



Installation, operating and maintenance instructions

**Three-phase asynchronous motors
with squirrel-cage rotor for low voltage applications**

**Three-phase asynchronous motors
with slip-ring rotor for low voltage applications**

Translation



KP./KPE./K1../K2../KU../KV../K4../K8..
BP./BPE./B1../B2../BU../BV../BE../BR..
WE../W2../W4../WU../G1../G2../GS1..
YP./YPE./Y1../Y2../YE../YU..
S(R)../SG../SP../SPE./S1../S8..
CP./CPE./C1../R1../R2../RE..
AR./A1../A2../AU../AV../AE..

Motors that comply with the Regulation 2005/32/EC and the order No. 640/2009 receive the marking IEx before the type designation, whereas x= 1,2,3 (acc. to EN 60034-30). (Example IE1-K21R 132 S4)

1. General

To prevent damage to motors and the driven equipment the procedures laid down in the Operating and Maintenance Instructions must be followed. Especially to avoid risk of injury, the separately enclosed Safety Regulations must be adhered to strictly.

Since for reasons of clarity the Operating and Maintenance Instructions cannot contain specific information with regard to all conceivable special applications and areas with special requirements, the user himself has to make appropriate protection arrangements during the installation process.

1.2. Qualified personnel

Installation work, commissioning and operation of motors must only be done by qualified personnel. Installation work shall only be done by qualified personnel who is skilled because of a technical education, expertise and schooling of knowledge about



- security regulations,
- accident prevention regulations,
- standards and approved rules of technique (for example VDE-regulations, standards).

The qualified personnel must have the ability to assess the assigned job, identify possible dangers and avoid them. The qualified personnel must be authorized by the person in charge for security of the plant to carry out the necessary work and tasks.

1.3. Intended use

This motor is only approved for the intended use given by the manufacturer in his catalogue and the corresponding technical documentation. Other or additional use is not intended. This includes consideration of all corresponding product documents. Changes or reconstruction of the motor are not allowed. External products and components that shall be used together with the motor must be approved or recommended by the manufacturer.

1.4. Disclaimer

Observance of this manual and the conditions and methods used for installation, operation, use and maintenance of the electric motor can not be monitored by the manufacturer. An improper installation can result in property damage and thus result in personal injuries. We therefore do not accept responsibility and liability for losses, damages or costs resulting from improper installation, improper or wrong use and maintenance or connected with this in any kind. We strive to improve our products continuously. Consequently technical data and illustrations remain subject to change without prior notice. Specifications may only be considered binding after written confirmation by the supplier.

EC motor regulation (EC) No. 640/2009

Since June 2011 the regulation (EC) no. 640/2009 of the European Commission for electric motors has become into force. This regulation specifies the eco design requirements for 2-, 4- and 6-pole low-voltage three-phase asynchronous motors in the output range from 0.75 kW to 375 kW.

The individual eco design requirements are scheduled as follows:

- After 16th June 2011 all motors must have at least the efficiency class IE2 specified in attachment I/no. 1 of the regulation.
- After 1st January 2015 all motors with rated output 7.5 kW to 375 kW must have either the efficiency class IE3 specified in attachment I/no. 1 of the regulation or the efficiency class IE2 specified in attachment I/no. 1 of the regulation but operating with speed control.
- After 1st January 2017 all motors with rated output 0.75 kW to 375 kW must have either the efficiency class IE3 specified in attachment I/no. 1 of the regulation or the efficiency class IE2 specified in attachment I/no. 1 of the regulation but operating with speed control.

The regulation permits the user to choose either an IE3-motor (fixed or variable speeds) or an IE2-motor operating in connection with a speed control. The user is responsible to observe the specifications of the EC regulation. The motor manufacturer labels his products accordingly.

The detailed scope and exemptions for special designs have to be taken directly from regulations (EC) No. 640/2009 and (EC) No. 4/2014.

2. Description

The motors have been manufactured in accordance with IEC 34-1, EN 60034-1 and other appropriate European standards. Motors can also be supplied complying with special regulations (e.g. classification regulations, regulations for explosion protection).

Separate additional instructions apply for the following motor versions:

Roller table motors

Motors in explosion protected design

The details on the relevant order confirmation constitute the scope of supply.

3. Efficiency

The efficiency is determined according to the specifications of EN 60034-2-1. For motors < 1kW the direct measurement method is used. The measurement uncertainty of this method is rated „low“. For motors \geq 1kW the individual loss method is used. The additional losses of this method are determined from the residual losses. The measurement uncertainty of this method is also rated as „low“. Efficiency and Efficiency class complying with EN 60034-30 are listed on the name plate of energy saving motors.

4. Degree of Protection

The degree of protection of the motors is indicated on their rating plate. The degree of protection of additional devices fitted to the motor can be different than the degree of protection of the motor. This needs to be taken into consideration during the installation of the motors. If motors are installed in the open (degree of protection \geq IP 44), they should be protected against direct effects of the climate (freezing of the fan due to direct fall of rain, snow and formation of ice).

5. Type of Construction

The type of construction of the motors is indicated on the rating plate. The motors can be used in different types of construction only with permission of the manufacturer and if necessary after modification carried out in accordance with the manufacturer's instructions. Especially with types of construction with vertical shaft the user has to ensure that foreign particles cannot fall into the fan cowl.

6. Transport & Storage

If possible the motors should only be stored in closed and dry rooms. Outdoor storage under cover is permitted for a short time only and requires adequate protection against all harmful effects of the climate. The motors also have to be protected against mechanical damage. Never transport or store the motors resting on their fan cowls. The eye bolts/attachment eyes of the motors together with appropriate lifting tackle must be used for transport. The eye bolts/attachment eyes are intended for the lifting of the motors only, without any additional parts such as bed plates, gears etc. If eye bolts/attachment eyes are removed after installation, the tapped holes must be blanked off permanently according to the Protection Standard. For longer periods of storage a low vibration environment shall be provided so that bearing damages due to downtime can be avoided. After a storage period of more than 12 months the condition of the grease must be checked before putting the motor into operation.



The transport lock is only ment for transportation. It must not be used for lifting weights!

7. Removal of the Transport Safety Device

On motors with transport safety device (roller bearing), the hexagon head screw provided for the fastening of the transport safety device is to be loosened and taken off together with the transport safety device. Subsequently the bearing cover bolt packed in a bag inside the terminal box is to be screwed into the bearing cover. If it is necessary for the motor type the bag will also contain a lock washer that is to be placed onto the bearing end shield bolt before screwing it into the bearing cover. After removal of the transport safety device micro movements of the rotor must be prevented by suitable measures (risk of downtime damages).

8. Installation and Fitting



Since during normal operation of electric motors, temperatures in excess of 100 °C can occur on their surface, any contact with them must be prevented if the motors are installed in accessible areas. Because of this temperature sensitive parts must never be fitted to them or have contact with them.

In types of construction IM B14 and IM B34 it must be ensured that the maximum usable screw depth specified in the table below is not exceeded, otherwise the winding will be damaged.

Vent holes must be kept free and the minimum distances stated in the dimensional drawings must be maintained so that the flow of cooling air is not obstructed. Care must be taken that the discharged warmed up cooling medium is not sucked up again.

For constructions with shaft end upwards the user must prevent liquid entry from the shaft!



The key in the shaft end is secured by the shaft protective sleeve for transport and storage only. Because of the danger that the key may be thrown aside, a start-up or a trial run with the key protected by the shaft sleeve only is strictly forbidden.

Transmission components (such as couplings, pinions or belt pulleys) should be drawn onto the shaft by means of pull-on devices or by heating-up the part to be drawn onto the shaft. For the purpose of drawing the transmission components onto the shaft, the shaft ends are provided with tapped centering holes according to DIN 332 Part 2. Transmission components must never be driven onto the shaft using hammer blows because the shaft, the bearings and other components of the motor could be damaged.

All components that are to be fitted to the shaft end must be balanced dynamically according to the balancing system of the motor (full or half key). The rotors of the motor are balanced with half key; this is indicated by letter H after the serial number on the rating plate. Motors with letter F after the serial number are balanced with full key. If possible the motors are to be installed in such a way that they are free from vibrations. With precision balanced motors special instructions are to be followed. When the installation is completed the user must ensure protection of movable parts and safety of operation.

Direct coupling to the driven machine requires a particularly accurate alignment. The shafts of both machines must be in alignment. The shaft height is to be adjusted to that of the driven machine using appropriate shims.

Belt drives put a lot of stress on the motor because of relatively high radial forces. When dimensioning belt drives, apart from the instructions and calculation programmes issued by the manufacturers of the belts, it must be ensured that the radial force permissible at the shaft end of the motor as stated in our data is never exceeded by the pull and pre-tensioning of the belt. When pre-tensioning the belt during installation the instructions of the belt manufacturers must be strictly adhered to.

Relatively large radial forces or masses can be taken up at the end of the motor shaft by the use of cylindrical roller bearings ("heavy bearing arrangement" VL). The minimum radial force at the shaft end must be a quarter of the permissible radial force. The permissible shaft end load is to be taken into account. The information can be taken from the tables and diagrams in the design selection data.



If the radial force falls below the minimum value, damage to the bearings can be caused within a few hours. Test runs in no-load state only permissible for a short period.

The threaded holes of the flange types listed in the table are through holes (type IMB14, IMB34).

To avoid damage to the winding overhang of the motor winding, **observe the maximum permissible tap depths in conformity with the following table.**

Flange type (EN 50347)	Old flange type (DIN 42948)	Tap depth (mm)
FT65	C80	6,5
FT75	C90	8
FT85	C105	8,5
FT100	C120	8
FT115	C140	10
FT130	C160	10
FT165	C200	12
FT215	C250	12

If a motor of type IMB34 without flanged attachments is used, the user has to take appropriate **measures** at the through holes to **maintain the specified degree of protection.**

9. Insulation Check & Replacement of Grease / Bearings

When the motor is first commissioned and especially after extended storage, the insulation resistance of the winding is to be measured to earth and between phases. The check must take place using the rated voltage, but at least 500 V.



During and immediately after the measurements dangerous voltages are present at the terminals. Therefore never touch the terminals and follow the operating instructions of the insulation resistance meter closely!

Depending on the rated voltage U_N , the following minimum values must be maintained with a winding temperature of 25 °C:

Rated Power P_N in kW	Insulation Resistance referred to Rated Voltage in $k\Omega/V$
$1 < P_N \leq 10$	6,3
$10 < P_N \leq 100$	4
$100 < P_N$	2,5

If the minimum values are lower, the winding must be dried properly until the insulation resistance corresponds to the required value.

When the motor is commissioned after a prolonged period of storage inspect the bearing grease visually and replace it if hardening and other irregularities occur. If the motors are to be commissioned by the manufacturer after more than three years following their delivery then the bearing grease must always be replaced. With motors fitted with covered or sealed bearings the bearings must always be replaced with new bearings of the same type after a storage period of four years.

10. Motor connection



The connection has to be done by qualified personnel according to the valid security regulations. Outside of Germany the required national standards must be applied. Name plate designations have to be observed under all circumstances!

Take extra care when connecting the supply cables in the terminal box of the motor. The nuts of the connection screws have to be fastened without force. Before connecting the power line, the existing motor connections must eventually be retightened.

Terminal box overview

Terminal box type	Terminal board	Rated current [A]	Connecting thread	Tightening torque [Nm]
KA 05	K1M4	30	M4	$1,8 \pm 0,2$
KA 05-13	K1M4	30	M4	$1,8 \pm 0,2$
KA 05-13	K1M5	30	M5	$2,4 \pm 0,2$
KA 25 A	SB 5	25	M5	$2,5 \pm 0,5$
KA 25 A SS	SB 5	25	M5	$2,5 \pm 0,5$
K 63/25 A	SB 5	25	M5	$2,5 \pm 0,5$
KK 63 A	SB 6	63	M6	4 ± 1
KK 100 A	SB 8	100	M8	$7,5 \pm 1,5$
KK 200/100 A	SB 8	100	M8	$7,5 \pm 1,5$
KK 200 A	SB 10	200	M10	$12,5 \pm 2,5$
KK 400 A	SB 12	400	M12	20 ± 4
KK 400 B	KM 12	400	M12	20 ± 4
KK 400 B	KM 16	630	M16	30 ± 4
KK 630 A	KLP 630-16	630	M16	30 ± 4
KK 630 A	KLP 630-20	630	M20	30 ± 4
KK 1000 A	KLSO 1000	1000	current bar	-

11. Commissioning

Please follow the Safety Regulations closely. All work is to be carried out only when there is no voltage on the motor. The installation must be carried out according to the valid regulations by qualified skilled personnel. Initially the mains conditions (voltage and frequency) must be compared with the data on the rating plate of the motor. The dimensions of the connecting cables must be adjusted in line with the rated currents of the motor.

The connection points of the motor are marked in accordance with EN 60034-8 (VDE 0530 Part 8). In Section 19 of these instructions the most common circuit diagrams for three phase motors in basic design are provided, according to which the connection will be implemented. For all other versions, the special circuit diagrams are glued to the inside of the terminal box cover or placed in the terminal box. An additional terminal box can be provided for the connection of auxiliary and protection devices (e.g. anti-condensation heaters); the same regulations apply as for the main terminal box.

Always start the motors with an over-current protection device that is set in accordance with the relevant nominal values of the motor ($\approx 1,05 I_{nom}$). Otherwise warranty claims with respect to damaged windings become void. Before the motor is connected for the first time it is recommended to check the insulation resistances between winding and earth and between phases (see Section 9). After prolonged storage it is absolutely essential that the insulation resistance is measured. Before coupling the motor to the driven machine, check the direction of rotation of the motor to prevent possible damage being caused to the driven machine. If the power lines are connected with the phase sequence L1, L2, L3 to U, V, W, the direction of rotation is clockwise (view to shaft end on drive side DS). If two terminals are changed, the direction of rotation is counterclockwise (i.e. L1, L2, L3 to V, U, W). For machines with only one direction of rotation the required sense of rotation is marked by an arrow on the machine. For the permissible tightening torques for the terminal board bolts refer to the table below:

Tightening torques for bolts (terminal box, end shield, bearing cover)
 Series W.. and K.. 63 to 132T, W.. and K.. 56 to 100

Type		Type of construction	End shield		Fixed bearing cover		Terminal box	
W.. and K..	W.. and K..		DS	NS	DS	NS	or adapter	cover
Bolts/tightening torque for bolts M _A								
63...	56...	all	M 4	M 4	M 4 1,5 Nm (for W.. and K.. 100 L M 5 2,0 Nm)	M 4 1,5 Nm	M 4 2,5 Nm	M 5 1,0 Nm
71...	63...		2,0 Nm	2,0 Nm				
80...	71...		M 5	M 5				
90...	80...		4,0 Nm	4,0 Nm				
100 L	90...		M 6	M 6				
100 LX,112...	100...	B3	M 8	M 8 10,0 Nm	M 5 2,0 Nm	M 5 2,0 Nm	M 4 2,5 Nm	M 4 2,0 Nm
			10,0 Nm					
		B5, B14	M 8					
132 S...T	-	B3, B14-FT130	M 8	10,0 Nm				
		B5, B14	M 8	15,0 Nm				

Tightening torques for bolts (terminal box, end shield, bearing cover)
 Series W.. and K.. 112 to 355

Thread Ø	M5	M6	M8	M10	M12	M16	M20
End shield	-	-	25	45	75	170	275
Bearing cover	5	8	15	20	20	-	-
Terminal box	-	4	7,5	12,5	-	20	-

Before closing the terminal box make absolutely sure that:

- the connection has been made in accordance with the wiring diagram
- all terminal box connections are tightened
- all minimum values of air paths are maintained (larger than 8 mm up to 500 V, larger than 10 mm up to 750 V, larger than 14 mm up to 1000 V)
- the interior of the terminal box is clean and free from foreign particles
- unused cable entries are blanked off and the threaded plugs with seals are tightened
- the seal in the terminal box cover is clean and tightly glued and all sealing surfaces are in the correct state to ensure that the relevant degree of protection is maintained.

Before starting up the motor check that all safety regulations are strictly adhered to, that the machine is correctly installed and aligned, that all fixing parts and earthing connections are tightened, that the auxiliary and additional devices are functionally and correctly connected and if a second shaft end is fitted that the key is secured against being thrown aside.

If possible the motor is to be connected without load. If the motor is running smoothly and without any abnormal noises, the load of the driven machine is to be applied onto the motor. When the motor is started up it is recommended to monitor the current consumption if the motor is loaded with its driven machine so that any possible overloads and asymmetries occurring in the mains can be recognised immediately. The starter must always be in the starting position during starting. With slip ring motors the correct running of the brushes must be monitored. They must be absolutely spark-free.

For mountings like encoders, brakes and others please observe the corresponding operating and maintenance instructions of the manufacturer.

12. Maintenance

You are once again referred to the Safety Regulations, in particular to isolation, to securing against reconnection, to checking whether all components connected to a voltage source are in dead state. If it is necessary to disconnect the motor from the mains for maintenance work particular care must be taken to ensure that any possibly existing auxiliary circuits (e.g. anti-condensation heaters, forced ventilators, brakes) are also disconnected from the mains.

If the motor is to be dismantled during maintenance work, the sealing compound on the centering shoulders is to be removed. When re-assembling the motor these need to be re-sealed using a suitable motor sealing compound. Existing copper sealing washers must always be refitted.

Careful and regular maintenance, inspections and revisions are necessary to detect and clear faults in time, before consequential damages will happen. As individual operating conditions can not be defined for all applications the listed terms represent a general advice for undisturbed operation. Individual local conditions (degree of pollution, load, etc.) must be taken into account when adjusting these terms.

What to do?	Time period	Terms
First inspection	After about 500 operating hours	½ year at the latest
Control of air circulation and surface of motor	Depending on local environmental pollution	
Relubrication (as option)	See name plate or relubrication sign	
Main inspection	After about 10,000 operating hours	Once a year
Remove condensate water	Depending on the local environmental conditions	

12.2 Inspektions

12.2.1 Initial inspection

According to the requirements an initial inspection of the motor must be organised after approximately 500 hours of operation, but not later than half a year after start of operation.

The following examinations will be done at standstill of the motor:

- a) Check of the foundations. There must be no cracks or other damages like depressions.

The following examinations will be done when the motor is running:

- a) Check of the electric characteristics.
- b) Check of the bearing temperatures. It is examined if the permissible bearing temperatures will be exceeded during operation of the motor.
- c) Check of the running noises. When the motor is running, it is checked if the quiet running has changed for the worse.

If the examination results in differences from the values specified in the mainenance manual or if there are other faults or damages detected, than these must be corrected immediately.

12.2.2 Main inspection

According to the requirements a main inspection of the motor must be organised annually after approximately 10,000 hours of operation.

The following examinations will be done at standstill of the motor:

- a) Check of the foundations. There must be no cracks or other damages like depressions.
- b) Check of the motor alignment. The motor alignment must be within the given tolerances.
- c) Check of the fastening bolts. All bolts used for fixing mechanical and electrical connections must be tight (see also the table for tightening torques for bolts in chapter 11. Commissioning).
- d) Check of the cables and the insulation material. The examination must check if the cables and used insulation materials are in good conditions. They must not be discoloured or even burnt and they must not be broken, cracked or faulty in any other way.
- e) Check of the insulation resistance. The insulation resistance of the winding must be measured. The requirements in the maintenance manual (chapter 9) must be kept.
- f) According to the grease quality and bearing type of the motor it can be necessary to change the grease after 10,000 working hours (see chapter 13 Bearings and Lubrication). Apart from that the necessary relubrication periods for friction bearings must be observed, because they differ from the inspection periods.

The following examinations will be done when the motor is running:

- a) Check of the electric characteristics.

- b) Check of the bearing temperatures. It is examined if the permissible bearing temperatures will be exceeded during operation of the motor.
- c) Check of the running noises. When the motor is running, it is checked if the quiet running has changed for the worse.

If the examination results in differences from the values specified in the maintenance manual or if there are other faults or damages detected, than these must be corrected immediately.

13. Bearings and Lubrication

The anti-friction bearings of the motors in standard design are filled with anti-friction bearing grease in the factory (or with sealed bearings by the bearing manufacturer) according to DIN 51825 in compliance with the table below:

Motor type	Designation of grease	Design. acc. to DIN 51825	Temperature range in °C
Thermal class F Thermal class H rise F Standard, TII, AS, NS, VL, LL Marine design (SS) Smoke exhaust design FV, FV1, FV2 (up to 300°C/1h)	Asonic GHY 72	KE2/3R-40	-40 up to +180
For low temperatures	Asonic GLY 32	KPE2N-50	-50 bis +140
For high temperatures, Thermal class H rise H Roller table motors ARB, ARC Smoke exhaust design FV3 (up to 300°C/2h)	Berutox FH 28 KN	KHC1R-30	-30 bis +180
Power plant design Motors complying with VIK with relubrication device	HIGH- LUB LM 3 EP	KP3N-30	-30 bis +140
For very high ambient temperatures	Barrierta L55/3 HV	-	-25 bis 260
Customer request	Only after consultation with design department of VEM		

Under normal load and climatic conditions, the quality of grease guarantees an operation of the motor for approx. 10,000 service hours with two pole design and 20,000 service hours with multipole design. If not otherwise agreed the grease of anti-friction bearing must never be refilled during this period. However, the condition of the grease should be checked occasionally even before this time limit. The bearing itself or the grease of permanently lubricated bearings should be changed after approximately 3 years independent of operating hours. This is due to the reduction of lubrication properties of the grease. The indicated number of service hours is only valid for operation at rated speed. When using inverter feeding the indicated relubrication periods are reduced by 25% because of the higher temperature increase. If during operation of the motor via an inverter the nominal speed is exceeded then the regreasing period reduces approximately in the opposite ratio to the increase in the motor speed.

Regrease the bearings only after a thorough cleaning using suitable solvents. The same type of grease must be used. When replacing the grease only the equivalent types specified by the motor manufacturer can be used. Please bear in mind that the bearings should only be filled up to about 2/3 of their free space. A complete filling of the bearings and bearing covers with grease leads to increased bearing temperature and therefore to increased wear.

The regreasing of bearings with regreasing facility is carried out at the grease nipple when the motor is running using the grease quantity required for the respective motor. For the re-greasing intervals please refer to the table below:

Frame size		2-pole design	Design with 4-poles and more
Series IEC/DIN	Series Transnorm		
132 bis 280	100 bis 250	2.000 h	4.000 h
315	280 bis 315	2.000 h	4.000 h
355	-	2.000 h	3.000 h

The quantities of grease required for the re-greasing are stated in the below table (Please note that for the first re-greasing approx. twice the amount of grease is required because the grease lubrication pipes are still empty). The used grease is collected in the grease chamber of the external bearing cap. After approx. 5 re-greasings this old grease should be removed, e.g. as part of inspection work.

Series Trans-norm Size	Overall length pole number	Quantity of grease in cm ³		Series IEC/DIN Size	Overall length pole number	Quantity of grease in cm ³	
		D-end	N-end			D-end	N-end
112	alle	10	10	132	M4, MX6	17	17
132	alle	17	17	160	L2, MX2, L4, 6, 8	23	20
160	alle	23	20	180	M2, L4	23	23
180	2	23	23		M4, L6, 8	23	20
	≥ 4	31	31	200	L2, L4, 6, 8, LX 6	31	23
200	2	31	31		LX2	31	31
	≥ 4	35	31	225	M2	31	31
225	2	35	35		M4, 6, 8, S4, 8	35	31
	≥ 4	41	35	250	M2	35	35
250	2	41	41		M4, 6, 8	41	35
	≥ 4	52	41	280	2	41	41
280	2	52	52		≥ 4	52	41
	315	≥ 4	57	52	315	S,M2	52
S2		57	52	S,M ≥ 4, MX2		57	52
M,L,LX2		57	57	MY,L,LX2		57	57
S4, 6, 8		64	52	MX4, 6, 8		64	52
M,L,LX4, 6, 8		78	57	MY,L,LX4, 6, 8		78	57
355	2	57	57	355	2	57	57
	4	90	57		4, 6, 8	90	57
	6,8	90	57				

The necessary relubrication periods for roller bearings differ from the inspection periods and must be observed separately!

The motors up to size 315M are equipped as standard with anti-friction bearings with life-time lubrication. From size 315MX upwards they are equipped with relubrication devices which can be ordered for smaller motors as option. Information about bearings and relubrication can be found in the general installation, maintenance and operation manual or on the name plate or relubrication sign.



Maintenance works (without relubrication) has to be done at standstill of the motor. It has to be assured that the machine is secured against re-connection and labelled with an appropriate sign.

In addition the security advices and accident prevention regulations of the manufacturers for the use of oils, lubricants and detergents has to be observed!



Adjacent live parts have to be covered or secured! It has to be assured that the auxiliary circuits like anti-condensation heating are dead (zero potential).

For design versions with condensate drain hole please observe that the drain plug screw has to be lubricated with a suitable sealant (for example Epple 28) before relocking.

14. Long term storage (more than 12 months)

Long term storage must be done indoors in vibration-free, dry rooms with temperatures not below -20°C and not above +40°C. The storage environment must not contain aggressive gas, vapours, dusts and salts. Preferably motors shall be moved and stored only in original packing. Storage and transport with motors standing on their fan covers is not allowed. Additionally unprotected metal surfaces like shaft ends and flanges must be protected with a medium for long-time corrosion protection in addition to the existing factory-provided temporary corrosion protection. If there is a risk of motors being covered by moisture from condensation, please provide precautionary measures against humidity. Than a special packing in airtight sealed plastic foil is necessary or as alternative packing in plastic foil with desiccants. Please put desiccant bags in the terminal box as well.

For the transport please use the eye bolts/attachment eyes of the motors together with suitable lifting accessories. The eye bolts/attachment eyes must only be used for lifting the motors without additional mountings like foundation plates, gears and others.

Motors with reinforced bearings are supplied with a transportation safety device. The transportation safety device at the shaft end must only be removed during installation of the motor and before switching on.

15. Slipping Contact System

The slipping contact system is to be inspected at regular intervals. It is advisable to check the slip rings 2 – 3 times immediately after commissioning, at intervals of approx. 50 operating hours. Subsequently regular maintenance is to be carried out at intervals that depend on the relevant operating conditions.

A thin layer of patina should be formed on the surface of the slip rings. Generally such patina layer is formed after an operation of between 100 to 500 hours. If intensive scoring or burnt spots on the slip ring surface occur they must be removed immediately either by cleaning or if necessary by re-machining. If slight scoring appears it is not necessary to re-machine. The pressure of the carbon brushes must be checked. It should be between 18.5 kPa and 24 kPa. When replacing the brushes the same type of brush must always be used. New carbon brushes must be bedded-in. With box type brush holders care must be taken to ensure that the carbon brushes do not jam due to contamination.

The carbon brushes wear naturally and the abrasion can amount to 3 - 5 mm per 1,000 hours of operation.

16. Draining of condensation water

On installation sites where formation of dew and thus occurrence of condensation water can be expected inside the motor, the accumulated condensation water has to be drained at regular intervals through the opening at the lowest point of the end shield. Subsequently the opening must be closed up again.

17. Cleaning

So that the effects of cooling air are not interfered with, all parts of the motor must be cleaned at regular intervals. In the majority of cases it is sufficient to clean the machine with compressed air that is free from water and oil. Especially the vent holes and the spaces between the ribs must be kept clean. The dust generated by natural wear and deposited in the interior of the motor or in the slip ring space must be removed at regular intervals. It is recommended to include the electric motors in the regular routine inspections of the driven machine.

18. Auxiliary devices

As option the motors can be equipped with auxiliary devices.

18.1 Motors with Thermal Winding Protection

For monitoring the stator winding temperature it is possible to have thermo couples installed in the motor (PTC thermistors, KTY or PT100). For their connection suitable auxiliary clamps for auxiliary circuits are available in the main terminal box or in additional terminal boxes. The connection is done according to the attached connection diagram.

A continuity test of the thermistor sensor circuit using a test lamp, a hand generator and such like is strictly prohibited because this would destroy the sensors immediately. If it becomes necessary to verify the cold resistance of the sensor circuit (at approx. 20°C) then the measuring voltage must never exceed 2.5 V DC. It is recommended to carry out the measurement using a Wheatstone bridge with a 4.5 V DC supply voltage. The cold resistance of the sensor circuit must never exceed 810 Ohms; a measurement of the hot resistance is not necessary.



With motors that are fitted with thermal winding protection, care must be taken that when the thermal winding protection responds and after the cooling down of the motor, no hazards can occur due to spurious automatic reconnection.

18.2 Anti-condensation heating

The input supply voltage is indicated on the name plate of the motor. For their connection either in the main terminal box or in the auxiliary terminal boxes suitable clamps for auxiliary circuits are provided. The connection is done according to the attached connection diagram. The anti-condensation heating has to be switched on only after disconnection of the motor. It shall not be switched on while the motor is in operation.

18.3 Forced ventilation unit

The forced ventilation unit is dissipating the lost heat at operation of the main motor. During operation of the main motor the motor of the forced ventilation unit has to be switched on. After disconnection of the main motor the forced ventilation has to continue depending on the temperature. For motors with forced ventilation units that are dependent of the sense of rotation, the sense of rotation has to be observed unconditionally (see rotation mark). Only manufacturer approved forced ventilation units shall be used. The forced ventilation unit has to be connected according to the connection diagram that is supplied inside of the terminal box.

19. Warranty, Repair, Spare Parts

Unless expressly agreed otherwise only our contractual workshops are permitted to carry out repairs during the warranty period. Other repairs that may potentially be required can also be carried out by skilled personnel in these workshops. Details about Customer Service network can be obtained from the manufacturer on request. The spare parts are listed in Section 24 of these Operating & Maintenance Instructions. Maintenance carried out appropriately (provided it is as described in Section "Maintenance") does not constitute a breach of warranty provisions. The contractual warranty liability on the part of the manufacturer is not prejudiced by this.

20. Electromagnetic Compatibility

The motors, as non-independently working unit, have been checked with regard to their conformity with the EMC Standards. It is the responsibility of the equipment operator to ensure by suitable measures that the apparatus or plant in their entirety comply with the relevant electromagnetic compatibility standards.

21. Trouble Shooting

General mechanical and electrical faults are to be rectified according to the Schedule in Section 25. All Safety Regulations must be strictly observed when rectifying faults.

22. Terminal board circuits

For a machine with only one shaft end or with two shaft ends that have different diameters, the sense of rotation is that rotational direction which is seen, if a person looks at the front end of the only or thicker shaft end.

For each motor the correct connection diagram is attached. The connection must be done accordingly. For the connection of auxiliary circuits please see the additional connection diagram, which is also attached.

23. Disposal

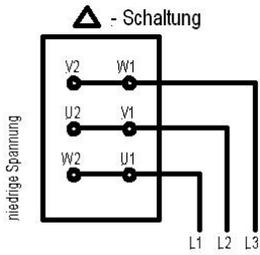
When disposing of the motors please observe applicable national law.

In addition please take care that all oil and grease is disposed according to the ordinance of waste oils (Altölverordnung). They must not be contaminated with solvents, cold cleaners and paint residues.

Before recycling the individual materials must be separated. Most important components are grey cast iron (housing), steel (shaft, stator and rotor sheets, consumables), aluminium (rotor), copper (windings) and plastics (insulation materials like for example Polyamide, Polypropylene and others). Electronic components like printed circuit boards (inverter, encoder, etc.) must be recycled separately.

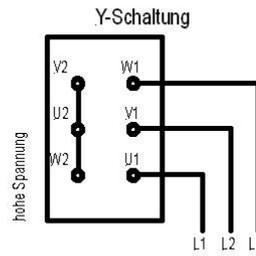
Single speed squirrel-cage motors:

Δ low voltage

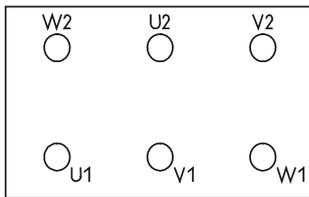


Single speed squirrel-cage motors:

Y high voltage

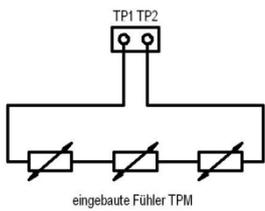


Star-delta switch connection:



For star-delta switch without bridges, connection according to the switch scheme

Motor with thermal winding protection



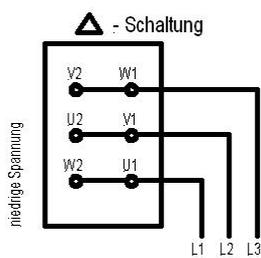
Terminal board connection as above

The connection will be implemented according to the connecting diagramme of the tripping device

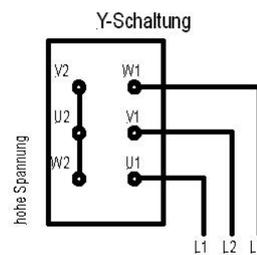
Slip ring motor

Stator

Δ low voltage



Y high voltage



Rotor

Rotor connection according to type either to rotor terminals or brush holders

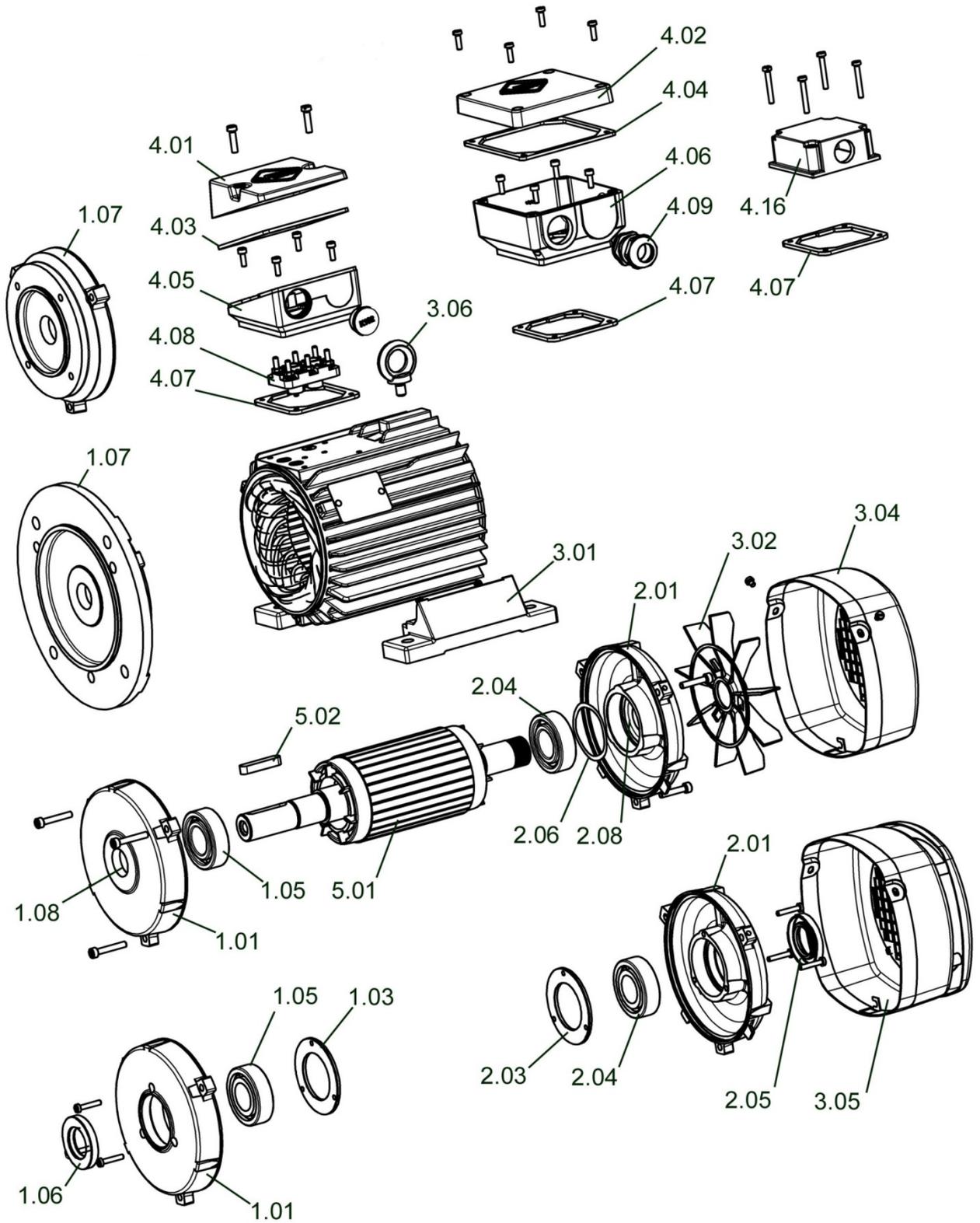


to the starter

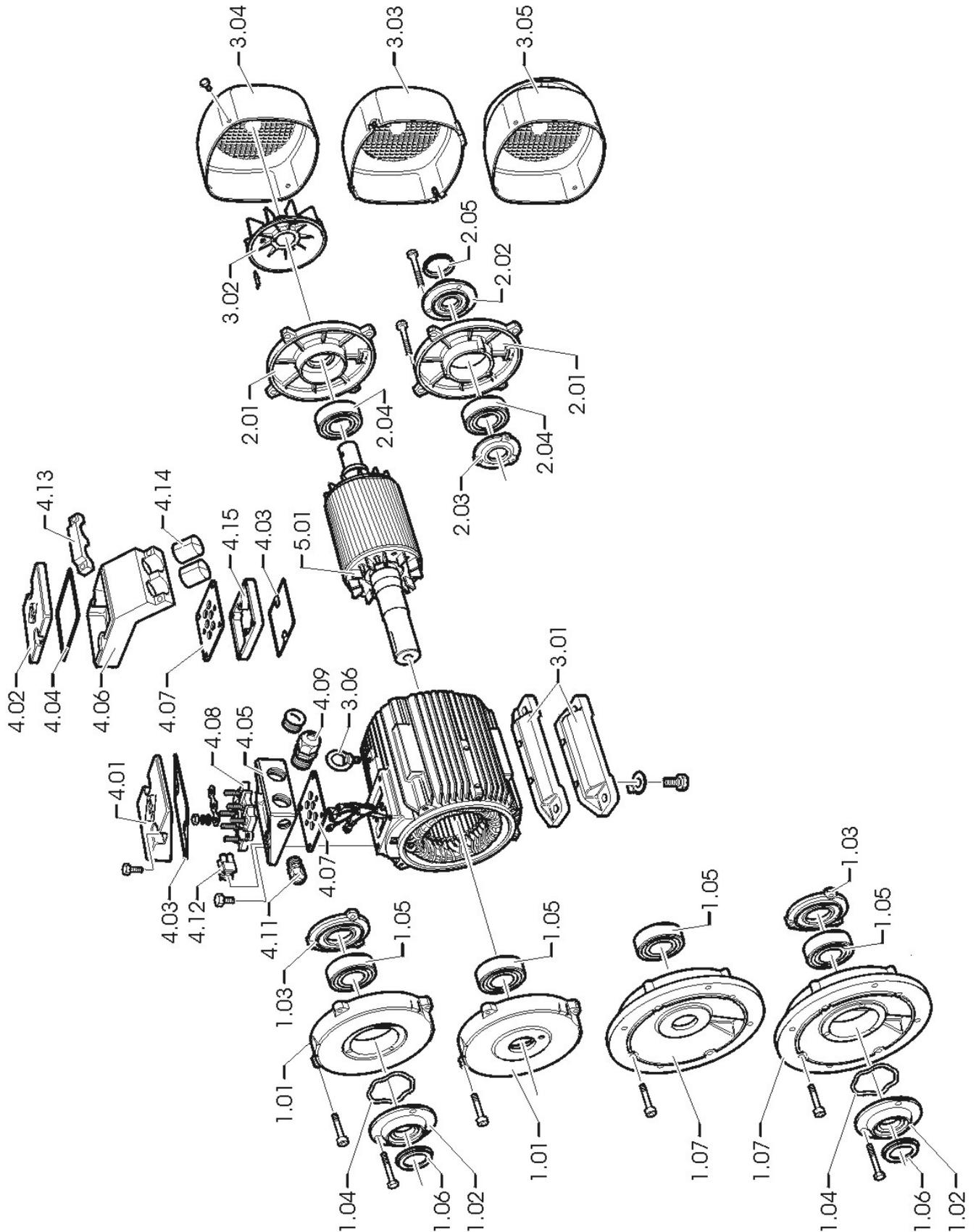
24. Construction of the motor

Item No.	Bezeichnung	Designation
1.01	Lagerschild D-Seite	End shield Drive end
1.02	Lagerdeckel, D-Seite, außen	Bearing cover, Drive end, external
1.03	Lagerdeckel, D-Seite, innen	Bearing cover, Drive end, internal
1.04	Tellerfeder / Wellfeder, D-Seite, nicht bei Rollenlagern	Disc spring / wave washer, Drive end, not for roller bearings
1.05	Wälzlager D-Seite	Antifriction bearing, Drive end
1.06	V-Ring D-Seite	V-type rotary seal, Drive end
1.07	Flanschlagerschild	Flange end shield
1.08	Filzring D-Seite	Felt ring, Drive end
2.01	Lagerschild N-Seite	End shield Non-drive end
2.02	Lagerdeckel, N-Seite, außen	Bearing cover, Non-drive end, external
2.03	Lagerdeckel, N-Seite, innen	Bearing cover, Non-drive end, internal
2.04	Wälzlager N-Seite	Antifriction bearing, Non-drive end
2.05	V-Ring N-Seite	V-type rotary seal, Non-drive end
2.06	Wellfeder	Wave washer
2.08	Filzring N-Seite	Felt ring, Non-drive end
3.01	1 Paar Motorfüße	1 pair of motor feet
3.02	Lüfter	Fan
3.03	Lüfterhaube, Kunststoff	Fan cowl, plastic
3.04	Lüfterhaube, Stahlblech	Fan cowl, sheet steel
3.05	Lüfterhaube mit Schutzdach	Fan cowl with canopy
3.06	Ringschraube	Lifting eye bolt
4.01/4.02	Klemmenkastendeckel	Terminal box cover
4.03/4.04	Dichtung Klemmenkastendeckel	Terminal box cover gasket
4.05/4.06	Klemmenkastenunterteil	Terminal box base
4.07	Dichtung Klemmenkastenunterteil	Terminal box base gasket
4.08	Klemmenplatte	Terminal plate
4.09	Kabeleinführung	Cable gland
4.10	Verschlusschraube	Screw plug for gland opening
4.11	Kabeleinführung für thermischen Wicklungsschutz	Cable gland for thermal winding protection
4.12	Anschluss für thermischen Wicklungsschutz	Terminal for thermal winding protection
4.13	Schelle	Clamp
4.14	Verschlussstücken	Sealing Components
4.15	Zwischenplatte	Adapter plate
4.16	Flacher Anschlusskasten	Flat terminal box
4.17	Normalienbeutel	Standard parts bag
5.01	Läufer, komplett	Rotor, complete
6.01	Schleuderscheibe, D-Seite	Grease thrower ring, Drive end
6.02	Schleuderscheibe, N-Seite	Grease thrower ring, Non-drive end
6.03	Labyrinthbuchse, D- u. N-Seite	Labyrinth gland, Drive and Non-drive end
6.04	Leitscheibe, D-Seite	Guide disc, Drive end
6.05	Leitscheibe, N-Seite	Guide disc, Non-drive end
7.01	Schleifringläufer mit Schleifringen	Slip ring rotor with slip rings
8.01	Bürstenhalter	Brush holder
8.02	Bürstenträgerplatte mit Bürstenbolzen	Brush carrier plate with brush rod
8.03	Schutzdeckel für Schleifringraum	Protective cover for slip ring compartment
8.04	Dichtung für Schutzdeckel	Gasket for protective cover
8.05	Deckel für Lüfterhaube	Cover for fan cowl
9.01	Klemmenkastendeckel für Läuferklemmenkasten	Terminal box cover for Rotor Terminal Box
9.02	Dichtung Klemmenkastendeckel für Läuferklemmenkasten	Gasket for terminal box cover for Rotor Terminal Box
9.03	Klemmenplatte für Läuferanschluss	Terminal board for rotor connection
9.04	Klemmenkastenunterteil für Läuferanschluss	Terminal box base for rotor connection
9.05	Kabeleinführung für Läuferanschluss	Cable gland for rotor connection
9.06	Zwischenflansch für Läuferklemmenkasten	Adapter flange for rotor terminal box
9.07	Verschlusschraube für Läuferanschluss	Screw plug for rotor connection

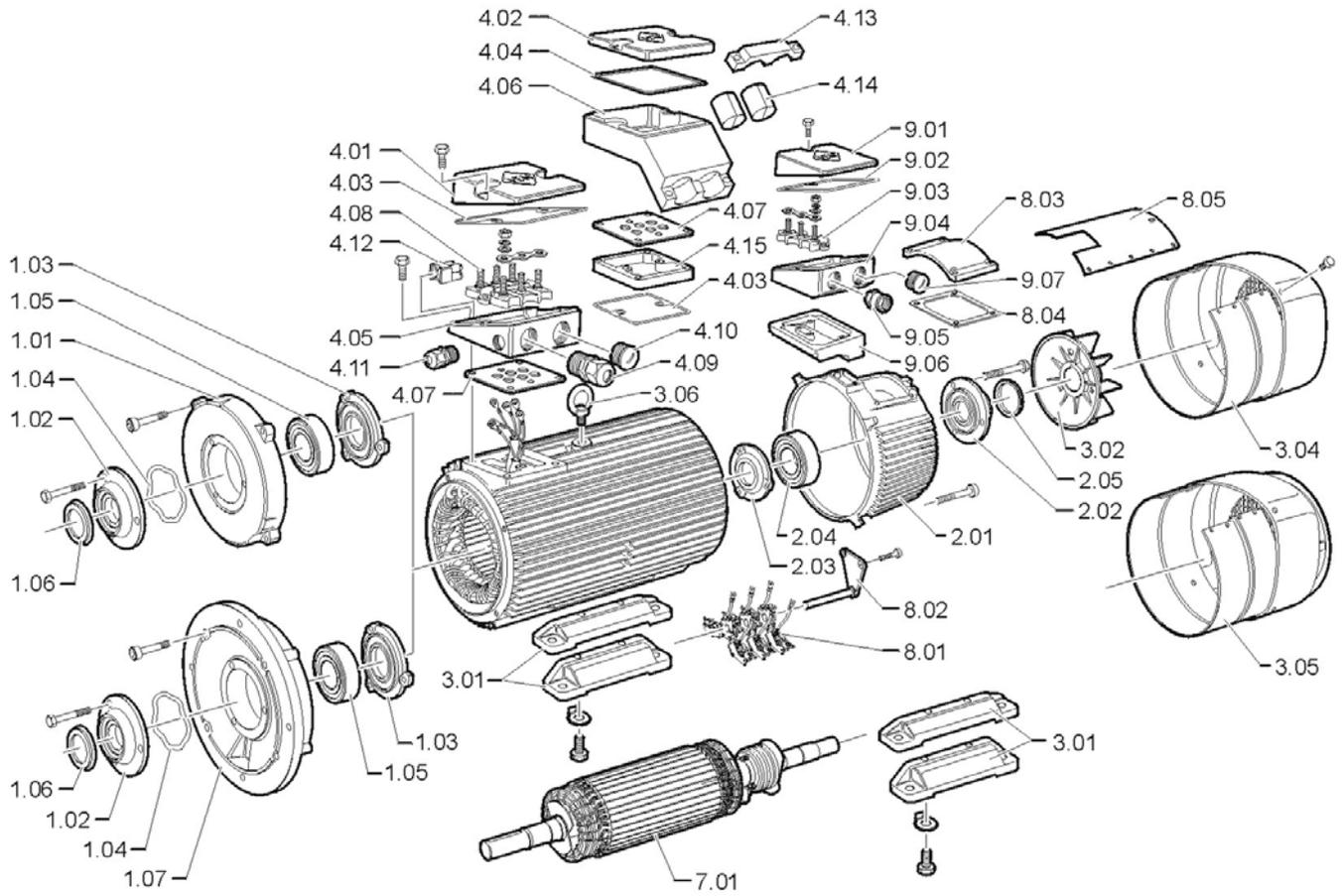
Three phase asynchronous motor with squirrel cage rotor / basic version K2.R 56 – 132T
 (example, delivered version may differ in details)



Three phase asynchronous motor / basic version K1.R / K2.R 112 - 355
(example, delivered version may differ in details)



**Three-phase asynchronous motor with slip ring rotor / basic version S11R / SPER, S11H / SPEH
(example, delivered version may differ in details)**



25. Trouble shooting

25.1 Electrical Faults

	Motor doesn't start	
	Motor runs up heavily	
	Humming noise during start	
	Humming noise during operation	
	Hum in time of the double slip frequency	
	Excessive warming up at no-load operation	
	Excessive warming up at rated output	
	Excessive warming up of individual winding sections	
	Possible cause of fault	Remedial measure
●	Overload	Decrease the load
●	Interruption of a phase in the supply conductor	check the switch and the supply conductor
● ● ●	Interruption of a phase in the supply conductor after switching-on	check the switch and the supply conductor
●	Mains voltage too low, frequency too high	check the mains conditions
●	Mains voltage too high, frequency too low	check the mains conditions
● ● ● ●	Stator winding misconnected	check the winding connections
● ● ●	Turn-to-turn fault	check the winding and the insulation resistance, repair in authorized service workshop
● ● ●	Phase-to-phase short circuit	check the winding and the insulation resistance, repair in authorized service workshop
●	Interruption in the squirrel cage winding	repair in authorized service workshop

25. 2 Mechanical Faults

	Dragging noise	
	Excessive warming up	
	Strong vibrations	
	Bearing warming up excessively	
	Bearing noises	
	Possible cause of fault	Remedial measure
● ● ●	Rotary parts are dragging	Determine the cause, re-align parts
●	Air supply reduced	Check the ventilation passages
●	Unbalance of the rotor	Take rotor off, re-balance it
●	Rotor not circular, shaft deformed	Take rotor off, co-ordinate further measures with the manufacturer
●	Imperfect alignment	Align motor & driven machine, check the coupling
●	Unbalance of the coupled machine	Re-balance coupled machine
●	Shocks from the coupled machine	Check the coupled machine
●	Irregularities from the gear	Check and repair the gear
●	Resonance with the foundation	Stiffen the foundation after consultation
●	Changes in the foundation	Determine the cause, eliminate it and re-align the machine
●	Too much grease in the bearing	Remove excess grease
●	Coolant temperature higher than 40 °C	Regrease bearing with suitable grease
●	V-type rotary seal or gamma ring are dragging	Replace V-type rotary seal or gamma ring, maintain the prescribed installation clearance
● ●	Lubrication insufficient	Lubricate according to instructions
● ●	Bearing is corroded	Replace bearing
● ●	Bearing clearance too small	Use bearing with larger bearing clearance
●	Bearing clearance too large	Use bearing with smaller bearing clearance
●	Chatter marks in the bearing track	Replace bearing
●	Standstill marks	Replace bearing
●	Cylindrical roller bearing operated at low load	Change the bearing according to manufacturer's instructions
●	Coupling pushes or pulls	Re-align motor & driven machine
●	Belt tension too high	Adjust the belt tension according to instructions
● ●	Bearing not aligned or stressed	Check the bearing bore, consult the manufacturer

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D-08066 Zwickau

EC Declaration of Conformity

The electrical apparatus

three-phase asynchronous motors/generators with squirrel-cage rotor,
three-phase asynchronous motors/generators with slip-ring rotor

of the series

AR../A1../A2../A4../AU../AV../AE..
BR../BP../B1../B2../B4../BU../BV../BE../BD../BL..
CP../CPE../C1..
G1../G2../G4../GS1../GE..
KP../K1../K2../KD../KL../KU../KV../K4../K8..
SP../SPE../S1../S8..
WE../W2../W4../WU../WV../WP../WD../WL..
YP../Y1../Y2../Y4../YE../YU../YV..
Gear motors S(R)14..., S(R)P4, S(R)K4..., SG..., SP...
KIXB...ARG... followed by the motor type

Motors that comply with the Regulation 2005/32/EC and the order No. 4/2014 receive the marking IEx before the type designation, whereas x= 1,2,3,4 (acc. to EN 60034-30-1)

are in conformity with the instructions of the following EU Directives :

2006/95/EC

Directive of the European Parliament and the Council from 12th December 2006 for harmonisation of legislative provisions of the member states concerning electrical equipment for operation within certain voltage limits

2004/108/EC

Directive about Electromagnetic Compatibility

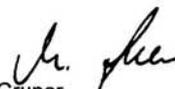
The conformity with the instructions of these Directives is proved by the observation of following standards:
European Standard / German Standard

EN 61000-6-1:2007-01, EN 61000-6-2:2005-08, EN 61000-6-3:2007-01, EN 61000-6-4:2007-01
EN 55014-1:2006-12, EN 55014-2:1997-02
EN 61000-3-2:2006-04, EN 61000-3-3:2013-08
EN 60034-1:2010-10, EN 60034-2-1:2014-09, EN 60034-5:2001-02, EN 60034-6:1993-11,
EN 60034-9:2005-05, EN 60034-30-1:2014-06, IEC 60038:2009-06, EN 60204-1:2006-06

The specified product is exclusively intended for fitting into another machine/installation. Start of operation is permitted until conformity of the end product with the directive 2006/42/EC is established.
Date of first application of CE-mark: 01.1996

Wernigerode, 2015-02-24


Strümpel
Managing Director


Gruner
Managing Director

This certificate attests the conformity with the named Directives; however, it is not a promise of properties in the meaning of product liability. In case of electronic communication, the signature does not appear.

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