

**Operation and
Maintenance Instructions
Three-phase Roller Table Motors
with Squirrel Cage Rotor
for Mains and Converter Feeding**



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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.

Roller table motors are special driving elements for the rolling mill industry. Roller table motors are subjected to unusually hard electrical and mechanical requirements. This fact results from their extremely various modes of operation and load situations with their variants such as continuous duty, intermittent duty and short-time duty as well as starting duty, electrical braking duty and reversing duty. Roller table motors are able to handle operative overloads (e.g. blocking of the motor caused by jammed rolled material).

1.1 Light roller table motors, type series A21R, A21O, A21F

The type series A21R (IC 411), A21O (IC410), A21F (IC 416) are derived from the VEM standard motor series and are of the same mechanical design with regard to their main structural elements. The windings of these motors have been adapted for driving roller tables. Furthermore, all screwed connections are additionally secured, and the corrosion protection has also been adapted for use in rolling mills.

1.2 Roller table motors for use with frequency converters, type series ARC

The type series ARC (IC 410) has been developed for use with frequency converters in rolling mills.

It provides a combination of the desirable properties of a converter-fed double squirrel cage rotor, with its acceleration-oriented torque characteristic (M_C/M_A approx. 3), and the mechanically robust design of a heavy roller table motor. With the exception of the form of its housing (ring-type ribs) and bearing/sealing arrangement on the drive end, its construction is identical to that of a VEM standard motor.

1.3 Heavy roller table motors, type series ARB

The heavy roller table motor ARB (IC 410) is intended for mains operation. Like the type series ARC the housing is provided with ring-type ribs and is composed of grey cast iron with ribs running transverse to the axis direction.

2. Description

The motors have been manufactured in accordance with IEC 34-1, DIN EN 60034-1, DIN VDE 0530 and other appropriate DIN standards. The details on the relevant Order Confirmation constitute the scope of supply.

3. 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 differ from 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 (Protection Standard \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).

4. 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 the 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.

5. 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 motors resting on their fan cowls. The eye bolts of the motors together with appropriate lifting tackle must be used for transport. The eye bolts are intended for the lifting of the motors only, without any additional parts such as bed plates, gears etc. If eye bolts are removed after installation, the tapped holes must be blanked off permanently according to the degree of protection.

6. Removal of the transport locking

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 cover bolt before screwing it into the bearing end shield.

7. 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 catalogue 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.

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 elements (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 the 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 fol-

lowed. 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.

8. 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. 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 / kW	Insulation Resistance referred to Rated Voltage / kΩ/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.

9. 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 DIN VDE 0530 Part 8. In Section 18 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 8). 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 mains supply with the phase sequence L1, L2 and L3 is to be wired to the connection points U, V, W, the motor is rotating clockwise looking at the shaft end. The direction of rotation can be changed by swapping the connections between 2 phases. For the permissible tightening torques for the terminal board bolts refer to the table below:

Terminal Board	Connecting Bolt Thread	Permissible Tightening Torque in Nm
16 A	M4	1.2 + 0.5
25 A	M5	2.5 ± 0.5
63 A	M6	4 ± 1
100 A	M8	7.5 ± 1.5
200 A	M10	12.5 ± 2.5
400 A	M12	20 ± 4
630 A	M16	30 ± 4

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 earth 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.

Please always observe the Safety Regulations during operation of the motor and when switching it off.

10. Maintenance

You are once again referred to the Safety Regulations, in particular to insulation, 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 washer must always be refitted.

11. 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.

12. Motors with thermal winding protection

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 has responded, and after the cooling down of the motor, no hazards can occur due to spurious automatic reconnection.

13. Bearings and lubrication

13.1 General

VEM motors are equipped with antifriction bearings of well-known manufacturers. The bearings have a nominal service life of at least 20,000 hours for maximum permissible load conditions. For motors without additional axial loading, the nominal service life is 40,000 hours for direct coupling and a horizontal installation position.

The following versions are shown in the bearing arrangement tables:

- Fixed bearing, Drive-end
- Without fixed bearing (floating bearing)
- Permanent lubrication
- Relubricating device
- Heavy bearing arrangement, Drive-end (for higher transverse forces)
- Light bearing arrangement

as well as the

- Antifriction bearing assignments
- Disc spring and wave washer assignments
- V-type rotary seal assignments

Graphical depiction of the bearing arrangements

The respective flat grease nipples may be noted from the tables in the dimensional drawings. Motors in standard design with two deep-groove ball bearings have bearings which are set by means of disc springs or wave washers. Exceptions are versions with cylindrical roller bearings on the drive end (heavy bearing arrangement VL).

The most important requirement for achieving the nominal bearing service life consists of proper lubrication, i.e. use of the proper type of grease for each operational situation, use of the correct quantity of grease, and maintenance of the regreasing intervals.

Frame sizes 56 - 160 are equipped with lifetime-lubricated bearings. These bearings must be replaced promptly in accordance with the grease consumption interval. For motors in frame size 180 and larger the bearings must be regreased promptly in accordance with the grease consumption interval so that the nominal bearing service life can be achieved. Under normal operating conditions, the grease charge provides 10,000 service hours with two pole design and 20,000 service hours with four or more pole design without regreasing.

Versions with regreasing devices provide 2,000 or 4,000 service hours respectively under normal operating conditions. The standard grease used (design version A2..) is type KE2/3R-40 lubricating grease according to DIN 51825. After five regreasing operations the used grease must be removed from the grease chamber of the external bearing cover. For information on bearing sizes, type and quantity of grease and regreasing intervals please refer to the additional plate affixed to the motor. For design series AR, a different type of grease KHC1R-30 according to DIN 51825 will be used.

13.2 Use of cylindrical roller bearings

By the use of cylindrical roller bearings ("heavy bearing arrangement" VL), relatively high radial forces or masses can be supported at the motor shaft end. Examples: belt drives, pinions or heavy couplings. The minimum radial force at the shaft end must be a quarter of the permissible radial force. Account must be taken of the permissible shaft end loading. These values are to be taken from the tables and diagrams in the constructive selection data.

Important note:

Radial forces below the minimum value can lead to bearing damage within a few hours. Test runs in no-load state are only permissible for a short period. If the specified minimum radial force is not achieved, we recommend the use of deep-groove ball bearings (so-called "light bearing arrangement"). The bearing arrangement can be re-configured on request.

13.3 Bearing loading and shaft end loading

Due to the international standardisation of asynchronous motors, dimensioning of the bearing arrangement and shaft is only variable within limits; a constructive optimum has thus been selected.

13.4 Admissible shaft end loading

The size of the permissible shaft end loading is determined using the following main criteria:

- permissible bending of the shaft, shaft end fatigue strength, bearing service life

The admissible shaft end loading (radial and axial forces) is based on a bearing service life of 20,000 hours and resistance to fatigue of >2.0.

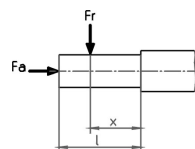
The loading diagram is specified in the following illustration:

F_r = radial shaft end loading

F_a = axial shaft end loading

l = length of the shaft end

x = distance of the application point F_r from the shaft shoulder



The type-related data for the permissible axial shaft end loading F_a and the permissible radial shaft end loading $F_{r0.5}$ (at the application point $x : l = 0.5$), $F_{r1.0}$ (at the application point $x : l = 1.0$) for the basic version and for the heavy bearing arrangement in horizontal and vertical mounting position of the motor are specified in the product catalogue.

The permissible radial forces are depicted as a function of the position of the application point on the shaft end for motors in horizontal and vertical mounting position of the motor (taking into account the effective direction of the radial force in relation to gravity).

The permissible forces given are valid for practically vibration-free mounting of the motors.

The shaft loading for frame sizes 315 L and LX and frame size 355 can be verified by the manufacturer on request.

The loadings F_r and F_a are generally dependent on the transmission elements used, i.e. on the axial and radial forces arising from these transmission elements, including their weights.

The forces are calculated using mechanical formulas, e.g. for belt pulleys

$$F_r = 2 \cdot 10^7 \cdot \frac{P}{n \cdot D} \cdot c$$

where

F_r = radial force in N

P = rated motor output in kW (transmission output)

n = nominal motor speed

D = belt pulley diameter in mm

c = pretension factor as stated by the belt manufacturer (for V-belts preferably 2.5)

In practice, the radial force F_r does not always act at $x : l = 0.5$. The conversion of the permissible radial force within the range $x : l = 0.5$ up to $x : l = 1.0$ can be done by linear interpolation.

If the calculated shaft loadings exceed the permissible ones, the drive elements must be changed. There are the following possibilities, among others:

selection of a larger belt pulley diameter, use of V-belts instead of flat belts, selection of another pinion diameter or skew angle of the teeth, selection of another coupling version, etc.

Generally, care must be taken that the resulting load application point of F_r will not be outside the shaft end. If a solution has still not been found, the manufacturer would be happy to check special constructions which can be used to deal with problems of this kind.

13.5 Bearing arrangements and their graphical depiction

13.5.1 Series A2.R

Basic version, Series A21R

Type	D-end						N-end				Figure		Fixed bearing					
	Antifriction bearing	V-Ring	γ-Ring	Felt ring	Wave washer	Disc spring	Antifriction bearing	V-Ring	Wave washer	Felt ring	D-end	N-end						
A21R 63	6201 2Z C3	-	-	11,5x19	-		6201 2Z C3	-	32	12x22	1	2	none					
A21R 71	6202 2Z C3			14,5x21			6202 2Z C3		35	15x24								
A21R 80	6204 2Z C3			19,5x26			6204 2Z C3		47	20x32								
A21R 90	6205 2Z C3			24,5x35			6205 2Z C3		52	25x40								
A21R 100	6206 2Z C3			29,2x40			6206 2Z C3		62	30x50								
A21R 100 LX																		
A21R 112 M	6208 2RS C3			39x60			6207 2RS C3		80	6207 2RS C3								
A21R 132 S2, 4T																		
A21R 132 S, SX2, M6, 8																		
A21R 132 M4, MX6																		
A21R 160 M, MX8																		
A21R 160 MX2, L	6309 2RS C3			100			6309 2RS C3		110	6309 2RS C3	3	5						
A21R 180 M4, L6, 8																		
A21R 180 M2, L4	6310 2RS C3			50A			-		-	-	-	-		-	-	-	-	-
A21R 200 L, LX6	6310 C3	50A																
A21R 200 LX2	6312 C3	60A	130	6312 C3	60A													
A21R 225 M2																		
A21R 225 S4, 8, M4, 6, 8	6313 C3	65A	140	6313 C3	65A	6		8										
A21R 250 M2																		
A21R 250 M4, 6, 8	6314 C3	70A	150	6314 C3	70A													
A21R 280 S2, M2																		
A21R 280 S4,6,8, M4, 6, 8	6316 C3	80A	170	6316 C3	80A	13		16										
A21R 315 S2, M2																		
A21R 315 S4, 6, 8, M4, 6, 8	6317 C3	-	180	6317 C3 ¹⁾	85A	18		19										
A21R 315 MX2																		
A21R 315 MX4, 6, 8	6220 C3	-	RB85	180	6317 C3	13		16										
A21R 315 MY2																		
A21R 315 MY4, 6, 8																		
A21R 315 L2, LX2																		
A21R 315 L4, 6, 8, LX4, 6, 8																		
A22R 355 ... 2polig																		
A22R 355 ... 4-, 6-, 8-polig																		
A22R 355 ... 4-, 6-, 8-polig																		
A22R 355 ... 4-, 6-, 8-polig																		
A22R 355 ... 4-, 6-, 8-polig																		
A22R 355 ... 4-, 6-, 8-polig																		

1) for vertical types of construction Q317 C3, figures 18 and 21

From sizes K21R 315 MX standard version with relubrication device

Basic version, Series A20R

Type	D-end						N-end				Figure		Fixed bearing	
	Antifriction bearing	V-Ring	γ-Ring	Felt ring	Wave washer	Disc spring	Antifriction bearing	V-Ring	Wave washer	Felt ring	D-end	N-end		
A20R 56	6201 2Z C3	-		11,5x19	-	-	6201 2Z C3	-	32	12x22	1	2	none	
A20R 63	6202 2Z C3			14,5x21			6202 2Z C3		35	15x24				
A20R 71	6204 2Z C3			19,5x26			6204 2Z C3		47	20x32				
A20R 80	6205 2Z C3			24,5x35			6205 2Z C3		52	25x40				
A20R 90									6206 2Z C3	62				30x50
A20R 100									6206 2Z C3	-				-
A20R 112 M2, 4, 6, 8									6207 2RS C3		72	6207 2RS C3		
A20R 112 MX6, 8	90			6308 2RS C3										
A20R 132 S, M	6308 2RS C3						-		-	-	-	3		5
A20R 160 S, M	6310 2RS C3			-										
A20R 180 S2, M2	6310 C3	50A	-		-	-	6	8						
A20R 180 S4, 6, 8, M4, 6, 8	6312 C3	60A		130					6312 C3	60A				
A20R 200 M2, L2			6313 C3	65A	140	6313 C3	65A							
A20R 200 M4, 6, 8, L4, 6, 8	6314 C3	70A			150			6314 C3	70A					
A20R 225 M2			6316 C3	80A	170	6316 C3	80A							
A20R 225 M4, 6, 8	-	-			-			-	-	13	16			
A20R 250 S2, M2			6317 C3	RB85		180	6316 C3					80A		
A20R 250 S4, 6, 8, M4, 6, 8	6220 C3	RB100												
A20R 280 S2, M2	6317 C3	RB85	215	6317 C3 ¹⁾	85A	18	19							
A20R 280 S4,6,8, M4, 6, 8	6320 C3	RB100												
A20R 315 S2	-	-	-	-	-	-	-	-						
A20R 315 S4, 6, 8									6317 C3	80A				
A20R 315 M2, L2									6316 C3	80A				
A20R 315 M4, 6, 8, L4, 6, 8									6320 C3	85A				

1) for vertical types of construction Q317 C3, figures 18 and 21
From size K20R 315 standard version with relubrication device

Special version heavy bearing arrangement VL

Series A21R

Type	D-end			N-end		Figure		Fixed bearing
	Antifriction bearing	V-Ring	γ-Ring	Antifriction bearing	V-Ring	D-end	N-end	
A21R 132 S, SX2, M6, 8 VL	NU 208 E	40A		6207 RS C3	-	4	10	N-end
A21R 132 M4, MX6 VL	NU 308 E			6308 RS C3				
A21R 160 M, MX8 VL	NU 309 E			6309 RS C3				
A21R 160 MX2, L VL	NU 310 E	50A	6310 C3	50A	7	9		
A21R 180 M4, L6, 8 VL							6312 C3	
A21R 180 M2, L4 VL	NU 312 E	60A	6313 C3	65A				
A21R 200 L, LX6 VL					6314 C3	70A		
A21R 200 LX2 VL	NU 313 E	-	6316 C3	80A			15	
A21R 225 M2 VL					RB60	-		
A21R 225 S4, 8, M4, 6, 8 VL	NU 313 E	-	6317 C3 ¹⁾	85A				
A21R 250 M2 VL					RB65	-		
A21R 250 M4, 6, 8 VL	NU 314 E	-						
A21R 280 S2, M2 VL			RB70	-				
A21R 280 S4,6,8, M4, 6, 8 VL	NU 316 E	-						
A21R 315 S2, M2 VL			RB80	-				
A21R 315 S4, 6, 8, M4, 6, 8 VL	NU 317 E	-						
A21R 315 MX2 VL			RB85	-				
A21R 315 MX4, 6, 8 VL	NU 2220 E	-						
A21R 315 MY2 VL			RB100	-				
A21R 315 MY4, 6, 8 VL	NU 317 E	-						
A21R 315 L2, LX2 VL			RB85	-				
A21R 315 L4, 6, 8, LX4, 6, 8 VL	NU 320 E	-						
A22R 355 ... 2polig VL			NU 317 E	RB85				
A22R 355 ... 4-, 6-, 8-polig VL	NU 324 E	120S	-					

1) for vertical types of construction Q317 C3, figures 20 and 21
From size K21R 315 MX standard version with relubrication device

Special version heavy bearing arrangement VL, Series A20R

Type	D-end			N-end			Figure		Fixed bearing
	Antifriction bearing	V-Ring	γ-Ring	Antifriction bearing	V-Ring	D-end	N-end		
A20R 112 M2, 4, 6, 8 VL	NU 207 E	40A	-	6207 2RS C3	-	4	10	N-end	
A20R 112 MX6, 8 VL				6308 2RS C3					
A20R 132 S, M VL				6309 2RS C3					
A20R 160 S, M VL	NU 310 E	50A	-	6310 C3	50A	7	9		
A20R 180 S2, M2 VL									
A20R 180 S4, 6, 8, M4, 6, 8 VL	NU 312 E	60A	-	6312 C3	60A	15	16		
A20R 200 M2, L2 VL									
A20R 200 M4, 6, 8, L4, 6, 8 VL	NU 313 E	-	-	RB60	6313 C3	65A	19		
A20R 225 M2 VL									
A20R 225 M4, 6, 8 VL	NU 314 E	-	-	RB65	6314 C3	70A			
A20R 250 S2, M2 VL									
A20R 250 S4, 6, 8, M4, 6, 8 VL	NU 316 E	-	-	RB70	6316 C3	80A			
A20R 280 S2, M2 VL									
A20R 280 S4,6,8, M4, 6, 8 VL	NU 317 E	-	-	RB80	6317 C3 ¹⁾	85A			
A20R 315 S2 VL									
A20R 315 S4, 6, 8 VL	NU 2220 E	-	-	RB85	6317 C3 ¹⁾	85A	20	19	
A20R 315 M2, L2 VL	NU 317 E	-	-	RB100	6317 C3 ¹⁾	85A	20	19	
A20R 315 M4, 6, 8, L4, 6, 8 VL	NU 320 E	-	-	RB100	6317 C3 ¹⁾	85A	20	19	

1) for vertical types of construction Q317 C3, figures 20 and 21
From sizes K20R 315 standard version with relubrication device

Relubrication device, Series A21R

Type	D-end						N-end		Figure		Fixed bearing
	Antifriction bearing	V-Ring	γ-Ring	Felt ring	Wave washer	Disc spring	Antifriction bearing	V-Ring	D-end	N-end	
A21R 132 S, SX2, M6, 8	For reasons of design not possible at D-end										
A21R 132 M4, MX6	For reasons of design not possible at D-end										
A21R 160 M, MX8	For reasons of design not possible at D-end										
A21R 160 MX2, L 1)	6310 C3	-	RB50	-	110	-	6309 C3	45A	13	14	N-end
A21R 180 M4, L6, 8 1)							6310 C3	50A			
A21R 180 M2, L4 1)	6312 C3	-	RB60	-	130	-	6312 C3	60A	13	14	N-end
A21R 200 L, LX6 1)							6312 C3	60A			
A21R 200 LX2 1)	6313 C3	-	RB65	-	140	-	6313 C3	65A	13	14	N-end
A21R 225 M2							6313 C3	60A			
A21R 225 S4, 8, M4, 6, 8	6314 C3	-	RB70	-	150	-	6314 C3	70A	13	14	N-end
A21R 250 M2							6314 C3	70A			
A21R 250 M4, 6, 8	6316 C3	-	RB80	-	170	-	6316 C3	80A	13	14	N-end
A21R 280 S2, M2							6316 C3	80A			
A21R 280 S4,6,8, M4, 6, 8	6317 C3	-	RB85	-	180	-	6317 C3	80A	13	14	N-end
A21R 315 S2, M2							6317 C3	80A			
A21R 315 S4, 6, 8, M4, 6, 8	See basic version										
A21R 315 MX2	See basic version										
A21R 315 MX4, 6, 8	See basic version										
A21R 315 MY2	See basic version										
A21R 315 MY4, 6, 8	See basic version										
A21R 315 L2, LX2	See basic version										
A21R 315 L4, 6, 8, LX4, 6, 8	See basic version										
A22R 355 ... 2polig	See basic version										
A22R 355 ... 4-, 6-, 8-polig	See basic version										

1) degree of protection IP

Relubrication device, Series A20R

Type	Antifriction bearing	D-end				N-end		Figures		Fixed bearing				
		V-Ring	γ-Ring	Wave washer	Disc spring	Antifriction bearing	V-Ring	D-end	N-end					
A20R 112 M2, 4, 6, 8	6207 C3	-	RB35	72	-	6207 C3	35A	13	14	N-end				
A20R 112 MX6, 8				90							6308 C3	40A		
A20R 132 S, M	6310 C3		RB40	110		6309 C3	45A							
A20R 160 S, M			RB50			6310 C3	50A							
A20R 180 S2, M2	6312 C3			RB60		130	6312 C3				60A			
A20R 180 S4, 6, 8, M4, 6, 8			6313 C3				RB65				140	6313 C3	65A	
A20R 200 M2, L2	6314 C3			RB70		150						6314 C3	70A	
A20R 200 M4, 6, 8, L4, 6, 8			6316 C3				RB80				170	6316 C3	80A	
A20R 225 M2	6317 C3			RB85		180						6317 C3	80A	
A20R 225 M4, 6, 8			See basic version											
A20R 250 S2, M2														
A20R 250 S4, 6, 8, M4, 6, 8														
A20R 280 S2, M2														
A20R 280 S4,6,8, M4, 6, 8														
A20R 315 S2	See basic version													
A20R 315 S4, 6, 8														
A20R 315 M2, L2														
A20R 315 M4, 6, 8, L4, 6, 8														

1) Degree of protection IP 54

13.5.2 Bearing arrangement series ARC

Basic version

Type	Antifriction bearing	γ-Ring	Radial shaft sealing ring ¹	D-end			Wave washer	Disc spring	Antifriction bearing	Figure		Fixed bearing
				Amount of sealing grease in g	Radial shaft sealing ring ²	Liner				D-end	N-end	
ARC 112 M, MX	6207 C3	9RB 35 FKM	40x62x7	50	-	IR 35x40x17EGS	72	-	6207 C3	22	23	N-end
ARC 132 S, M	6308 C3	9RB 40 FKM	45x65x8		70	55x85x8	IR 40x45x17EGS		90			
ARC 160 S, M	6310 C3	9RB 50 FKM	55x75x7	80	70x100x10	IR 50x55x20EGS	110	6309 C3				
ARC 180 S, M	6312 C3	9RB 60 FKM	70x90x7	90	72x100x10	IR 60x70x25EGS	130	6310 C3				
ARC 200 S, M	6313 C3	9RB 65 FKM	72x95x10	100	80x110x10	IR 65x72x25EGS	140	6312 C3				
ARC 225 M	6314 C3	9RB 70 FKM	80x100x7	110	90x120x12	IR 70x80x30EGS	150	6313 C3				
ARC250 S, M	6316 C3	9RB 80 FKM	90x110x7,5	120	95x125x12	IR 80x90x30EGS	170	6314 C3				
ARC 280 S, M	6317 C3	9RB 85 FKM	95x120x12	130	105x140x12	IR 85x90x36EGS	180	6316 C3				
ARC 315 M, MX	6320 C3	9RB 95 FKM	105x130x12	150	125x160x12	IR 95x105x36EGS	215	6317 C3				
ARC 315 L, LX							260	6321 C3				
ARC 355 LY, L	260											
ARC 400 M, L	260											
ARC 400 LX	6324 C3	-	-	-	-	-	260	6320 C3 *)	24			

Lubrication grease Berutox FH28KN (KHC1R-30 acc. to DIN 51825)

*)special version isolated bearing N-side

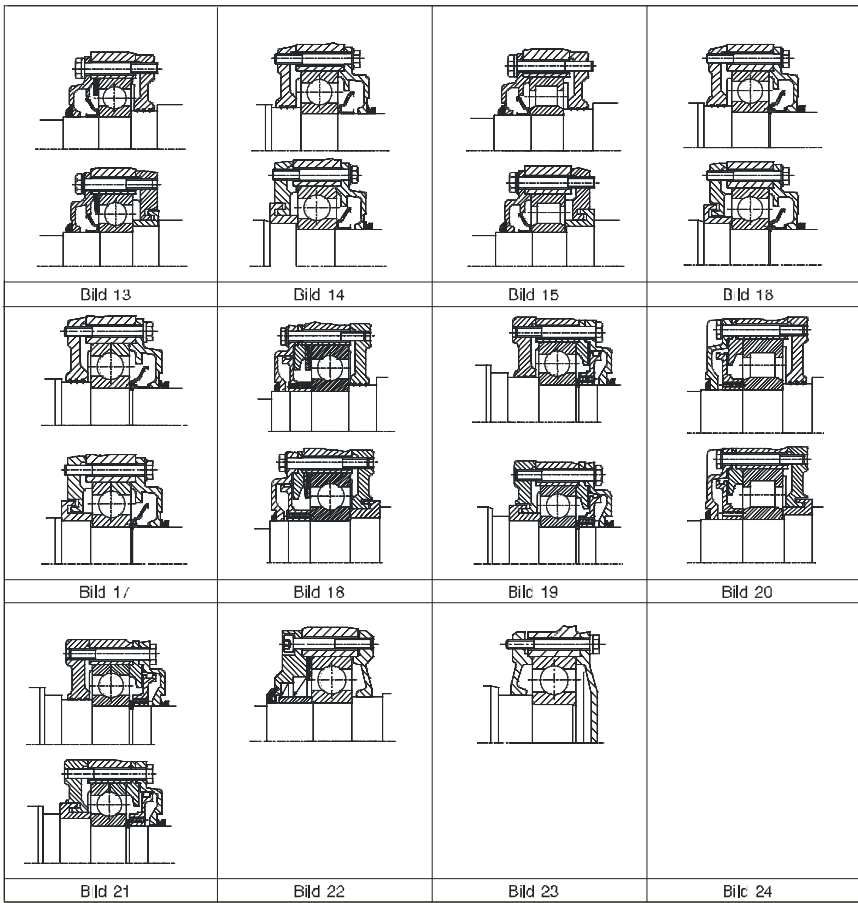
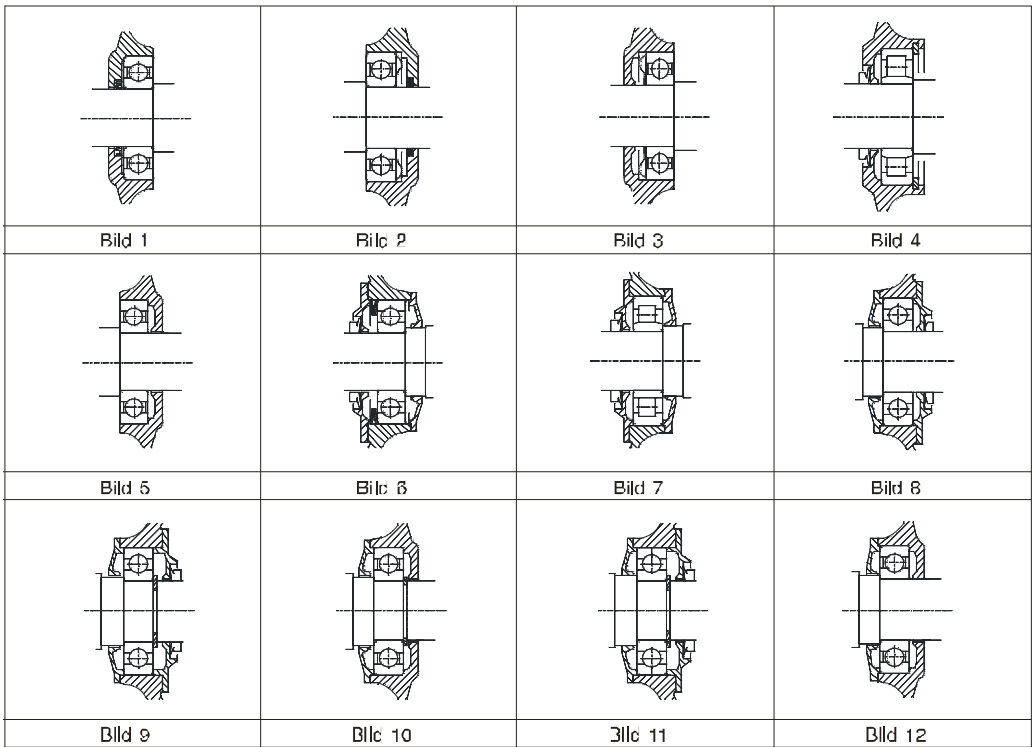
13.5.3 Bearing arrangement series ARB

Type	D-end and N-end antifriction bearing	Fixed bearing
ARB 22	6306 S1 C5	N-end
ARB 33		
ARB 54		
ARB 65	6310 S1 C5	

Lubrication grease Berutox FH28KN (KHC1R-30 acc. to DIN 51825)

13.5.4 Graphic depiction to the bearing arrangements

In the following figures, the versions of the different bearing arrangement are shown in detail.



13.6. Greasing, regreasing periods and required grease amounts

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

Type Series	Lubricating Grease acc. to DIN 51825	Grease Base
Light roller table motors A21R, A21O 56 – 132T, A20R, A20O 56 – 100 Forced ventilated roller table motors A21F 63 – 132T, A20F 56– 100	Asonic GHY 72	Lithium base
Squirrel cage motors A21R, A21O 132 – 355 and A20R, A20O 112 - 315 Forced ventilated roller table motors A21F 132 – 355 and A20F 112 - 315	KE2/3R-40	Polyurethane base
Roller table motors for frequency converter feeding ARC 112 to 400	Berutox FH28KN	
Heavy roller table motors ARB 22 to 65		

Under normal load and climatic conditions, the quality of grease guarantees operation of the motor for approx. 10,000 service hours with two pole design and 20,000 service hours with multipole design. Unless otherwise agreed the antifriction bearing grease does not have to be refilled during this period. However, the condition of the grease should be checked occasionally even before this time limit. The indicated number of service hours is only valid for operation at rated speed. If during operation of the motor via a frequency converter the nominal speed is exceeded then the regreasing period is reduced approximately in inverse proportion 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 a relubrication facility is carried out at the grease nipple when the motor is running using the grease quantity required for the respective motor. For the regreasing intervals please refer to the table below:

Frame size	Two-pole version	Four and multi-pole version
100LX, 112 bis 280	2.000 h	4.000 h 3.000 h
315		
355		
400		

The quantities of grease required for the regreasing are stated in the table below (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 cover. After approx. five regreasings this old grease should be removed, e.g. as part of inspection work.

Motors of type series ARB in standard design are always equipped with a relubrication device. In addition to the cyclical lubrication intervals listed, these motors must also be regreased after every longer stall time.

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

Light roller table motors, series A21R, A21O, A21F/A20R, A20O, A20F

Series A20.	Design length / Pole number	Grease amount in cm ³	
		D-end	N-end
112	all	10	10
132		17	17
160			20
180		23	23
	≥ 4	31	31
200	2		
	≥ 4	35	35
225	2		
	≥ 4	41	41
250	2		
	≥ 4	52	52
280	2		
	≥ 4	57	57
315 VL	S2		
	M2		
	S4, 6, 8		
	M4, 6, 8	64	52
355	2	57	57
	4, 6, 8	90	

Series A21.	Design length / Pole number	Grease amount in cm ³	
		D-end	N-end
160	LX2, M2, L4, 6, 8	23	20
180	M2, L4		23
	M4, L6, 8		20
200	L2	-	-
	LX2	31	31
	L4, 6, 8, LX 6		23
225	M2	35	31
	M4, 6, 8, S4, 8		35
250	M2	41	35
	M4, 6, 8		41
280	2	52	41
	≥ 4		52
315	2	57	52
	≥ 4		52
	MX2 VL	57	57
	MY2 VL		57
	MX4, 6, 8 VL		52
	MY4, 6, 8 VL	78	57

Roller table motors for converter feeding, series ARC

Series ARC, Size	Design length, Pole number	Sealing grease, D-end	Grease amount for the antifriction bearing in cm ³		
			D-end	N-end	
112	all	50	10	10	
132			17	17	
160			23	20	
180			31	23	
200			35	31	
225			41	35	
250			52	41	
280			120	57	52
315			130		57
355			150	90	

Heavy roller table motors, series ARB

Series ARB, Size	Design length, Pole number	Grease amount in cm ³ at D-end and N-end
ARB 22, ARB 33	all	12
ARB 54, ARB 65		23

14. 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. It is recommended to include the electric motors in the regular routine inspections of the driven machine.

15. Warranty, Repair, Spare Parts

Unless expressly agreed otherwise our authorised workshops are responsible for all repairs under warranty. Any other repairs that may potentially be required can also be carried out by skilled personnel in these workshops. Details about our Customer Service network can be obtained from the manufacturer on request. Spare parts are listed in Section 19 of these Operating and Maintenance Instructions. Maintenance carried out appropriately (provided it is as described in the 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.

16. Electromagnetic Compatibility

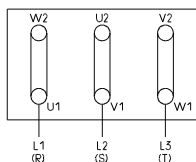
The motors, as a non-independently working unit, have been checked with regard to their conformity with the EMC Standards. It is the responsibility of the equipment operator to ensure by suitable measures that the equipment and systems in their entirety comply with the relevant electromagnetic compatibility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

17. Trouble Shooting

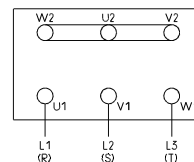
General mechanical and electrical faults are to be rectified according to the diagram in Section 20. All Safety Regulations must be strictly observed when rectifying faults.

18. Terminal board circuits, Single Speed Squirrel Cage Motor:

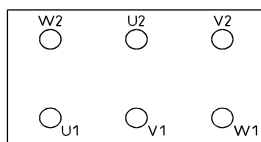
Δ low voltage



Y high voltage



Star Delta Switch Connection:

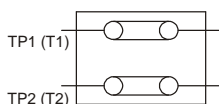


For Star Delta without bridges, connection as per the switch diagram

Motors with Thermal Winding Protection

Terminal board connection as above

From the motor



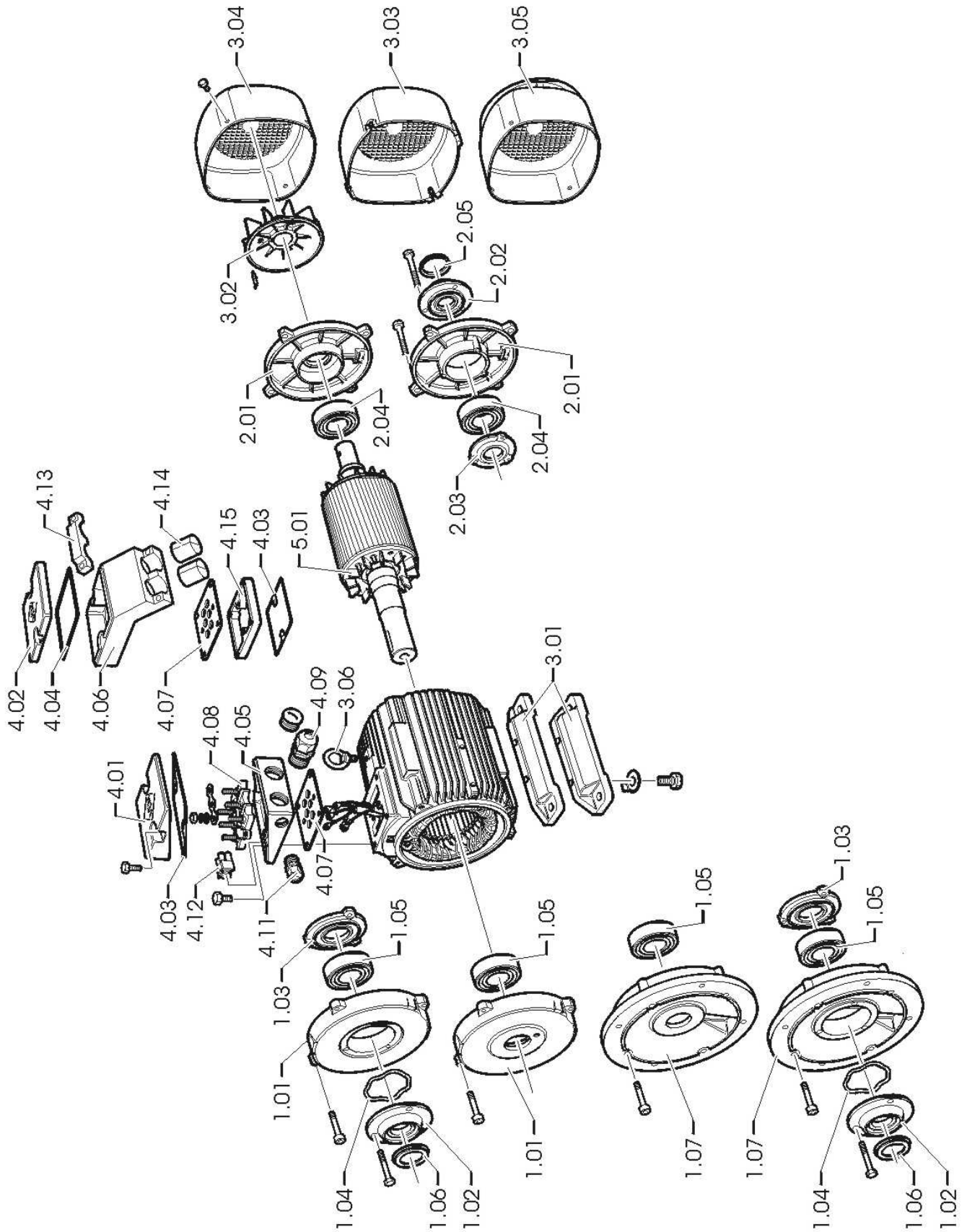
Connection of the tripping device

The connection is implemented as per the connection diagram of the tripping device

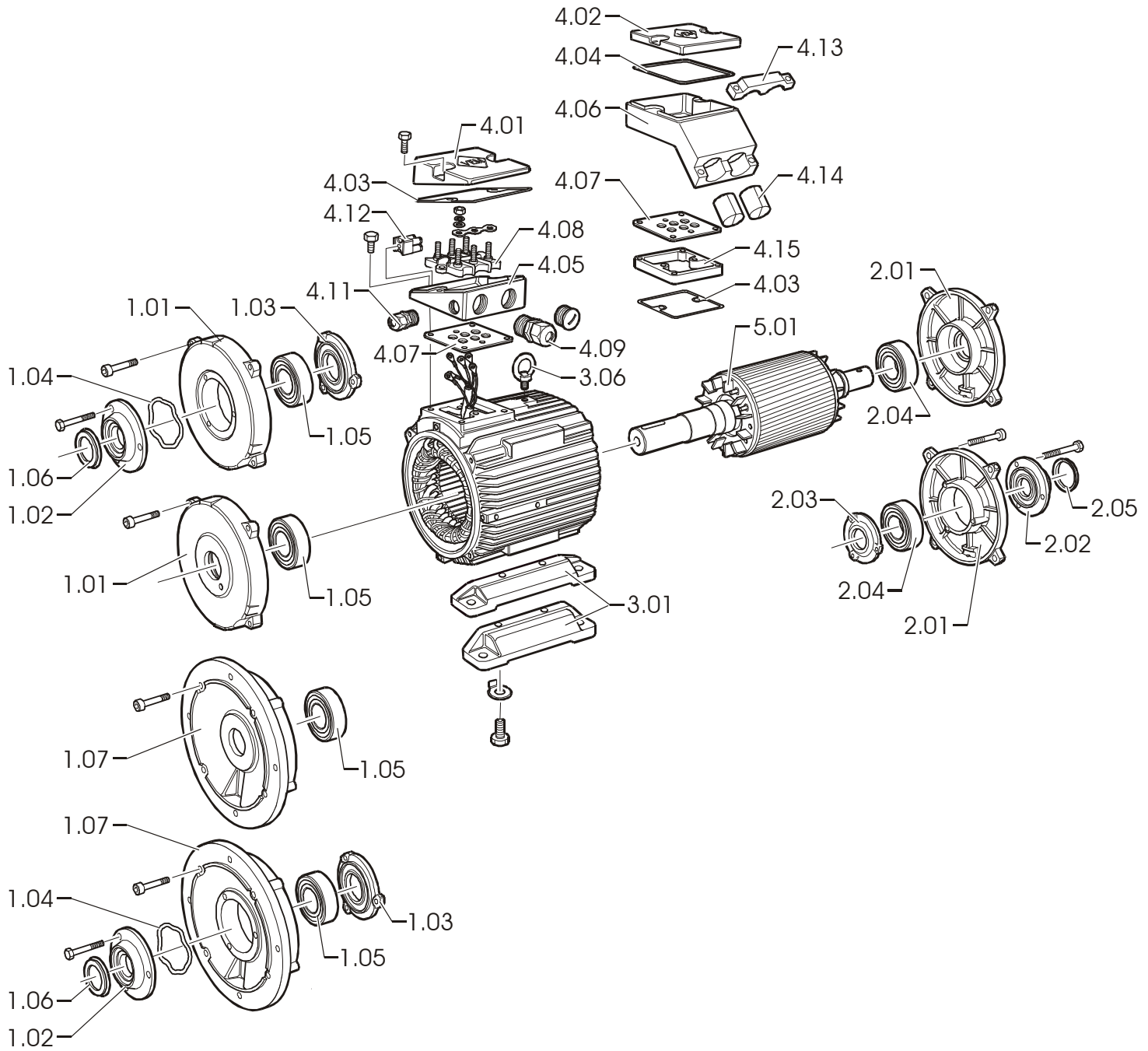
19. Construction of the motor

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
1.06-1	V-Ring D-Seite	V-type rotary seal, Drive-end
1.06-2	γ -Ring D-Seite	γ -type rotary seal, Drive-end
1.07	Flanschlagerschild	Flange end shield
1.08-1	Radial-Wellendichtring 1, D-Seite	Radial sealing ring 1, Drive-end
1.08-2	Radial-Wellendichtring 2, D-Seite	Radial sealing ring 2, Drive-end
1.09	Laufbuchse, D-Seite	Liner, 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 N-Seite (oder D-Seite)	Wave washer, Non-drive end (or 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 therm. 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
6.06	Abdeckblech, D-Seite	Cover, Drive-end
6.07	Abdeckblech, N-Seite	Cover, Non-drive-end
7.01	Drehgeber / Tachogenerator	Speed sensor / Tacho generator
7.02	Anbaubremse	Built-on brake
8.01	Getriebe	Gear

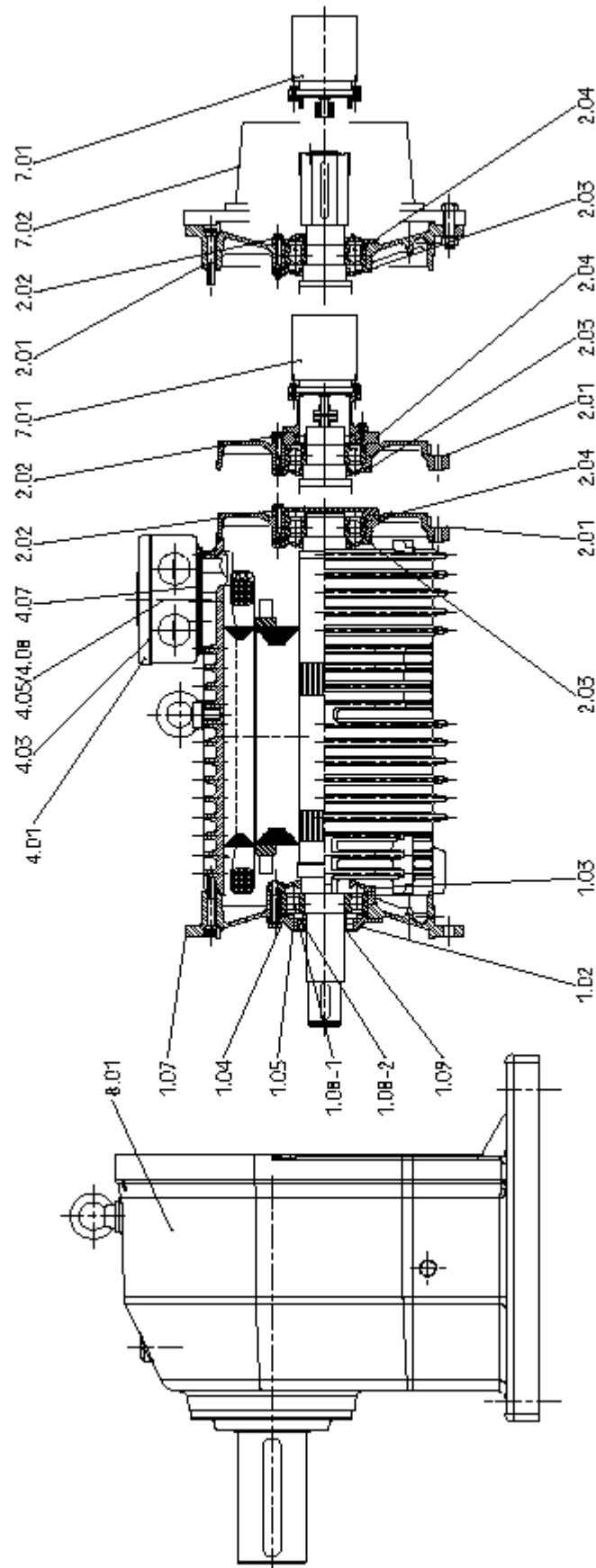
Three Phase Asynchronous Motor / Basic Version A2.R 112 - 355
(example, delivered version may differ in details)



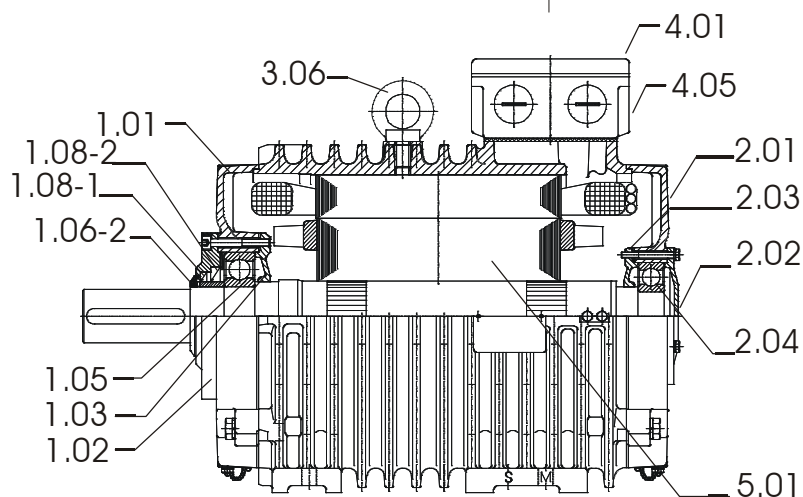
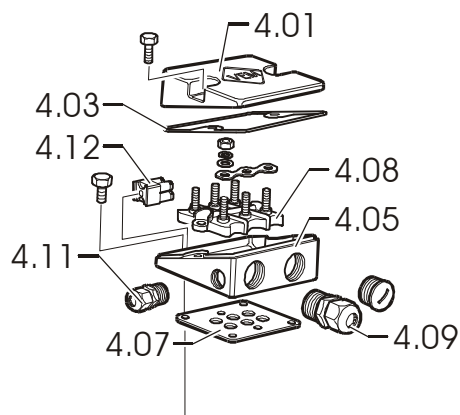
Non-Ventilated Three Phase Asynchronous Motor / Basic Version A2.O 112 - 355
 (example, delivered version may differ in details)



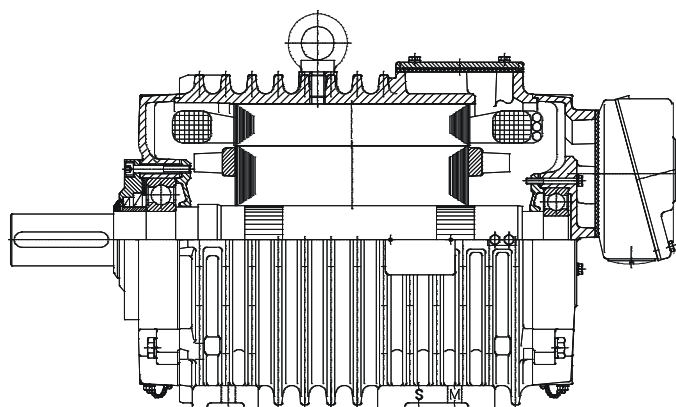
Three-phase roller table motor / Special versions AR. 112 – 355
Geared motor version,
Built-on speed sensor or tachogenerator,
Built-on brake
Built-on brake and speed sensor or tachogenerator
(example, delivered version may differ in details)



Three Phase Roller Table Motor / Basic Version ARC 112 - 355
 (example, delivered version may differ in details)



Anschlußkasten
oben

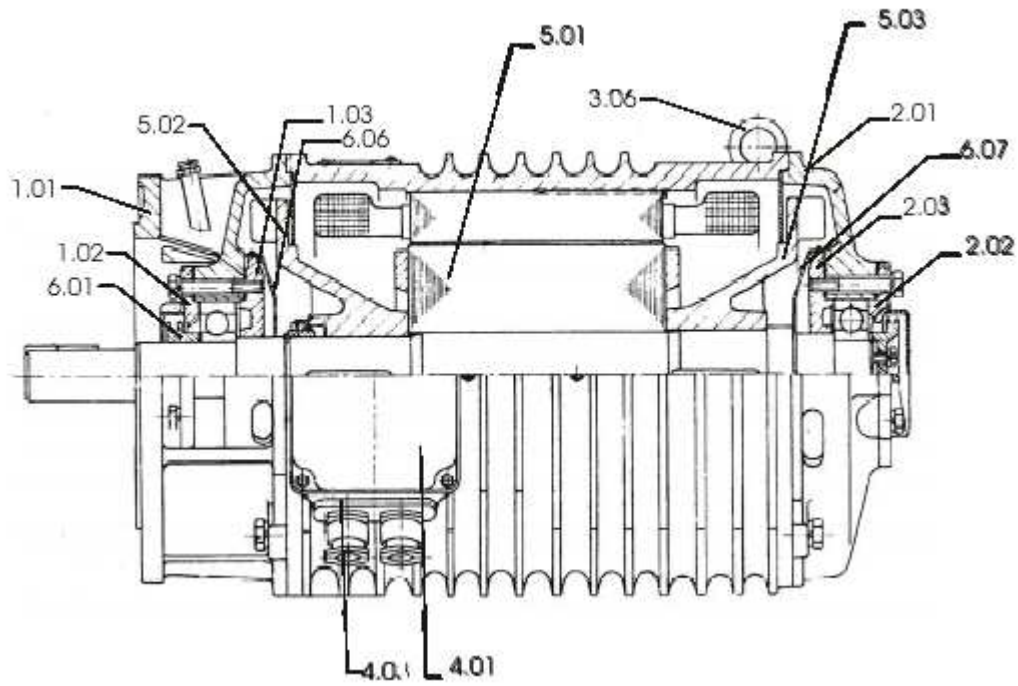


Anschlußkasten
hinten

Terminal box on top

Terminal box at the N end shield

Three Phase Roller Table Motor / Basic Version ARB 22 - 65
(example in type IM B5, other types (IM B3 and IM B35) available,
delivered version may differ in details)



20. Trouble Shooting

20.1 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 heating up in no-load operation	
	Excessive heating up at rated output	
	Excessive heating 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 conditions
● ● ●	Turn-to-turn fault	Check the winding and the insulation resistance, repair in authorised service workshop
● ● ●	Phase-to-phase short circuit	Check the winding and the insulation resistance, repair in authorised service workshop
●	Interruption in the squirrel cage winding	Repair in authorised service workshop

20.2 Mechanical Faults

	Dragging noise	
	Excessive heating up	
	Strong vibrations	
	Bearing heats 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 over 40 °C	Regrease bearing with suitable grease
●	V-type rotary seal or gamma ring is 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

Note:

We make all efforts to better our products continuously.
 Versions, technical data and figures could be changed therefore.
 They are always not binding before written confirmation by the supply factory.