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Three-Phase Current Servo Motors

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1 Safety Information

1.1 General Dangers in the Case of Failure to Observe the Safety Information

The electric drive is designed to the state of the art and was checked for operating safety before delivery. Nevertheless, the machine can represent a danger when it is improperly operated by insufficiently trained personnel or employed for inappropriate use.

This means:

- Danger to life and limb
- Danger to the machine and other material property of the owner
- Danger to efficient operation of the machine

	– This symbol shows information about protecting the system.
	– This symbol shows general safety information for the protection of operating personnel.
	– This symbol shows safety information about sources of electrical danger.

1.2 Safety-Conscious Working

Any person occupied in the owner's company with setup, operation, corrective maintenance and repair of the electric drive must have read and understood the Commissioning Instructions, especially the section on **safety**.

It is advisable that the owner has that confirmed in writing by all such persons.

The drive must be connected and maintenance carried out by qualified and authorized specialists only.

The responsibilities for operation and maintenance of the drive must be clearly defined and observed in order to avoid indefinite responsibilities as far as safety is concerned.

For all work related to setup, operation, resetting, adjustment, maintenance and repair, the system must be shut down. Shutting down the system means that the drive is turned off with the main switch, thus deenergizing all its components. The EMERGENCY STOP functions must also be checked.

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1.3 Various Safety Information for Operating and Maintenance Personnel

Electric drives must be used only in systems corresponding to VDE specifications.

In operation, the power unit and the motor coils are live! Never touch these components during operation! Connect measuring instruments only when the motor is deenergized and disconnected from the mains.



Start working on the motor connections only after you have made sure that they carry neither potential nor voltage.



Be particularly careful when touching the drive shaft directly or indirectly. You must only do this when the drive is stationary and disconnected from the mains!



Refrain from any operation impairing machine safety.

The operator is obliged to immediately report modifications having occurred on the machine that might impair its safety.

Safety equipment must never be dismantled or disabled.



If safety devices are removed during commissioning, repair and maintenance work, disable the machine. Remount the safety equipment immediately after completion of commissioning, repair or maintenance work.



After any and all operator activity involving the machine, the owner must carry out acceptance testing and document it chronologically in the machine log (maintenance book etc.) (name of the person/firm carrying out acceptance testing, date of testing, signature and report number). If this is not carried out, the owner may be faced with consequences relating to liability legislation.

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1.4 Indication of Special Dangers

Important! Before starting any maintenance work, lower the load.



Current: Check that the equipment is deenergized.
Main switch OFF!



Contact: Before starting work on the motor, check that the unit is switched off (ensure that the motor is deenergized!), idle and secured from being switched on again. Risk of injury!
Do not disconnect the motor connections during operation.
Danger to life! Do not touch the motor casing in rated operation.
Risk of burns!



1.5 No Unauthorized Additions or Modifications to the Drive

In the section on safety, it is indicated that for safety reasons unauthorized additions or modifications to the drive are not allowed. In case of doubt, please contact the manufacturer.



1.6 Appropriate Use

These machines are intended for commercial systems. They meet the standards of series DIN 0530/EN 60034. Use of this equipment in hazardous locations is prohibited unless expressly provided for (refer to additional information). If stricter requirements are specified, e.g. in non-commercial applications special guards to protect children, you must ensure that these requirements are complied with on the system side at set-up.

The machines are rated for ambient temperatures of +5° C to +40° C and site altitudes of 1000 m or less above sea level. Observe any information that differs from the data shown on the rating plate. On-site conditions at the place of use must correspond exactly with the information on the rating plate.

Electric motors are components for installation in machines in the sense of low-voltage guideline 89/392/EEC. You may not carry out commissioning until it has been determined that the end product conforms to this guideline (observe EN 60204-1).

When operating electric motors in accordance with their intended uses, the protection requirements must conform to EMC guideline 89/336/EEC. The person setting up the system is responsible for appropriate installation (e.g. physically separating signal lines and power cables, using shielded lines and cables.) In the case of systems with current converters, observe the manufacturer's EMC information.

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2 Technical Data

2.1 Motor Type, Product Number and Technical Data

Refer to the rating plate on the machine for the appropriate data.

3 Requirements of the Site

3.1 Transportation, Storage

Check the motors on delivery. In the case of transport damage, inform Baumüller Nürnberg GmbH or the sales office responsible immediately (for addresses, see back).



When storing motors for a relatively long period of time, damage can be avoided by taking the following precautions:

Store the motors only on dry premises at a constant temperature and without an aggressive atmosphere. Only store them out of doors in dust- and water-tight packaging material. Avoid permanent vibration acting on the motor. Protect the shaft and the connecting flange from corrosion.

3.2 Mounting Space Required

Mount the motors such that cooling air comes in and warm air is removed freely. This is ensured when the distance to neighbouring machine components is at least 10 cm.



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3.3 Site

On-site, the effective vibration severity of 4.5 mm/s must not be exceeded over the entire speed range. Measurement according to DIN 45665.



3.4 Ambient Conditions

The power output stated in the list applies to continuous running duty (S1) at nominal speed and at a maximum ambient temperature of 40° C with the machines at a site altitude of less than 1000 m above sea level. In different conditions, the required list power P_L is the product of the factors explained below and the required power $P_L = P \times k_1 \times k_2$. If three-phase machines are to be operated at an ambient temperature of more than 40° C or at site altitudes of more than 1000 m above sea level, the required list power P_L is the product of factors k_1 , k_2 given in the table below and the required power P .

Ambient temperature	40° C	45° C	50° C	55° C	60° C
Correction factor k_1	1	1.05	1.1	1.16	1.24
Altitude above sea level	Up to 1000 m	Up to 2000 m	Up to 3000 m	Up to 4000 m	Up to 5000 m
Correction factor k_2	1	1.06	1.17	1.3	1.55

In the case of sites above 1000 m where the ambient temperature drops by approx. 10° C per 1000 m, power correction is not necessary.

At ambient temperatures above 40° C and with motors of enclosed design, contact the manufacturer for any design modifications that may be required.

3.5 Environmental Influences

You should generally prevent the motor from coming into contact with aggressive media.



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4 **Operation**

All work may only be carried out by qualified specialists, with the low-voltage machine idle, deenergized and secured from being switched on again. This also applies to auxiliary circuits, e.g. the anti-condensation heater. Check that the equipment is deenergized!



Exceeding the tolerances in VDE 0530, Part 1/IEC 34-1 – +5% for the voltage, +2% for the frequency, as well as the ones for the curve shape and symmetry – increases heating and affects electromagnetic compatibility. Observe the information on the rating plate and the terminal diagram in the terminal box. The equipment must be coupled up such that a permanent, safe electrical connection is maintained (with no protruding wire ends); use the assigned cable tips. Make a safe PE connection. The smallest clearances between uninsulated live parts and ground may not be less than the following values:

8 mm where $U_N \leq 550 \text{ V}$, 10 mm where $U_N \leq 725 \text{ V}$, 14 mm where $U_N \leq 1000 \text{ V}$.

There may be no dirt or damp in the terminal box. Seal any unneeded cable entry holes and the terminal box itself dust- and water-tight. Secure the feather key for test operation without drive elements. In the case of low-voltage machines with brakes, check that the brake is working properly before carrying out commissioning.

Vibration levels of $v_{\text{eff}} \leq 3.5 \text{ mm/s}$ ($P_N \leq 15 \text{ kW}$) or $v_{\text{eff}} \leq 4.5 \text{ mm/s}$ ($P_N > 15 \text{ kW}$) in coupled operation are insignificant. If changes different from normal operation occur, e.g. increased temperatures, noises or vibrations, find out the cause and contact the manufacturer if necessary.

Never disable guards, even in test operation. In case of doubt, switch off the low-voltage machine. If a lot of dirt accumulates, clean the airways regularly. Regrease bearing assemblies that have regreasing devices while the low-voltage machine is running. Observe the type of saponification. If grease exit holes are sealed with plugs (in the case of IP 54 protection located on the drive end and with IP 23 protection on the non-drive end), remove them before commissioning. Change permanently lubricated bearings after approximately 20,000 operating hours or three to four years at the latest.

4.1 **Instructions for Initial Commissioning**

Compare the available mains voltages to the values specified on the rating plate. Mount all guards before starting commissioning.



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4.2 Wiring Diagrams

Connect the motor according to the supplied wiring diagrams.

4.3 Notes

The motor must only be mounted to the appropriate attachment points (pedestal, flange) in the installation position for which it is designed. When mounting, ensure that the motor is attached unwarped.



Checklist for Initial Commissioning

Make a note of the motor type, the motor number and the version of the servo motor.

Check the connections. The motor shaft can be turned evenly (release the brake first with brake motors).

Measured at room temperature on U-V-W, the winding resistance corresponds to double the value of R_1 from the technical description. The tolerance of the measured value between the windings is less than 5% .

Connect only brushless tachometer generators.

Check the resolver according to the commissioning guide of the closed-loop controller used.

5 Preventive Maintenance

Important!

Before starting maintenance work, lower the load.

Before starting maintenance work, disconnect the machine from the mains.

Retighten as specified all connections, e.g. screws, that were loosened during maintenance work.



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5.1 Fan

If you have to carry out maintenance work on a force-ventilated motor, you must first remove the fan cowl. To do this, proceed as follows:

Motors without an additional incremental encoder:

- Release the M5 attachment screws (item 5)
- Pull off the fan cowl (item 6) towards the B-side
- Carry out the necessary maintenance work
- Carry out reassembly in the reverse order

Motors with an additional incremental encoder:

- Pull out the connections from the flange-type socket (item 3)
- In the case of the old version with Souriau flange-type sockets, press the crimp contacts inwards using a Souriau ejector, tool number 5106.021.09.16.
- In the case of the version with an Interconnectron flange-type socket, use an Interconnectron removal tool number B 038.
- Release the M5 attachment screws (item 5)
- Pull off the fan cowl (item 6) towards the B-side
- Carry out the necessary maintenance work
- Insert crimp contacts in the flange-type socket according to the strand numbers until they snap into place.
- Use the colours to check again that the plugs are assigned correctly.
- Carry out reassembly in the reverse order

1	Terminal box/socket main connection	4	Connection for fan
2	Connection for resolver	5	M5 DIN 912 screw
3	Connection for incremental encoder	6	Fan cowl

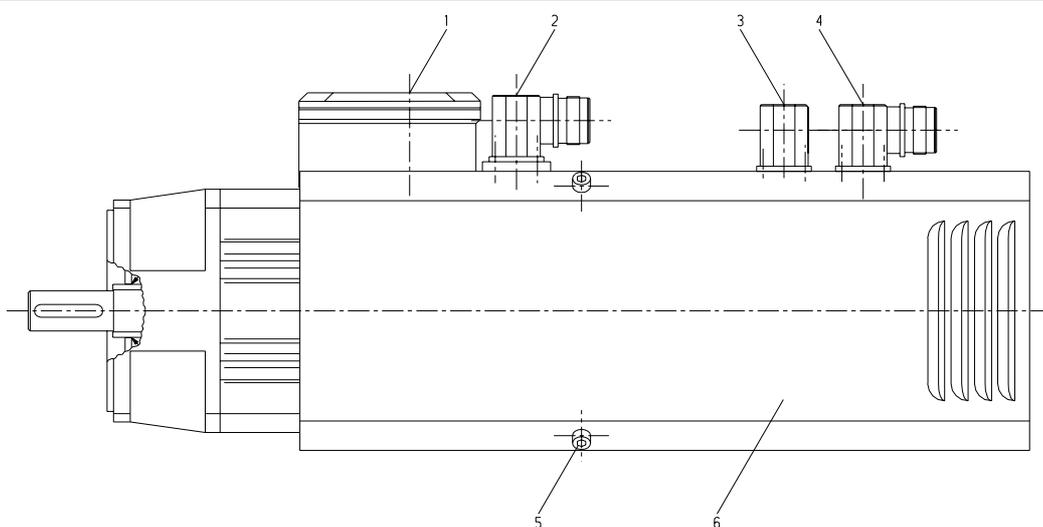


Figure 2

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5.2 DG 60 D Incremental Encoder

- Release the attachment screws for the incremental encoder.
- Remove the incremental encoder
- Remove the coupling's clamping piece from the incremental encoder shaft
- Fasten the coupling's clamping piece on the new incremental encoder
- Fasten the new incremental encoder on the adapter flange
- Align the new incremental encoder according to the zero pulse (if necessary).
- After this, tighten the M4 clamping screws using an appropriate tool

1	Connection for brushless tachometer	4	DG 60 D incremental encoder
2	Connection for incremental encoder	5	M6 DIN 6912 screw
3	Adapter flange	6	M4 clamping screw with washer

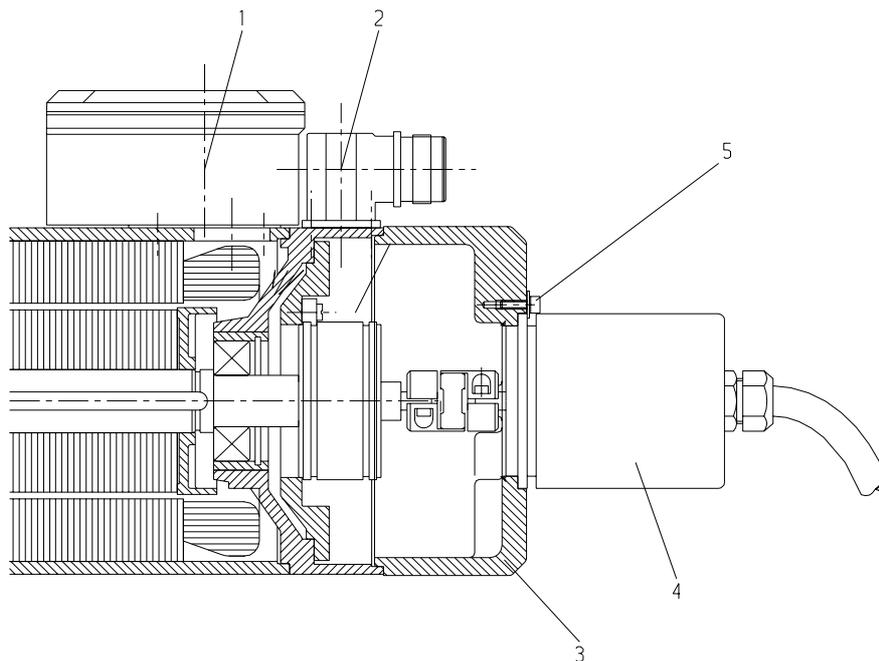
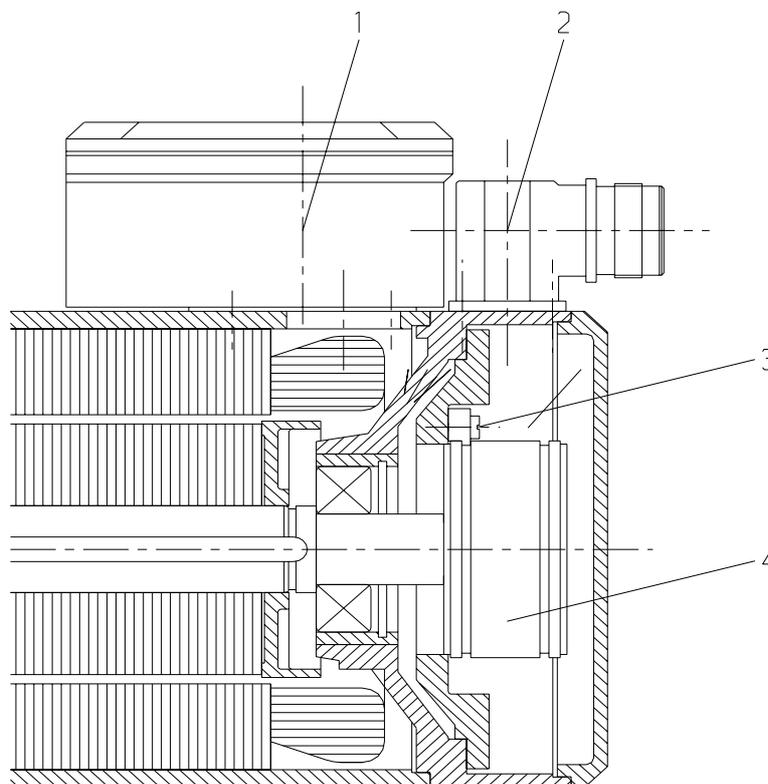


Figure 3

5.3 Replacing the Resolver

- When replacing the resolver, note that its locating angle is unknown at recommissioning.
- To prevent damage to the drive or the machine, it is absolutely necessary to set the correct locating angle on the controller as described in the controller's commissioning guide. If the commissioning guide does not deal with this, it is crucial to set the motor in an authorized specialist workshop. You cannot repair the motor yourself. 
- The resolver comprises a stand and an impeller that is glued to the motor shaft.
- The impeller is connected via a connecting stud, Item 3 (fastened using clamping unit, Item 12) to the motor shaft, Item 2.
- You can remove the resolver's stator as follows:
Pull out the connections from flange-type socket, Item 8 using Interconnectron removal tool number B 038.
Check the resolver in accordance with the controller's commissioning guide.
Now correctly set the locating angle as described in the controller's commissioning guide.

1	Terminal box
2	Resolver connection
3	DIN 84 M3 screw
4	Resolver



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5.4 Replacing the Drive End Shields of the Impeller and the Ball Bearings

- Take out the non-drive end shield, the incremental encoder and the tachometer impeller as described in 5.1/5.2.
- Pull out the drive-end shield and the impeller towards the drive end. Due to the magnetic pulling force, you must use a certain amount of force, which increases with the size of the motor.
- Release the screws of the bearing cover and remove the drive end shield from the impeller.
- Use a retractor to pull off the ball bearing and the inner raceway from the impeller.
- Replace the defective part.
- Carry out reassembly in the reverse order.
- Balance the impeller.

List of replacement ball bearings to be used, listed by motor size.

Motor Type and Size	Ball Bearings on A-S	Ball Bearings on B-S
DS 36	6001 2ZR C3	6001 2ZR C3
DS 45	6004 2ZR C3	6003 2ZR C3
DS 56	6204 2ZR C3	6203 2ZR C3
DS 56, short motors	6004 2ZR C3	6203 2ZR C3
DS 71	6205 2ZR C3	6203 2ZR C3
DS 71, short motors	6205 2ZR C3	6203 2ZR C3
DS 100	6207 2ZR C3	6205 2ZR C3
DS 100, short motors	6206 2ZR C3	6206 2ZR C3

All the bearings in question are lifetime-lubricated.

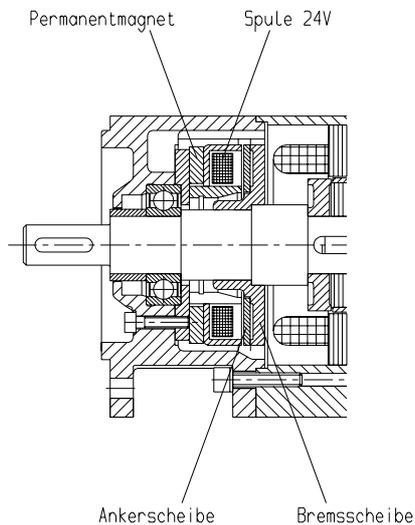
The ball bearings are filled with lithium-soap grease.

When replacing bearings, ensure that the surrounding area is clean and handle bearings with care.

Handling bearings incorrectly can have an adverse effect on their useful lives or even damage them.

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5.5 Replacing the Brake



Permanentmagnet
Spule 24V
Ankerscheibe
Bremsscheibe

Permanent magnet
24V coil
armature disk
Brake disk

- Take out the non-drive end shield and the resolver as described in 5.2.
- In the main terminal box or the main outlet box, release the red and blue wires for the brake connection.
- Remove the fastening screws of the drive end shield
- Pull out the drive end shield and the impeller towards the stator housing. Due to the magnetic pulling force, you must use a certain amount of force, which increases with the size of the motor.
- Release the brake's fastening screws and remove the drive end shield from the impeller.
- Use a retractor to pull off the complete brake, with the ball bearing and the inner raceway, from the impeller
- When you remount, you must use a new ball bearing, a new inner raceway and a new complete brake.
- Connect 24 V DC to the (red) positive wire.
- Heat the brake disk and fit it on the impeller. Ensure that the brake disk is in contact with the shaft shoulder.
- Balance the impeller.
- Heat a new ball bearing and mount it on the impeller.
- Heat the inner raceway too and fit it on the impeller.
- Carefully run the two wires through the cable duct provided for them in the stator housing and connect them in the main terminal box or the main outlet box. Observe the connection diagram!
- Now remount the end shield.
- Before recommissioning the drive, you must carry out functional testing to detect possible faults and, if necessary, to remove them.

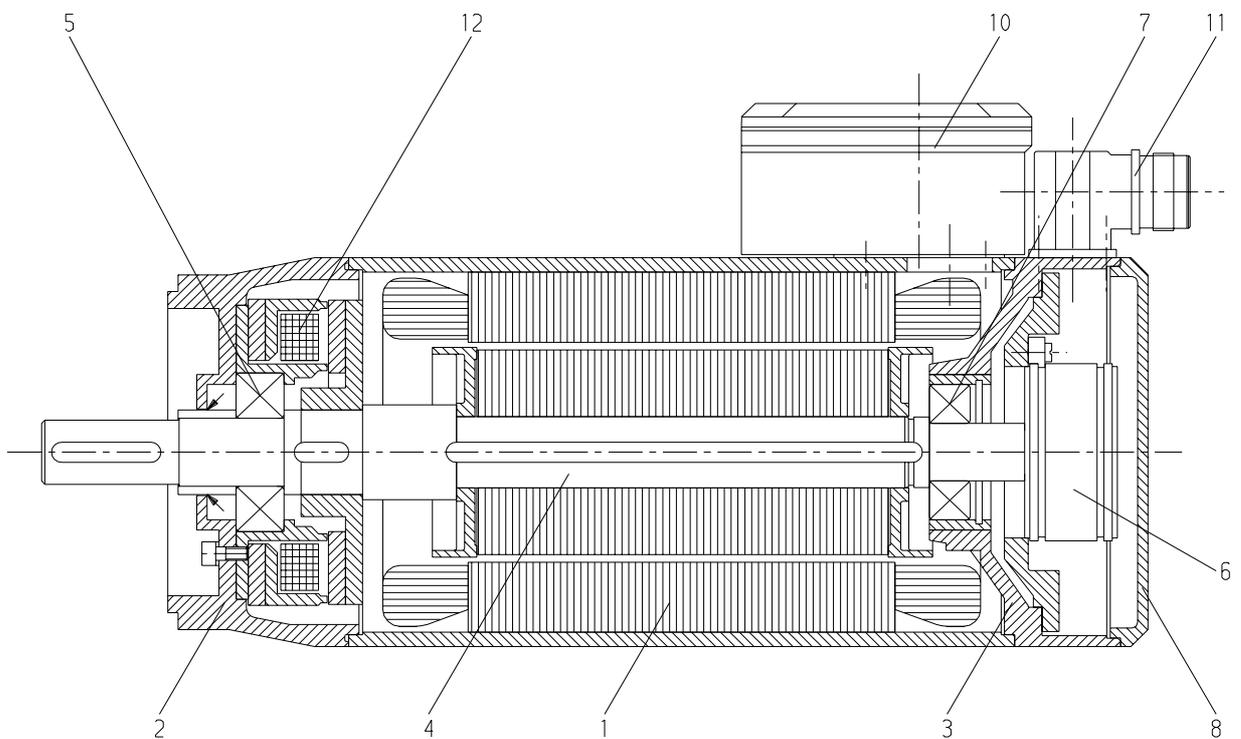
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5.6 Replacing the Motor Housing with the Winding

- Dismount the resolver as described in section 5.1.
- Remove the impeller with the drive end shield as described in section 5.2.
- In the case of motors with built-in brakes, remove the brake as described in section 5.3.
- Remove the housing fastening screws on the non-drive side.
- Replace the motor housing (if necessary, compare the values of the coil resistances with the table values).
- Check that the rotor has no axial and radial play.
- Check that the impeller rotates easily.
- With brake motors, check the function of the brake.
- Connect the motor and set the resolver in accordance with the closed-loop controller's commissioning instructions.

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6 List of Spare Parts



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1 2 3 4 5 6	Housing with winding Drive end shield Non-drive end shield Motor shaft with impeller package Ball bearing A side Resolver	7 8 10 11 12	Ball bearing B side Cover Terminal box/connector main connection Flange-type socket for resolver Holding brake
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7 Decommissioning and Disposal

At decommissioning of the motors, the following also applies:

- Before starting any work, lower the load.
Disconnect the motor from the mains.



The motor contains materials like steel, copper, insulation materials and lubricants. You must disassemble the motor appropriately and dispose of the material separately.