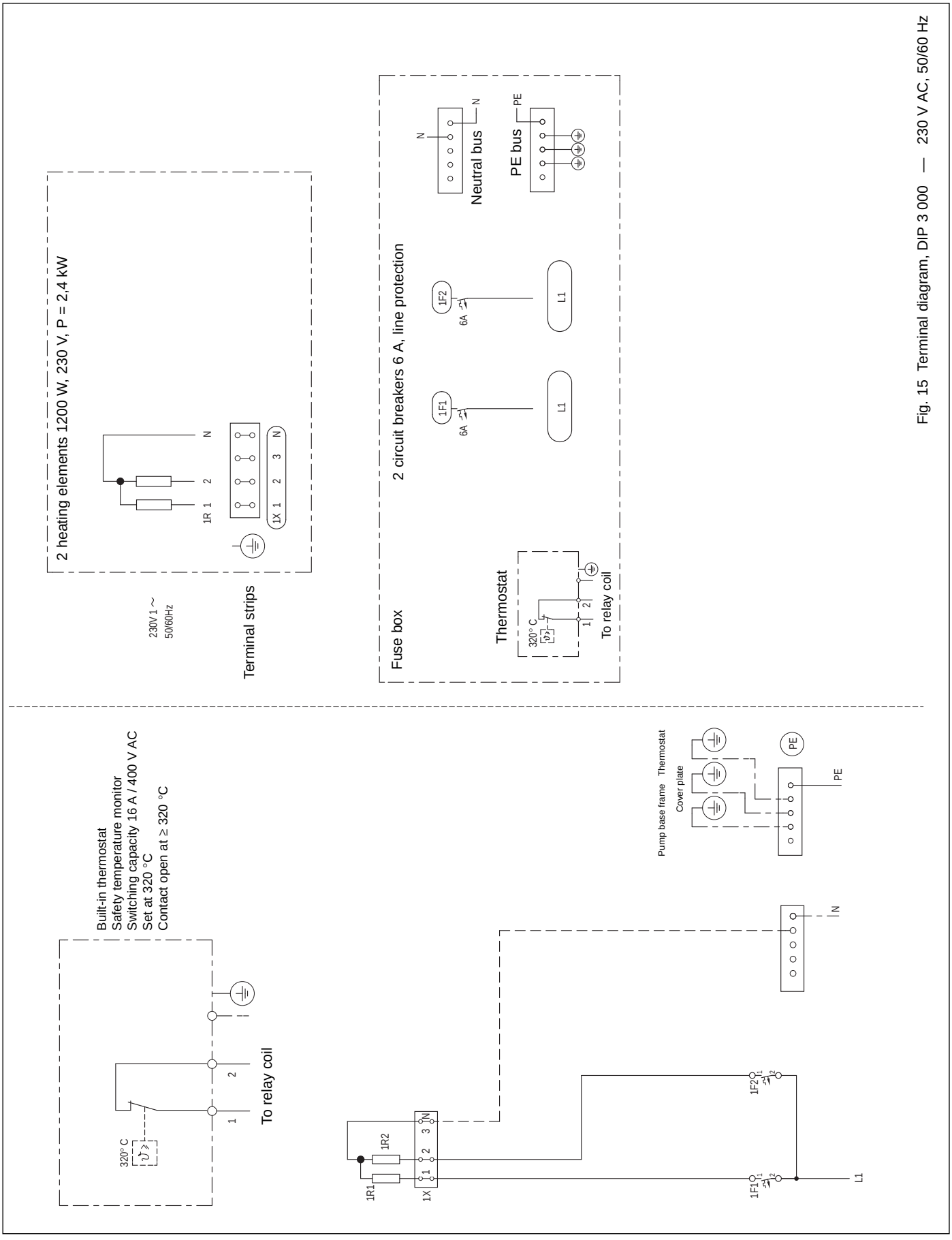


Fig. 15 Terminal diagram, DIP 3 000 — 230 V AC, 50/60 Hz

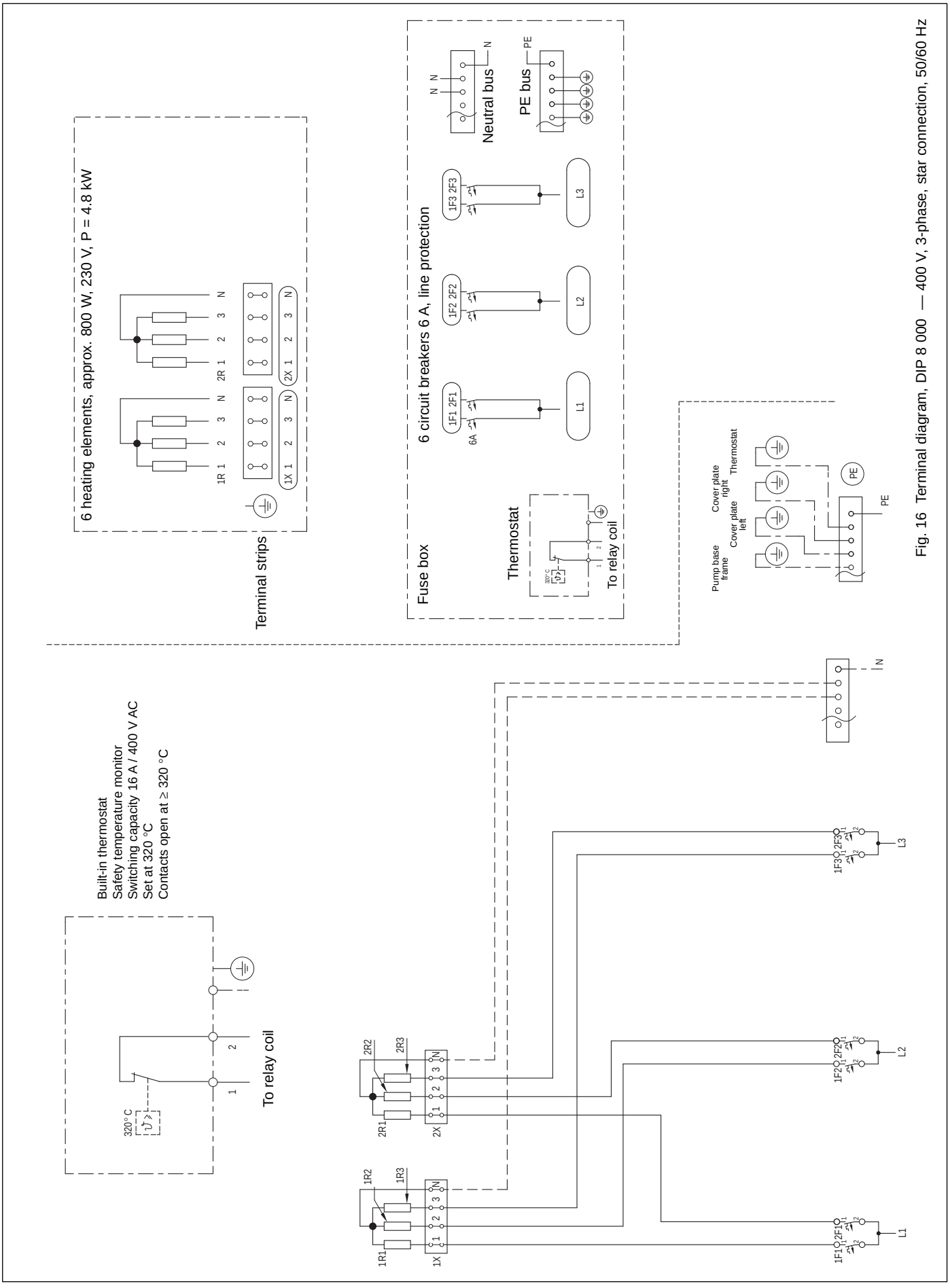


Fig. 16 Terminal diagram, DIP 8 000 — 400 V, 3-phase, star connection, 50/60 Hz

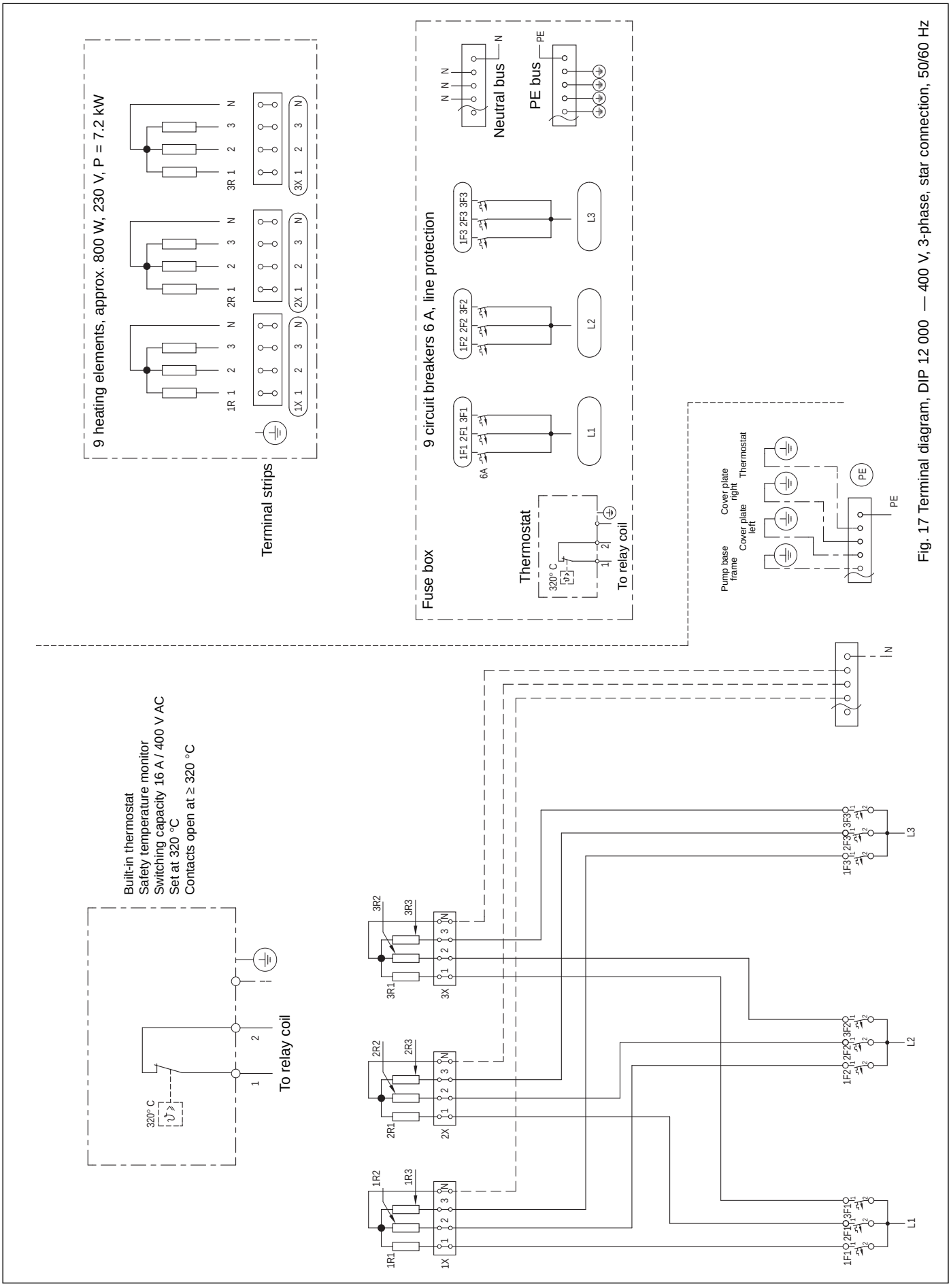


Fig. 17 Terminal diagram, DIP 12 000 — 400 V, 3-phase, star connection, 50/60 Hz

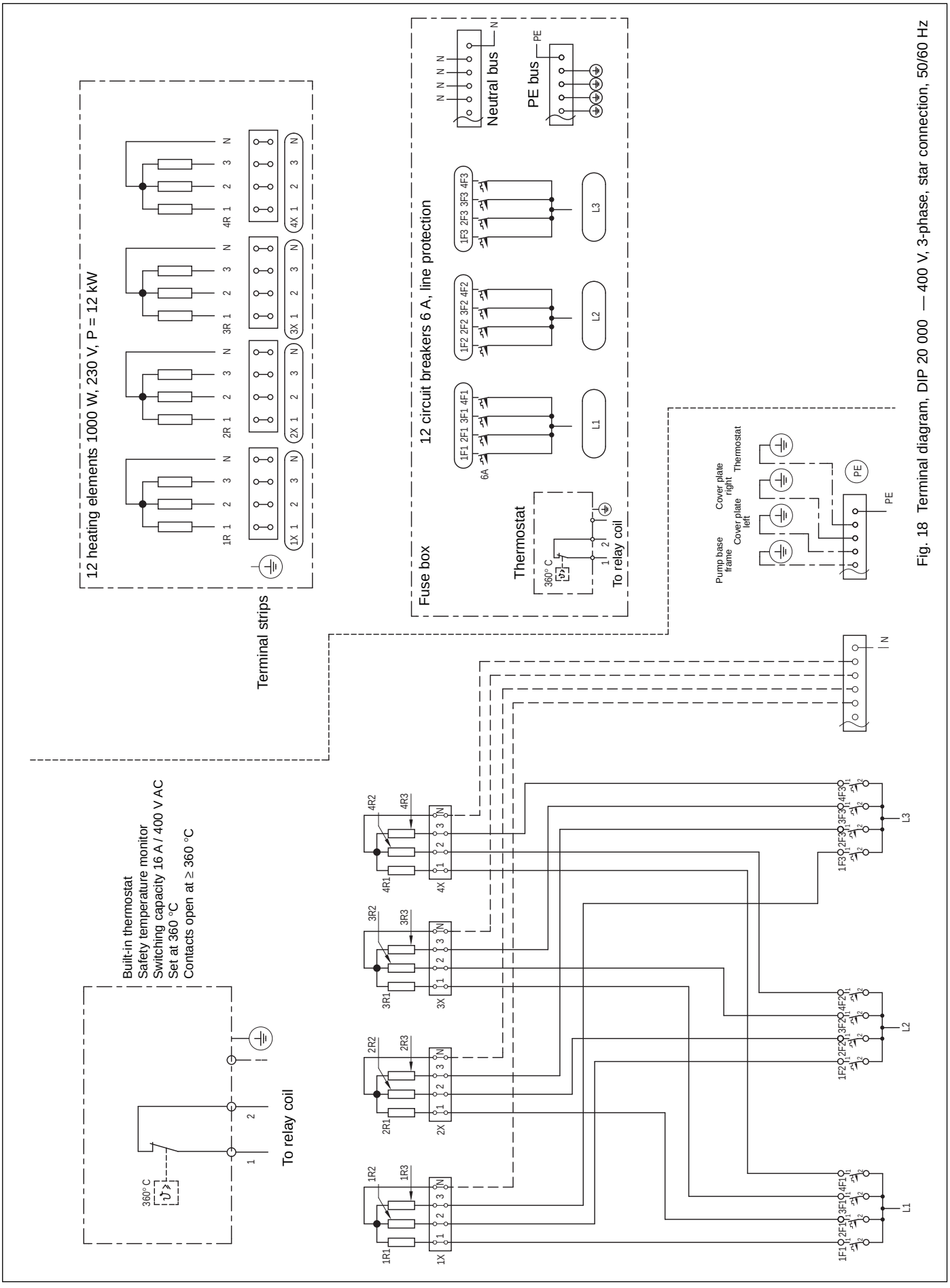


Fig. 18 Terminal diagram, DIP 20 000 — 400 V, 3-phase, star connection, 50/60 Hz

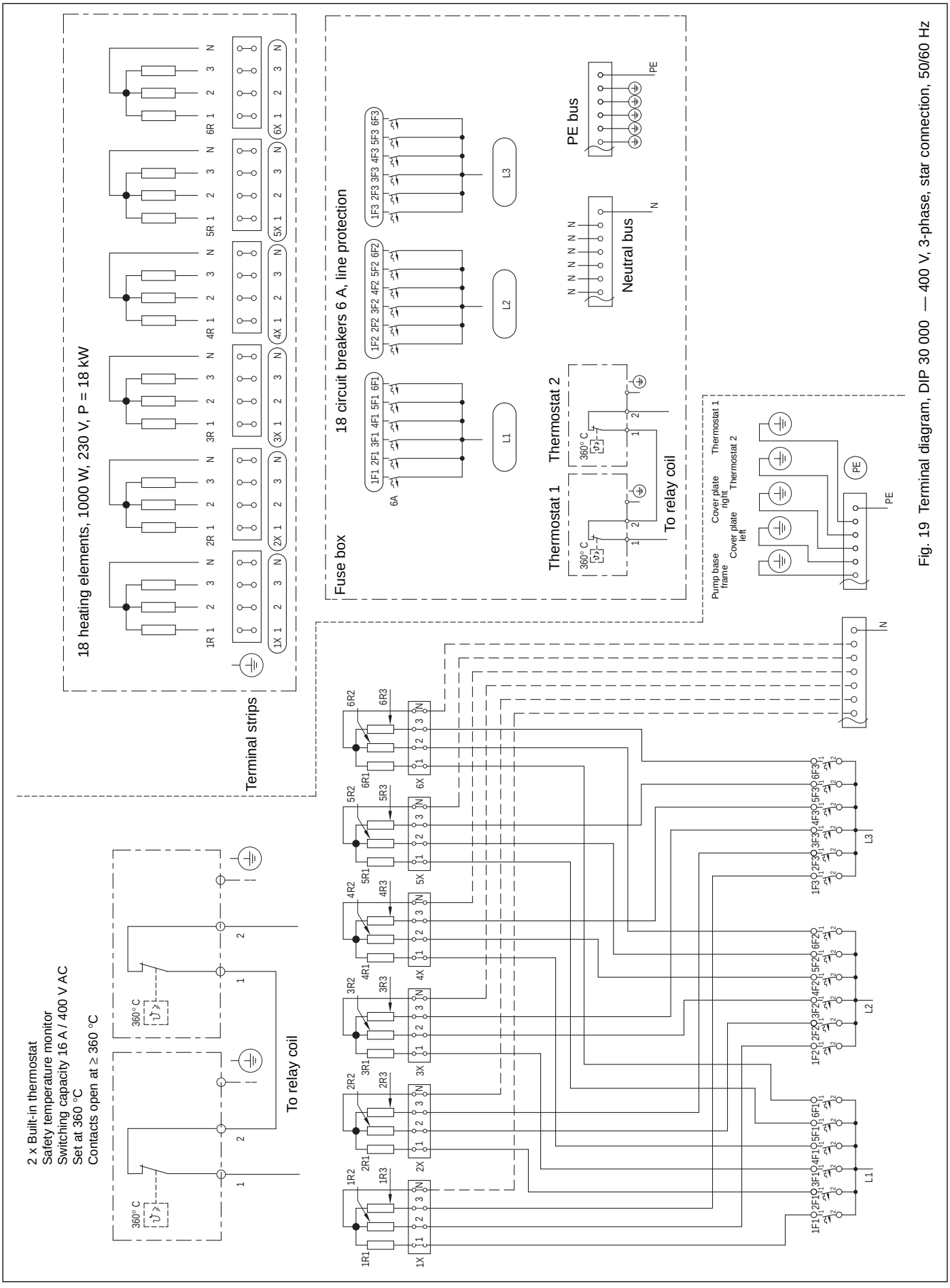


Fig. 19 Terminal diagram, DIP 30 000 — 400 V, 3-phase, star connection, 50/60 Hz

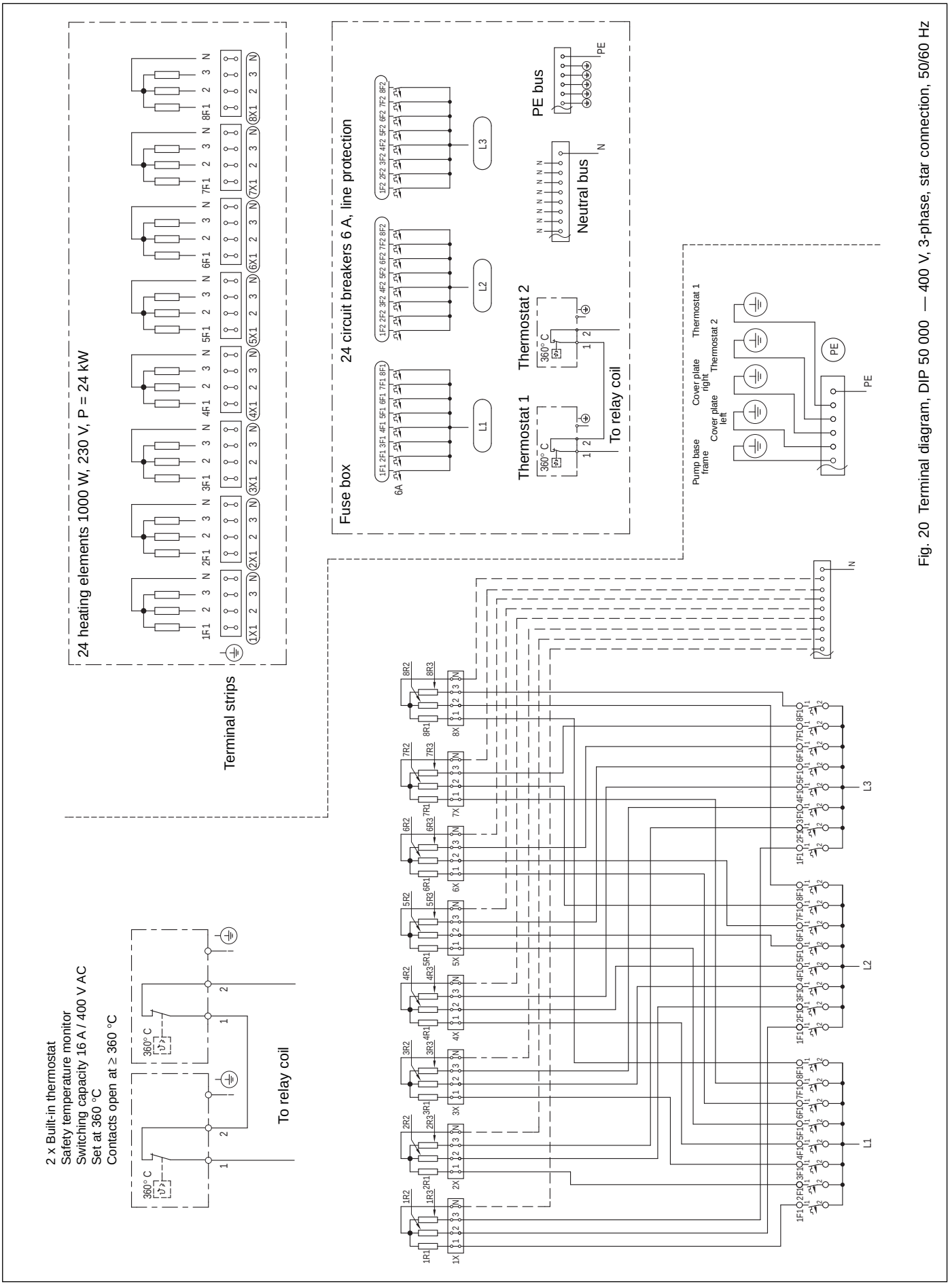


Fig. 20 Terminal diagram, DIP 50 000 — 400 V, 3-phase, star connection, 50/60 Hz

LEYBOLD

VDMA

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 Vacuum Equipment and Components

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

2. Reason for Return

_____
_____
_____
_____
_____
_____

3. Condition of the Vacuum Equipment and Components

- Has the equipment been used?
  yes ❒ no ❒
- What type of pump oil/liquid was used? _____
- Is the equipment free from potentially harmful substances?
  yes ❒ (go to Section 5)
  no ❒ (go to Section 4)

4. Process related Contamination of Vacuum Equipment and Components:

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

*) Vacuum equipment and components which have been contaminated by biological explosive or radioactive substances, will not accepted without written evidence of decontamination!

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

Trade name Product name Manufacturer	Chemical name (or Symbol)	Dangerous material class	Measures if spillage	First aid in case of human contact
1.				
2.				
3.				
4.				
5.				

5. Legally Binding Declaration

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

Name of organisation or company: _____

Address: _____ Post code: _____

Tel.: _____

Fax: _____ Telex: _____

Name: _____

Job title: _____

Date: _____ Company stamp:

Legally binding signature: _____

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

 Order No.: 2121

GA 04.106/6.02 - 03/2003

EC Manufacturer's Declaration

In the spirit of Appendix IIb to the 89/392/EEC Machinery Directive

We, the Leybold Vakuum GmbH, declare herewith that the commissioning of the incomplete machine designated below is prohibited until such time as it has been determined that the system in which this incomplete machine is to be installed complies with the EC Machinery Directive.

Product designation:

Oil diffusion pumps

Models:

DIP 3 000

DIP 8 000

DIP 12 000

DIP 20 000

DIP 30 000

DIP 50 000

Catalog numbers:

222 10 /20 /25 /30 /35 /40

The products comply with the following directives:

- EC Low-Voltage Directive (73/23/EEC)
- EC Directive on Electromagnetic Compatibility (89/336/EEC)

Applicable, harmonized standards:

- EN 292
- EN 1012, Part 2
- EN 50081-2
- EN 50082-1
- EN 60204
- EN 61010

Applied national standards and technical specifications:

- DIN 28400
- DIN 28403
- DIN 2501
- ISO 1609

Cologne, 5 September 1996

Beeck, Diffusion Pump Division Manager

Cologne, 5 September 1996

Kersken, Diffusion Pump Development Section

LV.GB.0101.02.09.96

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LV_05546_2003 PG 03.2003

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