Installation, operating and maintenance instructions

Transnorm motors with squirrel-cage rotor
Low-voltage (up to 1.000 V)
High-voltage (up to 11.000 V)
Size 315 … 450

Translation

W41./W42./ A41./A42.
W52.

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= 2,3 (acc. to EN 60034-30)
(Example IE3-W42R 355 M 2)

Edition 12.2014 **Ident.-no. 83627 01**

This manual is subject to changes.

Content

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.

1.1 Qualified personnel

Electric motors have dangerous life parts and rotating parts and can also be hot on the surface. It is not permitted to stand on the motor. All work in connection with transport, storage, installation, connection, commissioning and maintenance must be done by responsible qualified staff (in accordance with EN 50110-1 / DIN VDE 0105 / IEC 60364). Improper use can result in severe injuries and material damage.

1.2 Intended use

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

The motors comply with the harmonized standard series IEC/EN 60034 / DIN VDE 0530. The use in explosive atmosphere is prohibited, if they are not expressly designed for this application.

Delivery of motors complying with special regulations (i.e. classification societies, regulations for explosion protection) is possible. For these applications special additional manuals are available like for example for roller table motors and motors in explosion protected design. As scope of delivery the details on the corresponding order confirmation are binding.

High-voltage motors are designed for use in industrial plants according to the directive for machine safety 2006/42/EC. The commissioning is prohibited until the final product complies with the directive (please observe especially the local security and installation regulations i.e. EN 60204).

1.3 Check after delivery

Please check if there was any damage on the motor during transport. Transport damages must be reported immediately to the forwarding agent and 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 cannot 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.

A claim of warranty is excluded in case the operation conditions of the motor were changed, the design of the motor was modified or repair work was done without prior written agreement from the production site of VEM that has manufactured the motor.

1.5 Used units

The units used in the manual are based on the SI system (metric system).

2. General description

2.1 Motor design

Three-phase asynchronous motors with squirrel-cage rotor in series **W41./W42./A41./A42./W52.** Are surface-cooled motors (rip cooling) that are manufactured in shaft sizes 315, 355, 400 and 450 mm. The motors are manufactured in basic design with cooling type IC 411 and type of protection IP 55. Other types of cooling, i.e. IC 416 (forced ventilation), IC 410 (non-ventilated) and IC 31W (cooling with water jacket) or types of protection (i.e. IP 54, IP 56 or IP65) are possible on request as special design. The horizontal types of construction IM 1001 (IM B3), IM 2001 (IM B35) and the vertical type of construction IM 3011 (IM V1) are standard design. Other types available on request.
Please refer to the name plate and to the data sheets of the electronic catalogue for all information on your motor.

The motors consist of the following main components:

- Stator housing with laminated core and winding
- End shield with bearing
- Rotor with pressure casted winding
- Fan with fan cover
- Terminal box

The stator housing with feet is produced in grey cast iron. The end shields and terminal boxes for low-voltage motors are also made in grey cast iron. For high-voltage motors a welded steel construction is used for the terminal box. The cover of the fan on N-end is made of steel sheets or glass fibre reinforced plastics. The terminal box is placed on top as standard. For terminal boxes from shaft size 355 upwards an assembly of the terminal box at the sides is not possible.
The terminal boxes KK 200, 400 A and B can be rotated through 90°. The terminal boxes KK 630A and 1000A can be rotated through 180° and can be placed on top/straight, on top/diagonally to the right and on top/diagonally to the left. A later modification to another location is not possible for these types of terminal boxes. Marked earthing points can be found in the terminal box and on the stator housing.

2.2 Bearing

The motors are designed for horizontal types of construction and in basic design „light duty bearing“ with grooved ball bearings on D- and N-side. The basic design “heavy duty bearing” has a cylinder roller bearing on D-side. Other types of constructions can have a different type of bearing design. All bearings are dust-tight and from shaft size 315MX upwards they have lubrication device and grease feed regulator. (Information about bearings see chapter 12.3)

2.3 Cooling system

The motors are surface cooled (cooling type IC 411 complying with IEC 60034). The heat exchange is done from stator core to the ripped housing and from shaft size 355MX there is also an additional internal cooling cycle, which transfers part of the generated thermal losses to hollow rips designed as cooling channels. The motors all have an outer and inner fan. For cooling type forced ventilation (IC 416) the outer fan is not used. The air for surface cooling is sucked in through the additional fan installed within the cover.

2.4 Monitoring devices

Monitoring devices (thermal winding protection, speed monitoring, vibration monitoring, etc.) can be installed on customer request. For protection of stator windings against thermal overload PTC thermistors according to DIN 44081 can be installed (from shaft size 400 2 sets are standard; for high speed motors there are 6 PT100 in an additional terminal box). In addition it is possible to install PT100 sensors for monitoring of the winding temperature and/or bearing temperature. The related triggering units can be supplied on request.

2.5 Identification of motor

Each motor is marked with an identification number. It is listed on the name plate of the motor. This identification number must be indicated in each correspondence concerning the motor as it is a unique information necessary for identification of the individual motor.

As standard the motor name plate is printed in German/English as standard. Other languages are available related to the order and to the motor type. On the name plate the following details of the motor are listed: type designation, motor number and the most important rated values like output, rated voltage and frequency, rated current, type of construction, power factor, speed and thermal class. The information can differ according to the individual types. For motors with lubrication device the amount of grease for each lubrication and the lubrication periods are also listed on the name plate or on an additional plate. The name plates are fixed on the housing by grooved drive studs. They can be made in aluminium or stainless steel.

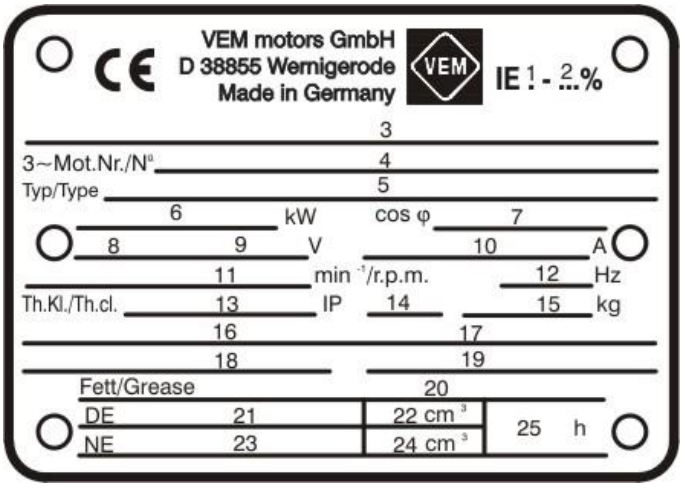


Figure 1 Example for name plate and mains operation

Item no.	Information on name plate/designation	
1	Efficiency class (IE1/IE2/IE3…)	
2	Efficiency	
3	Standard and individual approval stamp	
4	Motor number, current type	3~Mot.no.
5	Type designation	
6	Rated output	kW
7	Rated power factor	
8	Connection type	
9	Rated voltage	V
10	Rated current	A
11	Rated speed	r.p.m.
12	Rated frequency	Hz
13	Thermal class	Th.cl.
14	Type of protection	IP
15	Mass of product	kg
16	Additional information	
17	Additional information, coolant temperature 1 / coolant temperature 2*)	°C *)
18	Type of construction	
19	Month/year of construction	
20	Type of grease	
21	Bearing DE	
22	Amount of grease DE	g
23	Bearing NE	
24	Amount of grease NE	g
25	Lubrication interval	h

*) when coolant temperature is 40°C, no indication on the name plate

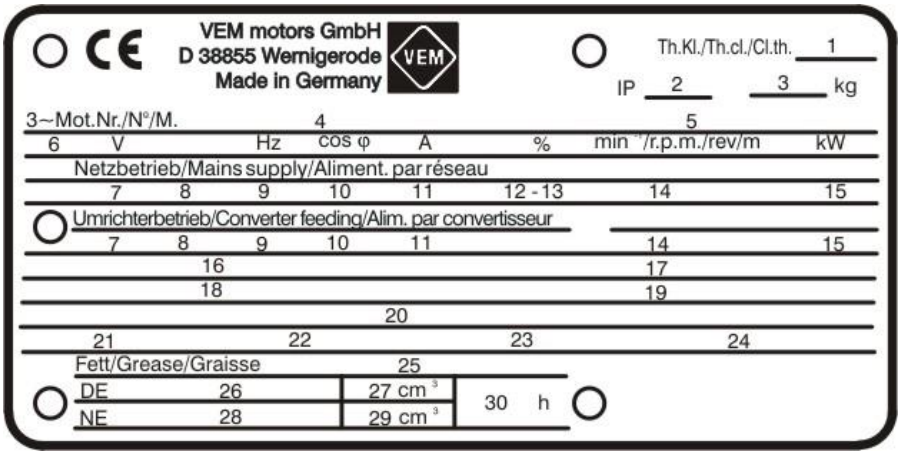


Figure 2 Example for name plate and inverter operation

Item no.	Information on name plate/designation	
1	Thermal class	
2	Type of protection	
3	Mass of product	kg
4	Mot.-Nr. current type	3~Mot.no.
5	Type	
6	Units of measurement	V
		-
		Hz
		cos φ
		A
		r.p.m.
		kW
7	Rated voltage	
8	Connection type	
9	Mains frequency	
10	Rated power factor	
11	Rated current	
12	Efficiency class	
13	Efficiency	
14	Rated speed	
15	Rated output	
16	Inverter information part 1	
17	Inverter information part 2	
18	Inverter information part 3	
19	Inverter information part 4	
20	Additional information	
21	Type of construction	
22	Standard	
23	Month/year of construction	
24	Additional information, coolant temperature 1 / coolant temperature 2*)	°C *)
	Standard and individual approval stamp	
25	Type of grease	
26	Bearing DE	
27	Amount of grease DE	g
28	Bearing NE	
29	Amount of grease NE	g
30	Lubrication interval	h

*) when coolant temperature is 40°C, no indication on the name plate

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 ≥ 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, 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.

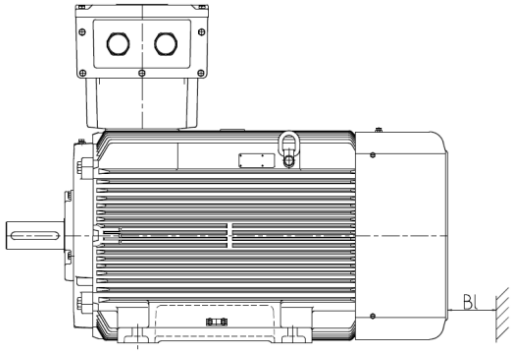
6. Transport, Storage and Packing
If possible the motors should only be stored in closed and dry rooms. Outdoor storage under cover is permitted for a short time only and requires adequate protection against all harmful effects of the climate. The motors also have to be protected against mechanical damage. 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. No other additional load must be lifted together with the motor. 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.

When handling parts of the motor ropes for lifting must not be slung around bearings on the shaft. If transport is not possible in another way the bearings must be protected accordingly.

7. Installation and Fitting
7.1 General remarks
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.

The permissible coolant temperature (room temperature at place of installation) according to IEC/EN 60034-1 is max. 40°C/min. –20°C without labelling and the permissible altitude of site is up to 1000 m above sea level (other than the given values have to be specified on the name plate of the motor and must be certified separately if necessary).

Please make sure that the cooling air can enter and leave the air in/outlet without hindrance and without getting sucked in again. Inlet and outlet openings have to be protected against pollution and dirt particles. The direct intake of discharged air from neighbouring aggregates must be prevented by suitable measures. The minimum distance of air inlet of the fan cover against any obstacles (dimension Bl) has to be observed under all circumstances.



Size	Bl [mm]
315	55
355	60
400	100
450	100

Figure 3: Minimum distance for air inlet

It must be prohibited that foreign particles and liquids can fall into the fan of motors with vertical shaft orientation. This shall be done as follows:

Shaft end directed downwards:
The protection cover of the fan is equipped with a protective roof (supplied condition).

Shaft end directed upwards:
For type of constructions with shaft end upwards the operator has to ensure that no foreign substances can fall inside from above. For shaft ends directed upwards it must be prohibited that water or other liquids can penetrate into the motor next to the shaft.

When setting up surface-cooled motors it must be observed that the bore for condensate drain is located at the lowest point. If the bores are closed as standard, they must be closed again after the condensate is drained. When the bores are open direct contact with water jets or water splashes must be avoided. A careful set-up of the motors on completely level fundament is absolutely necessary to avoid tension during fastening. When machines must be coupled exact alignment is necessary. It is recommended to use elastic couplings.

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 centring 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.

7.2 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).

7.3 Deconservation

The motor is conserve by the manufacturer. The conservation of machine parts must only be removed when the installation starts at the installation site. The deconservation is done by using commercial solvents (i.e. benzine or cleaning solvents).

Caution!
When using chemical solvents observe the warning notices and instructions for use in the applicable material safety data sheet. Chemicals must be suitable for the components, especially for plastic parts.

7.4 Completion of motor

In some exceptional cases the transport of the motor is done with all accessories (i.e. fan cover, fan motors or encoders) separately. These parts must be attached to the motor by using the supplied securing components according to the dimensional drawing.

7.5 Mounting the coupling

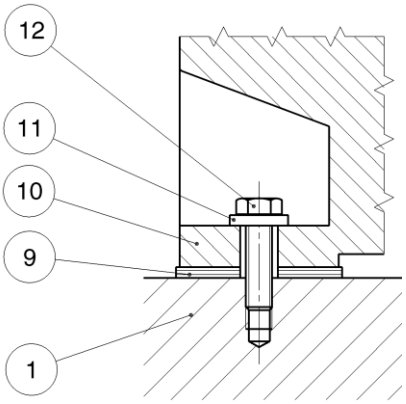
Caution!
For motors with two floating bearings only couplings with limited axial clearance must be used.
Attention!
The coupling must be balanced with balancing class G2.5 according to ISO 1940.

The following steps are necessary, if nothing else is described by the manufacturer of the coupling:

- The mounting temperature of the coupling must be detected.
  (belongs to the scope of work for coupling design)
- The dimensions and shape of shaft end and coupling bore must be checked.
- All contact surfaces must be deconserved (see chapter 7.3)
- The coupling half must be warmed evenly until mounting temperature is reached (i.e. by induction heating, in a furnace or with a ring burner.
- The coupling half must be mounted quick and centrically on the shaft end. During this assembly no hammering must be used so that the bearings will not be damaged.

7.6 Steel foundations

The design of a steel foundation is determined by the application of the motor. In many cases they are foundation slabs or steel floors in buildings or vehicles. Foundation slabs must be erected on load-bearing concrete.
When the motor is starting or running down the natural frequency is passed in case of foundations with deep frequency tuning. This can result in unsteady running for a short period of time.



1	Steel foundation
9	Shims for exact alignment
10	Foot of machine
11	Washer, reinforced
12	Hexagonal head screw ISO 4017

Procedure:

- The motor is placed on the prepared raw foundation.
- The exact alignment can be done immediately if the threaded holes for the foot bores are already available in the steel foundation (1) (see chapter 8). In all other cases further steps are necessary.
- The motor must be aligned roughly. During this process a uniform gap (for exact dimension refer to the coupling manufacturer or plant project) between the coupling and the work machine must be kept. The dimension of the gap must be measured right and left. The difference should not be bigger than 0.5 mm. The motor must stand 3-4 mm lower than the work machine so that it is possible to do exact alignments with shims.
- The foot bores have to be marked on the steel foundation (1).
- The motor is removed.
- In the marked places core holes must be drilled in the steel foundation suitable for the hexagonal head screws (12). The holes must then be threaded. Chips from threading must be removed.

- After the motor has again been placed on the steel foundation the exact alignment can start immediately (see chapter 8).

7.7 Concrete foundations

The used concrete must have a minimum quality complying with strength class C20/25 according to EN 206-1 or C20/25 according to DIN 1045-2. Before starting the work the raw foundations must be compared with the information on the dimensional drawing.

The term „anchor bolt“ is used in the following for anchor screws, stone bolts and T-head bolts.

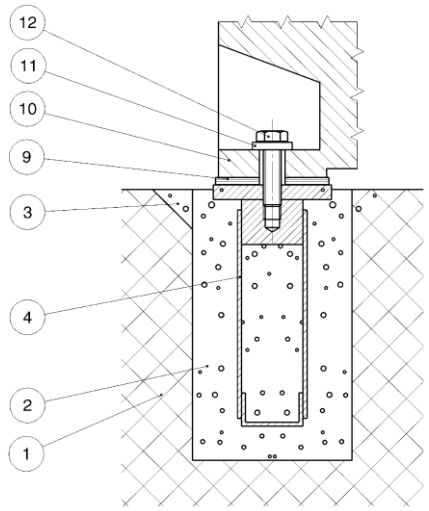
In the following figures the anchor bolts are used shortened. The length depends on the constructional details.

Tightening torques

The tightening torques are only valid for anchor bolts in concrete foundations. For tightening torques for motor screws refer to chapter 11.

	Threads lubricated with MoS2 compound (μ=0,11)		Threads slightly oiled (μ=0,14)	
Dimension	Assembly	Test	Assembly	Test
	[Nm]	[Nm]	[Nm]	[Nm]
M24	148	126	182	155
M30	296	252	366	311
M36	509	433	631	536
M42	826	702	1025	871

7.7.1 Concrete foundation with foundation blocks



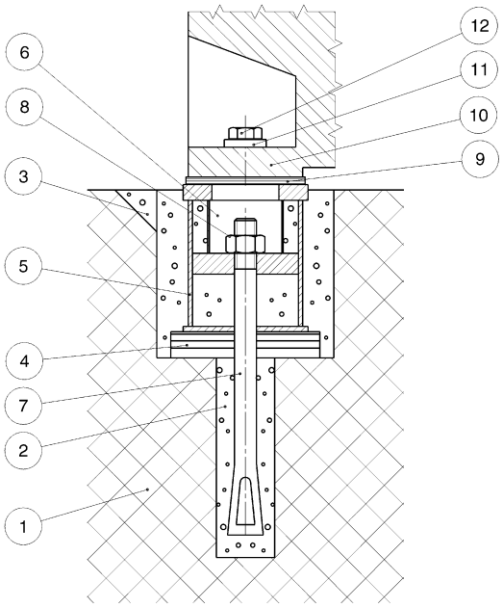
1	Raw foundation
2	Cast concrete
3	Sprue
4	Foundation block
9	Shims for exact alignment
10	Foot of machine
11	Washer, reinforced
12	Hexagonal head screw ISO 4017

Procedure:

- The foundation blocks (4) are screwed on centred to the through bores of the machine feet (10) without the shims (9). To ensure exact centring the hexagonal head screws (12) can be covered with pieces of cardboard.
- The motor is placed on the prepared raw foundation (1) were the holes for the foundation blocks (4) are already available.
- The motor must be aligned roughly. During this process a uniform gap (for exact dimension refer to the coupling manufacturer or plant project) between the coupling and the work machine must be kept. The dimension of the gap must be measured right and left. The difference should not be bigger than 0.5 mm. The motor must stand 3-4 mm lower than the work machine so that it is possible to do exact alignments with shims.
- With a water level the horizontal alignment in longitudinal and transversal direction is checked. For the longitudinal check the water level is placed on the cylindrical shaft end or the clutch hub; for the transversal check it is placed on the housing. If necessary the above listed steps must be repeated.
- The bores of the foundation blocks must be wetted and if necessary excess water must be removed.

- The bores of the foundation blocks must be filled with concrete (2). Take care that the concrete is not higher than approx. 10 mm below the upper edge of the concrete block (4).
- Depending on the type of concrete the hardening of the cast concrete can take up to one week. During hardening the motor should remain placed on the foundation.
- The hexagonal head screws (12) in the motor feet must be loosened. If strips of cardboard were used, they must be removed. Then the exact alignment can be done (see chapter 8).

7.7.2 Concrete foundation with base plate or base frame / with stone bolts



1	Raw foundation
2	Cast concrete
3	Sprue
4	Flattened steel bar for rough alignment
5	Base plate / base frame
6	Anchor bolt sleeve
7	Anchor bolt: stone bolt DIN 529
8	Hexagonal nut ISO 4032
9	Shims for exact alignment
10	Foot of machine
11	Washer, reinforced
12	Hexagonal head screw ISO 4017

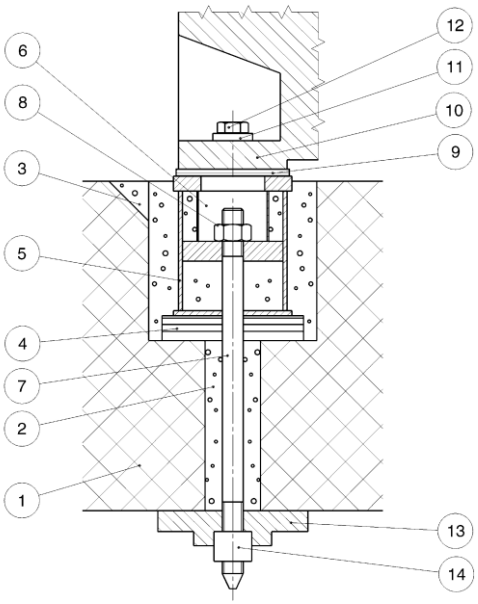
In the following the construction with base plates is described. The construction with base frame is done in the same way.

Procedure:

- The base plates (5) must be screwed centred to the through bores of the motor feet (10) without shims (9). To ensure exact centring the hexagonal head screws (12) can be covered with pieces of cardboard.
- The stone bolts (7) must be placed from below in the anchor bolt sleeves (6) and then fastened at the upper end with a hexagonal nut (8). The thread should jut out for approx. 20 mm.
- The motor is placed on the prepared raw foundation (1). Below the base plate there should be 40 to 60 mm space for flattened steel bars for rough alignment (4).
- By placing flattened steel bars (4) between raw foundation (1) and base plate (5) the motor is roughly aligned. The flattened steel bars (4) should be placed within a distance of approx. 500 mm and immediately left and right of the anchor bolt sleeves (6) so that the stone bolts (7) will not distort the base plate when tightened. The motor must stand 3-4 mm lower than the work machine so that it is possible to do exact alignments with shims later. During the rough alignment a uniform gap (for exact dimension refer to the coupling manufacturer or plant project) between the coupling and the work machine must be kept. The dimension of the gap must be measured right and left, on top and from below. The biggest difference should not be bigger than 0.5 mm.
- With the hexagonal head screws (8) the stone bolts (7) are fastened.
- With a water level the horizontal alignment in longitudinal and transversal direction is checked. If necessary the above listed steps must be repeated.
- The block-outs in the raw foundation must be wetted and if necessary excess water must be removed.
- The block-outs are filled with cast concrete (2). Take care that the concrete is not higher than approx. 10 mm below the upper edge of the base plate (5).
- Depending on the type of concrete the hardening of the cast concrete can take up to one week. During hardening the motor should remain placed on the foundation.

- When the cast concrete is completely hardened, the hexagonal nuts (8) of the stone bolts (7) must be tightened crosswise.
- The hexagonal head screws (12) in the motor feet (10) must be loosened. If strips of cardboard were used, they must be removed. Then the exact alignment can be done (see chapter 8).

7.7.3 Concrete foundation with base plate or base frame / with anchor bolts



1	Raw foundation
2	Cast concrete
3	Sprue
4	Flattened steel bar for rough alignment
5	Base plate / base frame
6	Anchor bolt sleeve
7	Anchor bolt: stone bolt DIN 529
8	Hexagonal nut ISO 4032
9	Shims for exact alignment
10	Foot of machine
11	Washer, reinforced
12	Hexagonal head screw ISO 4017
13	Anchor plate
14	Special foundation nut

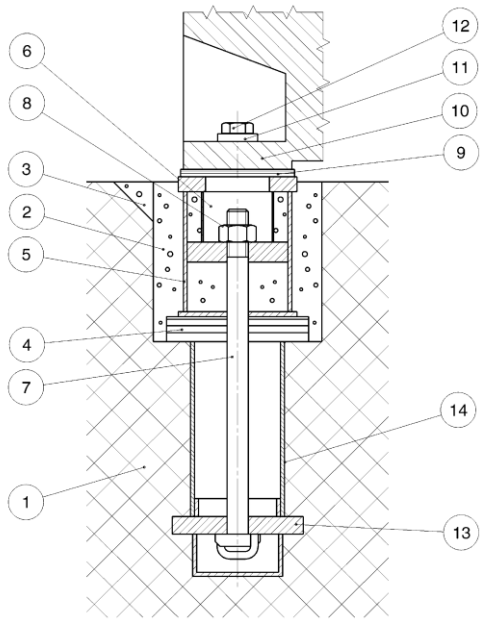
In the following the construction with base plates is described. The construction with base frame is done in the same way.

Procedure:

- The base plates (5) must be screwed centred to the through bores of the motor feet (10) without shims (9). To ensure exact centring the hexagonal head screws (12) can be covered with pieces of cardboard.
- The stone bolts (7) must be placed from below in the anchor bolt sleeves (6) and then fastened at the upper end with a hexagonal nut (8). The thread should jut out for approx. 20 mm.
- The motor is placed on the prepared raw foundation (1). Below the base plate there should be 40 to 60 mm space for flattened steel bars for rough alignment (4).
- The anchor plates (13) and special foundation nuts (14) are fastened temporarily so that a height alignment is possible. If necessary repeat the adjusting of the hexagonal nut (8) and special foundation nut (14).
- By placing flattened steel bars (4) between raw foundation (1) and base plate (5) the motor is roughly aligned. The flattened steel bars (4) should be placed within a distance of approx. 500 mm and immediately left and right of the anchor bolt sleeves (6) so that the stone bolts (7) will not distort the base plate when tightened. The motor must stand 3-4 mm lower than the work machine so that it is possible to do exact alignments with shims later. During the rough alignment a uniform gap (for exact dimension refer to the coupling manufacturer or plant project) between the coupling and the work machine must be kept. The dimension of the gap must be measured right and left, on top and from below. The biggest difference should not be bigger than 0.5 mm.
- With the hexagonal head screws (8) the stone bolts (7) are fastened crosswise. Take care that no distortions result in the machine feet.
- With a water level the horizontal alignment in longitudinal and transversal direction is checked. If necessary the above listed steps must be repeated.
- The block-outs in the raw foundation must be wetted and if necessary excess water must be removed.
- The block-outs are filled with cast concrete (2). Take care that the concrete is not higher than approx. 10 mm below the upper edge of the base plate (5).
- Depending on the type of concrete the hardening of the cast concrete can take up to one week. During hardening the motor should remain placed on the foundation.

- When the cast concrete is completely hardened, the hexagonal nuts (8) of the stone bolts (7) must be tightened crosswise.
- The hexagonal head screws (12) in the motor feet (10) must be loosened. If strips of cardboard were used, they must be removed. Then the exact alignment can be done (see chapter 8).

7.7.4 Concrete foundation with base plate or base frame / with T-head bolts



1	Raw foundation
2	Cast concrete
3	Sprue
4	Flattened steel bar for rough alignment
5	Base plate / base frame
6	Anchor bolt sleeve
7	Anchor bolt: T-head bolt DIN 261
8	Hexagonal nut ISO 4032
9	Shims for exact alignment
10	Foot of machine
11	Washer, reinforced
12	Hexagonal head screw ISO 4017
13	Anchor plate DIN 24539
14	Anchor plate DIN 24539 tube

In the following the construction with base plates is described. The construction with base frame is done in the same way.

Procedure:

- The anchor plates (13) and the corresponding tubes (14) are embedded in concrete according to the planned position of the anchor bolts in the raw foundation (1). During this process the tubes must not be filled with concrete.
- The base plates (5) must be screwed centred to the through bores of the motor feet (10) without shims (9). To ensure exact centring the hexagonal head screws (12) can be covered with pieces of cardboard.
- The T-head bolts (7) must be placed from below in the anchor bolt sleeves (6) of the base plate (5) and then fastened at the upper end with a hexagonal nut (8). The thread should jut out for approx. 20 mm.
- The motor is placed on the prepared raw foundation (1). Below the base plate there should be 40 to 60 mm space for flattened steel bars for rough alignment (4).
- The T-head bolts (7) are inserted in the anchor plates (13). There is only one possibility to insert the T-head bolts in the anchor plates. They are then fastened by rotating them around 90° in clockwise direction. To be able to do a rough alignment take care to have enough clearance for the anchor bolts.
- By placing flattened steel bars (4) between raw foundation (1) and base plate (5) the motor is roughly aligned. The flattened steel bars (4) should be placed within a distance of approx. 500 mm and immediately left and right of the anchor bolt sleeves (6) so that the T-head bolts (7) will not distort the base plate (5) when tightened. The motor must stand 3-4 mm lower than the work machine so that it is possible to do exact alignments with shims later. During the rough alignment a uniform gap (for exact dimension refer to the coupling manufacturer or plant project) between the coupling and the work machine must be kept. The dimension of the gap must be measured right and left, on top and from below. The biggest difference should not be bigger than 0.5 mm.
- With the hexagonal head screws (8) the T-head bolts (7) are fastened crosswise. Take care that no distortions result in the machine feet (10).
- With a water level the horizontal alignment in longitudinal and transversal direction is checked. If necessary the above listed steps must be repeated.
- The block-outs in the raw foundation must be wetted and if necessary excess water must be removed.

- The block-outs are filled with cast concrete (2). Take care that the concrete is not higher than approx. 10 mm below the upper edge of the base plate (5). The tubes (14) must not be embedded in concrete so that it is possible to change the T-head bolts (7) later.
- Depending on the type of concrete the hardening of the cast concrete can take up to one week. During hardening the motor should remain placed on the foundation.
- When the cast concrete is completely hardened, the hexagonal nuts (8) of the T-head bolts (7) must be tightened crosswise.
- The hexagonal head screws (12) in the motor feet (10) must be loosened. If strips of cardboard were used, they must be removed. Then the exact alignment can be done (see chapter 8).

8. Fastening, exact alignment

Caution!

A good alignment is prerequisite for a quiet, vibration-free operation of the motor. This is valid for rigid and flexible coupling. If the alignment is not correct, coupling defects or bearing damage can occur.

The length of engagement of the hexagonal head screws in the foot bores must be at least as long as the diameter of the screws.
The term „anchor bolt“ is used in the following for anchor screws, stone bolts and T-head bolts.

Tightening torques

See chapter 11

Necessary measurement devices

- Gauge with stand
- Laser alignment device
- Sensor gauge
- Water level

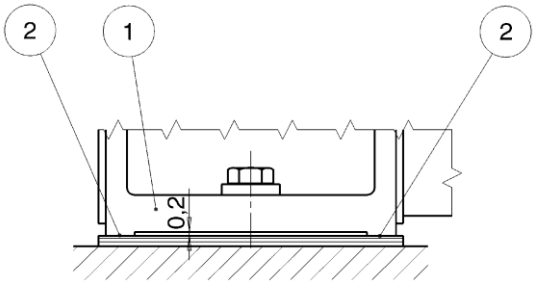
Preliminary preparations

Before exact alignment the following preparations must be done:

- The cast concrete must be hardened completely.
- Check the tight fit of the anchor bolt in the base plate or the base frame. Tightening torques see chapter 7.6.
- The openings of the anchor sleeves must be closed by using the supplied covers.
- All transport devices must be removed. See chapter 7.2.

Work flow

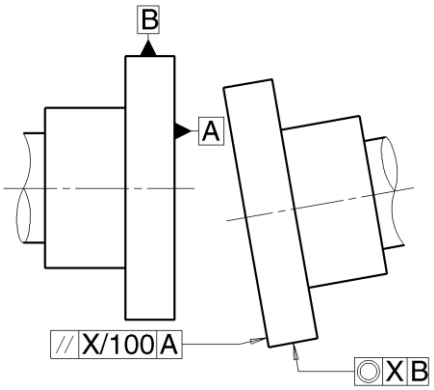
The exact alignment of the motor is done by measurement between the coupling halves of the motor and the work machine.
For alignment shims are placed under the motor feet. The thinnest shims must not be thicker than 0.3 mm. The shims must be combined in a way that the height compensation is realised with the smallest possible amount of shims. The shims must be fitting for the size of the feet. It must be possible that the whole foot rests on the shim. Motors with grey-cast feet have 0.2 mm relief cuts in the contact surfaces. These relief cuts are used for realising defined clamping. Therefore the rest of motor feet on the foundation must only be checked for all surfaces outside of the relief cuts during assembly.



1	Foot of the motor
2	Check of shims

Procedure (Figures see chapter 7):

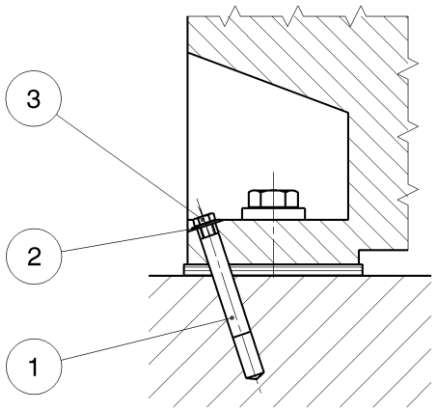
- The motor feet (10) must be loosely fitted to the foundation by using hexagonal head screws (12) and washers (11). Take care that there is enough clearance under the hexagonal head so that a height alignment of the motor is possible.
- A height alignment is done with shims (9) on all motor feet (10) until the coupling half of the motor is level with the coupling half of the work machine.
- Check with the sensor gauge on the shims, if the feet of the motor are evenly loaded. If necessary correct the shims.
- Check with the water level if the motor is horizontally level at right angle to the longitudinal axis. If necessary the above listed steps must be repeated.
- The motor must be moved axially so that the gap between the coupling halves complies with the dimension given by the coupling manufacturer or the plant specification.
- Check with a gauge if the axial runout of the coupling halves on the shafts is kept. The shafts must be rotated during this test. The values for axial runout must not exceed x given in the table below. Alternatively the manufacturer must be contacted.
- With the laser alignment device the following tolerances are checked. If the manufacturer of the work machine has defined dimensions about an increase in height for the work machine, this specification must be observed during alignment as well.



Speed [r.p.m.]	x [mm]
< 1,400	0.03
1,400 … 2,900	0.02
➢ 2,900	0.01

- The exact alignment is done by adding or removing shims and by moving the motor until the tolerances are kept. Afterwards fasten the hexagonal head screws (12) for the motor feet (10) crosswise.
- Recheck the correct alignment. This check must be repeated again after the rotor is rotated around 180°.
- The measured values must be recorded.

Bolting of the motor



1	Taper pins EN 28736
2	Washer, reinforced
3	Hexagonal head screw ISO 4017

The bolting of the motor is recommended to assist the alignment process during a possible reinstallation of this motor.

Procedure:

- Near the screw holes of the motor feet diagonal bores are made; the diameter depends on the size of the machine and is 12 to 25 mm. These bores must be extended diagonally into the steel parts of the foundation with the same diameter.
- These bores must be opened by using a taper reamer (taper 1:50) until it is possible to insert the taper pin flush from above.
- On the taper pin (1) the hexagonal head screw (3) must be screwed on together with the washer (2) for approx. 5 mm. Then the taper pin (1) is driven in carefully by using a hammer so that it is sunk in some mm.
- The hexagonal head screw (3) is screwed on tight by hand.
- When the motor is disassembled the taper pin can be removed by fastening the hexagonal head screw.

9. Insulation Check

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. 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!

Caution! Secure motor against accidental starting! Ground the windings at least 10 s to avoid electrostatic charging before and after insulation measurement!

To assess the insulation resistance the following table is used. Please observe that always the insulation value R_{is} of the cold motor (that is at ambient temperature of approx. 25°C) is assessed, as values from warm motors are not unambiguously reproducible. For a new motor from production or after rewinding of the stator the minimum value of the insulation at ambient temperature must comply with the values of point 1 in the table.
During transport and storage under unfavourable conditions this value can be reduced without damage to the insulation. Even motors standing still for some time under extreme climate conditions and with no anti-condensation heating (condensation on the winding) can be taken into operation if the insulation resistance of the cold motor is not below the values from point 2 of the table. If the insulation value is below that value the windings must be dried or in some special cases even cleaned and then dried. It must be checked if the insulation value was restored after a short time of operation. Under normal storage conditions and operational breaks the insulation resistance must not fall below the values from point 2 when the motor is still cold.

Voltage	Rated voltage < 1.5 kV	Rated voltage > 1.5 kV
Test voltage	> 100 V up to max. 500 V	1000 V
Test duration	1 min	
1. Winding new or after rewinding, dry, 25 °C	R_{is} > 50 MΩ	R_{is} > 100 MΩ
2. Winding after longer operational time, drying condition unknown, 25 °C	R_{is} > 1 MΩ	R_{is} > 5 MΩ / kV

Table: Insulation resistance

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

10. Motor connection

10.1 Electric connection for low-voltage (up to 1,000 V)

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!

The electric installation should be organised in detail before realisation. Connection diagrams delivered with the motor must be read carefully before starting installation work. It is important that the supply voltage and the frequency comply with the data on the name plate of the motor. In addition the mains voltage and the frequency must be within the limits of the tolerances specified within the corresponding standard. Please observe the data on the name plate and the connection diagram under all circumstances.

CAUTION! Ground the motor with the provided connection terminals for the grounding in the terminal box and on the foot.

The terminal box must be free of pollution, humidity and foreign particles. The terminal box itself, the cable glands and unused cable entries must be closed protected against dust and water. 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. The terminals for connecting additional devices and monitoring units are situated in the terminal box (in the additional terminal box only when ordered accordingly).

CAUTION ! The distances between live parts and against ground must not go below the following values:

Rated voltage U_N	[V]	400	500	725	1,000
Minimum distance	[mm]	6	8	12	14

Terminal box overview

Terminal box type	Terminal board	Rated current	Connecting thread	Tightening torque
		[A]		[Nm]
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	-

The arrangement of cable lugs, nuts and counter nuts must be done according to the drawings from chapter 20 (Design of terminal boxes).

10.2 Electric connection for high-voltage (2.2 kV up to 11 kV)
The terminals for connecting addition devices and monitoring units are situated in the additional terminal box.

CAUTION ! The distances between live parts and against ground must not go below the following values:

Rated voltage U_N	[kV]	3	3.3	6	6.6	10	11
Minimum distance	[mm]	36	40	60	70	100	110

The arrangement of cable lugs, nuts and counter nuts must be done according to the drawings from chapter 20 (Design of terminal boxes).

Terminal box	Rated current	Type of protection	Terminal	Cable lug	Max. terminal cross section
	[A]				[mm^2]
6 kV	250	IP 55	DIN46264-6-M16-Ms or DIN46264-6-M12-Ms *)	DIN46234	150
10 kV ± 10%	315 (400)	IP 55	DIN46264-6-M16-Ms	DIN46234, DIN46235	240

*) Bolt M12 only permitted for short-circuit power at the terminals of 200 MVA (DIN V 42962)

10.3 Direction of rotation
The marking of the terminals is done according to DIN EN 60034-8 / IEC 60034-8. In standard design motors are suitable for both directions of rotation. When the phases L1, L2, L3 are connected correct at the terminals U-V-W the motors rotate in clockwise direction; that means seen from the drive end the direction of rotation is in clockwise direction.

For motors only suitable for one direction of rotation the direction is marked by an arrow on the motor, on the fan or on the name plate. When these motors shall be operated in the other direction please contact the manufacturer first!

For direct starting and pole-changing motors with separate winding the direction of rotation can be reversed by changing two of the line conductors on the terminal board. For motors with star/delta-starting and pole-changing motors with Dahlander winding two line conductors must be changed at the supply to the motor switch.
A motor with only one shaft end or two shaft ends with different diameters the direction of rotation is that one seen from the front end of the only shaft end or the bigger shaft end.

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 (≈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 counter clockwise (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)

Thread Ø	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Attachment eyes	-	-	-	150	250	400
End shield	25	45	75	170	275	-
Bearing cover	15	20	20	-	-	-
Terminal box	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 (see ch. 7)
- 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.
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 centring 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 cannot 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	
Lubrication (as option)	See name plate or lubrication sign	
Main inspection	After about 10,000 operating hours	Once a year
Remove condensate water	Depending on the local environmental conditions	

12.1 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 (for standard grease and max. 120°C)
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.

12.2 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).
b) 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.
c) 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.
d) 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 12.3 Bearings and Lubrication). Apart from that the necessary lubrication 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.

12.3 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 up to 300°C/1h	Klüberquiet BQ 72-72 Asonic GHY 72	KE2/3R-40	-40 up to +180
For low temperatures	Asonic GLY 32	KPE2N-50	-50 up to +140
For high temperatures, Thermal class H rise H Roller table motors ARB, ARC Smoke exhaust design above 300°C/2h	Berutox FH 28 KN	KHC1R-30	-30 up to +180
Motors complying with VIK with lubrication device	HIGH- LUB LM 3 EP	KP3N-30	-30 up to +140
For very high ambient temperatures	Barrierta L55/3 HV	-	-25 up to 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 lubrication 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 above:

After extended storage time the bearing grease must be checked visually before starting the motor. When hardening or other irregularities are noticeable the grease must be exchanged. If the motor will be taken into operation after more than three years after delivery from the manufacturer the grease must be changed anyway.

		D-Seite (DS)										N-Seite (NS)			
		Leichte Lagerung LL						Schwere Lagerung VL							
				Druckfedern										Druckfedern	
	Bauform	Lagertyp	Tellerfeder	Typ	Stück	V-Ring	Ring	Lagertyp	Tellerfeder	V-Ring	Ring	Lagertyp	V-Ring	Typ	Stück
IE3-W41R 315 S2, M2	IM B3 IM V1	6316 C3	170	-	-	80A	-	NU 316 E	170	80A	-	6316 C3	80A	-	-
IE3-W41R 315 MX2, MY2, L2, LX2	IM B3 IM V1	6317 C3	180	-	-	-	85	NU 317 E	180	-	85	6317 C3 Q317 C3	85A	-	-
IE3-W41R 315 S4, M4	IM B3 IM V1	6317 C3	180	-	-	85A	-	NU 317 E	180	85A	-	6316 C3 Q316 C3	80A	-	-
IE3-W41R 315 MX4, MY4 IE3-W41R 315 L4, LX4	IM B3 IM V1	6320 J C3	215	-	-	-	100	NU 320 E	215	-	100	6317 C3 Q317 C3	85A	-	-
IE3-W41R 315 S6, M6, MX6, MY6 W41R 315 S8, M8, MX8, MY8		6320 J C3	215	-	-	-	100	NU 320 E	215	-	100	6317 C3 Q317 C3	85A	-	-
IE3-W41R 355 M2	IM B3 IM V1	6317 C3	180	-	-	-	85	NU 317 E	180	-	85	6317 C3 Q317 C3	85A	-	-
IE3-W41R 355M 4, 6	IM B3 IM V1	6324 J C3	260	-	-	-	120	NU 324 E	260	-	120	6317 C3 Q317 C3	85A	-	-
W41R 355 MY8, M8	IM B3 IM V1	6324 J C3	260	-	-	-	120	NU 324 E	260	-	120	6317 C3 Q317 C3	85A	-	-
W42R355MX2, L2	IM B3 IM V1	6317 C3	180	-	-	-	85	NU 317 E	180	-	85	6317 C3 Q317 C3	85A	- -	- -
W42R355MX4, 6, 8;L4, 6, 8	IM B3 IM V1	6324 J C3	260	-	-	-	120	NU 324 E	260	-	120	6317 C3 Q317 C3	85A	- -	- -
W42R /W52R 400M2, MX2, L2	IM B3	6317 C3	-	0D12110 1.1200	12	-	85	NU 317 E	-	-	85	6317 C3	85A	-	-
	IM V1	7317B		-	-	-	85	7218B+NU218 E	-	-	90	6317 C3	85A	0D12110 1.1200	12
W42R / W52R 400M4, 6, 8; MX4, 6, 8;L4, 6, 8	IM B3	6324 J C3	-	0D22400 1.4310	12	-	120	NU 324 E	-	-	120	6319 C3	85A	-	-
	IM V1	7324B		-	-	-	85	7226B+NU226 E	-	-	90	6319 C3	85A	0D12110 1.1200	21
W42R / W52R 450M2, MX2, L2	IM B3	6317 C3	-	0D12110 1.1200	12	-	85	NU 317 E	-	-	85	6317 C3	85A	-	-
W42R / W52R 450M4, 6, 8; MX4, 6, 8;L4, 6, 8	IM B3	6326 J C3	-	0D22400 1.4310	18	-	130	NU 326 E	-	-	130	6322 C3	110A	-	-

Special bearings according to project specifications are available on request. Binding information for the bearings is given on the name plate of the motors.
The bearings of design series A41./A42. are identical with the design series W41./W42.

Frame size	2-pole design	Design with 4-poles and more
315	2.000 h	4.000 h
355	2.000 h	3.000 h
400	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 regreasings this old grease should be removed, e.g. as part of inspection work.

Series IEC/DIN	Overall length pole number	Quantity of grease in cm^3	
Size		D-end	Size
315	S,M ≥ 4, MX2	57	52
	MY,L,LX2	57	57
	MX4, 6, 8	64	52
	MY,L,LX4, 6, 8	78	57
355	2	57	57
	4, 6, 8	90	57
400, 450	2	57	57
	4, 6, 8	90	65

The necessary lubrication 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 lubrication devices which can be ordered for smaller motors as option. Information about bearings and lubrication can be found in the general installation, maintenance and operation manual or on the name plate or lubrication sign.

Maintenance works (without lubrication) 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.

12.4 Condensate drain

In places of operation where condensation and therefore resulting condensate water inside of the motor is expected, the condensate drain hole at the lowest point of the end shield must be opened regularly to drain the condensate water. Afterwards the hole must be closed again.

12.5 Cleaning

The effect of cooling air must not be hindered. Therefore all parts of the motor must be cleaned regularly. In most cases it is sufficient to clean with a jet of water- and oil-free compressed air. Especially the air inlets and spaces between cooling rips must be kept clean. Coal dust from natural friction inside of the motor or inside the slip ring compartment must be removed regularly. It is recommended to include the electric motor in the regular inspections of the work machine.

13. 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.

14. Additional devices (optional)

14.1 Thermal motor protection

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.

14.2 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.

14.3 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.

15. 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.

16. Trouble Shooting

General mechanical and electrical faults are to be rectified according to the Schedule in Section 22. All Safety Regulations must be strictly observed when rectifying faults.

17. Disposal

NOTE: The motor does not contain any harmful substances. The criteria for harmful substances are: carcinogenic, mutagenic, toxic, poisonous, radioactive, hazardous to water, climate-changing, ozone depleting; especially all substances from attachment VI “Ban for manufacturing and usage“ from ordinance on hazardous substances.

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.

Component	Material	Hints for disposal
Bearing	Grease	Disposal of waste requiring special supervision
Shaft	Steel	Waste for disposal
Housing, end shields, bearing covers	Grey-cast iron, casted steel	Waste for disposal
Stator cores without winding	Electric steel	Waste for disposal
Winding	Copper with insulation	Waste for disposal
Cables	Copper with insulation	Waste for disposal
Current bars Connecting bolt	Copper Brass	Waste for disposal
Parts with fiberglass reinforcement, inspection glass, filter mats, corrugated tubes	Different organic materials	Waste for disposal
Coal brushes	Graphite	Waste for disposal

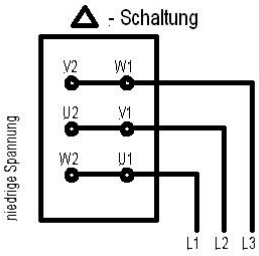
18. Warranty, Repair, Spare Parts

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 21 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.

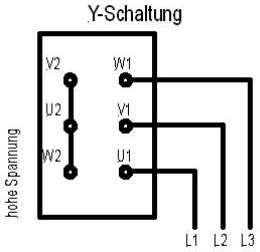
19. Terminal board connections / connection diagrams

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.

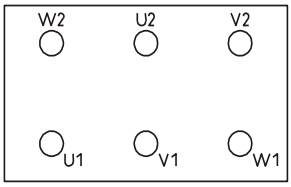
Single speed squirrel-cage motors:
Δ low voltage



Single speed squirrel-cage motors:
Y high voltage



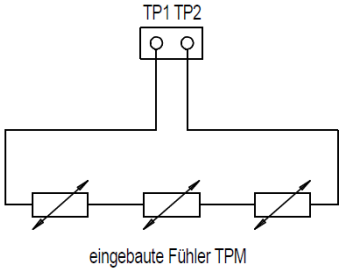
Star-delta switch connection:



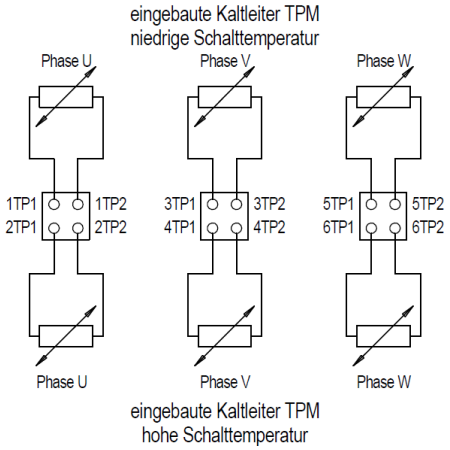
For star-delta switch without bridges,
connection according to the switch scheme

Motor with thermal winding protection
Terminal board connection as above

1 set of PTC thermistors (TPM) in the winding



2 sets of PTC thermistors (TPM) in the winding



The connection of PTC thermistors is done according to the connection diagram of the tripping device.

20. Design of terminal box
20.1 Design of terminal box for low-voltage applications
(Design example Y connection; position of terminal link see chapter connection diagrams)

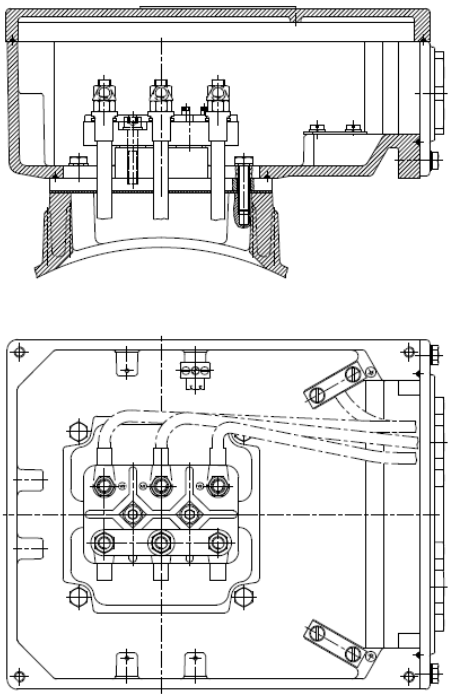


Figure 1 Terminal box KK 400B

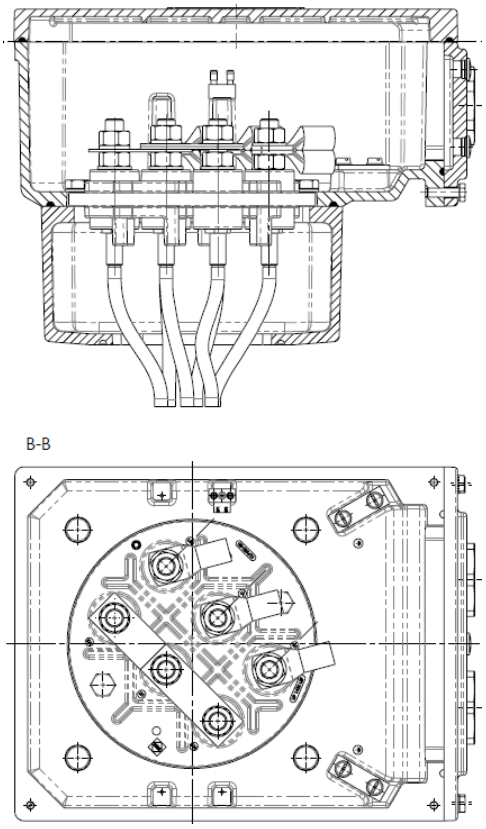


Figure 2 Terminal box KK 630 A,
Connection with cable lugs

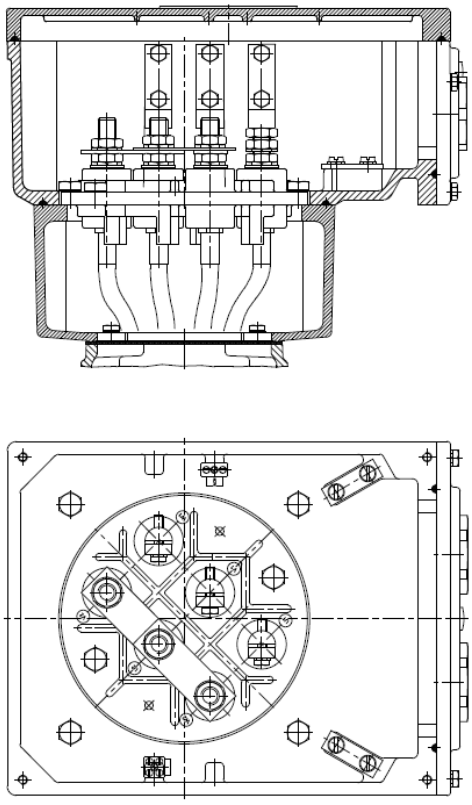


Figure 3 Terminal box KK 630 A
Connection without cable lugs

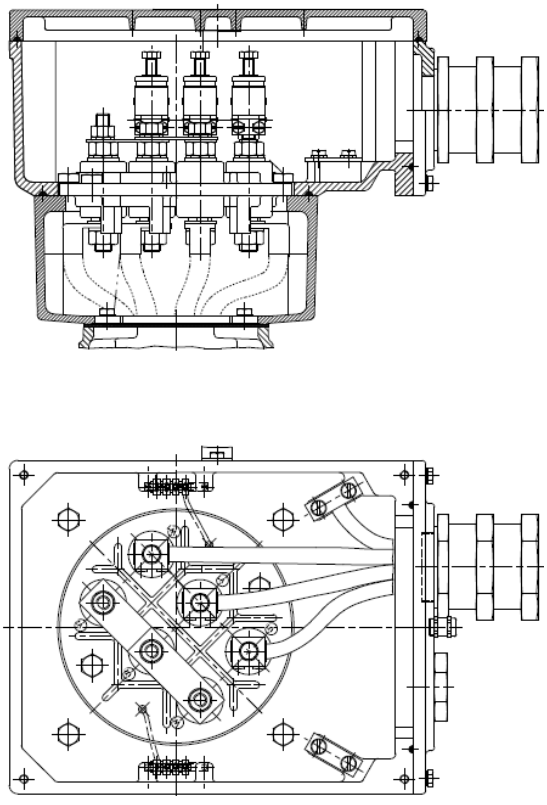


Figure 4 Terminal box KK 630 A
Connection without cable lugs

Standard- and Ex-design
(Illustration without terminal links, position of terminal links see chapter connection diagrams)

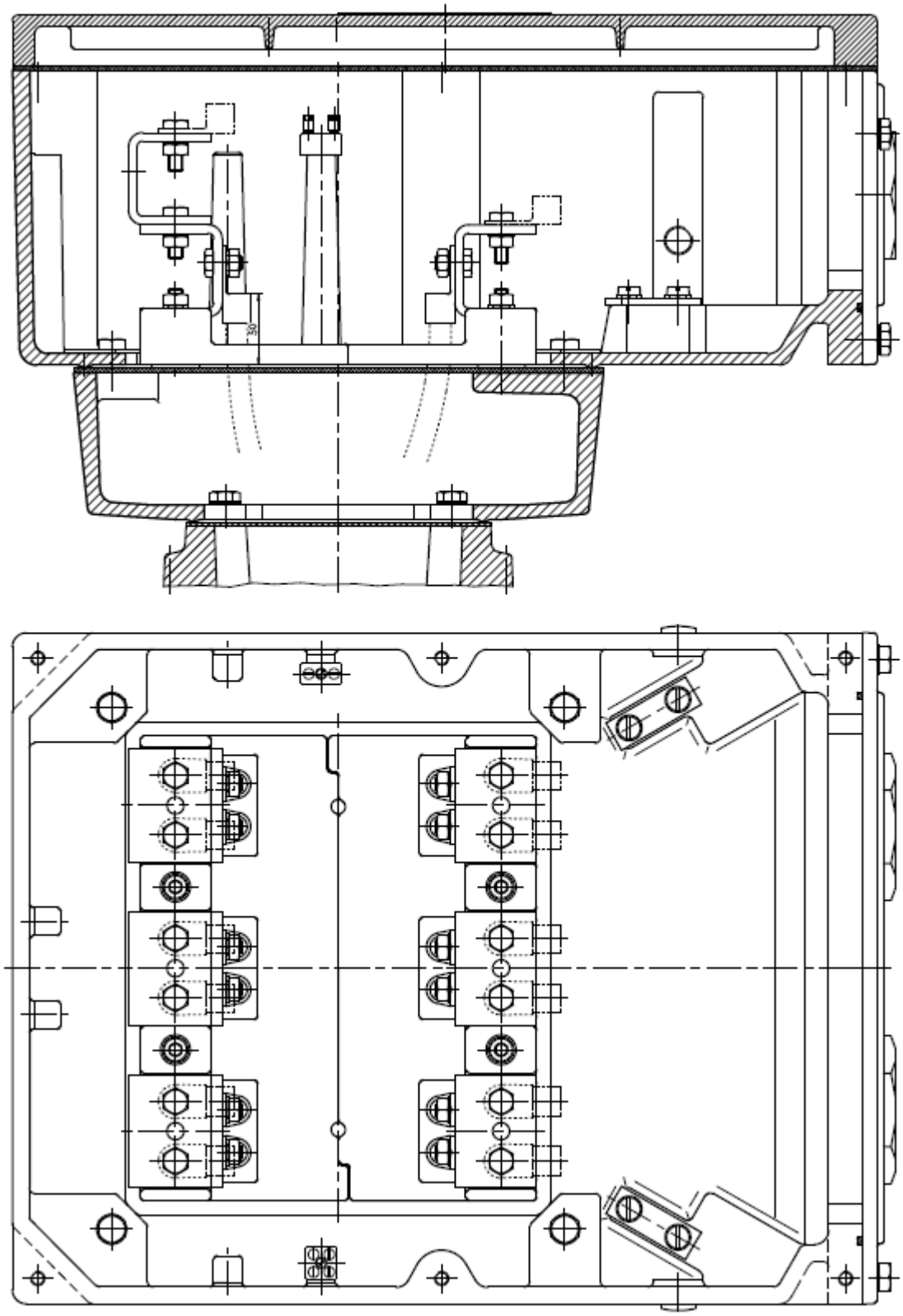


Figure 5 Terminal box KK 1000 A
Connection with cable lugs

20.2 Design of terminal box for high-voltage applications

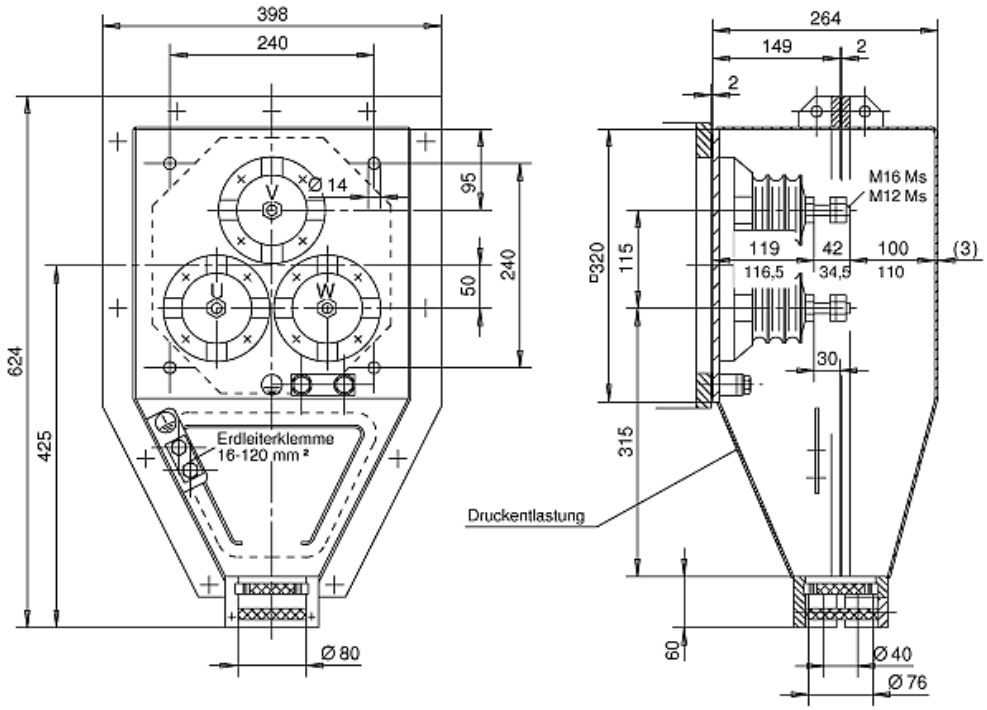


Figure 6 Terminal box rated voltage 6 kV

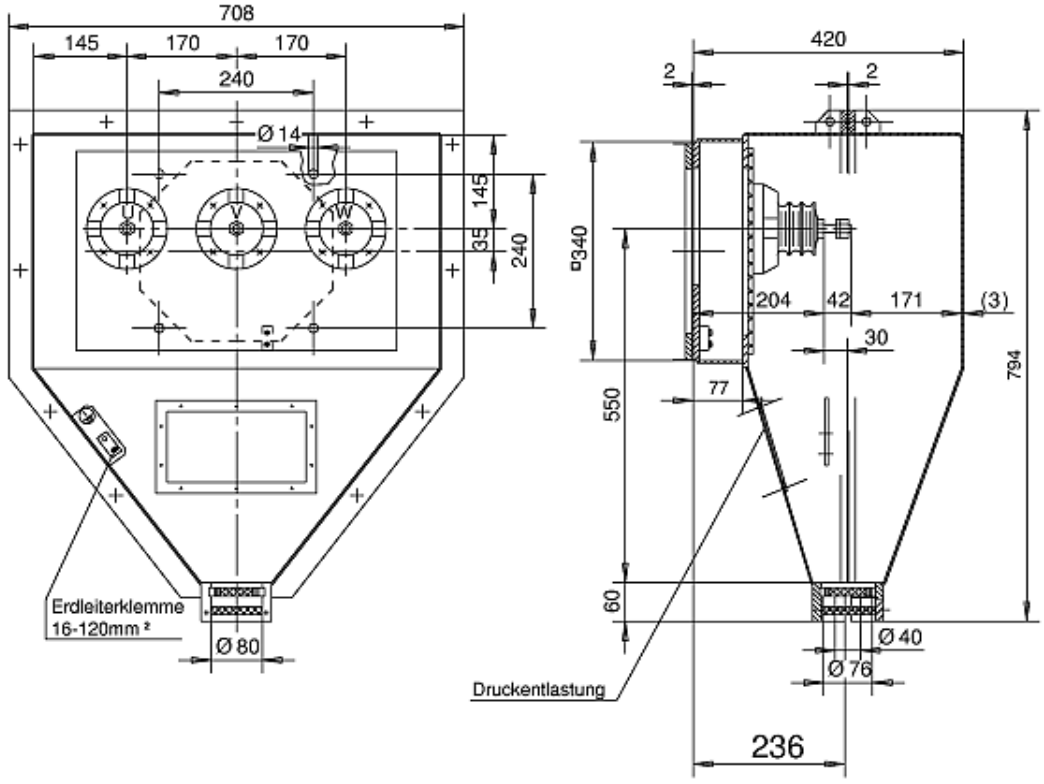
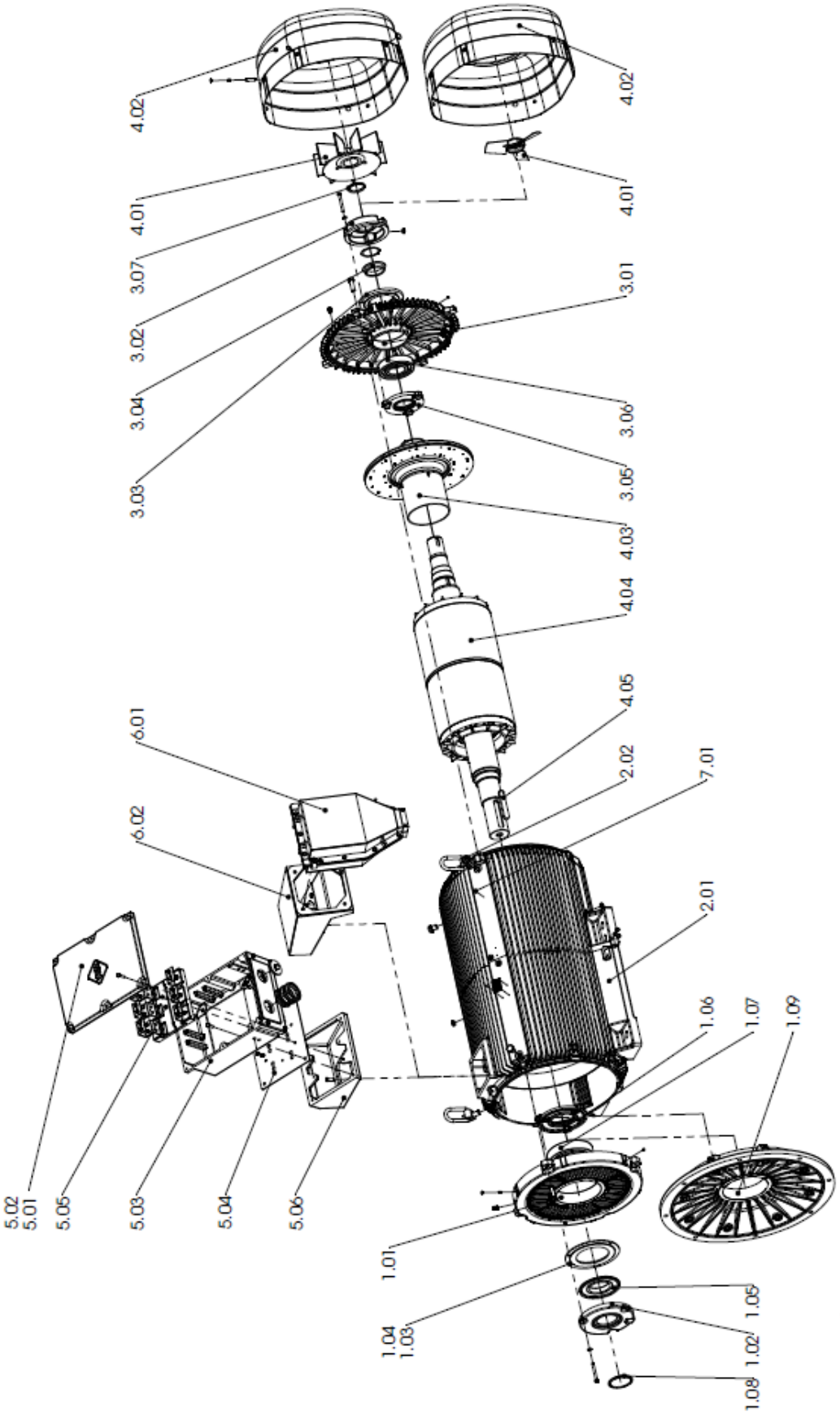


Figure 7 Terminal box rated voltage 10 kV

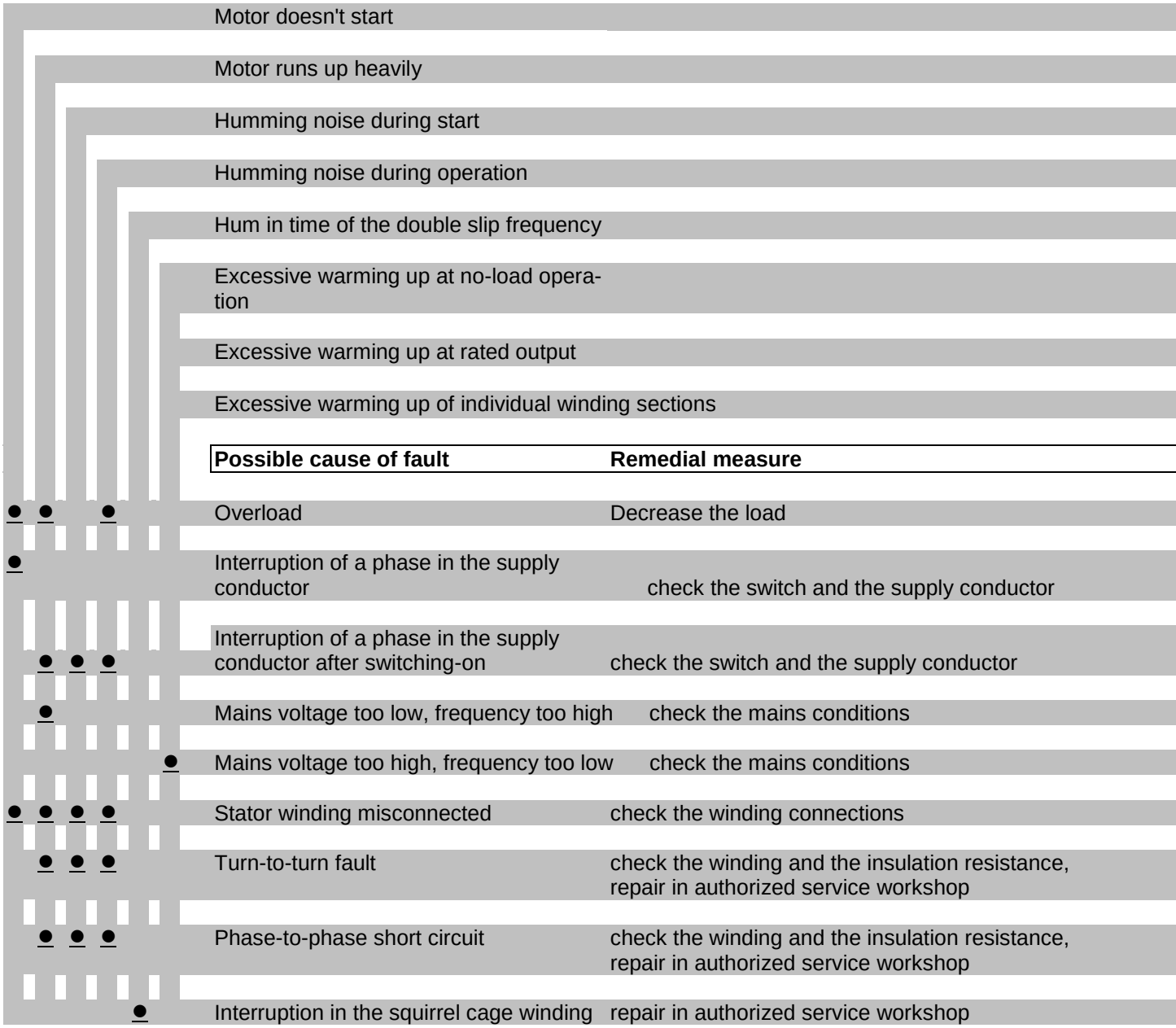
21. Overview of spare parts

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	Leitscheibe D-Seite	Guide disk drive-end
1.04	Druckfedern	Pressure springs
1.05	Schleuderscheibe D-Seite	Grease thrower ring, drive-end
1.06	Lagerdeckel D-Seite,innen	Bearing cover, drive-end, internal
1.07	Wälzlager D-Seite	Antifriction bearing, drive-end
1.08	Dichtring D-Seite	Gasket ring drive-end
1.09	Flanschlagerschild	Flange end shield
2.01	Gehäuse mit Wicklung	Housing with winding
2.02	Lastaufnahmeöse	Shackle
3.01	Lagerschild N-Seite	Bearing cover, non-drive end, external
3.02	Lagerdeckel N-Seite,außen	Bearing cover, non-drive end, internal
3.03	Leitscheibe N-Seite	Guide disk non-drive-end
3.04	Schleuderscheibe N-Seite	Grease thrower ring, non-drive-end
3.05	Lagerdeckel N-Seite,innen	Bearing cover, non-drive end, internal
3.06	Wälzlager N-Seite	Antifriction bearing, non-drive end
3.07	Dichtring N-Seite	Gasket ring non-drive-end
4.01	Lüfter	Fan
4.02	Lüfterhaube	Fan cowl
4.03	Innenlüfter	Inner fan
4.04	Läufer, komplett	Rotor, complete
4.05	Paßfeder	Feather key
	Klemmenkasten Motortyp W4..	Terminal box for typ W4..
5.01	Klemmenkastendeckel	Terminal box cover
5.02	Dichtung Klemmenkastendeckel	Terminal box cover gasket
5.03	Klemmenkastenunterteil	Terminal box base
5.04	Dichtung Klemmenkastenunterteil	Terminal box base gasket
5.05	Klemmenplatten mit Aufbau	Terminal plate
5.06	Zwischenflansch mit Dichtung	Adapter flange with gasket
	Klemmenkasten Motortyp W52.	Terminal box for typ W52.
6.01	Klemmenkasten, komplett	Terminal box, complete
6.02	Zwischenstück	Adapter
7.01	Transponder	Transponder

Three phase asynchronous motor / basic version W41./W42. 315 – 450, W52. 400 - 450 (example, delivered version may differ in details)



22. Trouble shooting
22.1 Electrical Faults



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

22. 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

23. EC declaration of conformity for low voltage motors and generators

VEM motors GmbH
Carl-Friedrich-Gauß-Str. 1
D-38855 Wernigerode

VEM motors Thurm GmbH
Äußere Dresdener Str. 35
D-08066 Zwickau

EC Declaration of Conformity

The electrical apparatus

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

of the series

KP./KPE./K1../K2../KU../KV../K4../K8..
BP./BPE./B1../B2../B4../BU../BV../BE..
AR., BR.
A1../A2../A4../ AU../AV../AE..
SP./SPE./S1../S8..
WE../W2../W4../WU../WV..
R1../R2../RE..

G1../G2../G4../GS1../GE..
CP./CPE./C1..
YP./YPE./Y1../Y2../Y4../YE../YU../YV..
Gear motors S(R)I14.., 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 (acc. to EN 60034-30)

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

2006/95/EG
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/EG
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, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4
EN 55014-1, EN 55014-2
EN 61000-3-2, EN 61000-3-3
EN 60034-1, EN 60034-2-1, EN 60034-5, EN 60034-6, EN 60034-9, EN 60034-30
IEC 60038
EN 60204-1

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.

Wernigerode, 2014-01-16

Sander
Managing Director

Strümpel
Factory Manager

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.

EWN-1200, Blatt 1, Seite 2

24. Declaration of incorporation of partly completed machinery

ERKLÄRUNG FÜR DEN EINBAU EINER UNVOLLSTÄNDIGEN MASCHINE

nach Maschinenrichtlinie 2006/42/EG, Anhang II Teil 1B

DECLARATION OF INCORPORATION OF PARTLY COMPLETED MACHINERY

acc. to Machinery Directive 2006/42/EG, Annex II Part 1B

Hiermit erklärt der Hersteller:
The manufacturer hereby declares:

VEM motors GmbH
Carl-Friedrich-Gauß-Strasse 1
38855 Wernigerode
Germany

der unvollständigen Maschine:
for the partly completed machinery:

Hochspannungsmotor / High voltage motor
Typ / Type … ….
Serien-Nr. ……./….

die Anwendung und Einhaltung folgender grundlegender Anforderungen nach Anhang I:
the application and fulfilment of the following essential requirements acc. to annex I:

1.1.2, 1.1.3, 1.1.5, 1.2.6, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8.1,
1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8, 1.5.9, 1.5.10, 1.5.13, 1.5.15,
1.6.1, 1.6.5, 1.7.2, 1.7.4.1

Die Inbetriebnahme der unvollständigen Maschine ist solange untersagt, bis die Konformität der Maschine, in welche die unvollständige Maschine eingebaut wurde, mit der Maschinenrichtlinie 2006/42/EG festgestellt ist.
The partly completed machinery must not be put into service until the final machinery into which they have been incorporated has been declared in conformity with the provisions of Machinery Directive 2006/42/EC.

Wir erklären, dass die speziellen technischen Unterlagen nach Anhang VII Teil B erstellt wurden und verpflichten uns, diese auf Verlangen den Aufsichtsbehörden in digitaler Form zu übermitteln.
We declare that the relevant technical documentation acc. to annex VII Part B has been prepared and agree to submit it to the national authorities in digital form on request.

Bevollmächtigter für die Zusammenstellung der speziellen technischen Unterlagen:
Authorised person to compile the relevant technical documentation:

Dirk Seehase VEM motors GmbH
Carl-Friedrich-Gauß-Strasse 1
38855 Wernigerode
Germany

Wernigerode, *<Datum>*

……
Wolfgang Wiedemann
Leiter Qualitätssicherung
Head of quality dept.

VEM motors GmbH

Carl-Friedrich-Gauß-Straße 1
D-38855 Wernigerode
fon: +49-(0)39 43-68-0
fax: +49-(0)39 43-68-21 20

email: motors@vem-group.com
web: www.vem-group.com