

Operating manual: Three-phase squirrel cage motors

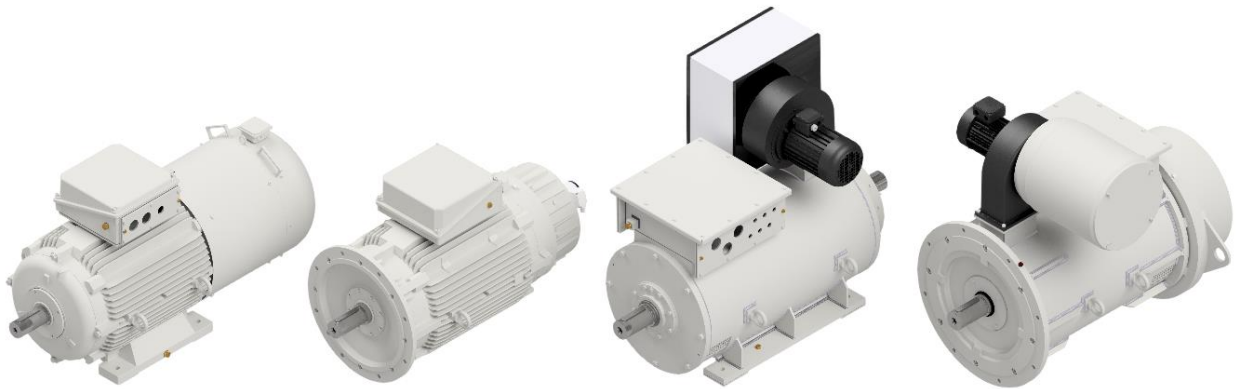




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1 General information

1.1 Using the documentation

This documentation is part of our products, it is used to explain our products, and is meant for those personnel who assemble, install, commission and service our products.

Before using our products, the documentation should be fully read by those responsible for the system and operation, as well as those who independently work with our product.

In case of a motor with head exchanger (air-air-cooling or air-water-cooling) the documentation, including but not limited to all kinds of manuals and safety instructions, shall be taken into consideration.

These can be supplied by the Wölfer Motoren GmbH if necessary.

If you have any general questions or need further information, please do not hesitate to contact Wölfer Motoren GmbH.

1.2 Meaning of the signal words

The following list explains the difference and significance of signal words.







Table 1: Explanation of the signal words

Signal word	Explanation	Potential impact in case of non-observance
▲ DANGER	Imminent danger	Serious injuries including death
▲ WARNING	Likely threatening situation	Serious injuries including death
▲ CAUTION	Likely threatening situation	Slight injury
ATTENTION	Potential damage to property	Damage to the drive system or its surroundings
NOTE	Attached note: Relieves the load on the drive system	

1.3 Structure of the section-related warnings

The section-related warnings are not meant only for a separate operation, but a process sequence within a topic. The danger symbols used indicate a general or specific danger.

Table 2: Explanation of the danger symbols according to DIN EN ISO 7010

Graphic representation	Registration No.:	Indication
	W001	General danger zone
	W012	Warning against dangerous electrical voltage
	W015	Warning against suspended load
	W017	Warning against hot surface
	W019	Warning against the risk of crushing
	W018	Warning against automatic start-up

1.4 Structure of the integrated warnings

The integrated warnings are included directly in the usage instruction, even before the risky operating step.

The formal structure of an integrated warning is shown below:

▲ SIGNAL WORD! Type and source of danger.

Potential consequences of non-observance and measures to avert the danger.

1.5 Exclusion of liability

To ensure safe operation, optimum performance and the specified characteristics of our products, we request you to carefully follow the following information and instructions given in this documentation.

Wölfer Motoren GmbH shall not assume any liability for personal injuries, damage or losses to property caused by non-observance of this operating manual.

1.6 Type label

The label for the motors mentioned in this operating manual is based on the following examples.

**1.6.1 Motor type: MODRKF 280X-6/H(T)**

M	Marine version
O	internally cooled motor
D	Three-phase current
R	Operation with a frequency inverter
K	Intermittent operation
F	Forced-cooled version
280	Size according to IEC
X	Overall length
6	Number of poles
H	Brake label (example)
(T)	prepared for mounting an encoder

1.6.2 Motor type: DRKO 225M-4bT

D	Three-phase current
R	Operation with a frequency inverter
K	Intermittent operation
O	Without a fan
225	Size according to IEC
M	Overall length
4	Number of poles
b	Internal label
T	with encoder mounted

It should be noted that the letter "O" at the beginning of a letter combination indicates an internally-cooled motor. The letter "O" at the end of a letter combination indicates a motor without a fan.



1.6.3 Motor type: MODRKL 450L-6bbT

M	Marine version
O	internally cooled motor
D	Three-phase current
R	Operation with a frequency inverter
K	Intermittent operation
L	Heat exchanger (air-air)
450	Size according to IEC
L	Overall length
6	Number of poles
bb	Internal label
T	with encoder mounted

1.6.4 Motor type: MODRW400L-6bbbT

M	Marine version
O	internally cooled motor
D	Three-phase current
R	Operation with a frequency inverter
W	Heat exchanger (water-air)
400	Size according to IEC
L	Overall length
6	Number of poles
bbb	Internal label
T	with encoder mounted



2 Safety instructions

To avoid physical injuries and damage to property, we request those responsible for the system and operation, as well as those who work independently with our products, to note and follow the safety instructions given below.

If you have any general questions or need further information, please do not hesitate to contact Wölfer Motoren GmbH.

2.1 Introduction

The following safety instructions mainly refer to the three-phase motors manufactured by Wölfer Motoren GmbH. We request you to also follow the safety instructions subsequently added to this documentation.

2.2 General

⚠ ATTENTION!

During operation, and depending on the type of protection, motors may have current-carrying, open (if the plugs or terminal boxes are open), moving or rotating parts, as well as hot surfaces.

The following points should be considered during transport, storage, installation, assembly, making connections, commissioning, maintenance and repair:

- Compliance with this documentation
- Compliance with the warning and safety signs on the motor
- Compliance with the project documentation
- Compliance with the commissioning instructions
- Compliance with the circuit diagrams
- Compliance with system-specific regulations and requirements
- Compliance with the safety and accident prevention regulations

In case the drives are faulty, we request you to inform us or to file a complaint with the concerned transport company. Never install damaged drives under any circumstances!



2.3 Target group

Mechanical as well as electrical work should be carried out exclusively by trained technicians, i.e. those who are familiar with the setup, the mechanical and electrical installation, commissioning, rectification of any faults and maintenance of our products.

We expect them to have the following qualifications:

- Successful training in the mechanical field (for mechanical work)
or
- Successful training in the electrical field (for electrical work)
- Knowledge and understanding of this documentation

Transport, storage, operation, and disposal work should be carried out exclusively by trained personnel.

Depending on their work, all technicians should wear protective clothing.

2.4 Use of our products

The three-phase motors manufactured by Wölfer Motoren GmbH are intended for commercial installations.

Before installing and commissioning our products in the intended machine, it should be ascertained whether the machine complies with the local laws and regulations. The machinery directive 2006/42/EG in particular and the EMC directive 2004/108/EG have to be followed in the respective area of application. Our low-voltage machines are compliant with the low voltage directive 2014/35/EU and are components for installation in machines as defined in the machinery directive 2006/42/EG. Commissioning is not allowed until the conformity of the end product has been established with this directive.

The use in explosion-protected zones is strictly prohibited if our products are not intended for this purpose.

Motors with type of protection \leq IP 23, as well as motors which are not specifically designed for outdoor installation, should not be used outdoors.

Air-cooled motors are designed for ambient temperatures from -15 °C to +40 °C (0°C to 40°C for machines with water as primary or secondary coolant), as well as installation heights of $\leq 1,000$ m above sea level. Special ambient conditions are indicated on the rating plate. All the details and conditions on the rating plates attached to our products should be noted and also followed.

In case of marine versions certified by ship classification societies the environmental conditions set by the respective ship classification guidelines are to be respected.

These requirements are also noted on the rating plate.

2.5 Transport and storage

Upon receiving our delivery, we request you to first check externally for transport damage. If you notice any visible damage to the packaging, we request you to inform the concerned transport company and file a complaint. If you notice the damage only after incoming inspection, we request you not to commission our products for the time being.



⚠ DANGER!

Our motors are packed on pallets, in boxes or wooden crates. Lifting the packed motors using inadequate lifting equipment or non-qualified personnel may lead to following incidents involving crushing.

- Packaged motor may fall down if the lifting equipment is not handled properly.



Comply with the following instructions to avoid the risk of injury:

- Use only trained personnel for fork-lift trucks.
- Cordon off the lifting and moving zone for unauthorised personnel.



⚠ DANGER!

Lifting our motors from the packaging and transport equipment as well as moving and placing them down at the intended location using cranes may lead to the following incidents involving crushing and getting hit

- The additional load on the eyebolts or improper seating in the holder, may lead to the bolts breaking or breaking off from the housing.





- Operation of the crane by unqualified personnel may lead to uncoordinated crane movements and thus result in the load falling down.
- Placing the motor down or manoeuvring the motor when flanging it the intended location and instructions given by unqualified assembly personnel may lead to crushing of limbs.

Comply with the following instructions to avoid the risk of injury:

- Since the eyebolts are designed only for the weight of the motor, we request you not to add any additional loads. You should also check whether the eyebolts are tightened properly.
- The built-in ring screws are according to DIN 580. The loads and specifications mentioned in DIN 580 should be followed in general. All the ring screws provided on the motor have to be attached for transport. The pulling direction of the lifting equipment should not exceed an angle of 45° according to DIN 580. A cross beam should be used as shown in figure 1 to avoid damage to the terminal box or parts of the external fan.
- Use only trained personnel for operating the crane and assembling the motor.
- Cordon off the lifting and moving zone for unauthorised personnel.

If low-voltage machines are stored, then the following points should be noted:

- Care should be taken to ensure a dry, dust-free and low-vibration environment ($V_{\text{eff}} \leq 0.2 \text{ mm/s}$) to avoid damage to the bearings during rest.
- Machined surfaces (flange contact surface and open end of the shaft) should be treated with anti-corrosion agents.
- The motors should be stored at the intended usage or delivery location on a wooden base
- Severe temperature changes should be avoided due to the formation of condensation
- Stacking of motors is not permitted
- The ambient storage temperatures of -15 °C to +40 °C (according to DIN EN 60034-1) should be adhered to. The manufacturer has to be contacted in case of deviation from these ambient conditions.
- To avoid continuous rings, the rotor should be turned by a part of a revolution every two weeks or at regular intervals.

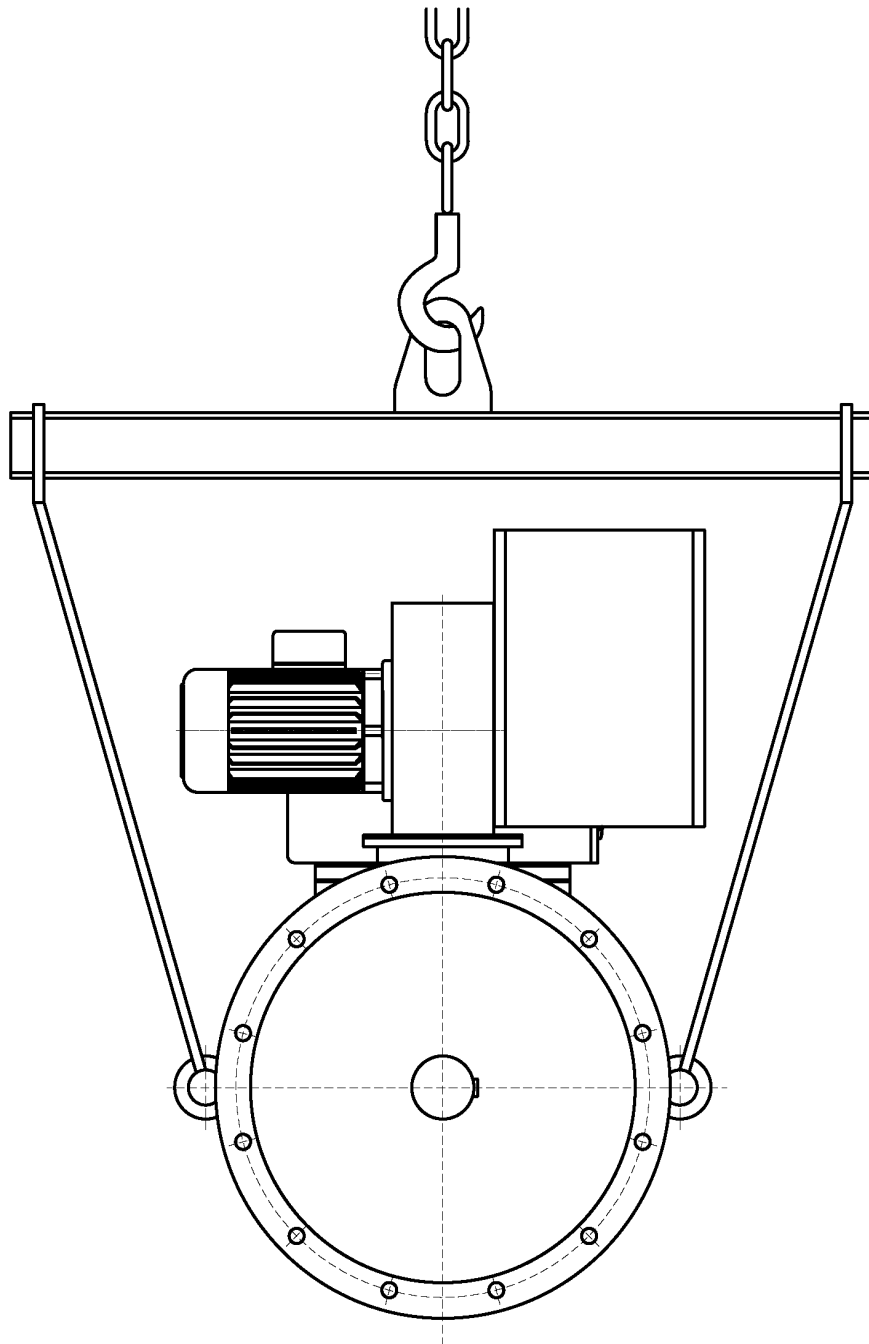


Figure 1: Use of cross beam for transporting the Wölfer motors.

2.6 Setup



▲ DANGER!

Lifting our motors from the packaging and transport equipment as well as moving and placing them down at the intended location using cranes may lead to the following incidents



- Packaged motor may fall down if the lifting equipment is not handled properly.



Comply with the following instructions to avoid the risk of injury:

- Use only trained personnel for fork-lift trucks.
- Cordon off the lifting and moving zone for unauthorised personnel.

We request you to ensure that the base or flange is mounted properly, that the position is balanced and that the alignment is precise in case of direct coupling. Likewise, setup-related resonances with the rotational frequency and mains frequency should be avoided. Motors with attached brake should be ventilated. The armature should be rotated by hand. Please inform us if you hear any unusual grinding noises. The direction of rotation should be checked in the decoupled condition.

The pulleys and couplings should be assembled or removed only using the fixtures provided and covered with appropriate contact protection. Improper belt tensions should be avoided. The permissible radial and axial shaft loads should not be exceeded by the use of pulleys, gears, etc. These loads values can be obtained from Wölfer Motoren GmbH.

Models with the shaft end facing upwards should be provided with a cover to prevent objects from falling into the fan. In the process, it should be noted that ventilation is not restricted and that the exhaust air is not sucked in directly by adjacent devices.

Please read the associated instructions in the chapter "Mechanical installation".

2.7 Electrical connection

The electrical connection should be made only when the low voltage machine is stationary, is unlocked and secured against being switched on again, and by staff trained for this purpose. The same applies to the auxiliary power circuits, such as the anti-condensation heater and the external fan.

⚠ WARNING!

Please check to ensure that power is switched off!

Exceeding the tolerances defined in the DIN EN 60034-1 (VDE 0530, part 1)

- Voltage: $\pm 5\%$
- Frequency: $\pm 2\%$
- Waveform and symmetry

results in increased heating and affects the electromagnetic compatibility. The DIN EN 50110-1 and, where appropriate, existing national regulations, such as DIN VDE 0105-1 for Germany have to be followed. The details on the circuit diagram at the terminal box, as well as the rating plate details are also to be respected.

When connecting the motor, a safe electrical connection has to be always ensured. Wire ends should not protrude out! We request you to use the appropriate cable end fittings and ensure a reliable earthing connection. The minimum values for the distance to non-isolated and current-carrying parts, in accordance with IEC 60664 and national regulations, should be complied with after making the connections!

The following values indicate the distances for low voltage according to DIN VDE 0110.

Table 3: Distances for low voltage in accordance with DIN VDE 0110

Secondary voltage U_N	Distance
$\leq 550\text{ V}$	8 mm
$\leq 725\text{ V}$	10 mm
$\leq 1000\text{ V}$	14 mm

Please ensure that there are no foreign objects in the terminal box and that moisture does not form in the box. Therefore, we request you to ensure that the terminal box itself and cable entry openings which are no longer needed, are kept dust- and waterproof. We also request you to secure or check the key without the drive elements and the brake for a low voltage machine before the trial run or direct commissioning.

Please note the comments in the chapter "Electrical installation"!

2.8 Commissioning / operating the motor

If you notice any deviations of the motor vis-a-vis the normal operation, for example unusual noises or vibrations, and increased temperatures, we request you to first determine the cause. If you are unable to rectify the problem by yourself, please feel free to contact Wölfer Motoren GmbH. The safety device should never be deactivated under any circumstances, even during the trial run. If you are not sure, please switch off the motor for the time being.

If the motor is operated in contaminated surroundings, such as dust-containing air, we request you to ensure that the airways are kept open and they are cleaned periodically if necessary.

2.9 Surface temperature during operation



▲ CAUTION!

The surfaces of the drive may become very hot during operation. Please protect the hot surfaces using covers and/or warning signs to avoid risk of burns. We also request you to note that cooling the motor down is very important before starting any kind of work!

3 Motor design

3.1 Types

The types for rotary electric machines are designated according to DIN EN 60034-7 code I and code II. The most commonly used types for standard motors are shown in table 4 and 5.

Table 4: Types with bearing plates, horizontal mounting

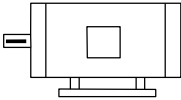
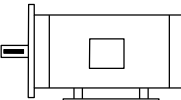
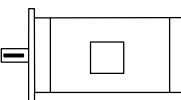
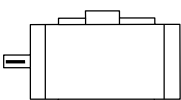
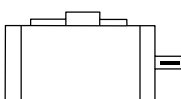
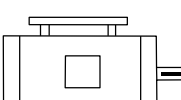
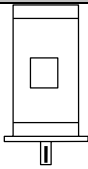
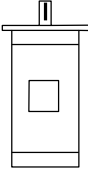
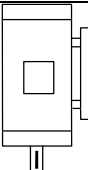
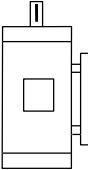
	Code I	Code II	Description
	IM B3	IM 1001	2 bearing plates with stand, open shaft end Installation on substructure
	IM B35	IM 2001	2 bearing plates with stand, open shaft end, Flange shape A on AS Installation on flange base
	IM B5	IM 3001	2 bearing plates, without stand open shaft end Flange shape A on AS, flange mounting
	IM B6	IM 1051	2 bearing plates, with stand open shaft end, roof Mounting Stand seen from AS left
	IM B7	IM 1061	2 bearing plates, with stand open shaft end, roof Mounting Stand seen from AS right
	IM B8	IM 1071	2 bearing plates, with stand open shaft end, roof mounting

Table 5: Types with bearing plates, vertical mounting

	Code I	Code II	Description
	IM V1	IM 3011	2 bearing plates without stand, open shaft end bottom Flange shape A on AS, flange mounting bottom
	IM V3	IM 3031	2 bearing plates without stand, open shaft end top Flange shape A on AS, flange mounting top
	IM V5	IM 1011	2 bearing plates with stand, open shaft end bottom Wall mounting
	IM V6	IM 1031	2 bearing plates with stand, open shaft end top Wall mounting

3.2 Dimensional designations

The symbols given in table 6 indicate the dimensions of the motor in the Wölfer dimension sheets.

Table 6: Comparison of the dimensional designations

Previously /DIN	DIN/EN 50347: 2003	Designation
b	A	Distance between the centre lines of the mounting holes (front view)
n	AA	Width of stand end (front view)
f	AB	Overall dimension across the stand (front view)
g	AC	Diameter of the machine
a	B	Distance between the centre lines of the mounting holes (side view)
e	BB	Overall dimension across the stand
w ₁	C	Distance from shaft collar of the drive side to the centre line of the mounting holes in the adjacent stand
d	D	Diameter of the shaft end on the drive side
l	E	Length of shaft end from the collar on the drive side
b, u	F	Width of the keyway or the key of the drive-side shaft end
t	GE	Depth of the keyway of the drive-side shaft end relative to the diameter
h	H	Distance between the centre line of the shaft and the bottom of the stand (basic dimension)
c	HA	Thickness of the stand
p	HD	Distance between the top of the lifting eye, the terminal box or other maximum projecting part on the top of the machine and the bottom of the stand.
s	K	Diameter of the hole or width of the slots in the stand of the machine
k	L	Total length of the machine with one shaft end

Continuation Table 6: Comparison of the dimensional designations

DIN 332	Designation
s4	Internal thread S4 for a D-fit for shaft ends according to DIN 748
Wölfer symbols	Designation
s'	Width of the slot in the stand (front view)
q	Distance between the centre of the terminal box and the shaft end of the drive side

3.3 Motor type: DRKF...T

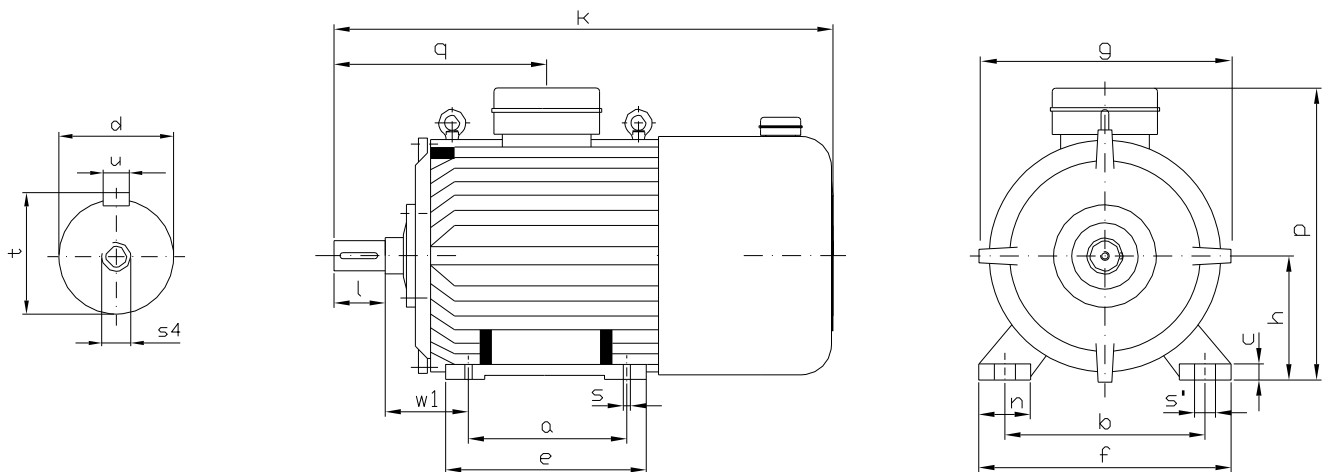


Figure 2: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 416, type of protection: IP 55, model: IM B3

3.4 Motor type: DRKO...T

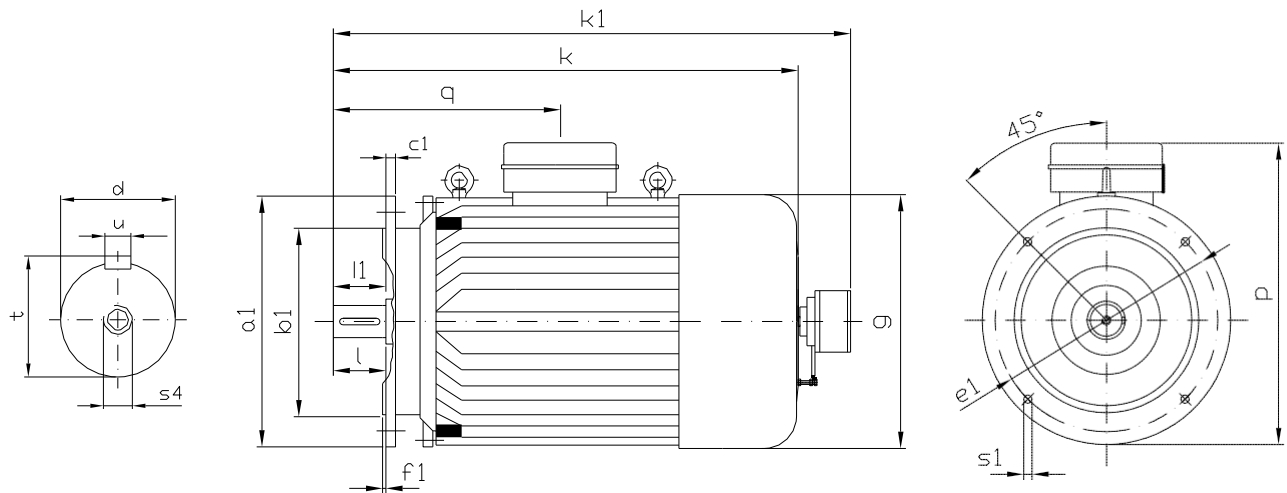


Figure 3: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 411, type of protection: IP 55, model: IM B5

3.5 Motor type: DRK...HT

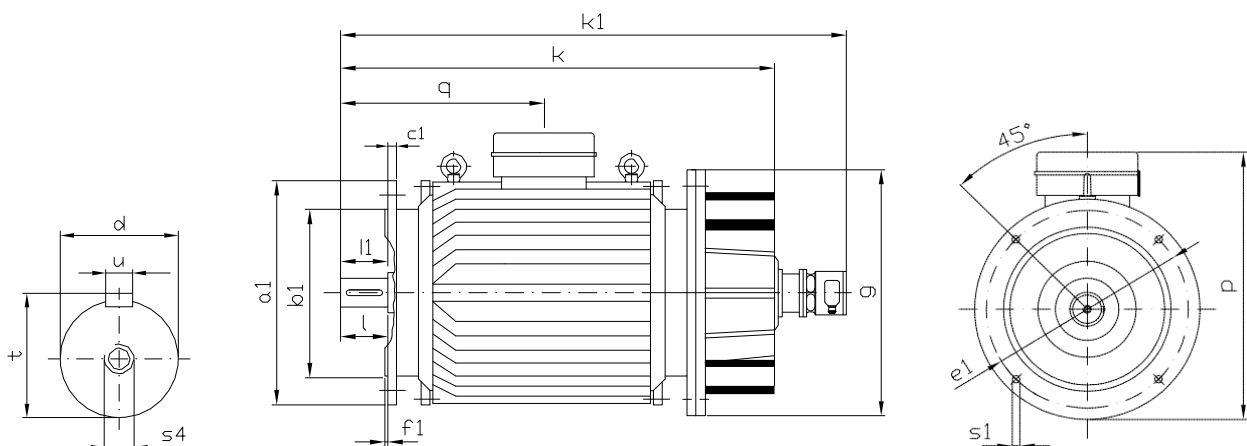


Figure 4: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 410, type of protection: IP 56, model: IM B5

3.6 Motor type: ODRKF...T

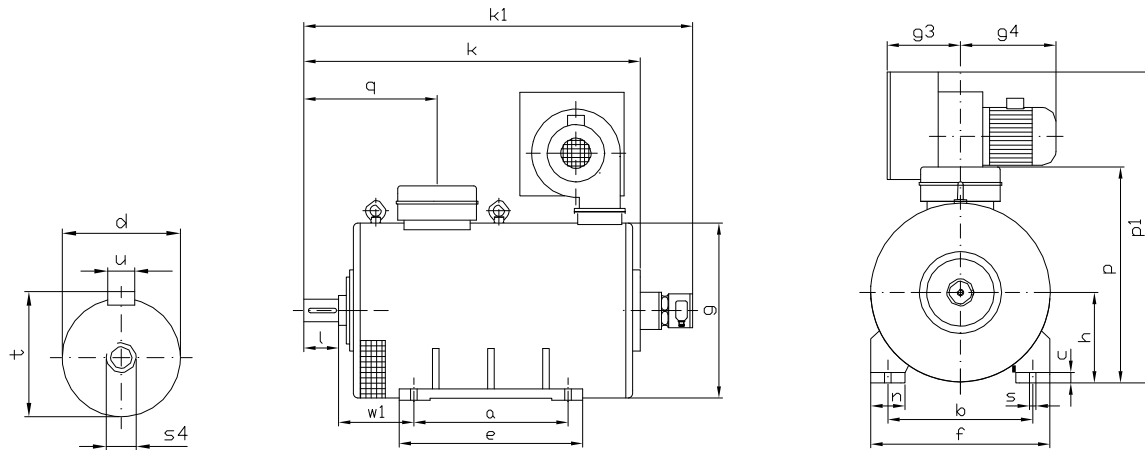


Figure 5: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 06, type of protection: IP 23, model: IM B3

3.7 Motor type: ODRKF...T

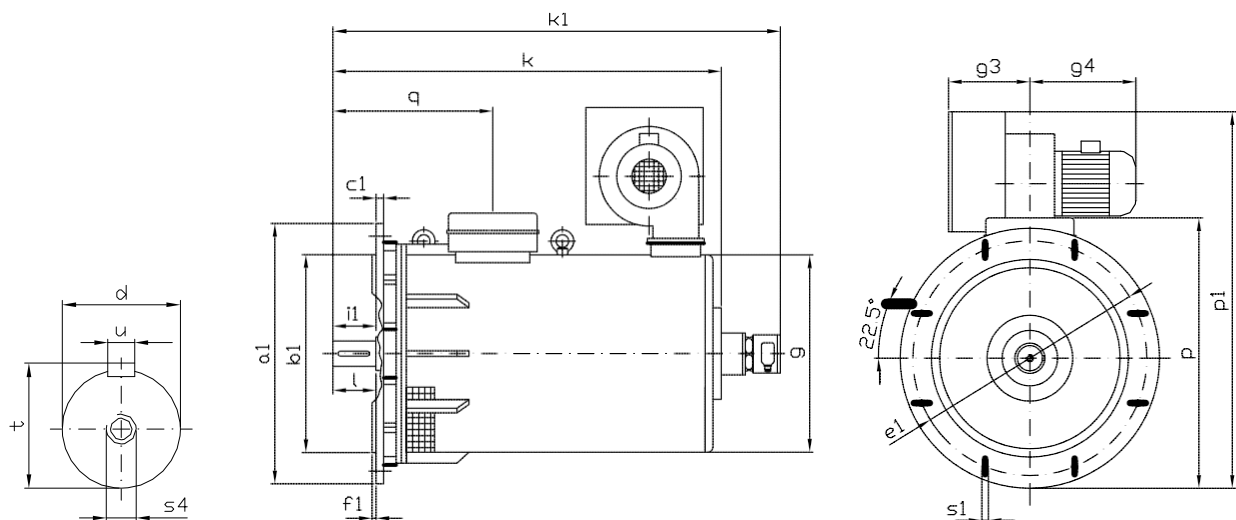


Figure 6: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 06, type of protection: IP 23, model: IM B5

3.8 Motor type: ODRK...T

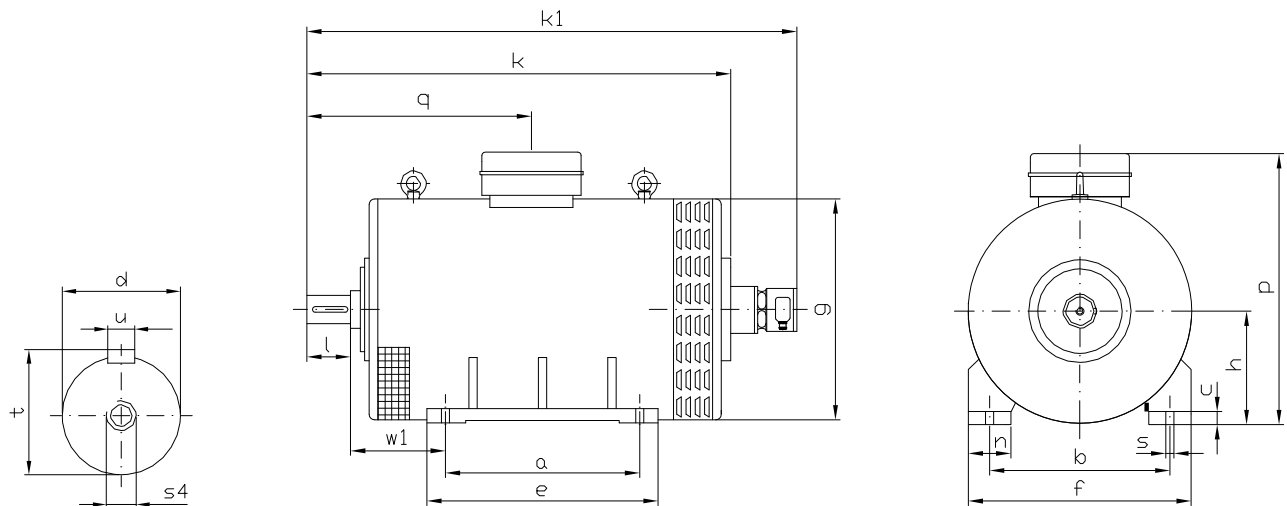


Figure 7: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 01, type of protection: IP 23, model: IM B3

3.9 Motor type: ODRK...T

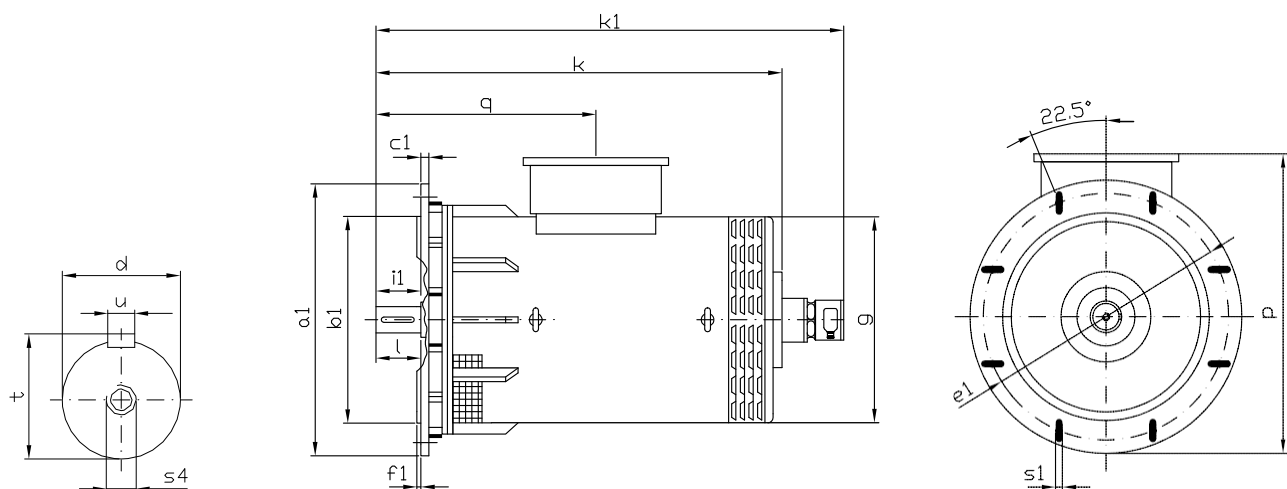


Figure 8: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 01, type of protection: IP 23, model: IM B5

3.10 Motor type: ODRKL...T

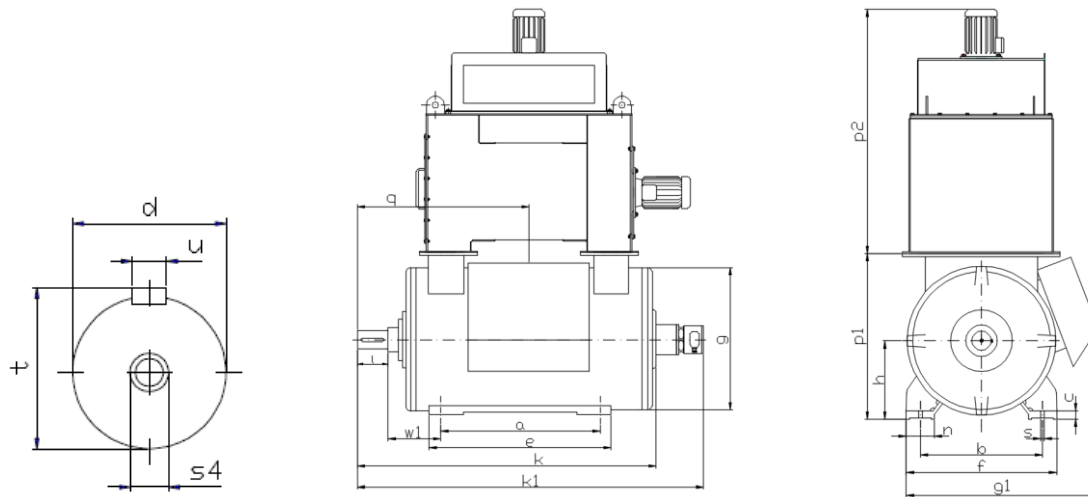


Figure 9: Three-phase squirrel-cage motor with encoder: Cooling IC 616, type of protection: IP 56, model: IM B3

3.11 Motor type: ODRW...T

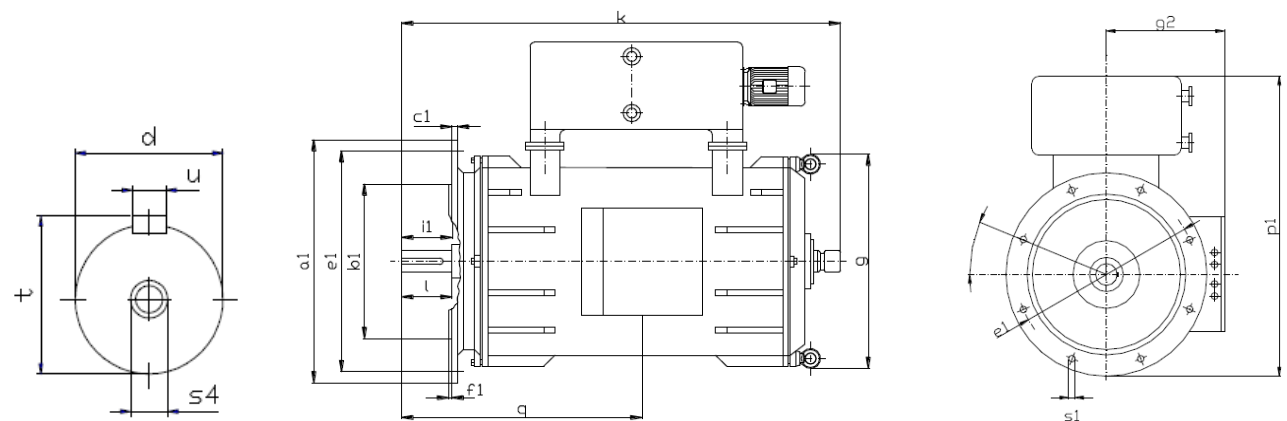


Figure 10: Three-phase squirrel-cage motor with encoder and mounting flange: Cooling IC 86W, type of protection: IP 55, model: IM V1

3.12 Rating plate

The individual items should be explained based on the following rating plate.

[18]	IE2		W ö l f e r		CE		
[1]	Type	MODRKF 280X-6/HT					[7]
[2]	No.	XXXXXX	3xAC Motor		year	2016	[8]
[3]	Volt	0-660/660Y		Hz	0-50/120		[9]
[4]	kW	0-300/300	S3-100%		Amp	330/300	[10]
[5]	rpm	0-987/2366		IP 23	IM B5		[11]
[6]	cos φ	0,84/0,91	Insul.cl. F		amb.temp.	-20- +55 °C	[12]
	η:	Fans:	Brake:				[13]
	Encoder:	Heating:		Motor protection:			
		EN 60034		kg	1,760.00		
		[14]	[15]	[16]	[17]		

- [1] Type designation
- [2] Motor number
- [3] Rated voltage (working range)
- [4] Rated power (working range)
- [5] Rated speed (working range)
- [6] Power factor
- [7] Motor type (three-phase AC motor)
- [8] Year of manufacture
- [9] Rated frequency (working range)
- [10] Rated current (depends on the operating point)
- [11] Type
- [12] Ambient temperature (working range)
- [13] Efficiency data, customer-specific data about the fan, brake encoder, anti-condensation heater and sensors as well as customer article numbers
- [14] Operating mode
- [15] Thermal class
- [16] Degree of protection according to IEC 60034-5
- [17] Weight
- [18] Data on the energy efficiency class according to DIN EN 60034-30-1:2014

4 Mechanical installation

▲ NOTE!

The safety instructions given in Chapter 2 of this operating manual have to be followed during the mechanical installation.

4.1 Before the installation



▲ ATTENTION!

The motor has to be appropriately installed as shown on the rating plate.

The drive should be mounted only if the following conditions are met:

- The supply voltage of the mains network or the output voltage of the frequency inverter and the supply frequency have to match the specifications given on the rating plate.
- The motor is not damaged (for example: damages caused by transport or storage)
- All the existing transport locks have been removed
- Ambient temperature has to be met according to the specifications on the rating plate
- Surroundings without oils, acids, gases, vapours, radiations, etc.
- The installation height should not exceed a maximum of 1000 m above sea level
- Refer to the enclosed operating manual of the encoder
- Refer to the enclosed operating manual of the brake

4.2 Motors stored for long durations

The following points should be noted about the grease life and insulation resistance, if the storage period exceeds 6 months:

- It is advisable to replace the lubricants as they age and the base oil may leak out.
- Check the seals for damage or cracks before commissioning
- Checking the insulation resistance shows whether the motor has absorbed moisture due to storage for long duration. The insulation resistance of the winding, phase to phase and phase to ground should be measured before commissioning.

⚠ ATTENTION!

Damp windings may cause leakage currents, arcing and breakdowns. The insulation resistance of the stator winding should be at least 1.0 MΩ in motors for 220-1000 V, measured at a winding temperature of 20 °C. If the values are lower, then the winding has to be dried, preferably with air not exceeding a temperature of 80 °C.

4.3 Installing the motor**⚠ CAUTION!**

The open keyway has sharp edges which may cause minor injuries. This can be prevented by inserting a key or covering it with a protective sleeve.

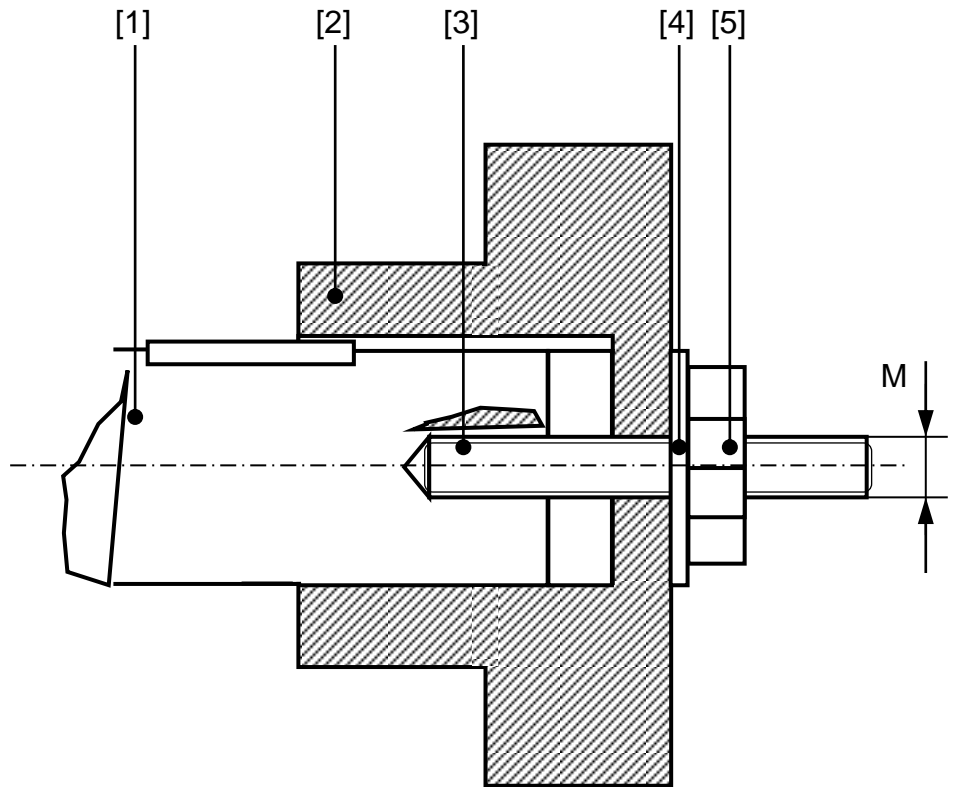
**⚠ ATTENTION!**

The mounted components or the drive itself may be damaged if the assembly is not proper.

To avoid any damage to property, please follow the following instructions:

- The substructure should have the following properties:
 - Level/Flat
 - Vibration dampening
 - Torsion-resistant
- The maximum permissible flatness error has to be determined for stand and flange mounting according to DIN ISO 1101.
- Before mounting the coupling, the corrosion protection, dirt etc. has to be removed from the shaft end using commercially available solvents. The corrosion protection should never be removed using emery paper or scraped off. The solvent should not get into the bearings or seals as it may damage the material.
- Before starting the assembly, please check whether the machine shaft and the coupling, hollow shaft of the gearbox or similar connection elements are not damaged, free of burrs and foreign bodies. The machine has to be provided with a centring hole according to DIN 332 and has to be lightly lubricated using a suitable grease.

- A basic approach for mounting a coupling or a hollow shaft onto the motor shaft is shown below

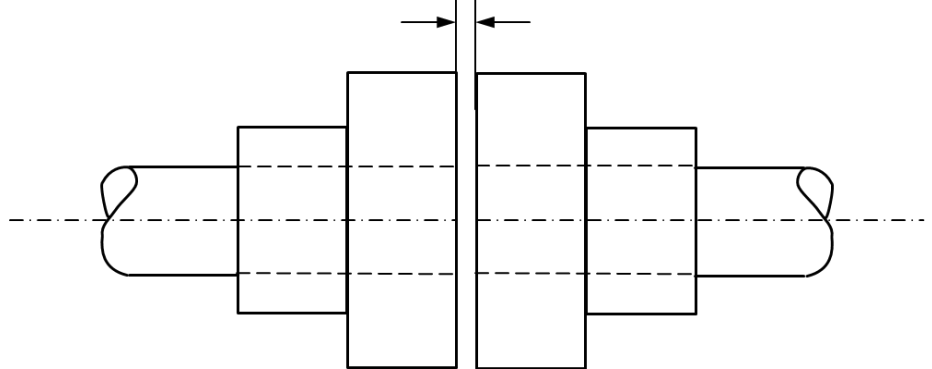


[1]	Motor shaft	[4]	Thrust washer
[2]	Coupling	[5]	Nut
[3]	Threaded rod	M	Thread size

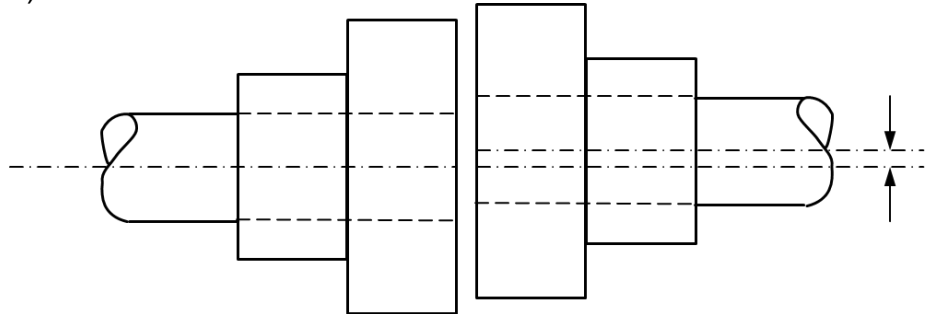
The coupling has to be mounted according to the above figure only with a threaded rod and associated thrust washer and nut.

- The motor and drive unit have to be carefully aligned so that the drive shaft is not unduly loaded. The permissible radial and axial forces have to be noted and may be obtained from Wölfer Motoren GmbH. Perform the following matching in accordance with the information provided by the coupling manufacturer when assembling the couplings

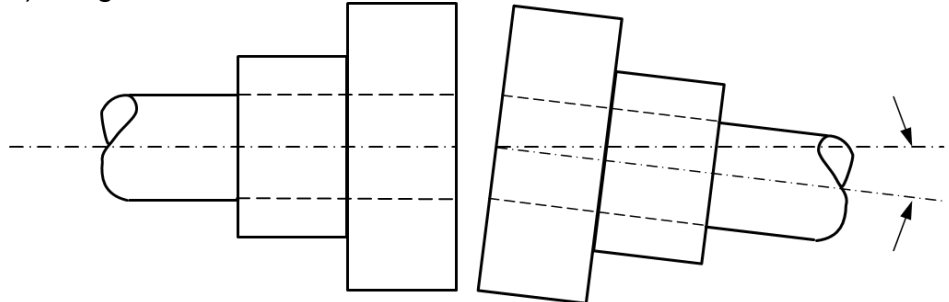
a) Maximum and minimum distance



b) Axial offset



c) Angular offset



- Pulleys or couplings should only be mounted using a mounting tool to avoid damages to the shaft end. In the event of impact and shock, there is a risk of damaging the bearing and damage to other mounted components such as encoders.
- Unobstructed cooling air supply has to be ensured for the motor. Exhaust from other equipment should not be sucked in
- Parts to be mounted on the shaft should be dynamically balanced using a half key (i. e. without keyway) since the shaft is also dynamically balanced by default using a half key. The precise balancing state of the shaft is indicated on the shaft end face or the rating plate using the following abbreviations:



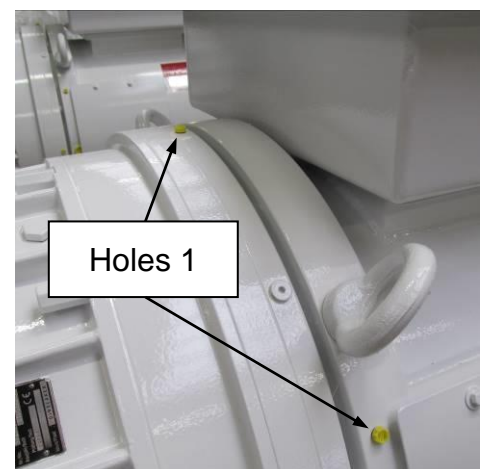
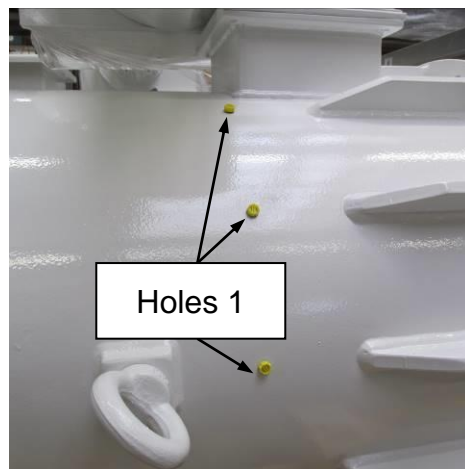
- H \triangleq half key
- F \triangleq full key
- N \triangleq without key
- X \triangleq smooth shaft
- Condensate drain holes should be at the lowest point of the motor after installation. Open the closed condensate drain holes from time to time and close them again.
- If necessary, the shaft has to be protected again against corrosion
- If it is necessary to tighten the bolted joints of the flange and stand mounting as well as the connection to customer structures with a defined torque, we recommend you to use the torques according to the VDI guideline VDI 2230 sheet 1 November 2015 in the temperature range specified by DIN EN 60034-1.

**⚠ ATTENTION!**

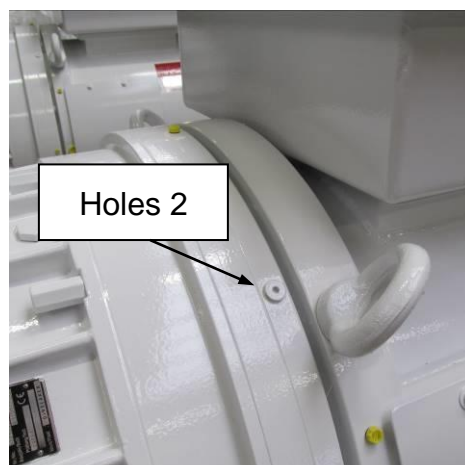
The motor housing has several holes, which have been provided for specific uses or have been made during production and have no further use.

Holes 1:

Holes provided for mounting bars, which are closed at the factory using yellow Kapsto screw plugs GPN 700 M8 and O-ring seal.

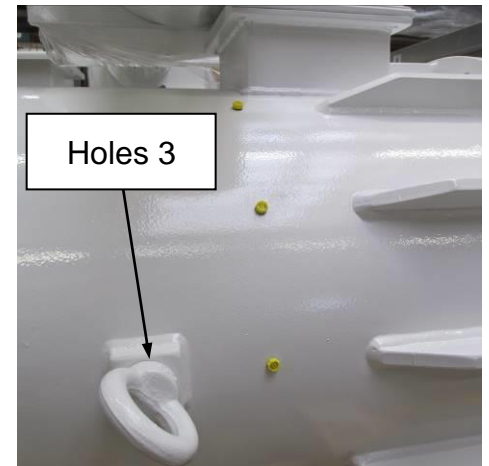
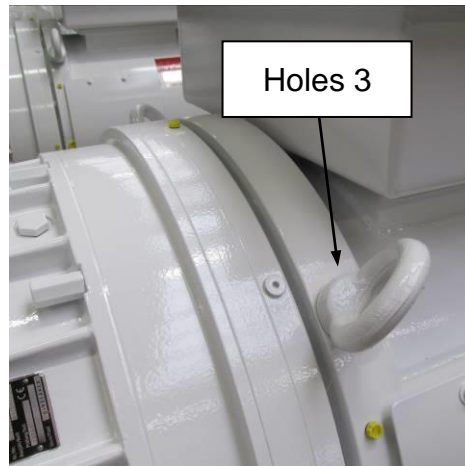
**Holes 2:**

Holes provided for vibration sensors, which are closed at the factory using galvanised countersunk Allen screws M8 x 20 mm according to DIN 7991 / ISO 10642 with a copper washer 8 x 14 x 1.5 mm according to DIN 7603 A.

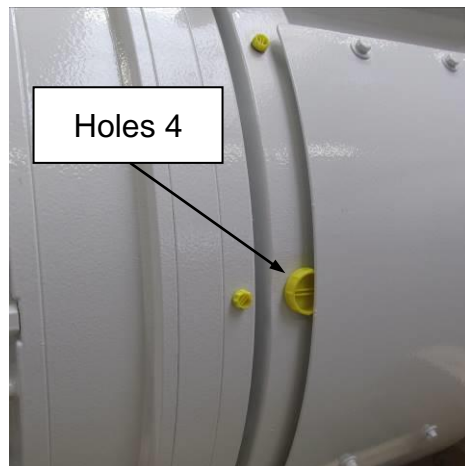


Holes 3:

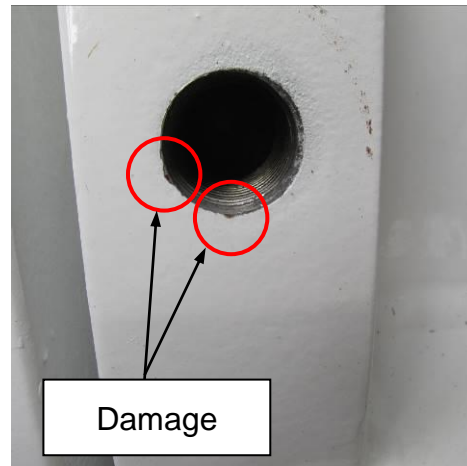
Holes provided for eyebolts, which are closed at the factory using galvanised M24 steel ring screws according to DIN 580, C15E.

**Holes 4:**

Production holes, which are closed at the factory using yellow Kapsto screw plugs GPN 700 M24 and O-ring seal.



By replacing the plugs and / or the eyebolts, the paint, including the primer coating, may be damaged. These places have to be touched up as specified in Chapter 7.6 to ensure full corrosion protection.



5 Electrical installation



▲ ATTENTION!

Risk of injury caused by electric shock. Could result in serious injuries or death.

Comply with the following instructions to avoid the risk of injury:

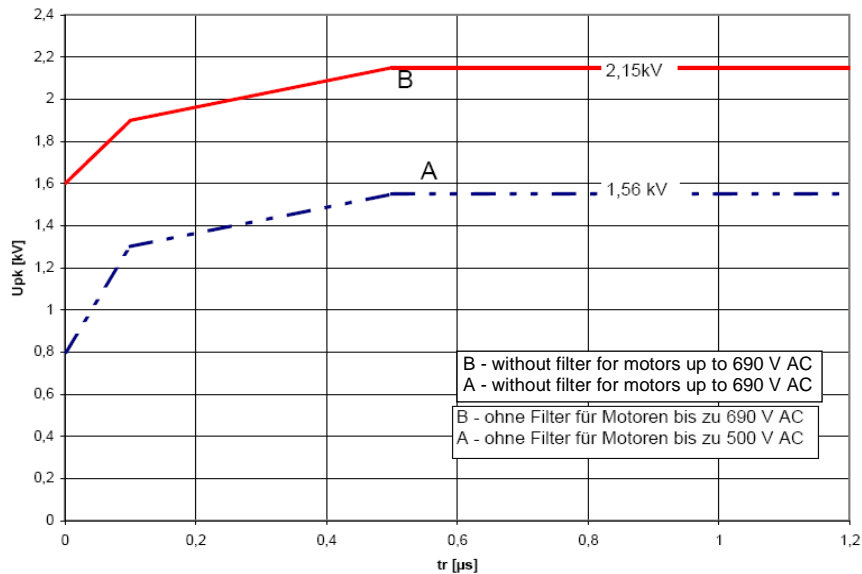
- Safety instructions as defined in chapter 2 have to be followed.
- The operating manual of the inverter has to be complied with.
- The wiring instructions of the inverter manufacturer have to be followed.
- The general installation conditions for low-voltage electrical equipment (according to IEC 60364-1:2005, DIN VDE 0100) have to be complied with when installing electrical systems.
- Connection diagrams and wiring diagrams have to be used. These are enclosed with the motor. The motor should not be connected if these documents are missing. The missing documents can be obtained from Wölfer Motoren GmbH

5.1 Wiring instructions

The safety instructions should be followed during installation.

5.2 Operation with a frequency inverter

For DR, ODR-series motors, a suitability for inverter operation is given as "general of purpose motor" according to DIN VDE 0530-25:2009 08 for supply voltages up to 690V. The limit voltage characteristic curve below can be used for a more precise explanation. The magnitude of the voltage peaks generated by the inverter can be adversely affected by the cable between the inverter and the electrical machine. In the "Inverter-cable-motor" system, the maximum value of the voltage peaks at the motor terminals should not exceed the values of the limit voltage characteristic curve shown below.



Limit value characteristic curves of the pulse voltage U_{pk} , measured between the motor terminals of two wires, depending on the rise time t_r according to DIN VDE 0530-25:2009-08

5.3 Connecting the motor using connection bars/ terminal block

⚠ ATTENTION!

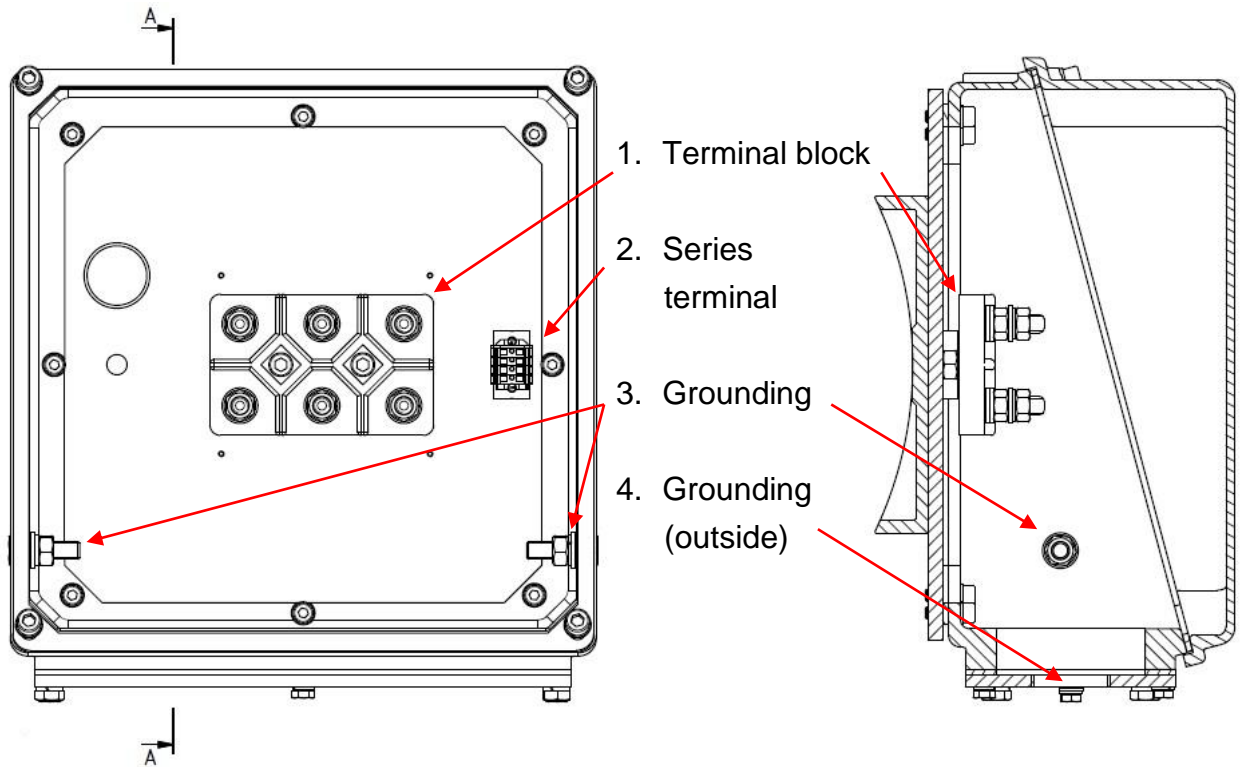
There should not be any foreign bodies, dirt and moisture in the terminal box. Unused cable entries and the box itself should be sealed such that they are dust and waterproof.

The terminal designation is specified according to the circuit diagram using stickers, punched letters or plastic labels/letters on the terminals, bolts, terminal blocks or bars. The connection designations correspond to DIN EN 60034-8.

The standard grounding dimensioning in Wölfer Products equals at least the specifications stated in DIN EN 60034-1.

In the case of machines having rated voltages greater than 50 V a.c. or 120 V d.c., but not exceeding 1000 V a.c. or 1500 V d.c., the terminal for the earthing conductor shall be situated in the vicinity of the terminals for the line conductors, being placed in the terminal box, if one is provided. Machines having rated outputs in excess of 100 kW (or kVA) shall have in addition an earthing terminal fitted on the frame.

The following image shows a typical Wölfer terminal box with terminal block. The terminal block, series terminal and grounding connection are marked.



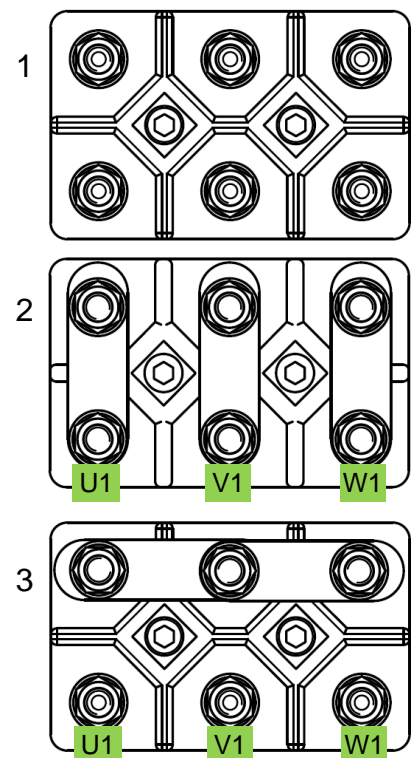
If not specified otherwise in the Motor documentation, the connections of the terminal block have to be connected with regard to the Motor's connection type using Clipboard connectors.

The drawing shows:

1. A terminal block without Clipboard connectors
2. A terminal block with Clipboard connectors for delta circuit
3. A terminal block with Clipboard connectors for star circuit

⚠ ATTENTION!

In some cases, the star point is formed inside the motor and the bridges in the terminal board connect the two winding inputs per wire (figure 2). This is marked by a Sticker inside the terminal box. Please do not use the Motor differing from the circuit diagram in those cases.



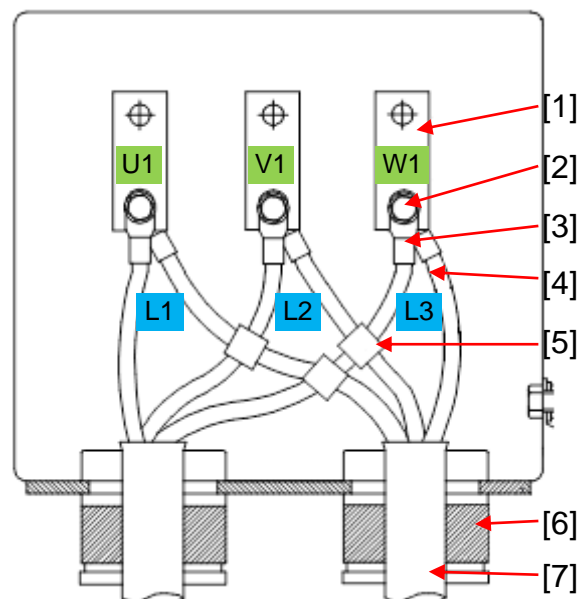
In case of larger machines with higher rated currents, the cable is often connected to bars / terminal blocks as shown in the figures below. Parallel cables are often connected to bars. The procedure is shown here as an example.

Cable cross-overs X [5] have to be protected using appropriate insulation and bandage in such a way that the cable insulation is not damaged by rubbing.

1. Connection bar / terminal block
2. Brass screw
3. Cable lug
4. Conductors routed like a fan
5. Protection of the cable cross-over
6. Cable fitting
7. Cable

U1 V1 W1 Wire connection designations on the terminal block / Connection bar

L1 L2 L3 Phase designations of the connection cable

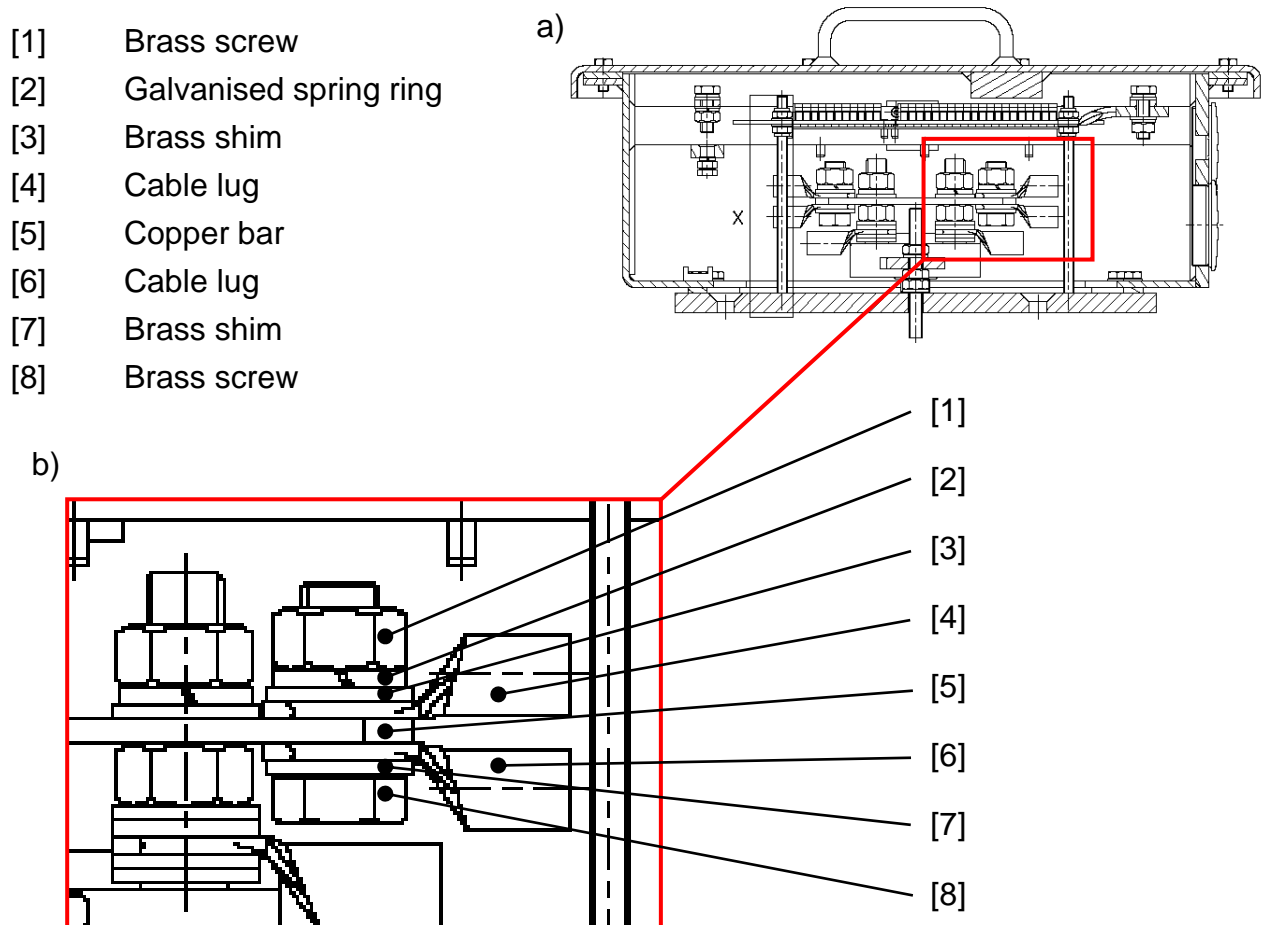


Connection bars are used for motors with higher currents or when connecting several cables per phase. Ensure that the contact surfaces are metallically pure and even when connecting. The hexagon nuts have to be tightened to the torques specified in Table 7 using a torque wrench depending on the thread strength.

Table 7: Tightening torques of the brass screws on the connection bars according to DIN 46200 at ambient temperatures according to DIN EN 60034-1.

Thread	Nm
M 10	10,0
M 12	15.5
M 16	30.0
M 20	52.0

A sample connection of the cables is shown below using the terminal box on one side of the connection bar. The connection of the opposite side is according to this approach (following figure).



cross section a) and cut-out b) of the terminal box with bars

The following points should be followed when connecting the motor, for motors with terminal block as well as Connection bars:

- Check the cable cross section
- Get the cables of the selected cross-section ready:
 - Cables are prepared and stripped according to the required length and cut
 - The cable lugs are attached
 - Mount the cable glands completely over the cable and insert the cable through the cable entries
 - Bend the individual conductors (phases) of a cable appropriately (figure below)
 - Connect the cable to the connection bars / terminal blocks [1]
 - Adjust the cable and fasten the cable glands
- Tighten the sealing ring and screwed fitting
- Connections and earthing conductor have to be tightly screwed
- Connection cables should be free to prevent damage to the cable insulation

- The winding connections in the terminal box have to be checked and tightened if necessary.
- The connections should be made according to the circuit diagram
- Protruding wire ends should be avoided
- Make the connection according to the specified direction of rotation. Note the phase designation of the connection bars / terminal block (see previous and following figures)
- In case of armoured cables, a fastening clamp has to be connected to the cable and then connected to one of the earthing bar ([1] in the following image) in the terminal box using an earthing cable.

Due to customer request, other Grounding concepts can be realised.

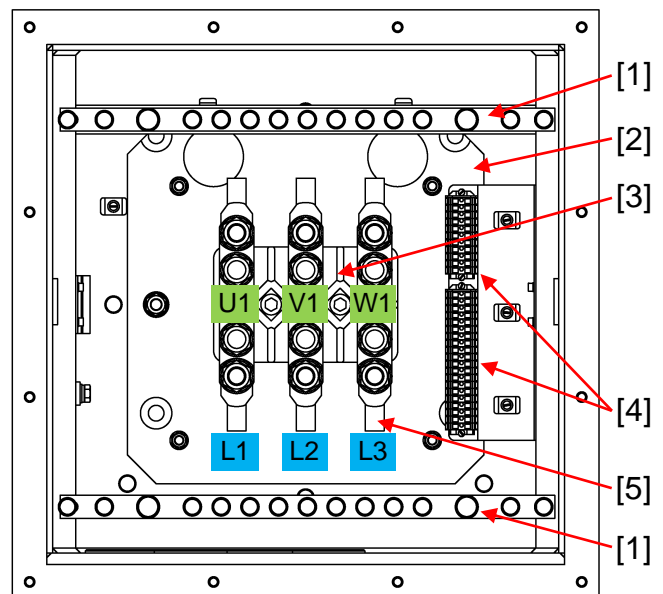
Following an example with terminal block, additional earthing bars, 25 series terminal and an acrylic glass touch-protection:

Top view of the terminal box of the MODRKF 280-4/TS800T and basic connection method to the connection bar / terminal block.

1. Earthing bar
2. Acrylic glass touch-protection
3. Terminal block
4. Series terminal
5. Cable shoes for the connection of the motor winding and the terminal block

U1 V1 W1 Wire connection designations on the terminal block / Connection bar

L1 L2 L3 Phase designations of the connection cable



5.4 Closing the terminal box

The tightening torques specified in table 8 for the screwed fitting, with a rubber seal in between, have to be used when closing the terminal box so as to ensure the required protection class.

Table 8: Tightening torques for metric ISO thread according to DIN ISO 262 and DIN ISO 965-2 at ambient temperatures according to DIN EN 60034-1.

Thread	Pitch	Tightening torque [Nm]
M6	1.00	approx. 4.2
M8	1.25	approx. 7.3
M10	1.50	approx. 17.0
M12	1.75	approx. 34.0

▲ ATTENTION!

After about 14 days, the screw fitting of the terminal box has to be tightened again using the torque specified in table 8, to ensure the required protection class.

5.5 Other equipment

▲ ATTENTION!

Possibly PTC thermistors as well as PT measuring resistors are installed in the winding head and for monitoring the bearings. Other components such as the anti-condensation heater for the terminal box, the brake, the air brake coil and for the motor windings are also housed in the terminal box, if present. If the additional components are connected incorrectly, they may be damaged immediately (e. g. temperature sensor). The connection has to be done according to the enclosed connection diagram for the respective machine at the terminal block (see sub-chapter 5.3).

5.6 Earthing the machine

Earthing the machine is extremely important for safety reasons, which is why it should be imperatively done with utmost care!

The earthing concept is based on DIN EN 60034-1. The earthing concept is additionally extended in the terminal box in the form of additional earthing bars (see sub-chapter 5.3, [8]) or earthing screws.

5.7 Direction of rotation

Generally, the motors are suitable for both directions of rotation. In case of motors with only one direction of rotation, the same is shown on the motor using an arrow. Connecting the terminals U1, V1, W1 to phases L1, L2, L3 (in alphabetical or natural sequence) always results in clockwise rotation, viewing from the drive side. This applies to all motors even if they are not suitable for clockwise rotation (IEC 60034-8 / DIN VDE 0530-8). Please feel free to consult Wölfer Motoren GmbH in this regard.

5.8 Changing the direction of rotation

The direction of rotation can be reversed by swapping any of the power supply cables on the motor terminal board with direct activation and pole-changing motors having separate windings.

In case of motors with star/delta starters and pole-changing motors with Dahlander winding, 2 power supply cables have to be swapped at the supply to the motor switch. For a machine with only one shaft end or two shaft ends of different thickness, the direction of rotation is the direction of rotation of the rotor as seen by an observer looking at the front side of the single or thicker shaft end.

In case of forced ventilation, the direction of rotation is shown separately by an arrow on the forced ventilation.

6 Commissioning

▲ NOTE!

The safety instructions given in chapter 2 of this operating manual have to be followed at all times.



▲ WARNING!

Risk of injury caused by electric shock. Could result in serious injuries or death.

Comply with the following instructions to avoid the risk of injury:

- Safety instructions as defined in chapter 2 have to be followed.
- The operating manual of the inverter has to be followed.
- The wiring instructions of the inverter manufacturer have to be followed.



▲ CAUTION!

The surfaces of the drive may become very hot during operation. Please protect the hot surfaces using covers and/or warning signs to avoid risk of burns. We also request you to note that cooling the motor down is very important before starting any kind of work!

▲ ATTENTION!

The specified values for the torque and the current should not be exceeded. The limit values for acceleration processes have to be requested separately. Property may be damaged in case of non-compliance. The current can be limited at the inverter.

6.1 Before commissioning

The following points should be ensured before commissioning:

- The drive is not damaged and not blocked
- Any existing transport locks have been removed
- For longer storage periods, follow the procedures given in the chapter "Motors stored for long durations"
- All the connections have to be done properly
- The direction of rotation of the motor has to be adhered to as defined in chapter "Direction of rotation"
- All the safety covers are mounted properly



- All the monitoring devices are connected properly and configured for the rated operation
- The rating plate specifications have to be followed
- The motor voltage and fundamental frequency has to be matched with that of the mains supply
- The limit speed should not be exceeded during inverter operation
- The ambient conditions / coolant temperature as specified on the rating plate has to be complied with
- The following points have to be checked:
 - Auxiliary equipment is working
 - Clean cooling surfaces and unobstructed air inlet openings
 - Safety measures carried out
 - Proper mounting of the motor
 - Check the belt tension in case of belt drive
 - The terminal box cover has to be tightly closed, the cable entry and the unused cable entry openings on the terminal box have to be properly sealed.
 - Seals should be checked for any damage and cracks

7 Maintenance



▲ Warning!

Risk of crushing, which could lead to serious physical injury or death, caused by hoists falling down or an uncontrolled behaviour of motor or equipment.

To avoid this, the following points have to be noted:

- Avoiding the risk of the load falling down by securing or lowering the hoist drives
- Secure and/or cordon off the maintenance zone / machine
- The work should not be started if the motor, the brake and external fan, if available, and / or the anti-condensation heaters are not disconnected and secured against being turned on accidentally.
- Only original spare parts should be used as per the corresponding list of spare parts. The same can be obtained from Wölfer Motoren GmbH



▲ CAUTION!

The surfaces of the drive may become very hot during operation. Allow the motor to cool down before starting work to avoid the risk of burns!

▲ NOTE!

A careful and thorough maintenance of the machine is the best protection against faults and breakdowns. We recommend you to prepare a schedule for the maintenance work and the maintenance period. Most machines require some amount of maintenance, which means that the operator is obliged to maintain them when operating large electrical machines.

▲ NOTE!

Repairs or modifications to the motor / brake or fan system should only be carried out by Wölfer Motoren GmbH or authorised third parties.

7.1 Connecting cable

The connecting cable has to be periodically checked, in order to replace damaged cables. Only connecting cables according to DIN EN 60204-1 have to be used.

7.2 Terminal box

After opening the terminal box, sub-chapter 5.4 should be followed when closing the terminal box.

If the terminal box needs to be rotated, information for motor types with this option has to be obtained from Wölfer Motoren GmbH.

7.3 Bearing lubrication

7.3.1 Motors with permanent lubrication (closed bearing)

Motors with permanent lubrication at normal coolant temperatures (see DIN EN 60034-1 / IEC 60034-1 / DIN VDE 0530-1: -15 °C to +40 °C) have bearings with a lubricant filled at the factory, which only needs to be replaced after several years under normal conditions. These bearings are designed as closed bearings and cannot be re-lubricated.

7.3.2 Motors with re-greasing option (open bearings)



⚠ ATTENTION!

If the used grease is not removed from the grease collection chamber, it gets accumulated, and the bearings overheat. The grease collection chamber has to be emptied only when the motor is not running.

**▲ ATTENTION!**

The re-lubrication intervals are to be taken from the plates mounted to the engine, since these are decisively influenced by the engine's operational conditions.

In case of doubt, please do not hesitate to contact Wölfer Motoren GmbH to request this information.

**▲ ATTENTION!**

The required amount of lubrication is not identical for all Motors.

The required amount is noted on the plates mounted to the engine.

In case of doubt, please do not hesitate to contact Wölfer Motoren GmbH to request this information.

**▲ ATTENTION!**

Using incorrect bearing grease may damage the bearing. The compatibility of the lubricant being used and that already in the bearing has to be ensured.

From 2019 on, open bearings with re-greasing are by default lubricated with Klüberquiet BQH 72-102.

This has a service temperature of -40°C to +180°C.

The lubricate OKS 425 is used for an operation in lower temperatures.

It has a service temperature of -50°C to +130°C.

The lubricants above will be used by default from 2019 on. These two types unite the characteristics of the lubricants used so far.

The year 2018 marks the transition from the old lubricants to the new standard. For motors from this time period, please note the plates mounted to the engine.



Different lubricants were used for engines delivered before 2018.
Following a listing of the old lubricants with a short description of their relevant characteristics:

The previous standard was the lubricant BECHHEM HIGH-LUB L 2.
It has a service temperature of -30°C to +120°C (short term +140°C).

The alternative for higher ambient temperatures was the lubricant Arcanol TEMP110.
It has a service temperature of -35°C to +160°C.

For applications up to -40°C the lubricant Arcanol Multitop was used.
It has a service temperature of -40°C to +140°C.

If longer re-lubrication intervals were requested by the customer, the lubricant Berutox FH28EPK was used.
It has a service temperature of -20°C to +180°C.

In case of uncertainty regarding the used lubricant note the plates mounted to the engine or contact Wölfer Motoren GmbH to request this information.

The following points should be noted for motors with re-lubrication option:

- Re-lubrication using a grease gun has to be carried out via the greasing nipple on the bearing plate.
- Re-lubrication has to be done at least once a year.
- Motors with grease removal device: After re-lubrication, the used grease has to be removed by repeatedly pulling the device attached to the bearing until it stops.
- Motors with grease collection chambers: The intervals indicated on the rating plates have to be followed. To do this, the grease collection chambers have to be unscrewed when the motor is not running, and the used lubricant has to be removed. If this is not done, the lubricant accumulates, and the bearings are overheated.

**▲ DANGER!**

Re-lubrication during operation may result in serious crushing injuries.

For a uniform distribution of the lubricant, the motor has to be lubricated when it is not running by following the safety instructions given in Chapter 2 and then slowly started.

▲ NOTE!

The bearings may be damaged if the re-lubrication intervals are not followed. This results in premature bearing failure.

7.4 Condensation drain holes

For motors with IP5x degree of protection, the condensation drain holes are located in the A or B side bearing plate or motor housing, depending on the installation position. The condensation drain holes have to be closed using a screw, depending on the degree of protection and the installation position.

▲ NOTE!

Motors provided with condensation drain holes, which are tightly closed with a screw for protection class reasons, should be drained at reasonable time intervals, depending on the degree of condensation.

7.5 Return stop mechanism

The return stop mechanism has to be maintained according to the manufacturer's instructions. The maintenance instructions of the return stop mechanism have to be followed.

7.6 Corrosion protection

If the paint coating of the motor is damaged and during the subsequent touch-up work, the following PPG based coatings, which are employed by Wölfer as standard in accordance with DIN EN ISO 12944-2, with coating thickness and types of paint should be considered as the minimum requirement for ensuring the corrosion protection.

**Paint layer structure for PPG Paint**

Primer	Topcoat	Corrosion protection class	Layer thickness [µm]
	PUR Direct Topcoat	C3-High	120
HB EP Primer 0440	PUR Direct Topcoat	C5-M High	250

Due to customer specification (for example in an environment with special requirements for the paint), the above C5-M High coating can be primed with an additional “ZincRich EP Primer”. The resulting Layer thickness is 300µm.

For ‘bright’ colours with low opacity, the “HB EP Primer 0440” will be used even for C3-High to ensure a uniform colouring.

The Wölfer standard Colour is “light grey” (RAL 7035) with a gloss level of 50GL.

Due to the request of the customer the colour, gloss level and the above noted paint layer structure and thickness may differ from the standard.

Following are listed the formerly (up until 2015) as standard used coatings. Older Wölfer products are likely to be painted by these specifications, except those specified otherwise by the costumer at the time of the order.

If requested by the costumer, new products can be made this way as well.

Paint layer structure for International paints at welded housings

Primer	Layer thickness
Two component coating material on an epoxy resin basis	125µm
Interlayer	Layer thickness
Two component coating material on an epoxy resin basis	125µm
Topcoat	Layer thickness
Two components-Polyacrylate/polyisocyanate-Finish coat	60µm



Paint layer structure for International paints at cast housings

Primer	Layer thickness
Two component coating material on an epoxy resin basis	220µm
Interlayer	Layer thickness
Two component coating material on an epoxy resin basis	150µm
Topcoat	Layer thickness
Two components-Polyacrylate/polyisocyanate-Finish coat	80µm

Paint layer structure for Osnatol paints

Primer	Layer thickness
Osnapox Z1K sand yellow	80µm
Topcoat	Layer thickness
Osnacryl Pur G / Paint	80µm

7.7 Spare parts

Please always indicate type, motor number and spare part reference number when ordering spare parts. Type and motor number are given on the rating plate.



8 Disposal

The Wölfer products do not come under the European directive 2012/19/EU (old electric equipment act WEEE2).

The materials used in the Wölfer products can be divided into two different categories for disposal:

1) Scrap metal

The scrap metal is obtained by removing the entire electrical insulation system, including connection wires, windings, sensors and connection bars / terminal blocks from the terminal box of the motor. The scrap metal can then be disposed of via the conventional scrap metal disposal.

2) Electrical scrap

Components of the entire electrical insulation system, including connection wires, windings, sensors and connection bars / terminal block from the terminal box, removed under point 1), are included under electrical scrap. Since these components are covered and filled with our resin, the resin manufacturer recommends their disposal according to the EG directives 75/442/EEC and 91/689/EEC on waste and hazardous waste in the respective applicable versions.

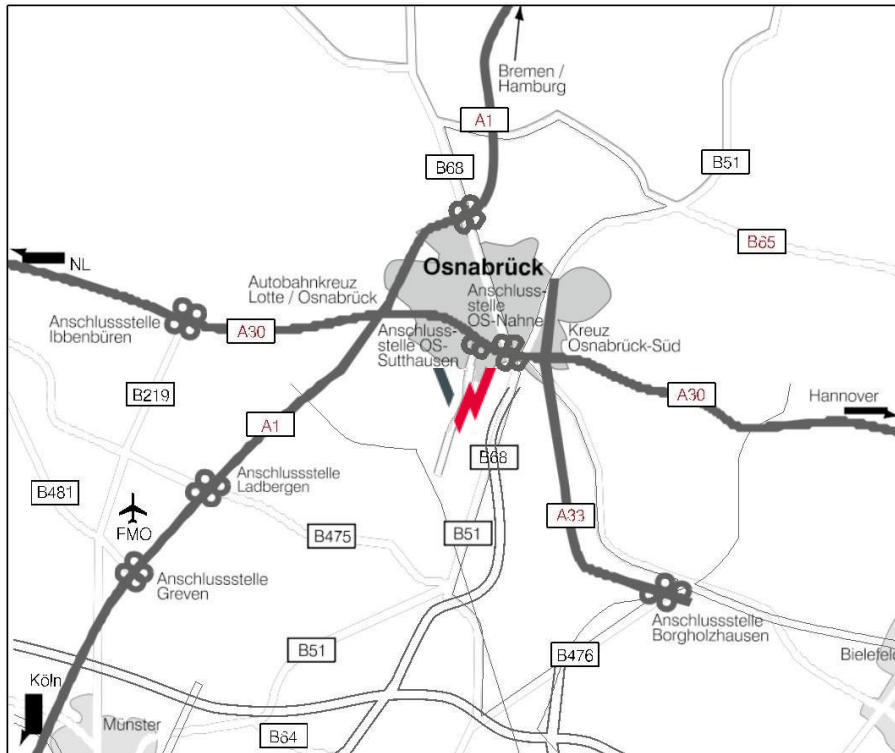
3) Brakes:

If brakes are mounted on the motor, then they should be disposed of according to the specifications of the brake manufacturer. The brake manufacturer should be contacted using the contact details given on the brake rating plate and/or the information given in the enclosed operating manual of the brake.

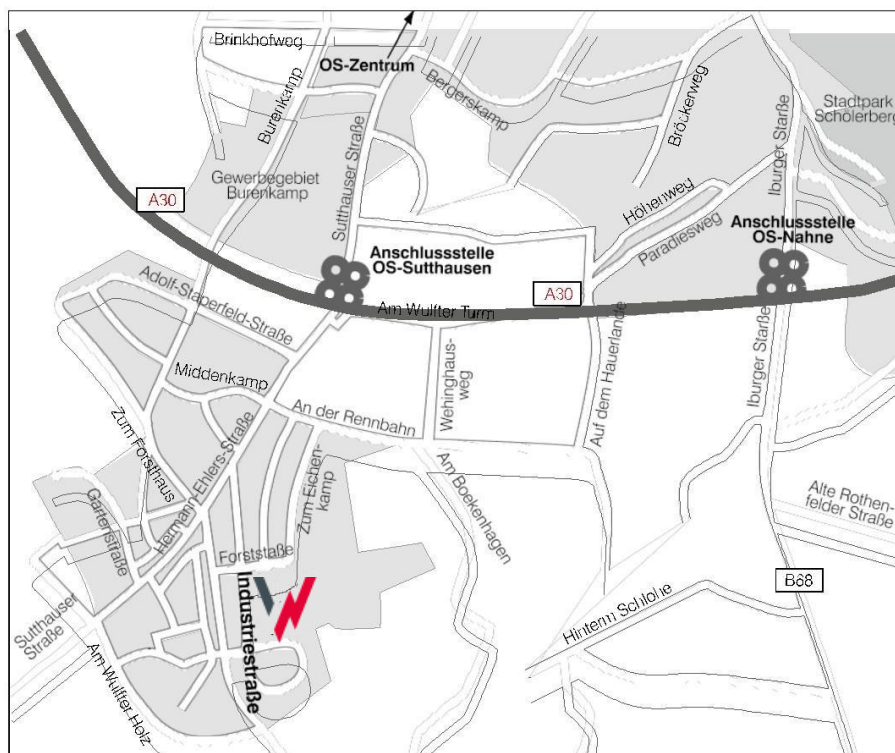


9 Contact

Directions: Osnabrück



Directions: Wölfer Motoren GmbH



Wölfer Motoren GmbH

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10 Appendix

10.1 EU DECLARATION OF CONFORMITY



EU DECLARATION OF CONFORMITY
according to the Directive 2014/35/EU

Osnabrück, 14. December 2022

Wölfer Motoren GmbH
Industriestraße 14
49082 Osnabrück
Germany

Managing Directors:
Steffen Liebich
Yorck H. Richter

Name and address of the manufacturer:

Wölfer Motoren GmbH, Industriestraße 14, 49082 Osnabrück

This declaration of conformity is issued under the sole responsibility of the manufacturer.

The technical documentation has been compiled in accordance with Annex III, Module A of Directive 2014/35/EU and is made available to authorized national bodies on reasonable grounds within a reasonable time.

The object of the declaration:

Three - phase AC motors (electric motors) of the series

D..., OD..., SD..., SOD..., MD..., MOD..., MSD..., MSO...

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

- **Directive 2014/35/EU: Electrical equipment designed for use within certain voltage limits**
- **Directive 2009/125/EC: Framework for the setting of ecodesign requirements for energy-related products with the Regulation (EU) 2019/1781**

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

- EN 60034-1:2011 Rotating electrical machines - Part 1: Rating and performance
- EN 60034-6:1996 Rotating electrical machines - Part 6: Methods of cooling (IC-Code)
- EN 60034-7:2001 Rotating electrical machines - Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM code)
- EN 60034-8:2014 Rotating electrical machines - Part 8: Terminal markings and direction of rotation

Yorck H. Richter
MANAGING DIRECTOR

Wölfer Motoren GmbH
Industriestraße 14
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