

Reparaturanleitung  
Repair manual  
Notice de réparation  
Manual de reparaciòn



Druckfest gekapselte Drehstrommotoren  
Three-Phase Explosion Proof Motors Flameproof Enclosure  
Moteurs triphasés à enveloppe antidéflagrante  
Motores de corriente trifàsica protegidos contra explosiones

## Explosion-Proof F&G Three-Phase Motors



## **Warning!** **Dangerous electrical voltage!** **Observe explosion protection measures!**

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### **Before commencing repair work**

The following safety instructions for the repair of explosion-proof three-phase motors in flameproof enclosures – designation: *Ex II 2.EEx d(e) IIC(B) T* – must be observed in addition to the general installation instructions and the provisions of the operating manual. The operating manual provides instructions on the installation of the standard motor types and is not a substitute for any specialist training in the sense of the relevant explosion protection standards.

- Disconnect the power supply of the device
- Ensure that the device cannot be accidentally restarted
- Verify isolation from the supply
- Earth and short-circuit
- Cover or enclose neighbouring units that are live.
- Follow the installation instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- The electrical installation must be carried out in accordance with the relevant regulations (e.g. for cable cross-sections, fuses, protective conductor connections).
- The opening of the motor without the manufacturer's consent, apart from the opening of terminal boxes, will invalidate the warranty during the warranty period.
- Original spare parts must be used for approved repairs or repairs outside of the warranty period.
- Electrically conducting and rotating parts of electric machines may cause serious and/or fatal injury.
- All transport, installation, commissioning and maintenance activities must only be carried out by qualified personnel. Observe the relevant standards for explosion protection such as EN 60079-14 and EN 50281-1-2, as well as national work safety regulations.
- Where installations are subject to these guidelines, appropriate safety measures must be taken in order to protect personnel from injury.
- Personnel must be instructed in how to proceed with care and observe the regulations in the transport, lifting and installation of the motor, as well as in recommissioning and repair.
- Do not use the lifting eye bolts to lift the motor together with the drive device.
- Do not use the supplied lifting eye bolts at ambient temperatures below  $-20\text{ °C}$ , in accordance with DIN 580. Lower temperatures could lead to the ring screws breaking and consequent injury to personnel and/or damage to the installation.
- The eye bolts should also not be loaded at an angle of more than  $45\text{ °}$  from the vertical direction and outside the plane of the ring, in accordance with DIN 580. In this case use transverse rods. Dimensions for positioning lifting eyes and minimum dimensions of transverse rods and chain lengths, see our operating manual.
- Suitable safety measures should be taken against possible brake failure on motors fitted with an external brake. This particularly applies to brake motors used in lifting applications.
- Avoid contact with the start and operation capacitors in single-phase motors until a secure discharge has occurred.
- If high-voltage tests are required, follow the procedures and precautionary measures laid down in the accident prevention regulations.

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## About This Manual

This manual describes the disassembly and assembly of CD.../BD... and dCD.../dBD... explosion-proof motors.

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### Abbreviations and symbols

This manual uses the following abbreviations and symbols:

DE: **D**rive end  
FS: **F**rame size  
NDE: **N**on-**d**rive end

► Indicates instructions on what to do

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→ Draws your attention to useful tips and additional information

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 **Important!**  
Indicates the possibility of minor material damage.

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 **Caution!**  
Indicates the possibility of major damage to property or slight injury.

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 **Warning!**  
Indicates the possibility of major damage to property or serious or fatal injury.

Except for the first page of chapters and empty pages at the end, the top left of the page shows the chapter title and the top right of the page shows the current section for greater clarity.

# 1 Explosion Protection



## Warning!

The repair and recommissioning of explosion-proof motors in flameproof enclosures must comply with the relevant legal provisions:

These are the Directive 94/9/EEC; this has been implemented in Germany by the draft for electrical equipment in hazardous areas Elex V, DIN EN 50014, 50018 and 50019 and VDE 0170/0 171 etc.

This particularly applies when work is carried out on parts on which explosion protection depends.

Parts on which explosion protection depends are:

- Gap connections and shaft bushings,
- Fastening screws,
- Seals,
- Cable glands and entries,
- Terminal points.

## Working on explosion-proof components

### Joint connections and shaft bushings



## Caution!

Gap surfaces (joint surfaces of components) must not be machined, coated or painted. Keep the surface metal clean. Surfaces must not have any surface damage (e.g. fractures or grooves).

Corrosion protection can be achieved using non-curing sealant (static gap surfaces) or sealant grease (static or rotating gap surfaces). Permissible sealing materials are Hylomar from Marston-Domsel, or Admosit and Fluid-D from Teroson.

### Fastening screws

Damaged screws must be replaced by new parts with the same material quality and must be sufficient for the number of fastening holes provided.

### Seals, cable glands, entries and terminal points

Damaged parts must be replaced by original parts.

### After repair work

If a part of a motor has been repaired on which explosion protection depends, the following requirements must be fulfilled for commissioning:

An appointed inspector must verify that the essential explosion protection features of the motor meet the requirements of the applicable regulations. This inspector must issue the operator of the motor with appropriate certification of this compliance. The inspector must attach an appropriate approval mark on the motor or by issuing a test report.



## Warning!

All components used on the motor must comply with the protection type of the motor concerned and the relevant standards. This is denoted by designations such as II 2 G EEx d IIC(B) T4, on motor and components.

Prior to recommissioning carry out the tests specified in Chapter "Tests", Page 24.

## 2 Maintenance Instructions

The following components form a flameproof enclosure depending on axle height:

- Housing,
- End shield,
- Bearing cover,
- Bushing plate with core or cable gland,
- Shaft sections in the vicinity of shaft bushings in the
  - Housing,
  - End shield or,
  - Bearing cover.

If these parts are damaged, such as due to fractures or grooves in the flameproof gaps (joints of individual components) they must be replaced with original parts. In accordance with EN 50018 gap surfaces must have a maximum average peak-to-valley height of  $R_a = 6.3 \mu\text{m}$  (ISO 468). Only original spare parts must be used.

If unmachined blanks are supplied and are finished by users themselves according to original drawings, these parts must be subject to parts tests in accordance with EN 50018.

Always renew shaft seals and roller bearings every time the motor is disassembled. The roller bearings must be covered at both ends, depending on type, and filled with anti-friction roller bearing grease for lifetime lubrication or must be open.

Replace damaged screws with screws of the same strength. These must be sufficient for the number of fastening holes provided.

Check the stator winding and dry or repair it if necessary. To do this refer to the enclosed instructions for assembly, commissioning and maintenance of three-phase squirrel-cage motors housed in a flameproof enclosure and in → Chapter "Tests", Page 24 of these instructions.



## Spare parts

The listed parts are available from the factory. The type and combination depends on the motor supplied. When making enquiries and orders for spare parts, please state the following:

- Spare part designation,
- Motor type and construction type,
- Motor no.

Part no.	Designation
<b>1</b>	<b>DE bearing assembly</b>
1.01	DE bearing cover, external
1.02	DE end shield
1.03	DE flange end shield
1.05	DE grease distribution disc, external
1.07	DE bearing cover, internal
1.08	DE shaft seal
1.10	DE roller bearing
1.11	DE relubrication device
<b>2</b>	<b>NDE bearing assembly</b>
2.01	NDE bearing cover, external
2.02	NDE end shield
2.05	NDE bearing cover, internal
2.06	NDE shaft seal
2.08	Cup spring
2.09	NDE roller bearing
2.10	NDE relubrication device
<b>3</b>	<b>Housing</b>
3.02	Stator winding, complete
3.03	Housing
3.05	Housing feet (1 pair)

Part no.	Designation
<b>4</b>	<b>Rotor</b>
4.01	Rotor, complete
<b>5</b>	<b>Ventilation</b>
5.01	Fan
5.02-03	Fan cowl
<b>6</b>	<b>Terminal compartment</b>
6.01	Terminal box
6.02	Terminal box cover
6.05	Cable bushing plate
6.08	Terminal plate
6.09	Core bushing
6.11	Cable gland
6.13	Bushing plate
6.14	Seal for terminal box cover
6.15	Seal for entry plate
6.16-17	Cable entry
6.18	Seal for bushing plate
<b>8</b>	<b>Brake</b>
8.10	Friction plate driver
8.11	Friction plate
8.20	Brake housing with coil, complete
8.30	One-way rectifier
8.40	Shaft seal
<b>9</b>	<b>Tacho-generator</b>
9.01	Tacho-generator
9.10	Torque arm
9.20	Tacho-generator housing
9.40	Shaft seal

## 4 Disassembly

➔ Dismantle the individual groups of components in the order specified below.

### Ventilation system

- ▶ Remove the fastening screws ④ of the fan cowl (5.02-03) and remove it (➔ Fig. 3).
- ▶ Remove the retaining ring ② from the fan (5.01).

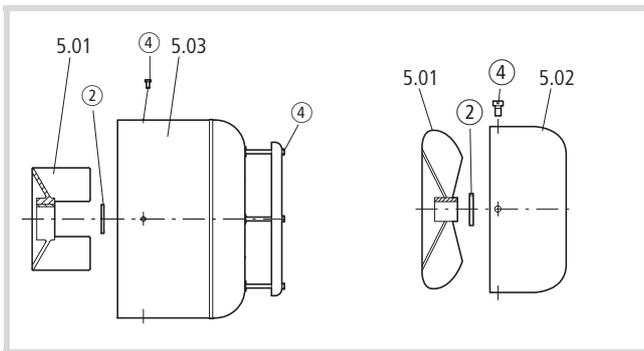


Figure 3: Undoing cowl screws and removing the retaining ring

**Important!**  
When removing the fan use an intermediate plate ② to protect the shaft centre hole. The extractor ① must engage behind the fan hub, otherwise the fan may break.

- ▶ Use the extractor ① to remove the fan (5.01) from the shaft. Remove small fans manually (➔ Fig. 4).

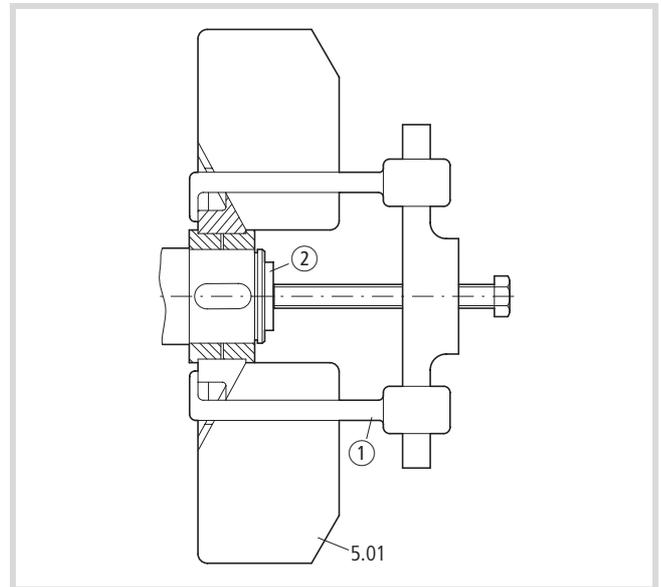


Figure 4: Removing the fan (5.01)

- ① Extractor
- ② Intermediate plate

**Important!**  
When removing the featherkeys use an intermediate plate to protect the shaft.

- ▶ Use the featherkey removal device to remove the featherkeys of the fan (5.01) from the shaft and the second retaining ring if fitted.

Further dismantling steps are required for motors without an integrated brake or tacho-generator, refer to ➔ Section "End shields, rotors and roller bearings", Page 8.

### Integrated brake and rectifier, frame size 80 to 132

The following requirements must be fulfilled in order to dismantle the integrated brake and rectifier:

The fan must have already been removed.

- ▶ Remove the fastening screws of the brake housing.
- ▶ Force the brake housing (8.20) from the motor housing centre the forcing-off thread in the fastening cams.



#### Important!

Insert a metal strip (→ item ① in Fig. 5) under the forcing-off screws as soon as the housings have come apart, in order to protect the thread in the motor housing.

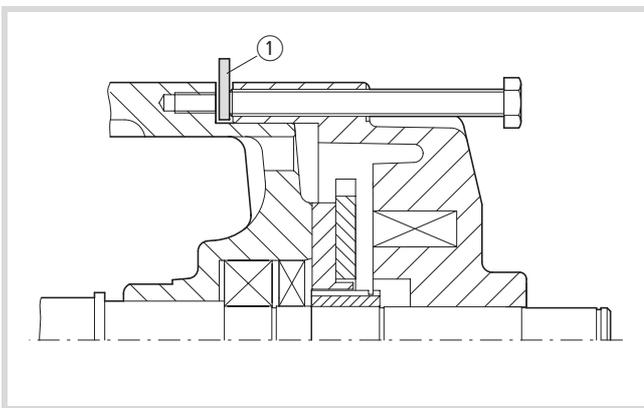


Figure 5: Inserting a metal strip

- ① 3 mm metal strip

- ▶ Lift off the brake housing (8.20) and rectifier and place it next to the motor.

The required cable length is provided in the motor housing.

To change the rectifier:

- ▶ Sever the cable to the motor directly at the board.
- ▶ Undo the cable to the brake coil at the terminal strip.

The additional wires moulded into the brake are for temperature monitoring and must be severed at the crimp connections or the terminal strip (depending on type) when the brake housing is exchanged.



#### Important!

When removing the friction plate use an intermediate plate ② to protect the shaft centre hole.

- ▶ Remove the friction plate from the friction plate driver (8.10).
- ▶ Remove the retaining ring positioned in front of the friction plate driver.
- ▶ Remove the friction plate driver (8.10) with the extractor ① (→ Fig. 6).

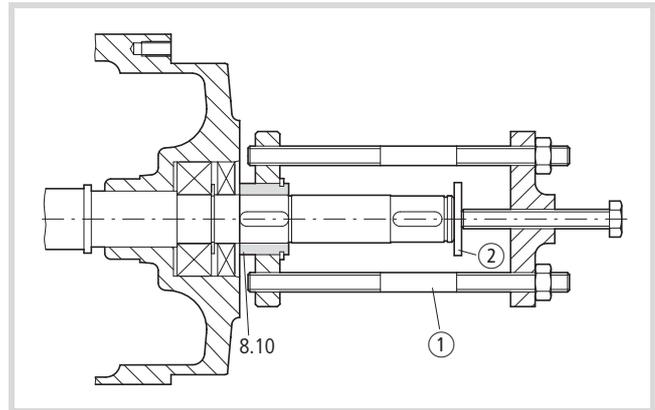


Figure 6: Removing the friction plate driver (8.10)

- ① Extractor
- ② Intermediate plate



#### Important!

When removing the featherkeys use an intermediate plate protect the shaft.

- ▶ Remove the featherkeys. With frame size 100, 112 and 132 remove the second retaining ring on the shaft.

### Integrated tachogenerator, frame size 80 to 132

The following requirements must be fulfilled:

The fan must have already been removed.

Follow the same dismantling procedure as for the brake.

To remove the tachogenerator (9.01) from the shaft undo the torque arm (9.10) and then carry out one of the following steps, depending on the type concerned:

- ▶ Remove the retaining ring in front of the tachogenerator (9.01) or
- ▶ Undo the terminal bolt on the hub of the tachogenerator.

The tachometer cable is drawn through the motor housing into the motor terminal compartment, so that the drive end must be opened before it can be withdrawn to exchange the tachogenerator (9.01).

### End shields, rotors and roller bearings

#### Frame size 56 to 225

##### Frame size 56 to 160

The following requirements must be fulfilled before dismantling: The fan and brake must have already been removed.

The NDE shaft seal (2.06) and retaining ring are located in front of the NDE roller bearing (2.09).

- ▶ Remove the NDE shaft seal (2.06) and the retaining ring (not with frame sizes 56 to 71).

**Frame size 180 to 225**

The following requirements must be fulfilled before dismantling:  
The fan and brake must have already been removed.

The NDE shaft seal (2.06) is located in front of the NDE roller bearing (2.09).

- ▶ Remove the NDE shaft seal (2.06) together with the external NDE bearing cover (2.01) by undoing the screws.
- ▶ Remove the cup springs (2.08) from the DE end shield (1.02).
- ▶ Unscrew the fastening screws from the DE end shield (1.02).

**Important!**

To protect the threaded holes, insert a metal strip (→ item ② in Fig. 7) under the forcing-off screws as soon as the end shield has separated from the motor housing. Both DE roller bearing (1.10) and NDE roller bearing (2.09) are damaged in the removal process on FS 80 to 225, and must be replaced with new bearings.

- ▶ Use the forcing-off thread holes ① in the holes of the end shield (normally one thread size larger than the fastening thread) to force the end shield and rotor from the housing spigot recess (→ Fig. 7).

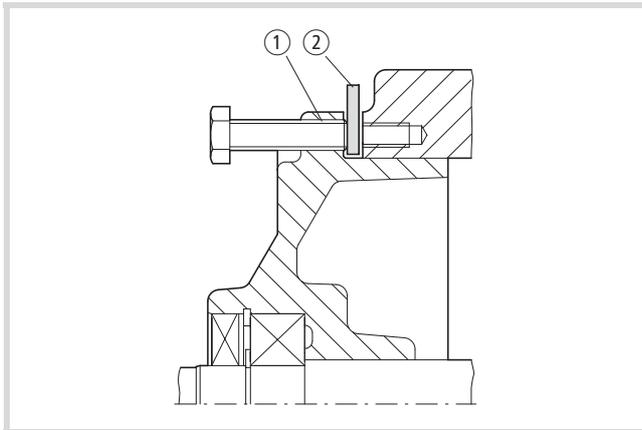


Figure 7: Forcing the end shield from the housing spigot recess

- ① Forcing-off thread holes
- ② 3 mm metal strip

- ▶ Remove the rotor carefully from the housing in order to avoid any damage!

**Important!**

When removing the featherkeys use an intermediate plate to protect the shaft.

- ▶ Extract the DE featherkey ③ from the shaft.
- ▶ Depending on the type concerned, remove
  - the DE shaft seal (1.08), with or without the external DE bearing cover (1.01)
  - the retaining rings ② and up to FS 160 ⑥ (→ Fig. 8)

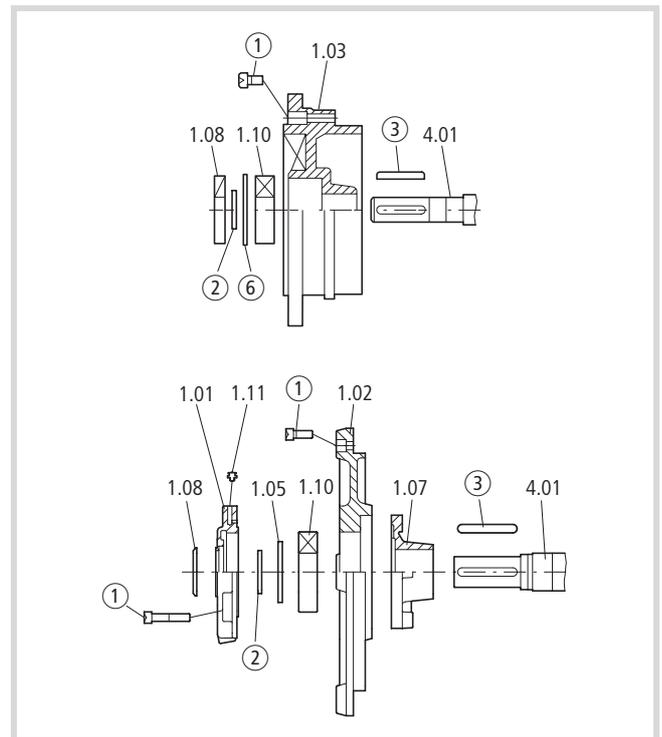


Figure 8: Position of DE shaft seal (1.08) and external DE bearing cover (1.01)

- ▶ Remove the DE end shield (1.02) and the DE roller bearing (1.10) from the shaft using an extractor (→ Fig. 9).

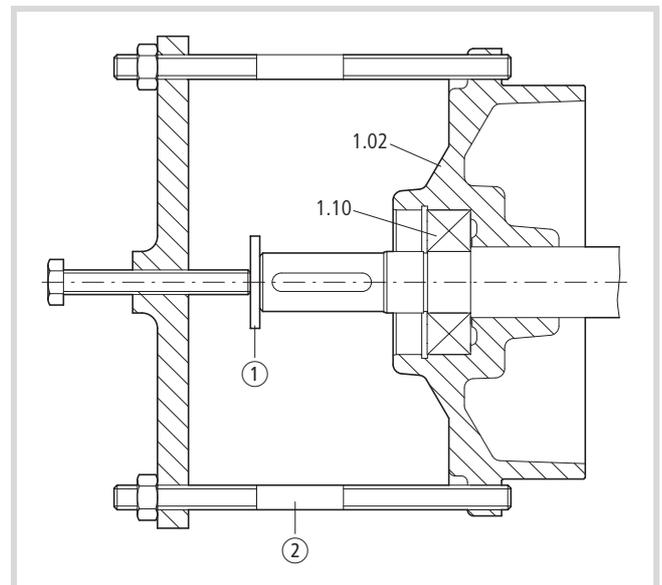


Figure 9: Removing the DE end shield (1.02) and DE roller bearing (1.10) from the shaft

- ① Intermediate plate
- ② Extractor

**Important!**

This will damage the DE roller bearing (1.10). It must be replaced with a new bearing. Use an intermediate plate ① to protect the shaft centre.

**Important!**

In order to prevent damage to the shaft bushing in the housing and end shield, use a soft (e.g. copper) mandrel to knock out the NDE roller bearing (2.09)! Use an intermediate plate ① to protect the shaft centre.

- ▶ With FS 80 to 132 use a mandrel to knock the NDE roller bearing (2.09) out of the housing through the shaft bushing. With FS 160 to 225 use a mandrel to knock the NDE roller bearing (2.09) out of the NDE end shield (2.02). With FS 56 to 71 the DE roller bearing (2.09) must be removed from the shaft using an extractor.

This will damage the bearings which must therefore be replaced.

- ▶ Unscrew and remove the fastening screws (frame sizes 160 to 225) from the NDE end shield (2.02).

**Important!**

Insert a metal strip under the forcing-off screws as soon as the end shield has separated from the motor housing holes in order to protect the threaded holes in the housing.

- ▶ Use the forcing-off thread holes in the end shield to force the NDE end shield (2.02) from the housing spigot recess (→ Fig. 7).

**From frame size 250**

- ▶ Unscrew the fastening screws of the external DE (1.01) and NDE (2.01) bearing covers.
- ▶ Remove the DE shaft seal (1.08) in front of the DE roller bearing (1.10) to be removed together with DE (1.01) and NDE (2.01) external bearing covers.
- ▶ Remove cup springs, depending on type.
- ▶ Unscrew and remove the fastening screws of the DE (1.02 or 1.03) and NDE (2.02) end shield.

**Only bearing point for frame size 250, NDE**

- ▶ Use the forcing-off thread holes to force the NDE end shield (2.02) together with the NDE roller bearings (2.09) from the housing spigot recess.

This will damage the NDE roller bearings which must be replaced.

**All other bearing points**

- ▶ Secure the end shield, for example, with threaded rods ① in the screw holes.
- ▶ Use the forcing-off thread holes to force the end shield from the housing spigot recess and from the roller bearing (→ Fig. 10).

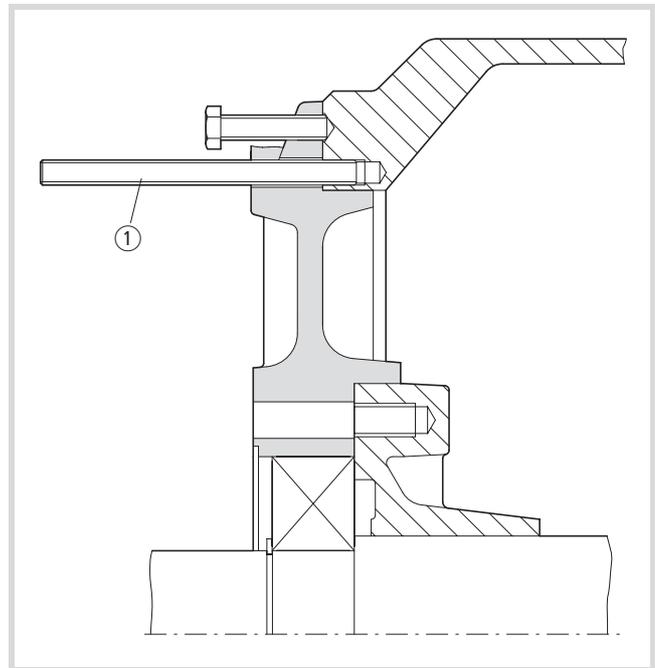


Figure 10: Forcing the end shield from the bearing

① Threaded rod

**Warning!**

The seating surfaces of the end shields on the housing must not be damaged by the forcing-off screws (e.g. deformations), in order to ensure perfect contact of the flameproof joints on the end shields on subsequent assembly.

- ▶ Remove the retaining rings located in front of the roller bearing.
- ▶ Remove the grease distribution disc if fitted.

**Important!**

When removing the bearing cover and roller bearing use an intermediate plate ① to protect the shaft.

- ▶ Remove the internal DE (1.07) or NDE (2.05) bearing cover together with the roller bearing from the shaft (→ Fig. 11).

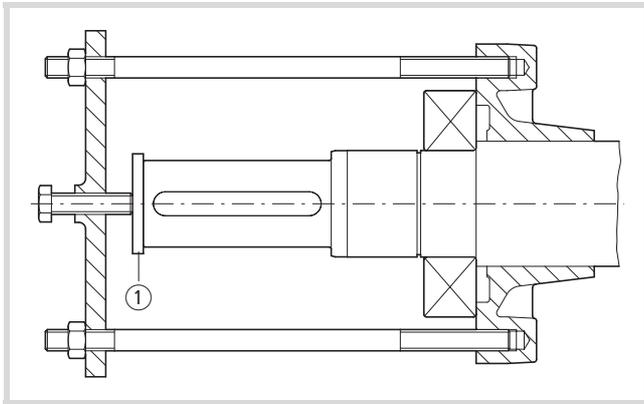


Figure 11: Removing the internal bearing cover and the roller bearing

- ① Intermediate plate

## Terminal box



### Warning!

All seals, cable entries, cable glands, and terminal points are elements of the explosion protection system and must only be replaced with original spare parts.

## Removing the terminal box

- ▶ Remove the terminal box cover (6.02).

### Frame size 63 to 112

With terminal boxes fastened with four screws, proceed as described in Section "Frame sizes 132 and 160", Page 11.

- ▶ Undo the terminals ① (→ Fig. 12) from the terminal plate (6.08).
- ▶ Unscrew the set screw ③ until the terminal box can be rotated easily.
- ▶ Unscrew the terminal box from the connecting piece of the housing.

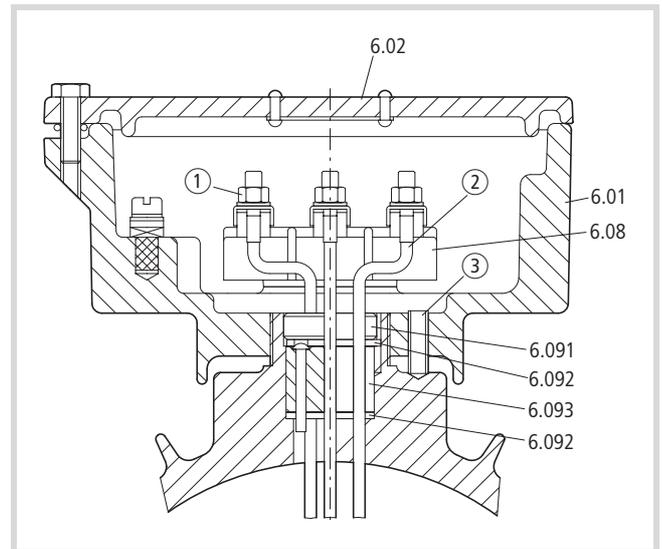


Figure 12: Undoing the terminals from the terminal plate (6.08)

- ① Terminals
- ② Disconnection point
- ③ Set screw to DIN 914

### Frame sizes 132 and 160

With flameproof terminal boxes, designation EEx d, proceed as described in Section "Frame size 63 to 112", Page 11.

- ▶ Undo the terminals ① (→ Fig. 13) from the terminal plate (6.08).

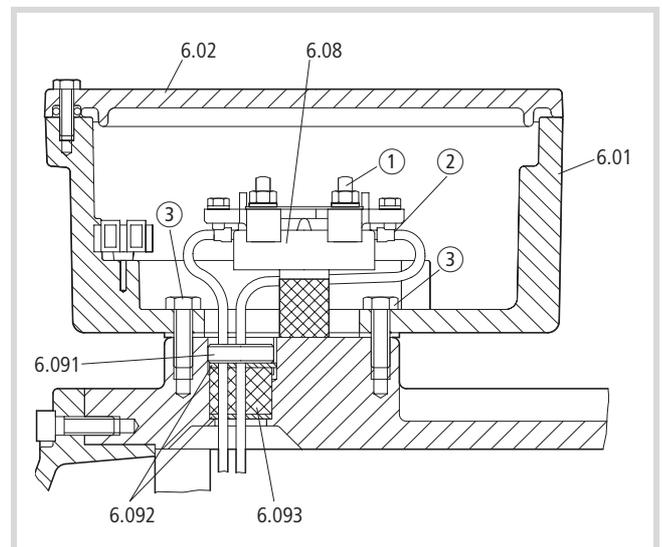


Figure 13: Undoing the terminals from the terminal plate (6.08)

- ① Terminals
- ② Disconnection point
- ③ Fastening screw

- ▶ Once you have unscrewed the four screws ③, lift the terminal box from the housing.

**From frame size 180**

- ▶ Undo the fastening screws ① (→ Fig. 14).
- ▶ Remove the terminal box (6.01) from the bushing plate (6.13).
- ▶ Using two forcing-off threads to force the bushing plate (6.13) with the cable glands (6.09) from the housing spigot recess.

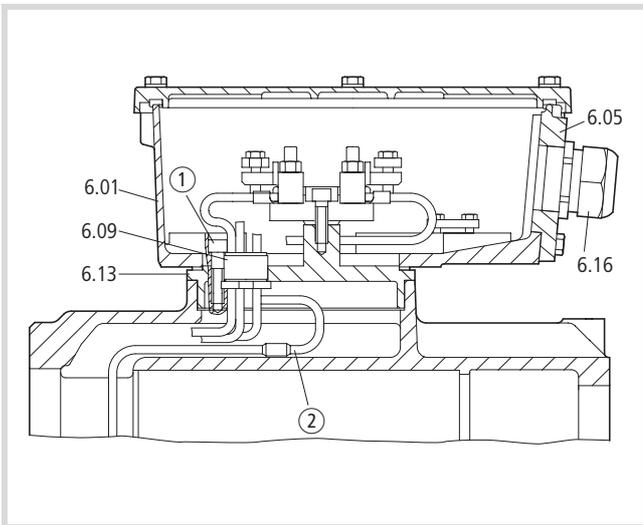


Figure 14: Removing the terminal box from the bushing plate

- ① Fastening screws
- ② Disconnection point

**Important!**

The seating surface of the bushing plate on the housing must not be damaged by the forcing-off threads (e.g. deformations), in order to ensure perfect contact of the flameproof joints on the bushing plate on subsequent assembly.

**Flameproof core bushing****Frame size 63 to 160**

- ▶ Undo the terminals ① (→ Fig. 12, Page 11 and Fig. 13, Page 11) on the terminal plate (6.08).
- ▶ Sever the winding cables directly on the cable lug ②.
- ▶ Loosen the pressure ring (6.091).
- ▶ Pull the winding cables through the pressure plates (6.092) and the sealing ring (6.093) into the housing.
- ▶ Remove the sealing ring and the pressure plates from the housing.

The pressure ring is secured with adhesive. It can be removed by overcoming the locking torque.

**From frame size 180**

Proceed as follows to disconnect the stator winding of motors with moulded core bushings (→ Fig. 14):

- ▶ Disconnect the winding cables directly next to the crimp connections ②.

If the winding cables are passed through the entries directly to the terminal plate, proceed as follows (→ Fig. 15):

- ▶ ① Disconnect the winding cables directly on the cable lug.
- ▶ ② Undo the gland for the core bushing (6.09).
- ▶ ③ Pull back the winding cables into the housing.

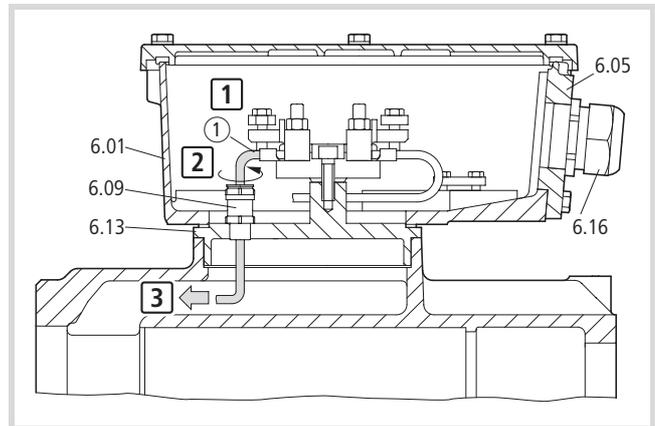


Figure 15: Undoing the terminals from the terminal plate (6.08)

- ① Disconnection point

**Motors with bolt-type glands**

- ▶ Undo the retaining plate ① and nut (→ Fig. 16).
- ▶ Disconnect the winding cables from the threaded bolts.

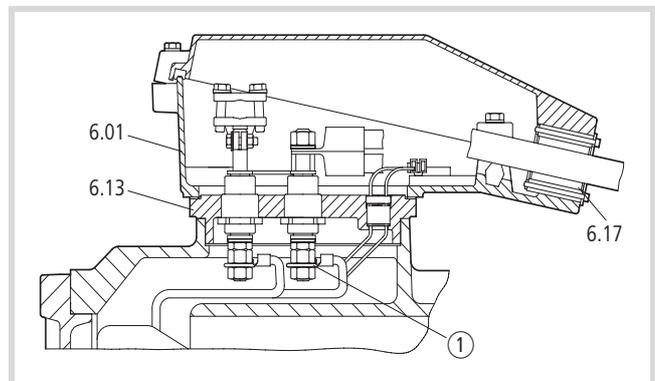


Figure 16: Terminal box with bolt-type gland

- ① Retaining plate

The glands or entries are secured with adhesive. They can be removed by overcoming the locking torque.

For the cores of the additional conductor, proceed as described in Section "Frame size 63 to 160", Page 12.

**Forcing out stator cores, frame size 63 to 132**

The motor must be dismantled completely, in order to force out the stator core.

→ A special removal device can be ordered from Moeller for forcing out a stator core from a pot-type housing.

- ▶ Push the removal device into the housing.
- ▶ Rotate the spindle ③. This will cause the arms ② (→ Fig. 17) to spread.

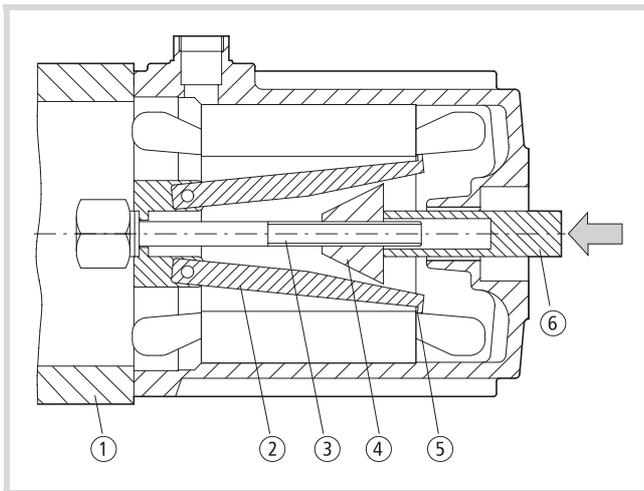


Figure 17: Removal device for stator cores

- ① Tube
- ② Arms
- ③ Spindle
- ④ Expander element
- ⑤ Shoulders
- ⑥ Sleeve

Different expander elements are available for different core diameters.

**Important!**

Ensure that the shoulders ⑤ of the arms ② completely engage behind the stator core and that the arms themselves are positioned correctly in the core. Pre-tighten the spindle ③ so that the device is secure and does not slide. This could otherwise damage the device.

- ▶ Place the device prepared in this way on a tube ① with an internal diameter larger than the internal diameter of the housing. The surface of the tube must be clean and smooth so that the contact surfaces of the motor housing are not damaged.
- ▶ Press with the sleeve ⑥ through the non-drive end of the shaft bushing onto the expander element ④ in order to push the stator core out of the housing.

**Caution!**

Do not damage the shaft bushing. This may make the housing unsuitable for further use!

## 5 Assembly

The following parts are those on which explosion protection depends:

- Screws,
- Seals,
- Cable entries and glands,
- Terminal points.



### Caution!

Only use original spares to replace parts on which explosion protection depends. Explosion protection will otherwise be lost.



### Important!

Protect all machined mounting surfaces against corrosion by greasing.

### Screw connections

Ensure that the screws are fitted without washers or other securing elements, and are sufficient for the number of fastening holes provided. The following tightening torques are required to prevent accidental loosening, unless otherwise specified:

Tabelle 1: Tightening torques for grade 8.8 screws

Screw size	Tightening torque Nm
M5	6
M6	10
M8	25
M10	49
M12	85
M16	210
M20	425

Tabelle 2: Tightening torques for conductive bolts

Thread size	Tightening torque Nm
M4	1.2
M5	2
M6	3
M8	6
M10	10
M12	15.5
M16	30

### Frame size 80 to 132

#### Motors with integral brake

The following steps must be carried out as shown in Figure 18:

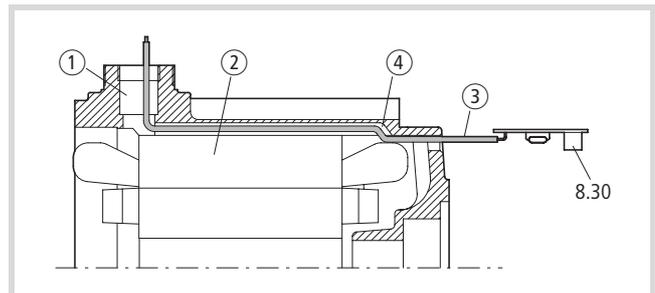


Figure 18: Cabling the rectifier (8.30)

- ① Core bushing
- ② Stator core
- ③ Connection cores of the rectifier
- ④ Groove in the housing

- ▶ Pass the connection cores ③ of the rectifier (8.30)
  - from the non-drive end
  - through a groove ④ in the housing
  - over the stator core ②
  - through the hole of core bushing ① to the drive end of the housing.

Two cores are for temperature monitoring, the other four are used for the brake power supply.

With versions without a rectifier, only four cores are required, two for temperature monitoring and two for the brake.

The core connection is described in Section "Fitting the terminal box using screws", Page 17.

#### Motors with an integral tachogenerator

The following steps must be carried out as shown in Figure 19, Page 15:

- ▶ Insert the rotor into the motor housing.
- ▶ Push the NDE roller bearing (2.09) with the internal cup spring (2.08) onto the shaft and into the housing at the same time.
- ▶ Depending on type, secure the roller bearing with a retaining ring.
- ▶ Push the tachogenerator (9.01) onto the shaft.
- ▶ Tighten the torque arm (9.10) of the tachogenerator (9.01) on the housing. Do not, however, secure the tachogenerator axially on the shaft.

→ The tacho-generator should not be secured on the shaft until the drive-end and thus the rotor have been completely assembled!

### Type with flameproof terminal boxes

Flameproof terminal boxes, designation, EEx d IIB+H2 T., do not require a flameproof core bushing. The terminal box and the motor housing form one complete flameproof compartment.

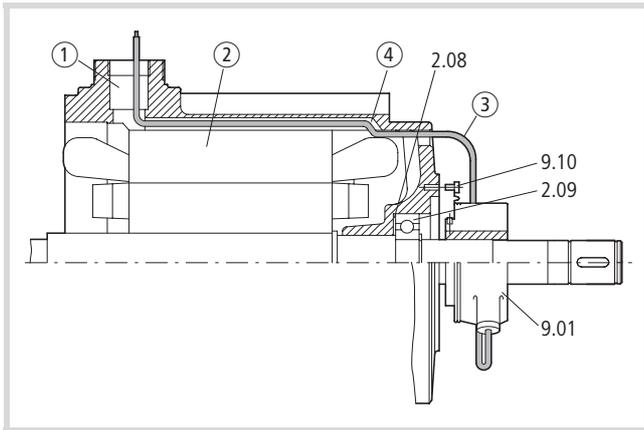


Figure 19: Mounting the tacho-generator (9.01)

- ① Core bushing
- ② Stator core
- ③ Tacho-generator connection cable (9.01)
- ④ Groove in the housing

### Important!

Do not pull the cable of the tacho-generator too strongly as it is not provided with strain relief for the cable.

- ▶ Pass the connection cable ③ of the tacho-generator (9.01)
  - from the non-drive end
  - through a groove ④ in the housing
  - over the stator core ②
  - through the wire hole of the core bushing ① to the terminal box.

Save a loop of the cable between the tacho-generator and the housing so that the housing (9.20) of the tacho-generator can be mounted without damaging the cable.

Depending on the type, secure the cable on the motor housing with a clip (→ Fig. 20).

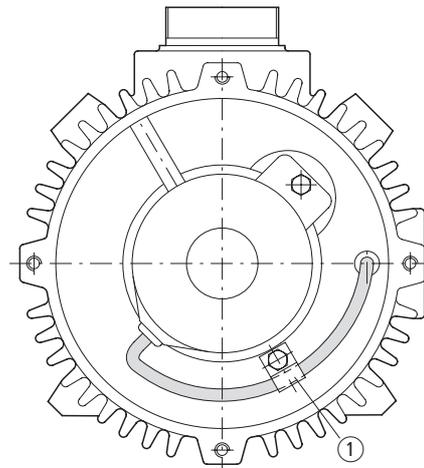


Figure 20: Securing the cable

- ① Clip

### Type with terminal box for increased safety

▶ With types with terminal boxes for increased safety, designation EEx de IIC(B) T., route the tacho-generator cable in the following way:

- from the tacho-generator (9.01) and tacho-generator housing (9.20) with flameproof cable entry ①
- to the terminal box (6.01) through a cable entry with increased safety protection ②.

Save a loop of the cable between the tacho-generator and the housing so that the housing (9.20) of the tacho-generator can be mounted without damaging the cable.

Depending on the type, secure the cable on the motor housing with a clip (→ Fig. 20).

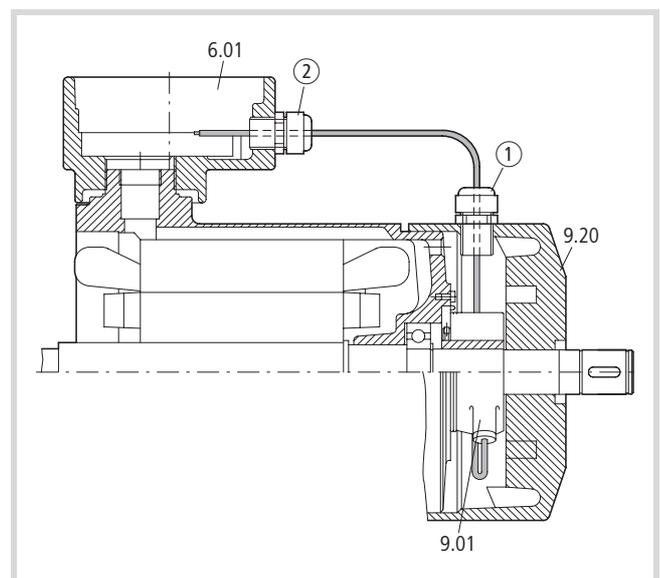


Figure 21: Cable route from the tacho-generator to the terminal box

- ① Flameproof cable entry
- ② Cable entry with protection type for increased safety ②.

## Flameproof cable glands, bushing plate

### Frame size 63 to 160

→ The correct mounting of the core bushing must be checked by an appointed specialist.

- ▶ Pass the stator winding leads and the additional cores through the sealing ring (6.093) located between two pressure plates (6.092) (→ Fig. 22).

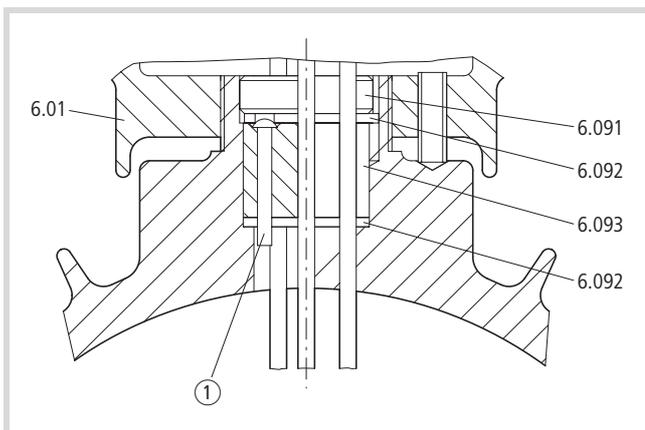


Figure 22: Passing the stator winding lead to terminal box

① Cu rivet to DIN 660

The upper pressure plate must have an anti-rotation feature if this is provided in the housing.

- ▶ Tighten the thrust ring (6.091) to at least 20 Nm.
- ▶ Secure it with an anaerobic adhesive (observe manufacturer's instructions).

Only wire supplied by Elumeg (type 155-U) can be used as winding cable, depending on the hole size in the sealing ring:

- Minimum external diameter 2.4 mm for 3 mm holes,
- Minimum external diameter 3.1 mm for 4 mm holes.

- ▶ Seal unused holes with Cu rivets 3 × 25 and 4 × 25 to DIN 660.

The rivet head must lie under the upper pressure plate (6.092) (→ Fig. 22).

### From frame size 180

- ▶ Screw the moulded core bushings and bolt-type glands (6.09) (→ Fig. 14 and Fig. 16) from the motor end into the bushing plate (6.13) and secure with anaerobic adhesive (observe manufacturers' instructions).
- ▶ Screw in rubber sealing cable entries (6.09, Fig. 15) from the terminal box side and secure with anaerobic adhesive.
- ▶ Connect the winding cables to the cables of the moulded core bushing using crimp connections.
- ▶ Insulate this using class F heat shrinkable tubing.
- ▶ Connect the winding cables to the bolt-type glands by using crimp cable lugs.
- ▶ Use a retaining plate ① (→ Fig. 23) to prevent the fastening nut from working loose.

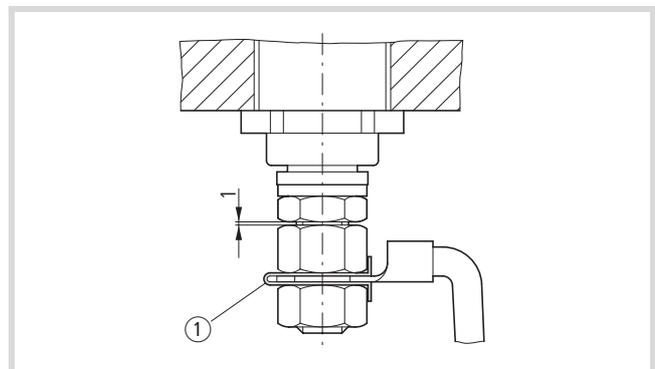


Figure 23: Securing the fastening nut

① Retaining plate

When using rubber sealed entries:

- ▶ Pass the winding cables with crimp cable lugs directly to the terminal plate (6.08) (→ Section "Terminal box", Page 11).

For the cores of the additional conductors, proceed as described in Section "Frame size 63 to 160", Page 12.

After fitting the bushings and connecting them to the winding cables:

- ▶ Insert the bushing plate (6.13) into the connecting piece of the housing.
- ▶ Depending on type, secure the bushing plate (6.13) on its own or together with the terminal box (6.01) in the housing.

## Terminal box

### Fitting the terminal box using a thread

Proceed as follows in order to fit the terminal box via a thread (→ Fig. 24):

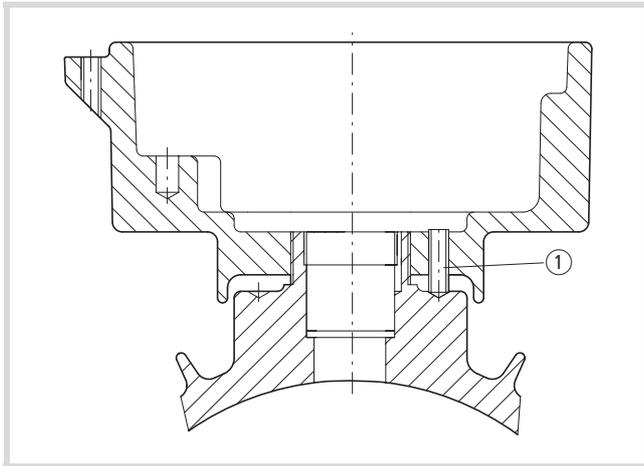


Figure 24: Fastening the terminal box (6.01) via a thread

① Set screw to DIN 914

- ▶ Screw in the terminal box up to the stop of the thread on the connecting piece of the housing.
- ▶ Now rotate the terminal box back up to one turn to the required location of the entries.
- ▶ Tighten the set screws ① for securing.
- ▶ Secure this with a contact anaerobic adhesive (observe manufacturer's instructions).

### Fitting the terminal box using screws

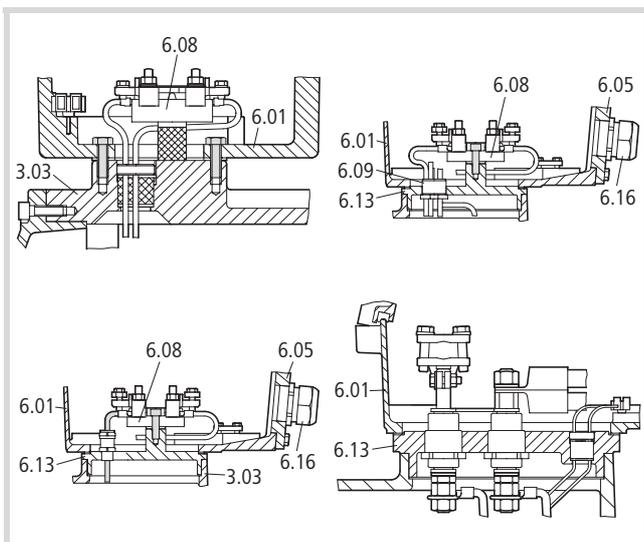


Figure 25: Fitting the terminal box using screws

Proceed as follows in order to fit the terminal box (6.01) using screws (→ Fig. 25):

- ▶ Place the terminal box (6.01) with a rubber seal (only use original seal) on the housing and the bushing plate (6.13).
- ▶ Fasten the terminal box with screws

### Proceed as follows with terminal boxes with a terminal plate:

- ▶ Screw the terminal plate (6.08) with two cylinder head screws.
- ▶ Crimp the terminal plate cable lugs onto the ends of the winding cables.
- ▶ Fasten the cable lugs using nuts and spring washers on the terminal plate, together with:
  - terminal clamp and terminal parts,
  - connection rails.

### Remaining procedure for all terminal boxes:

- ▶ Fasten the measuring and control cables in the mini-terminals.
- ▶ Screw the mini-terminals with the appropriate special screw.
- ▶ Request a circuit diagram (→ Section "Connection diagrams", Page 18) if none are available!

Tabelle 3: Cable markings

U1	red
U2	white and red
V1	black
V2	white and black
W1	blue
W2	white and blue
1 to 4	Brake
5 and 6	Tacho-generator
10 to 13	PTC thermistor temperature sensor
20 to 23	Resistance temperature sensor
70 and 71	Heater

- ▶ Place the terminal box cover (6.02) on the terminal box (6.01) and fasten it with screws.

With terminal boxes for increased safety, designation EEx e ensure the correct seating of the seal, if necessary secure in the cover with contact adhesive.

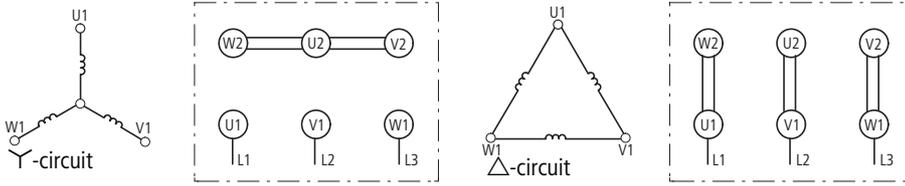
Proceed as follows with terminal box covers fastened via a thread:

- ▶ Screw in the cover up to the stop of the thread of the box.
- ▶ Depending on type, rotate the cover a maximum of ¼ turns up to the next stop and secure immediately with the set screw.

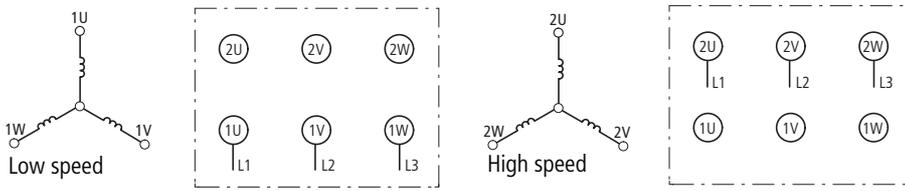
Connection diagrams

→ The circuit diagram provided with the motor must be observed.

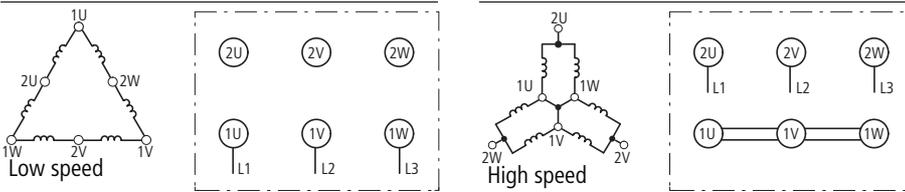
Single-speed – one pole



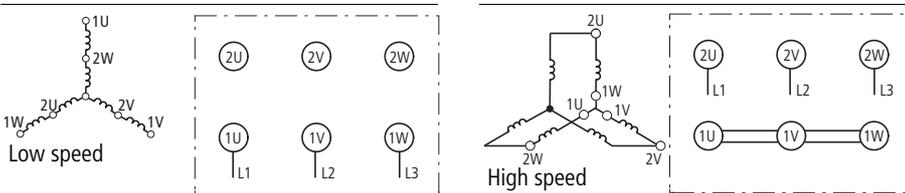
Pole-changing



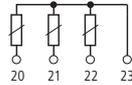
Dahlander circuit



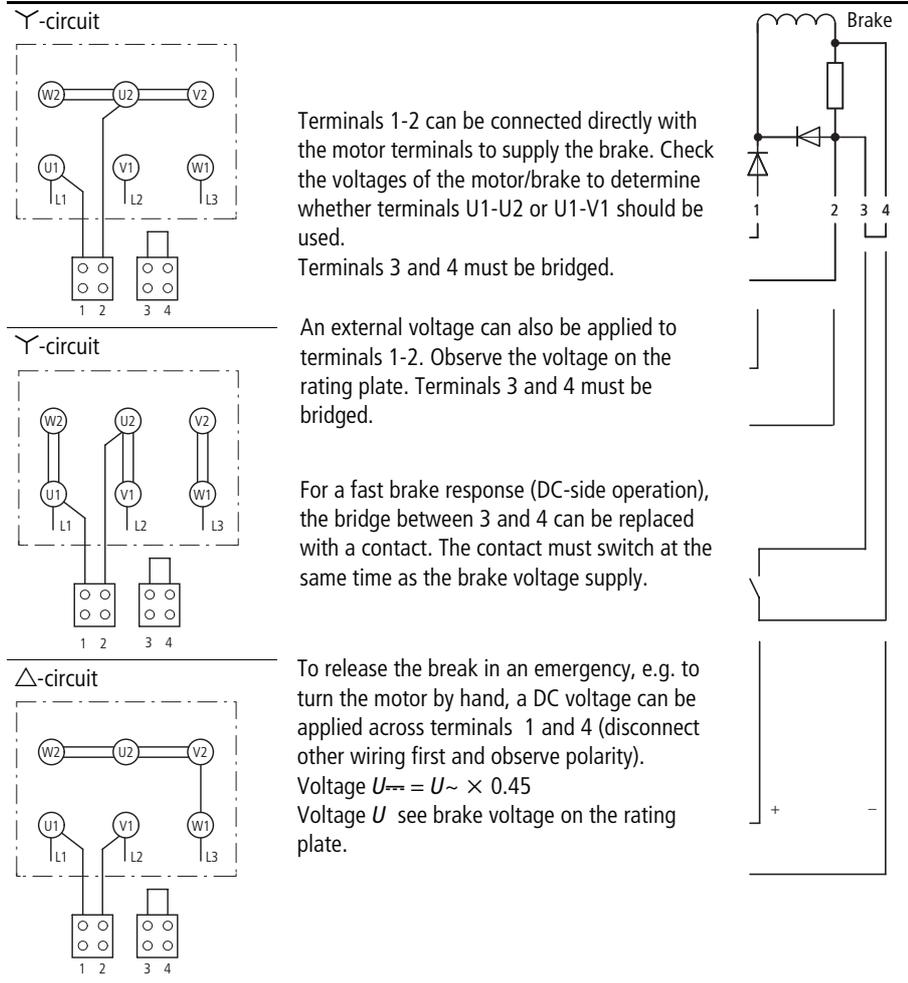
Dahlander circuit



5-6	Tacho-generator		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13	PTC thermistor disconnection		
20 to 23	PT 100 resistance temperature sensor		
70-71	Anti-condensation heater		



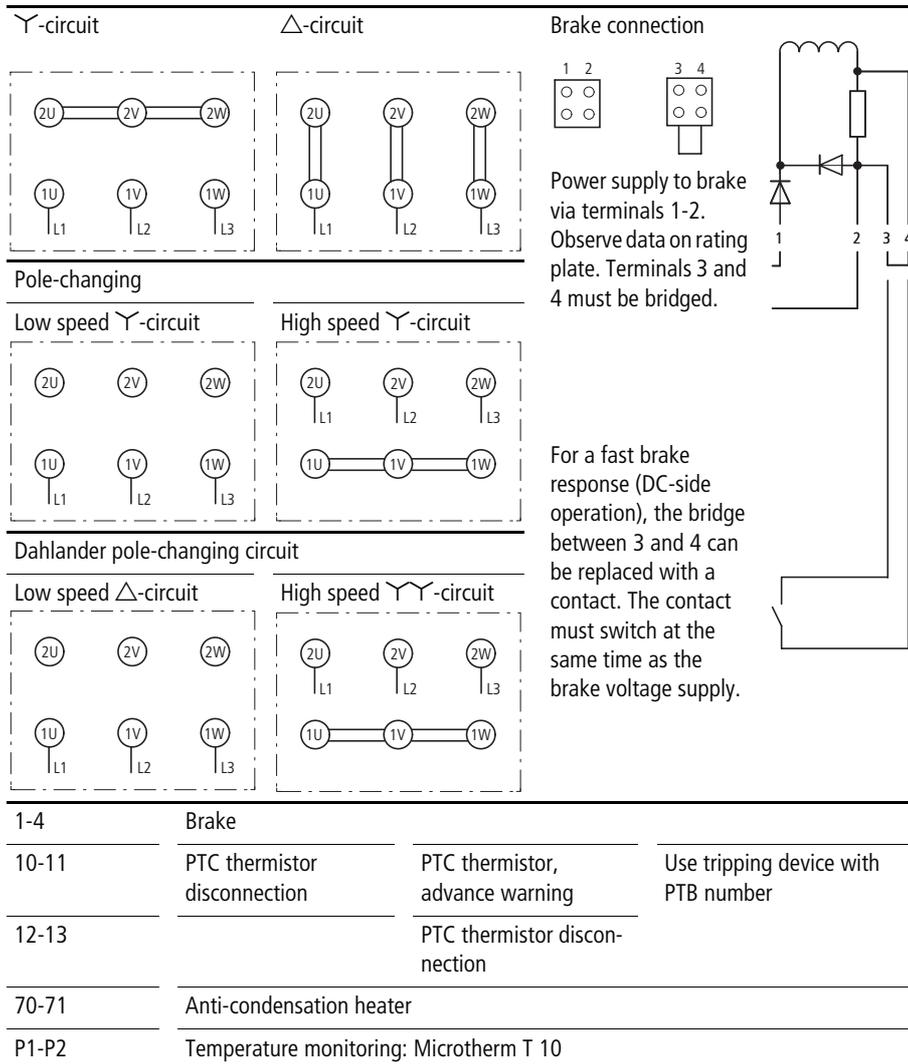
### Brake Motors With Integral Brake Brake Connection Via Motor Winding



1-4	Brake		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13		PTC thermistor disconnection	
70-71	Anti-condensation heater		
P1-P2	Temperature monitoring: Microtherm T 10		

English

### Brake Connection Via External Power Supply



### End shields, rotors and roller bearings

**Important!**  
During the remaining assembly steps, ensure that the roller bearings are fitted straight, are not offset and always support both rings at the same time. The bearings will be damaged if axial forces are only exerted on one ring (especially hammer blows)!

**Important!**  
Clean and grease well the joints of the individual assembly parts so that the joint surfaces are not damaged on assembly.

### Frame size 63 to 160

#### Frame sizes 160

- ▶ Push the NDE end shield (2.02) into the housing spigot recess and tighten it on the housing.

#### Motors with integral tachogenerator → Fig. 26.

- ▶ Push the DE end shield (1.02) into the housing spigot recess and tighten it on the housing.
- ▶ Whilst supporting the shaft at the non-drive end, push the DE roller bearing (1.10) using the mounting sleeve ① onto the shaft and into the end shield, and secure it with retaining rings.

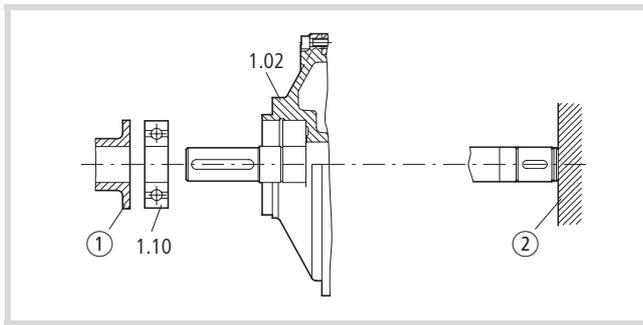


Figure 26: Fitting end shield and bearings

- ① Mounting sleeve
- ② Counter bearing

**All other types (→ Fig. 27)**

(not applicable to types with integral tachogenerator)

- ▶ Push the DE roller bearing (1.10) into the DE end shield (1.02).
- ▶ Push the DE end shield with the DE roller bearing onto the rotor.

**Important!**  
Push the rotor carefully into the housing. This will prevent any damage to the rotor winding and the shaft bushing at the non-drive end.

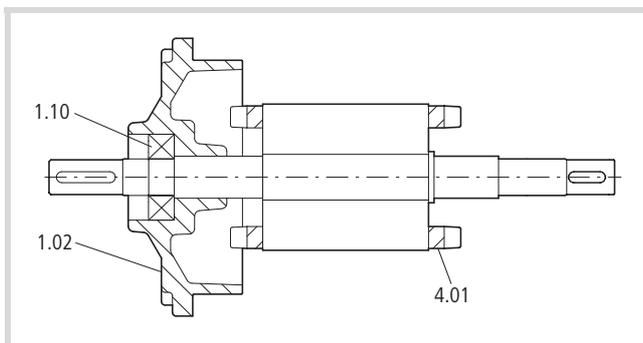


Figure 27: Rotor (4.01) with DE roller bearing (1.10) and DE end shield (1.02)

- ▶ Push the whole unit into the housing and fasten the end shield with screws.
- ▶ Insert a cup spring at the non-drive end in the bearing seat of the housing.
- ▶ Fit the DE roller bearing (1.10) whilst supporting the shaft at the drive end.
- ▶ Depending on type, secure the DE roller bearing, with a retaining ring in the shaft and in the housing.
- ▶ Depending on type, secure the NDE roller bearing, with a retaining ring in the shaft.

**Important!**  
When inserting the shaft end seals, cover the featherkey and retaining ring grooves in order to prevent any damage to the seal lips!

- ▶ Fit the DE (1.08) and NDE (2.06) shaft end seals in the housing as follows (→ Fig. 28):
  - with the seal lip facing outward,
  - flush on the drive side,
  - countersunk 2 mm at the non-drive end.
- ▶ Support the shaft and insert the featherkey ① in the drive end of the shaft.



Figure 28: Shaft seal

- ① Featherkey

**Frame size 180 to 225**

**Important!**  
Insert the rotor carefully into the housing in order to avoid any damage to the stator coil!

- ▶ Push both the DE (1.02) and NDE (2.02) end shields into the housing centre holes.
- ▶ Secure these with screws.
- ▶ Heat the inner rings of the roller bearing.
- ▶ Insert them at the same time onto the shaft and into the end shields.
- ▶ Secure the DE roller bearing with a retaining ring in the shaft.
- ▶ Insert four cup springs (2.08) at the non-drive end in an >><< arrangement with two in the NDE end shield (2.0) and two outside of the NDE bearing cover (2.01).

**Important!**  
Cover the featherkey and retaining ring grooves when fitting the bearing cover, in order to prevent any damage to the seal lips!

- ▶ Screw the external DE (1.01) and NDE (2.01) bearing covers with radial shaft seals fitted.
- ▶ Fit any DE (1.08) or NDE (2.06) axial shaft seals using a suitable sleeve bush ① (→ Fig. 29).

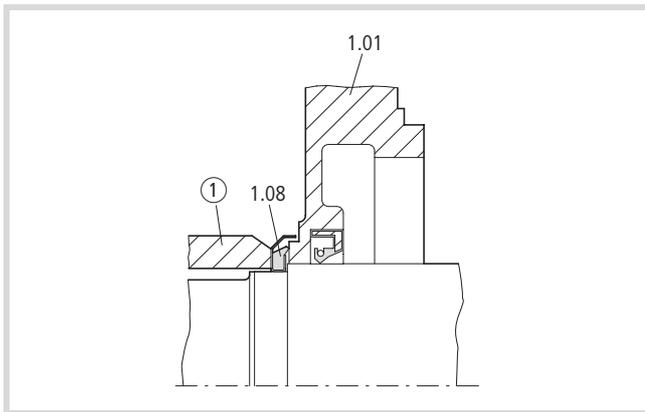


Figure 29: Fitting axial shaft seals

① Sleeve bush

- ▶ Support the shaft and insert the featherkey in the drive end of the shaft.

**From frame size 250**



**Important!**

Insert the rotor carefully into the housing in order to avoid any damage to the stator coil!

- ▶ Fit the internal DE (1.07) or NDE (2.05) bearing cover onto the shaft (with FS 250 only at the drive end).
- ▶ Heat up the roller bearing inner rings and fit them onto the shaft.
- ▶ Depending on type, insert the external DE grease distribution disc (1.05) and the retaining ring into the shaft.
- ▶ For easier fitting, screw a threaded bolt in one of the tapped blind holes of the inner bearing cover (→ Fig. 30).

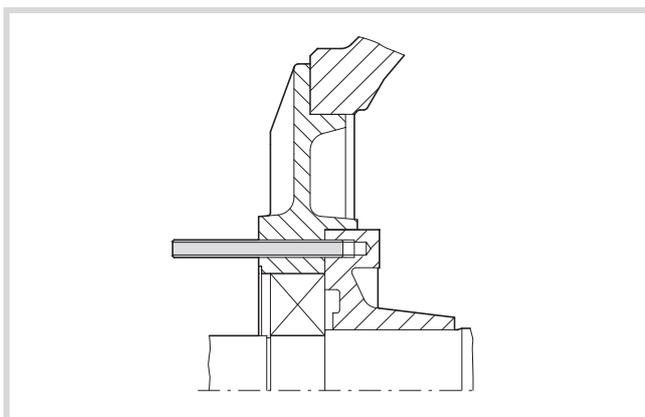


Figure 30: Screwing in a threaded bolt

When the end shields are fitted on the outer ring of the roller bearings, these bolts are guided into one of the four through holes in the end shield.

- Ensure the correct location of greasing grooves on motors with a lubrication device (→ Fig. 31).

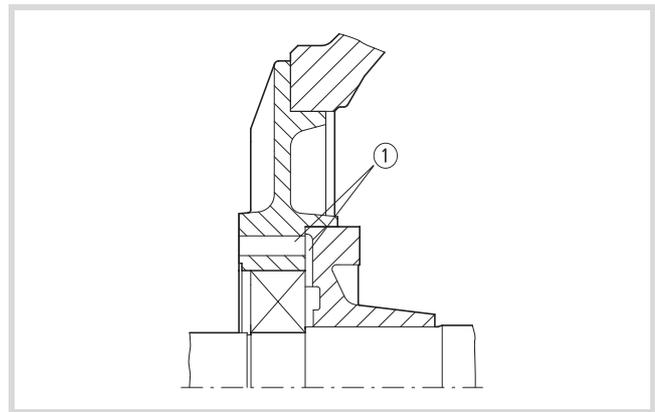


Figure 31: Location of the greasing channel

① Greasing channel

- ▶ Lift the rotor when centering the DE (1.02)/GS (2.02) end shields on the outer ring of the roller bearing and housing.
- ▶ Tighten the screws for the DE/NDE end shields.
- ▶ Depending on type, insert four cup springs (2.08) in an >>><< arrangement with two in the DE or NDE end shield and external DE or NDE bearing cover.
- ▶ Tighten the external bearing covers with an integral radial shaft seal.
- ▶ Screw in at least one bearing cover fastening screw before removing the threaded bolt (→ Fig. 30).
- ▶ Depending on type, insert any axial sealing rings with a sleeve bush (→ Fig. 29).
- ▶ Support the shaft and insert the featherkey in the drive end of the shaft.

**Brake**

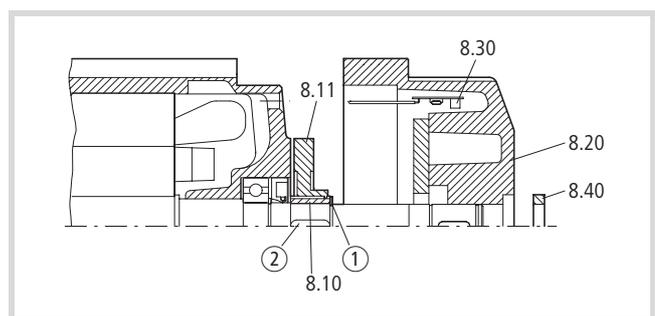


Figure 32: Motor with brake

① Retaining ring  
② Featherkey

- ▶ With frame size 100 and 112 insert a retaining ring directly in front of the NDE drive seal.

This ring is not required for frame size 80, 90 and 132.

- Support the shaft to protect the shaft bearings.

- ▶ Insert the featherkey ② for the friction plate driver (8.10) (→ Fig. 32).
- ▶ Fit the friction plate driver (8.10) and secure it with the retaining ring ①.
- ▶ Fit the friction plate (8.11).

→ Ensure that all featherkeys are fitted completely and symmetrically, in order to maintain the required braking torque!

- ▶ Solder the single-wave rectifier (8.30) to the wires coming out of the housing at the non-drive end according to the circuit diagram.
- ▶ Connect the brake coil and the temperature monitoring on the terminal strip of the single-wave rectifier (8.30).
- ▶ Insulate the entire single-wave rectifier with heat shrinkable tubing.
- ▶ Insert the single-wave rectifier in the recess provided in the brake housing.
- ▶ Fit the brake housing on the motor housing spigot recess and push the rectifier connection cable into the motor housing at the same time.
- ▶ Screw in the fastening screws and tighten.
- ▶ Push the shaft seal (8.40) into the brake housing with the seal lip facing outward.

## Tacho-generator

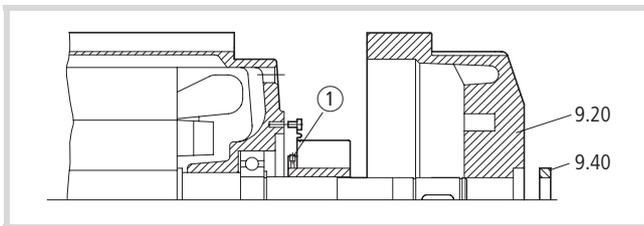


Figure 33: Tacho-generator

① Set screw to DIN 914

- ▶ After the drive end has been assembled completely secure the tacho-generator (9.01) axially on the shaft, depending on type,
  - with a retaining ring
  - with one or two set screws ① (→ Fig. 33).
- ▶ Tighten the housing of the tacho-generator (9.20) on the motor housing.
- ▶ Push the NDE shaft seal (9.40) into the tacho-generator housing with the seal lip facing outward.

## Ventilation system



### Important!

Support the shaft in order to prevent damage to the roller bearings when fitting on the fan!

- ▶ Insert the featherkey into the shaft.



When fitting the fan, ensure that pressure is only applied to the fan hub and not to the blades.

- ▶ Push the fan (5.01) onto the shaft up to the stop (shaft shoulder or retaining ring, depending on type).
- ▶ Secure the fan with a retaining ring in the shaft.
- ▶ Fit the fan cowl (5.02-5.03).
- ▶ Tighten the screws for the fan cowl.
- ▶ Depending on type, fit any relubrication tubes and impulse measuring nipples for monitoring the bearings.

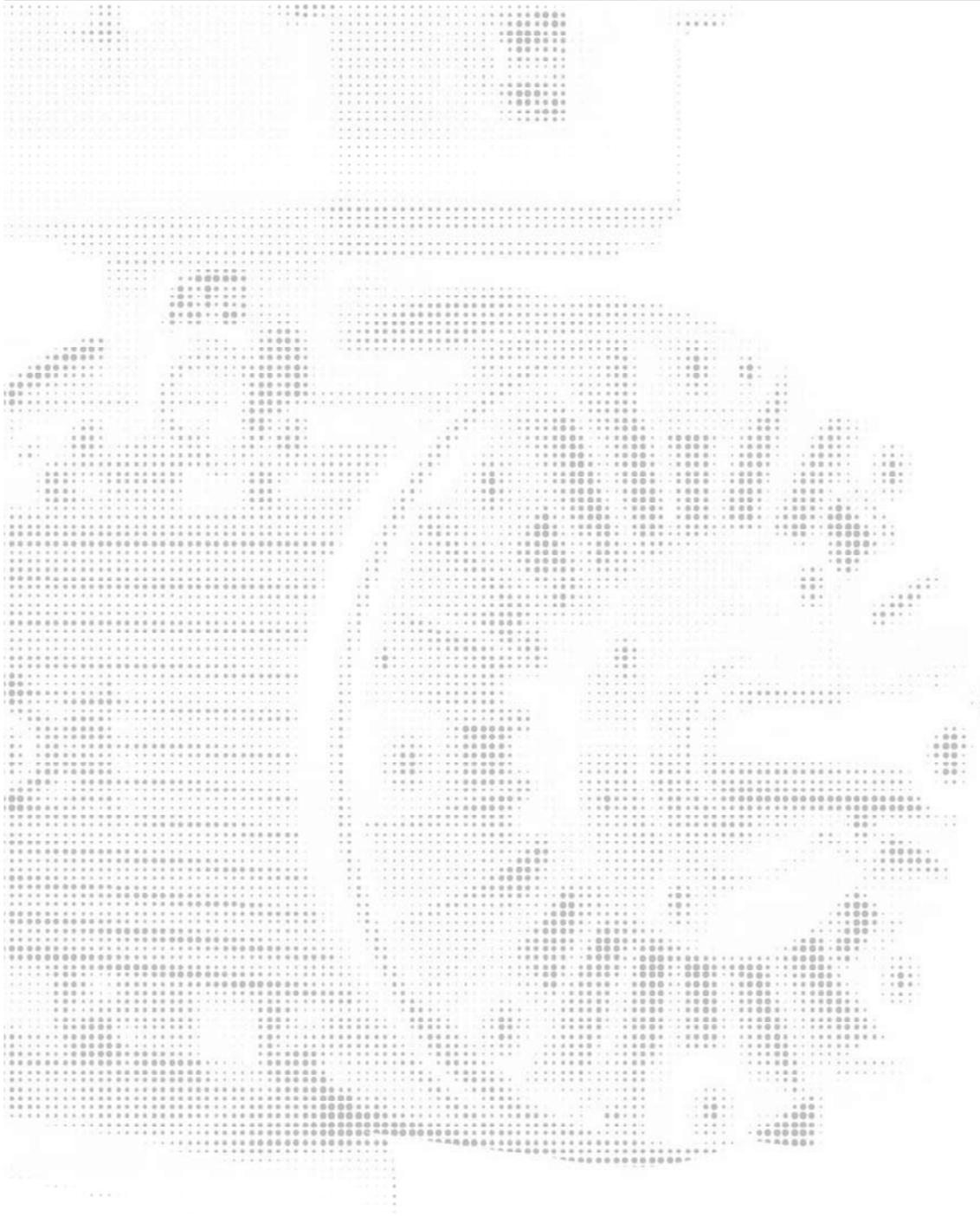
## 6 Tests

After assembly, it must be possible to turn the rotor by hand without it scraping or sticking. With brake motors, it must also be possible to release the brake at standstill in less than ten minutes. This is possible by applying a DC voltage at the terminals 1-2, according to the circuit diagram.

Prior to recommissioning carry out the following tests:

Type of test	Part tested	Test procedure	Requirement <sup>1)</sup>
Resistance	Winding	<ul style="list-style-type: none"> <li>• Contact</li> <li>• Check that resistance on all lines matches the reference values</li> </ul>	Permissible deviation from value specified for winding: max. $\pm 5\%$
	PTC thermistor	<ul style="list-style-type: none"> <li>• Continuity (<math>U_{\text{Test}} \leq 2\text{ V}</math>)</li> <li>• Type</li> <li>• Response temperature</li> </ul>	$R_{\text{erf}} \leq 1\text{ k}\Omega$ specified in winding
Insulation	Winding	<ul style="list-style-type: none"> <li>• Winding to iron</li> <li>• Phase windings to each other</li> </ul>	New winding: $2 \times$ rated voltage +1000 V. Used or partly renewed windings after cleaning and drying: 75 % of test voltage of a new winding
	PTC thermistor	PTC resistor to winding	500 V
Insulation value (resistance)	Winding insulation	<ul style="list-style-type: none"> <li>• Winding to iron</li> <li>• Phase windings to each other</li> </ul>	New windings: $R_{\text{iso}} \geq 50\text{ M}\Omega$ Used and partly renewed windings after cleaning and drying: $R_{\text{iso}} \geq 5\text{ M}\Omega$
Rotation field (only with new winding)	Connection	<ul style="list-style-type: none"> <li>• Mark connection wires</li> <li>• With <math>2\text{ p} \geq 12</math> and motors with several speeds: find out poles of winding with DC current</li> </ul>	Rotation direction, clockwise with UVW on L1, L2, L3 (observe bearing of the switching side)
Visual inspection	Winding	<ul style="list-style-type: none"> <li>• End-winding overhang</li> <li>• Winding bandage</li> <li>• Groove and phase insulation</li> <li>• Groove closure</li> <li>• Wire insulation</li> </ul>	Proper and complete condition
	Motor, complete	<ul style="list-style-type: none"> <li>• Terminal designation</li> <li>• Cold connection of terminals</li> <li>• Cable entry parts</li> <li>• Seals</li> <li>• Fan, fan cowl fastening</li> </ul>	Proper and complete condition
Test run	Motor, complete	<ul style="list-style-type: none"> <li>• Rotation direction, phase sequence</li> <li>• Check that the no-load current on all lines matches the reference values</li> <li>• No-load power consumption</li> <li>• With axial-flow fan, cooling air direction</li> <li>• Check even running with careful attention to bearings</li> </ul>	<ul style="list-style-type: none"> <li>• Running in time approx. 20 minutes</li> <li>• Deviation from no-load currents max. <math>\pm 10\%</math> and output values max. <math>\pm 15\%</math>.</li> <li>• Rotation direction arrow on fan cowl</li> <li>• According to empirical values and DIN/VDE 0530 T 14</li> </ul>
PTC thermistor function	PTC thermistor	<ul style="list-style-type: none"> <li>• Blocked rotor up to response of PTC thermistor</li> </ul>	<ul style="list-style-type: none"> <li>• <math>t_{\Delta}</math>time <math>\pm 20\%</math></li> </ul>

1) The data on the nameplate applies. If required, request additional characteristic data by stating motor type and production number



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