

# Operating Manual

**IP55**

- Three-phase-low-voltage machine  
with squirrel-cage rotor
- Explosion-safe Three-phase  
low-voltage machine  
with squirrel-cage rotor

**GB**

**SCHORCH**





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## Model Sizes 180M-315L

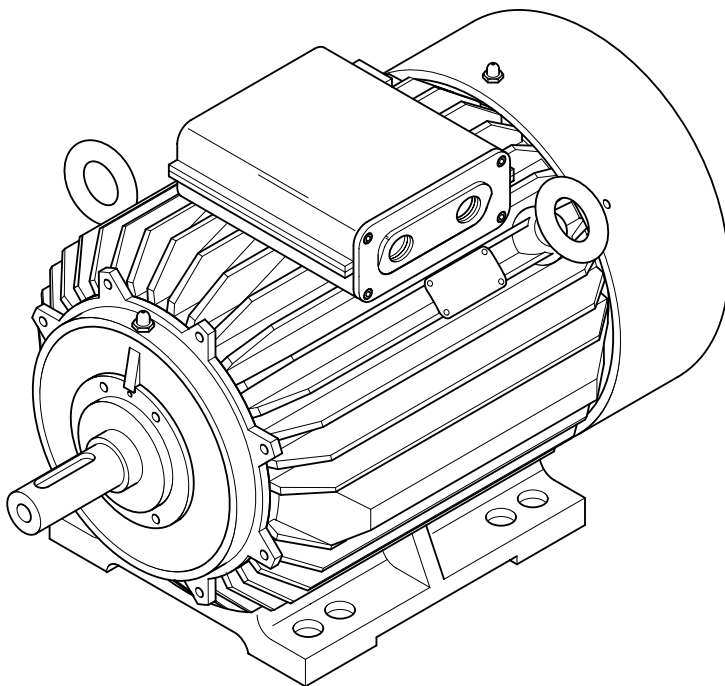
### Squirrel-cage rotors,

Type BC7, BD7, DA7, EA7, KA7, KB7, KC7, KE7, KH7

Example, Diag. 1

**Three-phase-squirrel-cage motor with squirrel-cage rotor**

**Basic model KA7**



*Diag. 1: Model size 180M-315L - Type KA7*

# Safety Instructions

## 1 Safety Instructions

### 1.1 General Instructions

Read the operating manual before transportation, assembly, commissioning, maintenance and repair, and comply with its instructions!

### 1.2 Symbols

In this operating manual 5 symbols are used which must receive special attention:



**Instructions concerning safety and the guarantee:  
The possibility of personal injury is included here.**



**Warns of electrical voltage.**



**Points out that damage to the electrical machine and / or auxiliary fittings can occur.**



**Indicates useful advice and explanations.**

**Ex Additional instruction for electrical machines of device group II for category 2 (zone 1) or device group II for category 3 (zone 2).**

## 1.3 Safety Regulations

Observe

- the safety regulations,
- accident prevention regulations,
- guide lines and acknowledged technical rules,

cited in this operating manual!

Non-compliance with safety regulations will result in the endangering of personnel and damage to the machine.

## 1.4 Regulations, Standards

When working on the electrical machine observe all valid accident prevention regulations and generally acknowledged technical rules!

- Accident prevention regulations laid down by the professional associations
  - „General Regulations (VBG 1)“
  - „Electrical Plant and Operational Means (VBG 4)“

- Harmonized European standards EN 60034

- VDE requirements

DIN VDE 0105  
DIN EN 60079  
or VDE 0165

Requirements for the Operation of High-Voltage Plant  
The Installation of Electrical Plant in Explosive  
Environments

- ElexV or Ev VO      Ordinance regarding Electrical Plant in  
Explosive Areas

# Safety Instructions

## 1.5 Conditions of Connection

Observe the regulations and conditions of connection laid down by the local electrical supply utility when connecting the electrical machine to the mains supply!



**All work on the electrical machine's electrical connections may only be carried out by electricians (as defined in DIN VDE 0105 and IEC 364)!**

Pay attention to the earthing when installing drives with IGBT convertors; especially make sure that there is no potential difference between the drive aggregate, engine and convertor. Make sure that the cables are correctly installed and that the earth connection has minimum induction.

## 1.6 Lettering, warning signs

Instructions attached to the electrical machine (e.g. rotation-direction arrows, instruction signs, lettering and warning signs) must be observed and kept legible.

## 1.7 Work activities to the electrical machine

**For safety reasons, only qualified personnel may carry out maintenance and repair activities**

**Qualified personnel are those persons who, on account of their professional training, experience and instruction, have sufficient knowledge of**

- safety regulations,
- accident prevention regulations,
- guide lines and acknowledged technical rules (e.g. VDE requirements, DIN standards).

**The qualified personnel must**

- be able to assess the work assigned to them and recognize and avoid possible dangers.
- be authorized by those responsible for the safety of the plant to carry out the required work.

## 2 Important Instructions

### 2.1 Stipulated Usage

This operating manual is valid for surface-cooled electrical machines designed for low-voltage use and of protection type IP 55 in accordance with EN 60034 - Part V. Higher protection types are specified on the rating plate (e.g. IP 68). In explosive environments only electrical machines which possess a registered explosion protection type may be used.

**Ex For electrical machines of device group II for category 2 (zone 1) or group II (zone 1) and of device group II for category 3 (zone 2) or group II (zone 2) apply also the data in Sections 8.1 and 8.2.**

Any other usage which goes above and beyond that stipulated is considered to be non-stipulated. Any other or further use shall be regarded as non-intended. We cannot be held liable for any damage or downtime that is caused by installation errors, non-observance of this manual or unprofessional repairs.

### 2.2 General Instructions

Use of this operating manual alleviates safe and proper transportation, assembly, commissioning, maintenance and repair of the electrical machine.

We reserve the right to make technical changes to the electrical means discussed in this operating manual.

Illustrations and drawings presented in this operating manual are simplified portrayals. On account of improvements and changes it is possible that the illustrations do not agree exactly with the electrical machine operated by you. Technical specifications and dimensions are not binding, and any possible claim cannot be based there upon.

We reserve all copyright to this operating manual and the drawings and other documents contained there in.

# Important Instructions

The manufacturer accepts no liability for damages,

- which arise during the period covered by the guarantee as a result of
  - negligent maintenance,
  - improper operation,
  - faulty installation,
  - wrong or inexperienced connecting of the electrical machine.
- which result directly or indirectly either from unilateral changes to the machine by the user or from non-compliance with the manufacturer's recommendations.
- which arise from the use of spare parts / accessories not recommended or supplied by the manufacturer.

## 2.3 Installation

The machines may be operated at heights of  $\leq 1000$  m above sea level, at coolant temperatures of  $-20$  to  $+40^{\circ}\text{C}$ . Exceptions are specified on the rating plate.

## 2.4 Ventilation

The distance between the air intake and any driven appliances, covers etc., must be at least  $1/4$  of the diameter of the air intake aperture. Air stream flow is from the non-drive side to the drive side.



The exhausting air stream must not be directly sucked in again.  
Keep the air intake and exit apertures free from dirt.

For a position other than horizontal, prevent solid objects from falling into the ventilation aperture install a suitable cover. The motor cooling must not be affected by such a cover.

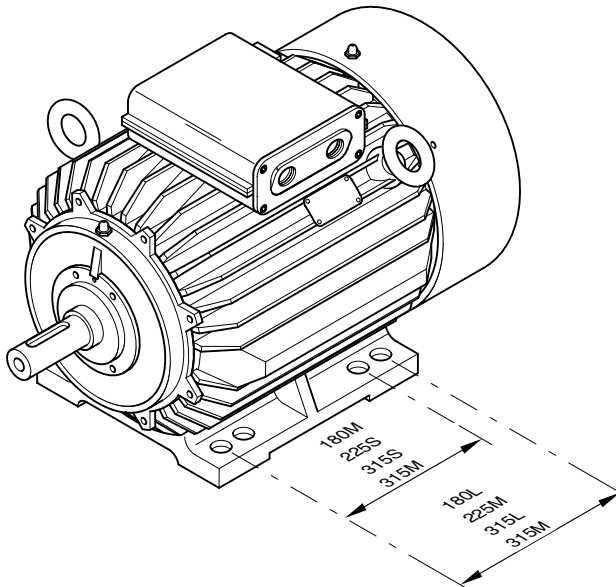
Electric motors with an external ventilator may only be operated while the external ventilator is active. (For the connection data of the external ventilator, see the rating plate.)

## 2.5 Electromagnetic Compatibility

The electrical machines correspond at least to EN 50081 Part 2 (electromagnetic compatibility, generic commission standard part 2: industrial environment) in accordance with VDE 0839 Part 81-2. This suffices for the operation of electrical machines in industrial areas.

## 2.6 Feet Anchoring Holes (Diag.2)

Electrical machines with axial heights of 180, 225 and 315 each have only one housing length.



Diag.2: Feet anchoring holes

## 2.7 Condensation Drain Holes

Prevent the condensate-drainage holes from becoming blocked

**Ex** Only open these drain holes for the purpose of drainage, close again afterwards.

# Transportation

## 3 Transportation

### 3.1 Safety Instructions



**When raising and transporting the machine observe the applicable accident prevention regulations and any generally acknowledged technical rules!**

- Accident prevention regulations
  - General Regulations (VBG 1),
  - Cranes (VBG 9),
  - Load Suspension Device in the Lifting Gear Industry (VBG 9a)
- DIN standards
  - DIN 15003 Lifting Gear, Load Suspension Devices
  - DIN 7540 Eye-Hooks, Goods Class 5
  - DIN 82101 Shackles

### 3.2 Lifting Eyes

Only suspend electrical machines from the lifting eyes provided.



Check that the twisted-in ring screws are firmly tightened

Do not subject to additional loads. The load eyelets have been designed for the weight of the electrical machine only.

Other supplementary lifting eyes which may possibly be available, e.g. on fan hoods, cooler fittings etc., are only suitable for the lifting of the respective individual parts.

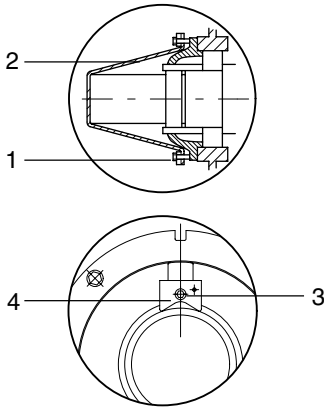
### 3.3 Securing Procedures for Transportation

Before shipment, use transport safeguards to protect electrical machines with cylinder-roller bearings from bearing damage.



Remove this device before commissioning and pack the securing hole with the plug supplied. Use the transportation securing device again if further transportation is required.

## Securing Procedures for Transportation, Examples



*Diag. 3: Example securing Procedures for Transportation*

- Rod fixing:
  - Undo bolts (1) and remove the rod fixing (2).
  - Screw in and tighten the shorter bolts supplied.
- Clamp fixing:
  - Undo bolts (3) and remove transportation shackle (4).
  - Stop up the threaded hole with the plug.



The machine is fitted either with a clamp fixing or a rod fixing.

The plug is attached to the information plate (drive shaft).

## 3.4 Transport Damage

Document any transport damage and immediately inform the transport company, insurance company and the manufacturer!

# Assembly and Commissioning

## 4 Assembly and Commissioning

### 4.1 Safety Instructions



During assembly and commissioning observe the following:

- safety instructions pages 6-8
- important instructions pages 9-11!

Installation activities may only be carried out by qualified personnel who - based on their training, experience and instructions - have sufficient knowledge of:

- safety regulations,
- accident prevention regulations,
- guide lines and acknowledged technical rules (e.g. VDE requirements, DIN standards).

The qualified personnel must

- be able to assess the work assigned to them and recognize and avoid possible dangers.
- be authorized by those responsible for the safety of the plant to carry out the required work.



It is recommended that you request the assistance of the manufacturer's assembly personnel.

## 4.2 Mechanical

### 4.2.1 Transmission Components



Only use flexible couplings;  
Rigid couplings may be applied only after consultation with the manufacturing factory.

Should a machine with two shaft ends have no drive element fitted on one of these shaft ends, ensure that the unused key cannot spin off the shaft. If the machine is of balance type „H“ then the key should be shortened by half!

If a machine with two shaft ends on one shaft end does not have a drive take-off element, the unused feather key must be secured against ejection. Note that in rotor alignment mode 'H' (see rating plate), this feather key must be shortened by 50%.

**Ex** Use only drive belts that are not electrostatically charged.

Each rotor is dynamically balanced according to its balance type with a full, a half or no key and, in accordance with ISO 8821, is labelled thus:

F = full key,  
H = half key,  
N = no key.



Rotors balanced with a full key → balance the drive component with open key way.



Rotors balanced with a half key → balance the drive component in a ungrooved state.

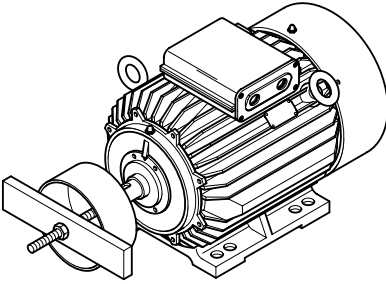
- Align the power take-off element in accordance with the alignment mode of the rotor. If the power take-off element is shorter, the part of the feather key that protrudes from the power take-off element and over the shaft contour must be finished (e.g.) or covered with a suitable ring of a corresponding length.
- Before fitting the drive component onto the shaft remove the anti-corrosion film on the shaft end with a suitable cleaning agent (e.g. naphtha).



Do not use emery or rub down the shaft to remove the protective film!

# Assembly and Commissioning

- Lightly grease or oil all seating surfaces and fit the drive element.



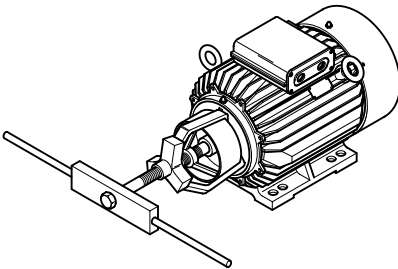
*Diag.4: Fitting with a centre bore*



In order not to damage the rolling bearing, use a suitable device to pull the power take-off element on (see Fig. 4) or off (see Fig. 5). If necessary, heat the power take-off element in accordance with the shrink dimension as indicated by the manufacturer.



Avoid hard blows and knocks when fitting the drive component. The bearings and / or the shaft will be damaged and the manufacturer's guarantee will be null and void.



*Diag.5: Dismantling*

## 4.2.2 Machine Base

Suitable supports for the electrical machine are support faces that guarantee the shock-free, low-vibration and rigid-coil operation of the machine and which will support the increased forces in short-circuited situations.



All the electrical machine feet must lie on an even, level plane in order to avoid stress in the housing.

The fastening elements of the electrical machines must be firmly tightened and locked in order to prevent them from becoming loose during operation.

Use washers with a large surface area in order to make the support surface sufficiently large.

Wrong installation can lead to resonances in rotary frequency and double mains frequency range.

In order to avoid damage to electrical machines in an idle state (stand-by operation) the following maximum rates of vibration must not be exceeded.

Idle Time	Rate of Vibration
up to 500 hrs	0,4 mm/s
more than 500 hrs	0,2 mm/s

### 4.2.2.1 Assessment Criteria for Vibration

With regard to vibration at the site location, the assessment criteria laid down in DIN ISO 3945 are to be complied with.

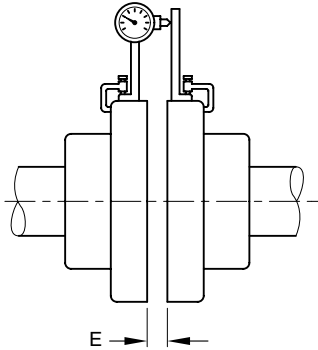
For rigid foundations the following measured values on the bearing housing can be considered as limiting values:

- 5.5 mm/s for the alarm,
- 11 mm/s for switch-off.

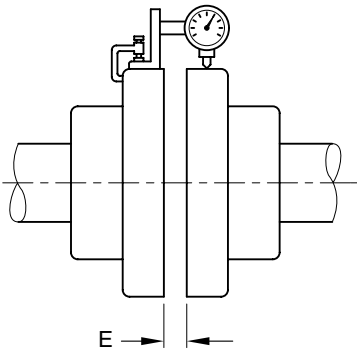


If the vibration values vary between warning and deactivation, only continue to operate the electrical machine while observing it or alert the manufacturer.

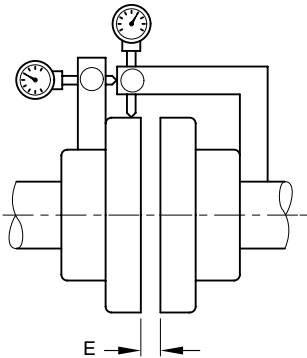
# Assembly and Commissioning



Diag.7: Angular alignment



Diag.8: Parallel alignment



Diag.9: Combined angular / parallel alignment

## 4.2.3 Alignment

- Align the electrical machine precisely in accordance with the already aligned driven appliance.
- Clamp on the dial gauges firmly. Carry out measurements at four measuring points, each separated by  $90^\circ$  whilst simultaneously turning both halves of the coupling.

### 4.2.3.1 Angular Alignment (Diag.7)

Compensate for any differences by inserting plates. Ensure that any residual inaccuracy, in reference to a measured radial diameter of 200 mm, does not exceed 0.03 mm.

### 4.2.3.2 Parallel Alignment (Diag.8)

Compensate for any differences by re-positioning or by inserting suitable plates so that the residual inaccuracy does not exceed 0.03 mm. Adjust the axial air gap between the two halves of the coupling (dimension „E“) in accordance with the specifications given by the coupling manufacturer.



Check alignment when the machine is in an operationally warm state.

### 4.2.3.3 Combined Angular and Parallel Alignment (Diag.9)

Diag.8 shows a method of combining both measurements which is relatively simple in concept. The dial gauges are placed in the corresponding holes of the flat bars (which are screwed or clamped on) and are then fixed by means of, for example, grub screws.

## 4.2.4 Additional devices

In order to protect the electrical machine various accessories may be fitted or attached subject to order, e.g.:

- temperature sensor for monitoring windings and bearings,
- space heater,
- measuring nipple for bearing monitoring.
- Speed-count (RPM) monitor.

# Assembly and Commissioning

## 4.3 Electrical



All work on the electrical machine's electrical connections must only be carried out by electricians (as defined in DIN VDE 0105 and IEC 364)!

### 4.3.1 Insulating Resistance



**Do not touch the connection terminals either during or after measuring. The terminal connections can carry high voltages! After carrying out the check earth the terminal connections briefly (5 seconds).**

- Using a hand generator (max. D.C. voltage = 630V) measure the insulating resistance of each individual phase to earth. Continue measuring until the measured value is constant.



The insulating resistance of new windings is  $> 100 \text{ M}\Omega$ .

Dirty and damp windings have considerably lower resistance values.

A coil is regarded as sufficiently dry and clean if the insulation resistance at  $75^\circ\text{C}$  is at least  **$1\text{M}\Omega$  je  $1\text{kV}$**  (see table).

If the values drop below the table values, the coil must be dried or cleaned. The coil temperature must not exceed  $75^\circ\text{C}$ .

Rated voltage	Windings temperature when cold			Operational temperature
	$15^\circ\text{C}$	$25^\circ\text{C}$	$35^\circ\text{C}$	
$U_N$	$15^\circ\text{C}$	$25^\circ\text{C}$	$35^\circ\text{C}$	$75^\circ\text{C}$
0,5 kV	30 M $\Omega$	15 M $\Omega$	8 M $\Omega$	0,5 M $\Omega$
1,0 kV	60 M $\Omega$	30 M $\Omega$	15 M $\Omega$	1,0 M $\Omega$



Dry the coil using the space heater or another heater or by applying an alternating voltage of 5-6% of the rated voltage (make a delta circuit) to the stator connection clamps U1 and V1.

# Assembly and Commissioning



Insulation resistance values are temperature dependent.

Guide values: a coil temperature increase or decrease of 10 k leads to the insulation resistance value being halved or doubled.

Remove the condensate water plug before drying the coil. Reclose it tightly once the condensate water openings have been dried.

## 4.3.2 Voltage and Circuit

Observe the circuit details given on the rating plate and compare the rated voltage to the mains voltage.

The permitted fluctuation in mains voltage amounts to  $\pm 5\%$ . Exceptions are specified on the rating plate.

## 4.3.3 Connection



**Connect the connection cables in accordance with the applicable regulations of the local electricity supply utility and in accordance with:**

- the DIN VDE requirements,
- the safety regulations,
- the accident prevention regulations.

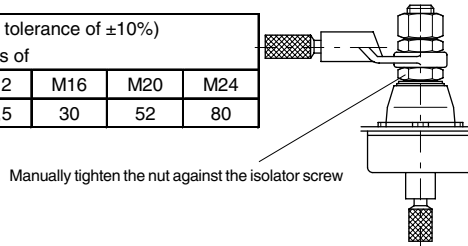
- Connect mains feeds with care, so that the contact force required for an electrical connection will be maintained over a long period (→ table on tightening torques, terminal layout and special arrangement of securing nuts see Illustration).

In addition to operating conditions, the firmness of the electrical connections should be checked.

# Assembly and Commissioning

If no other precise specifications have been made, the following tightening torques are valid for normal connections of securing screws and nuts used for electrical connections.

Tightening torques (Nm with a tolerance of $\pm 10\%$ ) for thread sizes of							
M5	M6	M8	M10	M12	M16	M20	M24
2	3	6	10	15,5	30	52	80



In electrical connecting work, the permitted torque is usually limited by the bolt material and / or the loading capacity of the insulators.



All electrical machines have a connection diagram on the inner side of the terminal box cover.



Match the cross-sectional area of the connecting cable to the rated current strength.

To avoid tension in the terminal connections fit the cable so it is not pulling from the connectors.

Take care that there are no foreign bodies, dirt and / or dampness present in the terminal box.

To guarantee the protective type when sealing the terminal box, use original seals.

Seal any unused cable feed apertures so that they are dust- and water-tight. The closing caps included in the delivery serve only as a transport safeguard; they do not form a tight seal.

# Assembly and Commissioning

## 4.3.4 Terminal Box Position (Side)

For electrical machines up to and including model size 315M - with normal output - it is possible to change the side terminal box position at a later date from RIGHT to LEFT or vice versa.



**For such a change within the guarantee period the prior agreement of the manufacturer is required. Clarify any change to the position of the connection box with the manufacturer.**

## 4.3.5 Direction of Rotation

Under normal conditions the electrical machines are suitable for operation in both directions of rotation. Exceptions are indicated on the rating plate with a corresponding directional arrow. For each respective direction of rotation the following stator connections are given:

Connection of L1, L2, L3	Direction of rotation viewed on the drive side
U1 - V1 - W1	right (cw)
W1 - V1 - U1	left (ccw)

In machines with two shaft ends, the information concerning the direction of rotation refers to the driven side of the shaft end.

- Check the direction of rotation by quickly switching the electrical machine (which has been connected in accordance with the regulations) „On / Off“ in its uncoupled state.

Before checking the direction of rotation or carrying out any trial operation (without drive element), always lock the feather key/keys.

Reversal of direction of rotation:	
Type of switch-on and winding	Measures
Direct switch-on and pole-shift motors with separate windings	Exchange two supply-cable conductors on the motor terminal board.
Star or delta connection and pole-shift motors with DAHLANDER winding	Exchange two supply-cable conductors at the incoming supply to the contactor combination.



**Only the person who is actually checking the direction of rotation may remain in the danger zone of the machine/operating machine. When checking the direction of rotation, observe DIN VDE 0105.**

# Assembly and Commissioning

## 4.3.6 Y/ $\Delta$ -start



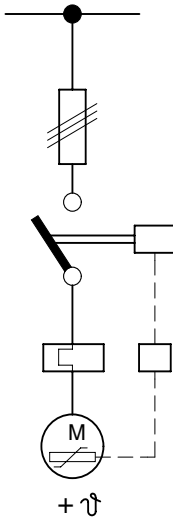
To avoid unpermitted transient current and torque impacts, the cross-over from Y to  $\Delta$  may only be effected if the start current of the Y stage has decayed, or if the run-up has ended.



During the run-up phase the machine should only be switched off in an emergency, in order to protect the switchgear and the machine itself.

## 4.3.7 Electrical machine Protection

- Connect the built-in semi-conductor temperature sensor to the trigger mechanism in accordance with the circuit diagram.
- Any possibly required continuity check of the temperature sensor should only be carried out using a measuring bridge (max. 5V).



In order to achieve total thermal protection of the machine, fit a supplementary thermally-delayed overload protector ( $\rightarrow$  Diag.10). Safety fuses alone tend to just protect the mains supply and not the electrical machine.

**Ex** Electrical machines of devices group II category 2 (zone 1) or of group II (zone 1) and category 3 (zone 2) or of group II (zone 2) are governed also by the information in Section 8.1 or 8.2.

Diag. 10: Protection using over-current relay, thermistor protector and fuse.

## 5 Maintenance

### 5.1 Safety Instructions



Maintenance work (except for greasing work) is only to be carried out when the machine is standing idle.

Ensure that the machine is safeguarded against accidental switch-on and is labelled with a corresponding warning sign.

Observe the safety regulations and accident prevention regulations of the corresponding manufacturer when using oils and greases, cleaning agents and spare parts!

Maintenance work on the machine's electrical power supply or to the electrical auxiliary / control supplies may only be carried out by electricians in compliance with DIN VDE 0105.



Ensure that the machine is switched so that it is not live.

Lock the machine against reactivation and indicate such by placing a warning sign on/by the switch.

Ascertain that the machine is not live!

Earth and short-circuit!

Cover or cordon off any neighbouring parts which are still live!



Ensure that the auxiliary power circuits e.g. space heater etc., are switched so as not to be live.

# Maintenance

## 5.2 Cleaning



Do not wash down the machine with water or other liquids.

- Check the whole cooling airway for dirt annually.
- In the event of severe dirt deposits dismantle the electrical machine and remove the deposits using suitable cleaning agents (e.g. superheated steam).
- Finally dry the winding and measure the insulating resistance.



During these procedures observe the specifications on page 20 given under 4.3.1 Insulating resistance.

## 5.3 Ball and Roller Bearing Maintenance

- Monitor bearing temperature during operation.
- Check the bearing for noise when running.
- Greasing of ball and roller bearings.
- Renewing the bearings.



- Should a rise in temperature or running noises occur during operation, switch off the electrical machine immediately in order to avoid any resulting damage. Inform the manufacturer's service department.
- Dismantle the bearing and check for damage (→ page 28 – 39).
- Should there be darkly coloured, matt- or polished-effect areas on the bearing, fit a new bearing.



The operational safety of the electrical machine is dependent upon maintenance of the lubrication schedule.

For the type of grease, see the rating or lubricating plate.

The standard versions of electrical machines have a relubricating device with grease-quantity regulator.

Initial lubrication of the bearing is carried out at our factory. The lubricating schedule and lubricant volumes are specified on the rating plate.

In the basic model the electrical machines are fitted with a button head grease nipple, M10 x 1, in accordance with DIN 3404.

## 5.3.1 Ball and Roller Bearing with Permanent Lubrication

Under normal operating conditions 2-pole electrical machines are maintenance free for around 10,000 operational hours, more-pole electrical machines for 20,000, however, in both cases at the most 3-4 years. At this juncture the ball and roller bearing and bearing cover should be washed out with a suitable cleaning agent. If necessary, renew the bearing. Half-fill with grease both the hollow spaces between the rollers and the roller track, and the grease chamber. Lightly smear the shaft bushes in the bearing covers or bearing shields with grease.

It is not possible to wash out and lubricate sealed-for-life bearings (2RS and 2Z bearings). Purchase new bearings from the manufacturer.

Use forcing screws or a suitable device for dismantling the bearings.

## 5.3.2 Lubrication

If grease exit holes are closed with plugs (IP54 drive end), remove the plugs before commissioning. Seal holes with grease.

If there are no grease-relief holes (degree of protection IP55), after 3-4 years the bearing covers or endshields, respectively, must be removed and the spent grease must be disposed of.



**Only carry out lubricating work when the machine is running:  
Be careful of moving parts!**



Observe the lubricant specification given on the rating or lubricant plate.

- Clean the grease nipple and apply the corresponding amount of grease (using the correct grade of grease) by means of a grease gun. To achieve this weight the grease gun both before and after use.

## 5.3.3 Lubricant

For the type of grease, see the rating or lubricating plate.

For basic model electrical machines the bearing can be re-filled (without cleaning) using lithium-saponified ball and roller bearing grease K3k in accordance with DIN 51825, for example, SKF LGMT3, Shell Alvania G3, Esso Beacon 3 etc..



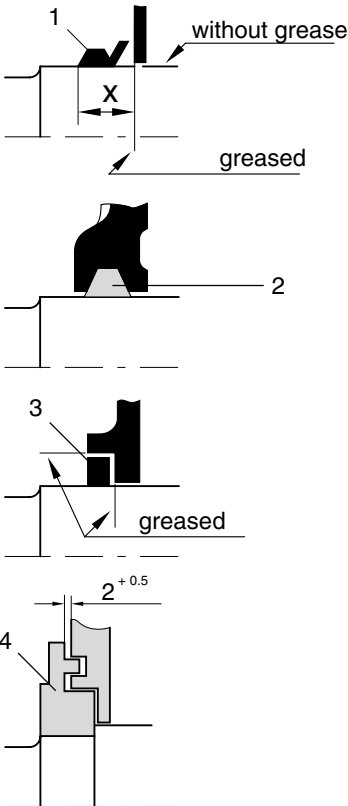
Carefully clean the bearings when switching to a type of grease with another soap basis, as indicated on the rating plate, since the rolling-bearing greases used must satisfy the following conditions:

- Drop point            approx. 190°C
- Ash content            4%
- Water content        0.3%

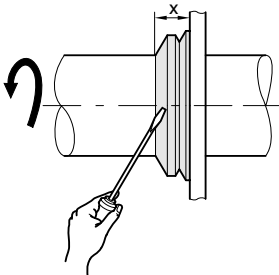


Changing over to a grade of grease with a different saponification base requires consultation with the machine manufacturer.

# Maintenance



Diag. 11: 1 V-ring  
2 Felt ring  
3 Neoprene sealing ring  
4 Labyrinth ring



Diag.12: V-type sealing ring

## 5.4 Bearing Seals (Diag.11)

- Before fitting new felt rings into the bearing cover, soak them in high-viscosity oil heated to 80°C. The shaft must slide easily in the felt ring and be completely sealed radially.
- Lightly grease the running faces.
- Push on the sealing rings (3) and V-rings (1), e.g. using a screwdriver whilst simultaneously turning the shaft (→ Diag.12).

△ When fitting V-rings onto flat sealing surfaces the dimension „X“ must be maintained.

Non-compliance will lead to overheating or destruction of the V-ring, or will result in a bad seal.

V-ring type	Fitting dimensionX (mm)
V-25 to V-38	9,0 -0,3
V-40 to V-65	11,0 -0,3
V-70 to V-100	13,5 -0,5
V-110 to V-150	15,5 -0,5

- Before installation, heat the labyrinth rings (4) to approx. 60-80 °C and push them towards the bearing cover; observe the remaining axial gap ( $2^{+0.5}$  mm).

## 5.5 Bearing Change - Shaft Height (AH) 180 to 315

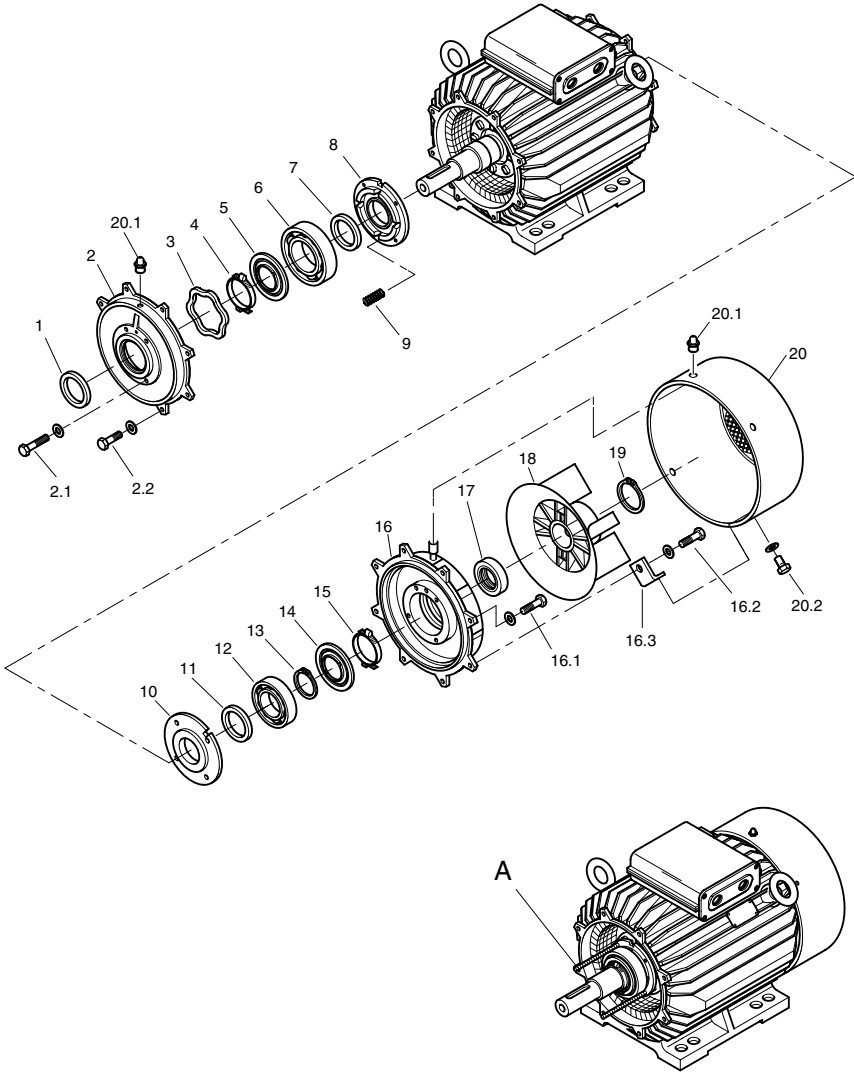


The prior agreement of the electrical machine manufacturer is required for bearing changes undertaken within the warranty period!

### 5.5.1 Dismantling Procedure for Drive and Non-drive Side Deep Groove Ball Bearings (→ Diag.13) (For drive side cylindrical roller bearing, see 5.5.3)

1. Unscrew the grease nipple (20.1), loosen screws (20.2), remove fan hood (20).
2. Loosen the circlip (19) and pull it off. Pull off the fan (18) using a pulling tool (metal fans should be heated up in this procedure).
3. Loosen screws (2.1), (2.2), (16.1) and (16.2). Pull off the bearing shields (2) and (16), together with the bearing seals (1) and (17), taking care not to tilt them.  
Take off the compensation washer (3) – only present on electrical machines  $\leq$  AH225.
4. Loosen and pull off the spring clips (4) and (15) – only present on electrical machines AH250. Pull off the collar oilers (5) and (14). (Collar oilers fitted in electrical machines of the range AH180 to AH225 have holes in the hub section which can be used for pulling off).
5. Loosen and pull off the securing ring (13).
6. By using a pulling tool and heating the inner ring slightly, remove the deep groove ball bearings (6) and (12).  
Remove the pressure springs (9) – only present on electrical machines AH250.
7. Pull off the inner bearing covers (8) and (10) together with the seals (7) and (11).
8. The rotor remains in the stator housing.

# Maintenance



Diag. 13: Bearing change AH180 to AH315

## 5.5.2 Assembly Procedure for Drive and Non-drive Side Deep Groove Ball Bearing (→ Diag.13) (For drive side cylindrical ball and roller bearing, see 5.5.4).



All securing screws must be fitted with the spring washers provided (DIN 6796).

1. Clean off the bearing seats with a suitable cleaning agent, check for any damage and measure the shaft with a micrometer after it has cooled.
2. Remove the old grease from the inner bearing covers (8) and (10), wash them out using a suitable cleaning agent and allow to dry.  
Fill the bearing covers (8) and (10) with new grease (use the correct type of grease) then push them onto the shaft along with bearing seals (7) and (11). Cover the compression springs (9) in the bearing-cover holes (8) with the same grease.
3. Heat the new bearing in an oil bath (or using inductive means – de-magnetize afterwards) to a temperature of 80°-90°C.

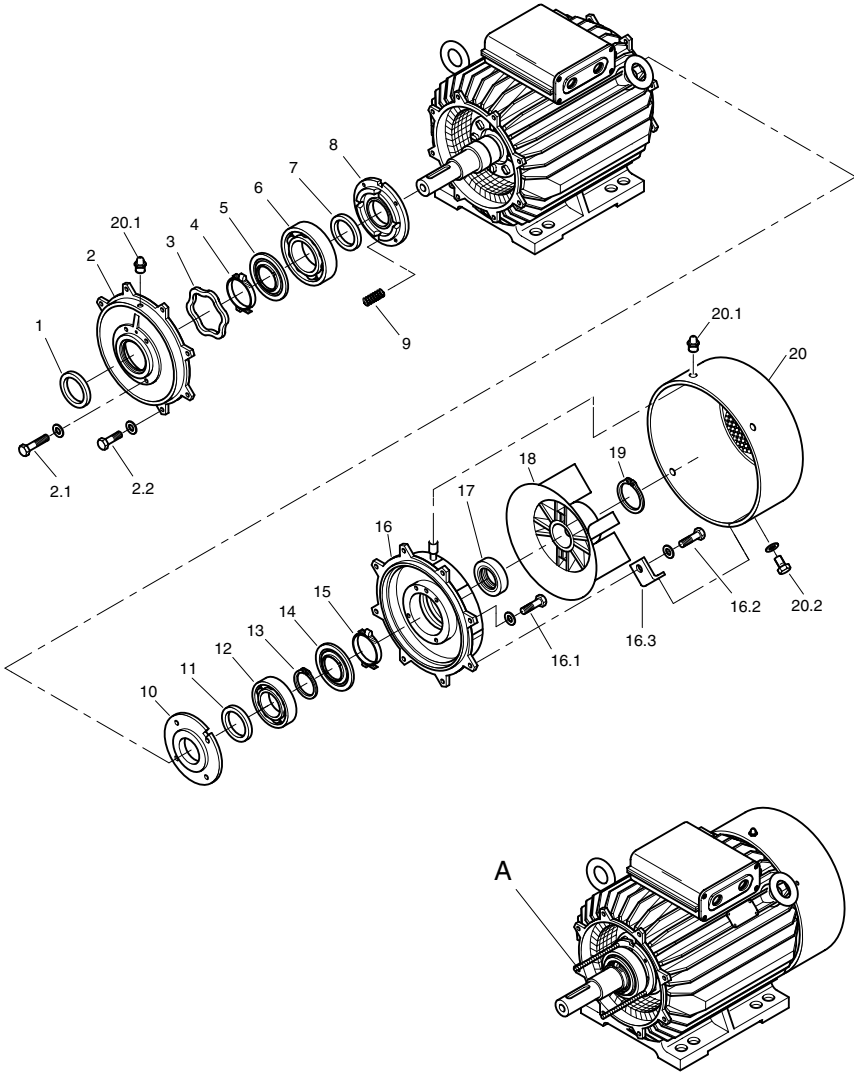


To ensure proper fitting push the heated bearings (6) and (12) onto their shaft seating and press them against the shaft shoulder for approx. 10 secs.

Once they have cooled down, fill the hollow bearing space with new grease (use the correct type of grease).

4. Push on the circlip (13) and secure it. Push on the collar oilers (5) and (14). Push on and tighten up the spring clips provided (4) and (15).
5. Remove the old grease from the bearing cover (2) and (16), wash out using a suitable cleaning agent and allow to dry. Place the compensation washer provided in position on the bearing shield hub.
6. For easy assembly screw in two studs (A) – about 100 mm long – into the threaded holes in the inner bearing cover (8) and (10).  
Push on the bearing shields (2) and (16) and screw down tightly using screws (2.2) and (16.2), together with mounting plate 16.3).  
Tighten up screws (2.1) and (16.1) (at this stage the studs (A) must be removed).
7. Fit the bearing seal (1) and (17) as described on page 27.
8. Fit the plastic fan (18) using a winding tool (metal fans should be heated up and pushed on), push on and secure the circlip (19).  
Place the fan hood (20) in position and tighten up the screws (20.2).  
Screw in the grease nipple (20.1).

# Maintenance

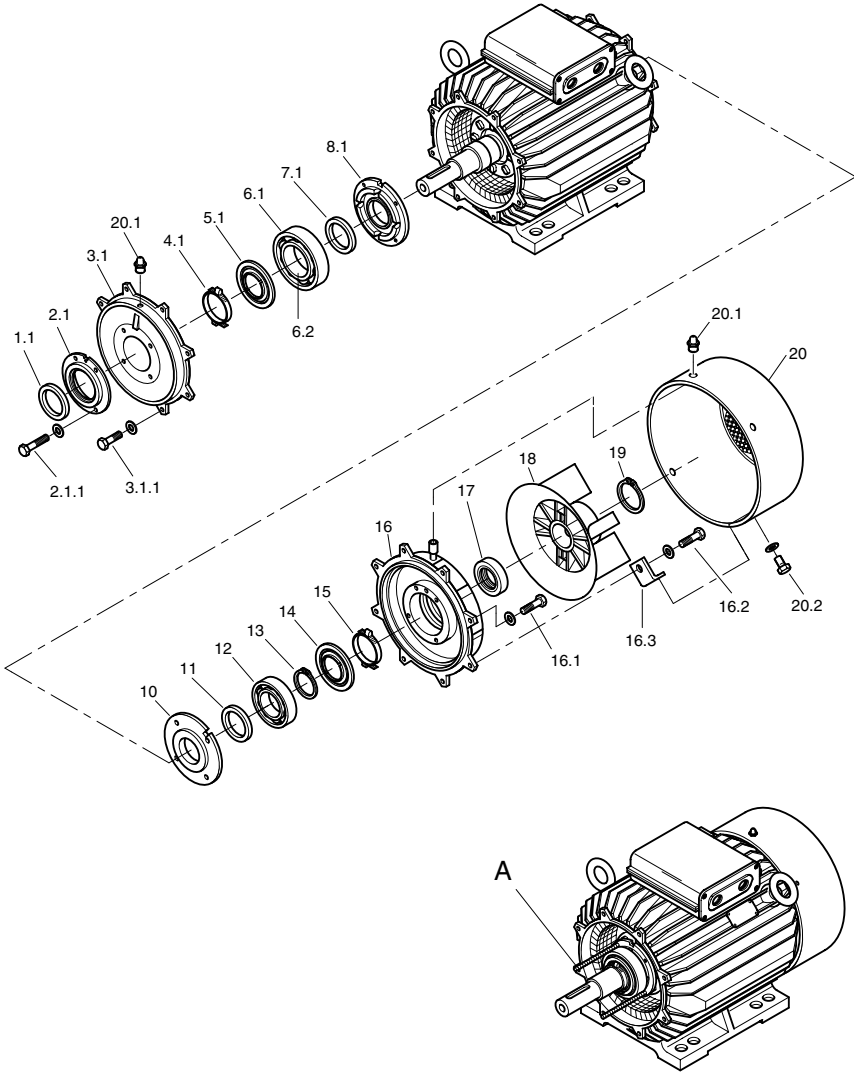


Diag. 13: Bearing change AH180 to AH315

## **5.5.3 Dismantling Procedure for Drive Side Cylindrical Roller Bearing (→ Diag.14) (For non-drive side deep groove ball bearing, see 5.5.1)**

1. Loosen screws (2.1.1) and pull off the bearing cover (2.1) together with the bearing seal (1.1).
2. Loosen and pull off the spring clip (4.1) – only present on electrical machines AH250. Pull off the collar oiler (5.1) (on electrical machines AH180 to AH225 the collar oilers have holes in their hub section which can be used for pulling off).
3. Loosen screws (3.1.1) and pull off the bearing shield (3.1). Press the outer bearing ring (6.1) out of the bearing shield hub.
4. Using a welding torch quickly heat up the inner bearing ring (6.2) and force off using, for example, a screwdriver.
5. Pull off the bearing cover (8.1) together with the bearing seal (7.1).

# Maintenance



Diag. 14: Bearing change AH180 to AH315

## 5.5.4 Assembly Procedure for Drive Side Cylindrical Roller Bearing (→ Diag.14) (For non-drive side deep groove ball bearing, see 5.5.2).



All securing screws must be fitted with the spring washers provided (DIN 6796).

1. Clean off the bearing seats with a suitable cleaning agent. Check for any damage and measure the shaft with a micrometer after it has cooled .
2. Remove the old grease from the inner bearing cover (8.1), wash it out using a suitable cleaning agent and allow to dry.  
Fill the bearing cover (8.1) with new grease (use the correct type of grease) then push it onto the shaft along with the bearing seal (7.1).
3. Heat the new inner bearing ring (6.2) in an oil bath (or using inductive means - de-magnetize afterwards) to a temperature of 80°-90°C.

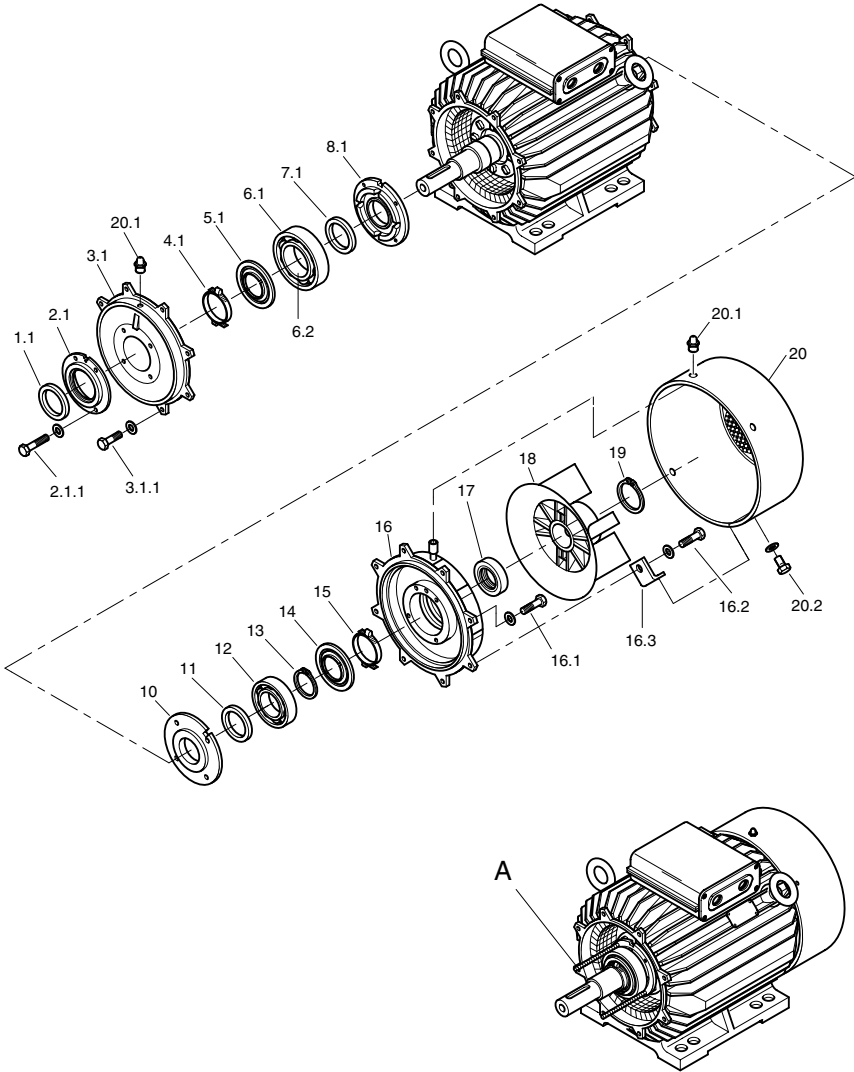


To ensure proper fitting push the heated inner bearing ring (6.2) onto its shaft seating and press it against the shaft shoulder for approx. 10 secs.

Lightly grease inner bearing ring (6.2) after cooling.

4. Wash out the hub of the bearing shield (3.1) using a suitable cleaning agent and allow to dry.
5. Press the bearing outer ring (6.1) into the end-shield hub and fill the hollow bearing spaces with new grease (use the correct type of grease).
6. For easy assembly screw in a stud (A) – about 100mm long – into the threaded hole located in the bearing cover (8.1). Push on the bearing shield (3.1) and tighten up using the screws (3.1.1).
7. Push on the collar oiler (5.1), push on and tighten up the spring clip (4.1) provided.
8. Remove the old grease from the bearing cover (2.1), wash out the cap using a suitable cleaning agent, allow it to dry. Push the bearing cover (2.1) onto the shaft and tighten up using screws (2.1.1) (in doing this remove stud [A]).
9. Fit the bearing seal (1.1) as described on page 27.

# Maintenance



Diag. 14: Bearing change AH180 to AH315

## 5.5.5 Dismantling Procedures for Non-drive Side Angular Contact Ball Bearing (O-layout) (→ Diag.15) (For drive side cylindrical roller bearing, see 5.5.3 and for drive side deep groove ball bearing, see 5.5.1).

1. Unscrew the grease nipple (20.1), loosen the screws (20.2) and take off the fan hood (20).
2. Loosen and pull off the circlip (19). Pull off the fan using a pulling tool (to facilitate this operation, metal fans should be heated up).

### **For designs fitted with labyrinth seals (1):**

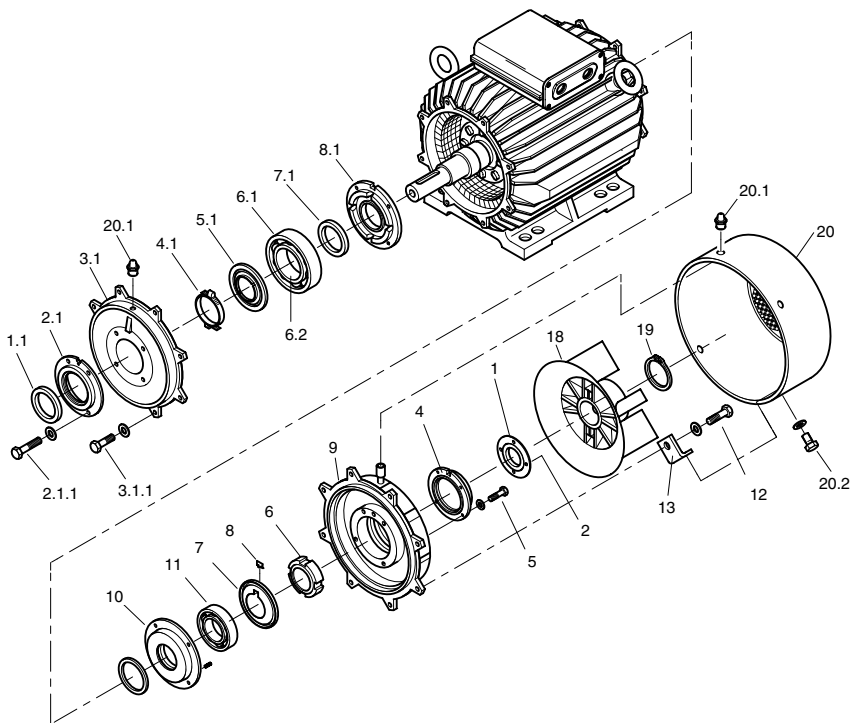
Screw studs into the threaded holes (2) and, using the studs, pull the seal from the shaft end.

### **For designs fitted with rotary seals:**

The rotary shaft seal is pulled off together with the bearing cover (4).

3. Undo the bearing cover securing screws (5) and pull off the bearing cover.
4. Undo the securing screw (shaft nut [6]).
5. Undo the shaft nut (6) with a hook spanner and pull it off the shaft end.
6. Pull off the collar oiler (7), taking care not to damage the torque device (8).
7. If applicable, undo the temperature sensor which is fitted on the outer surface of the bearing shield.
8. Undo the securing screws (12) of the bearing shield (9).
9. Pull the bearing shield off the shaft end by means of a pulling tool.
10. Push back the inner bearing cover (10).
11. Pull the angular contact ball bearing (11) from the rotor shaft using a pulling tool.
12. If the angular contact ball bearing is tightly seated, heat it up slightly (without heating the rotor shaft) and pull off using a pulling tool.

# Maintenance



Diag. 15: Bearing change AH180 to AH315

## 5.5.6 Assembly Procedures for Non-drive Side Angular Contact Ball Bearing (O-layout) (→ Diag.15) (For drive side cylindrical roller bearing, see 5.5.4, and for drive side deep groove ball bearing, see 5.5.2)

1. Clean off the bearing seats with a suitable cleaning agent, check for damage and measure the shaft with a micrometer after it has cooled.
2. Clean all individual parts of the bearing assembly. Check the felt ring seals in the inner bearing cover (10) and renew if necessary.
3. Completely fill the greasing spaces of the inner bearing cover with the specified grease (→ rating plate) and push the inner bearing cover onto the shaft.
4. Heat up the angular contact ball bearing (11) in an oil bath or using inductive means (de-magnetize afterwards) to a max. 100°C.



Do not heat the angular contact ball bearing with a naked flame.

5. Without tilting it, push the angular contact ball bearing onto the rotor shaft and right up to the stop.



Note the fitting position.

6. Apply grease to the angular contact ball bearing.
7. Push the collar oiler (7) against the angular contact ball bearing and take care that the torque device (8) locates in the grooves of the shaft and collar oiler (nose under the inner bearing ring).
8. Screw on the shaft nut (6) and tighten using a hook spanner.
9. Lock the shaft nut with the securing screw.
10. Screw in at least two studs (A) into the threaded holes of the inner bearing cover.
11. Push the bearing shield over the rotor and studs and in front of the angular contact ball bearing.
12. Using the studs, pull the bearing shield onto the outer ring of the angular contact ball bearing.



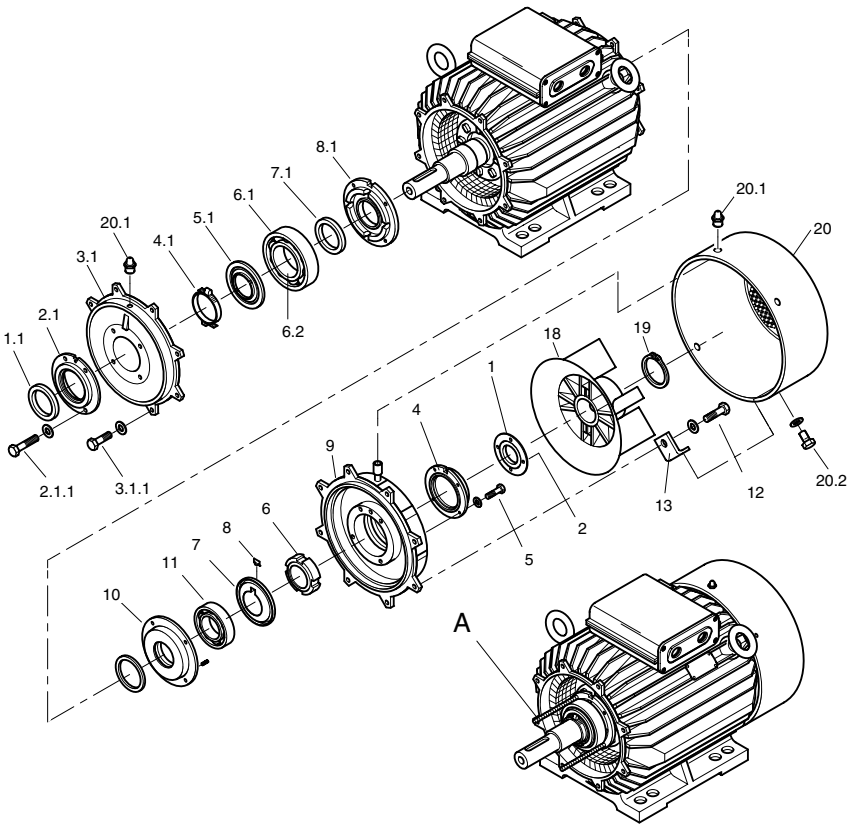
Blows and knocks during the pulling on operation will damage the angular contact ball bearing.

Do not tilt the bearing shield and bearing when they are being pulled on.

13. Tighten the securing screws (12) for the bearing shield and the angled stay (13) to the inner bearing cover.
14. Push the bearing cover (4) against the bearing shield (9) and tighten down using the proper screws (5).

# Maintenance

15. For designs fitted with a rotary shaft seal, push the new rotary shaft seal onto the bearing cover (4).
16. For designs fitted with a labyrinth sealing ring (1), heat the labyrinth sealing ring up to approx. 60°-80°C and push it against the bearing cover (4).
17. To raise the effectiveness of the labyrinth sealing ring we recommend that a small amount of grease be applied into the labyrinth opening.
18. Apply a film of grease to the contact surfaces of the rotary shaft seals in the outer bearing cover.
19. Pull on the plastic fan (18) using a pulling tool (metal fans should be heated up and then pulled on), push on the circlip (19) and secure, fit the fan hood (20), tighten using screws (20.2). Screw in the grease nipple (20.1).



Diag. 15: Bearing change AH180 to AH315

## 5.6 Maintenance plan

COMPONENT	DAILY	WEEKLY	EVERY 3 MONTHS	ANNUALLY	EVERY 5 YEARS
Bearing			For lubrication deadlines see rating plate		<ul style="list-style-type: none"> <li>- bearing change, check shaft seals, replace if necessary;</li> <li>- remove old grease;</li> </ul>
Heat exchanger Airways	Check			Clean	Clean
Driven appliance (Observe the manufacturer's specifications)			Check alignment and that the machine is secure	Check alignment and make sure that machine is secure	Check alignment and that machine is secure; Change grease / oil
Terminal box Earth				Clean internally; Re-tighten screws	Clean internally; Re-tighten screws
Stator winding				Measure insulating resistance	Check that feed cables are not torn, that they are firmly seated, check keys; measure insulating resistance
Auxiliary monitoring connections	Record measurement data			Check function	Check function
Motor as a whole	Pay attention to operating noise and quiet running			Re-tighten screws	Dismantle rotor; check that the rotor plates, fan and stator plates are firmly seated; Check that rotor bars are not broken; Clean

# Trouble shooting

## 6 Trouble shooting

### 6.1 Safety Instructions

A faulty electrical machine may only be repaired by qualified personnel at the request of the person responsible for the installation.

When determining the cause of a malfunction take into consideration all facets of the electrical machine (driven appliance, foundations, type of set-up, switchgear etc.).

Inform the manufacturer when damage occurs during the warranty period.

Request the manufacturer to provide service personnel. Tel.: +49 (0) 180/5003274



**When determining the cause of a malfunction, or when rectifying the malfunction, observe the following:**

- DIN VDE 0105,
- Accident prevention regulations, VBG 1, VBG 4!



**Ensure that the machine is switched so as not to be live.**

**Lock it against reactivation and designate such by placing a warning sign next to the activation switch.**

**Ascertain that the machine is not live!**

**Earth and short-circuit!**

**Cover or cordon off any neighbouring parts which are live!**



**Ensure that the auxiliary circuits, e.g. space heater etc., are switched so as not to be live.**

## 6.2 Malfunctions, Electrical

ELECTRICAL MALFUNCTION CHARACTERISTICS										
- Motor does not start										
- Motor runs, but with difficulty										
- Droning noise when starting										
- Droning noise during operation										
- Droning noise in time to the doubled induction frequency										
- Rapid rise in temperature when running without load										
- Rapid rise in temperature when running under load										
- Rapid rise in temperature of individual winding sectors										
					POSSIBLE CAUSES OF MALFUNCTION			REMEDIAL MEASURES		
●	●	●		●	Overload			Reduce load		
●					Interruption of a phase in the feed			Check switch and feeds		
	●	●	●	●	Interruption of a phase in the feed after switching on			Check switch and feeds		
●	●				Mains voltage too low, Frequency too high			Check mains supply state		
				●	Mains voltage too high, Frequency too low			Check mains supply state		
●	●	●	●		●	Stator winding connected up wrongly			Check the winding circuitry	
●	●	●	●		●	Winding or phase break in the stator winding			Determine winding and insulating resistances; Overhaul after consulting the manufacturer	
			●		Asymmetry in short-circuit cage			Overhaul after consulting the manufacturer		
				●	wrong direction of rotation of motor			Swap the mains connections U and W		
				●	Insufficient cooling due to dirty airways			Clean the airways, Check seals		
				●	Voltage too high, hence eddy current loss too high			Do not exceed 105% of the rated voltage		

# Trouble shooting

## 6.3 Malfunctions, Mechanical

MECHANICAL MALFUNCTION CHARACTERISTICS					
					– Rubbing noise
					– Rapid rise in temperature
					– Strong vibration
					– Bearings overheating
					– Bearing noise
					<b>POSSIBLE CAUSES OF MALFUNCTION</b>
					<b>REMEDIAL MEASURES</b>
●					Rotating parts rubbing
	●				Air feed choked, filter dirty, if applicable, wrong direction of rotation
		●			Rotor out of balance
		●			Rotor out of true, shaft distorted
		●			Faulty alignment
		●			Driven appliance out of balance
		●			Impact from the driven appliance
		●			Noisy gearbox
		●			Resonance with foundations
		●			Changes in the foundations
		●			Too much grease in the bearings
			●		Bearing dirty
			●		Ambient temperature > 40°C
			● ●		Felt rings pressing on the shaft
			● ●		Insufficient lubrication
			● ●		Bearing corroded
			● ●		Too little play in the bearing
			●		Too much play in the bearing
			●		Areas of rubbing on bearing track
			●		Furrows on the bearing
			●		Coupling pressing or pulling
			●		Too much belt tension
			● ●		Bearing twisted or skew
* if necessary, inform the manufacturer					

## 7 Repair Instructions



Only carry out repair work when the machine is standing idle.



Ensure that the machine is switched so as not to be live.

Lock it against reactivation and designate such by placing a warning sign next to the activation switch.

Ascertain that the machine is not live!

Cover or cordon off any neighbouring parts which are live!

Ensure that the auxiliary circuits, e.g. space heater etc., are switched so as not to be live!

Repair activities may only be carried out by qualified personnel who - based on their training, experience and instruction - have sufficient knowledge of:

- safety regulations,
- accident prevention regulations,
- guidelines and acknowledged technical rules (e.g. VDE requirements, DIN standards).

Such qualified personnel must

- be able to assess the work assigned to them, and to recognise and avoid possible dangers.
- be authorized by those responsible for the safety of the machine / plant to carry out the required work and activities.



Repair work carried out within the warranty period requires the prior agreement of the electrical machine manufacturer.



We recommend that only original replacement parts be used for overhauls.

# Stipulated Usage in Explosive Areas

## 8 Stipulated Usage in Explosive Areas

- Electrical machines for the use of device group II for category 2 (zone 1) or group II (zone 1):
  - Type of ignition protection Ex II2 G EEx e II (EN 50014/50019) or EEx e II T.
- Electrical machines for the use of device group II for category 3 (zone 2) or group II (zone 2):
  - Suitability for use in zone 2 under VDE 0165
  - Type of ignition protection EEx nA II EN 50021 (IEC 79-15)


### 8.1 Electrical machines for the use of device group II for category 2 (zone 1)

With regard to explosion-protected low voltage machines fitted with short-circuit rotor of the ignition protection type „Raised Safety e“ in accordance with EN 50014/50019, the following is valid as a supplement to the operating manual:

 **The machines may be used in explosive spaces and operating plant in accordance with the stipulations laid down by the responsible monitoring body (for ignition protection type and temperature class → rating plate)**

The competent supervisor official is responsible for establishing the degree of explosion danger posed by an operating site.

#### 8.1.1 Assembly

 **When assembling machines which are explosion protected observe the safety requirements, instructions and descriptions contained in chapter 4 „Assembly and Commissioning“.**

# Stipulated Usage in Explosive Areas

## 8.1.2 Installation

For national installation, i.e. installation within the area of jurisdiction of VDE requirements, observe the following requirements and ordinances:

- **DIN EN 60079 or DIN VDE 0165 - ‘Establishment of electrical installation in explosive areas’ and**
- **ElexV or ExVO - „Ordinance on electrical Plant in Areas with a Risk of Explosion“**

For installation in other countries the respective relevant national regulations are applicable.



**Machines fitted with external fans should be installed so that the inflow and outflow of cooling air is not obstructed.**

**For a position than horizontal, prevent solid objects from falling into the ventilation aperture install a suitable cover.**

**In construction forms with a shaft end pointing downwards, a protective cover must have been fitted on the ventilation opening in the factory.**

## 8.1.3 Connection

Compare the mains voltage with the data on the rating plate. Adapt the dimensions of the connection cables to the rated amperage under DIN VDE 0100 and while observing the ambient temperature. Connect machines according to the wiring diagram inside the connection cabinet.

Freely arrange the connection leads in the terminal box, so that the earth lead is longer than the others and that the insulation of the feeds is not damaged.

Insulate the cable ends so that the insulation reaches the terminal itself ( $\leq 5\text{mm}$ ).

Use form-flush securing elements or industrial stickers to protect allowed pipe entries against rotation. Standardly supplied entry-screw connections may only be used with permanently installed pipes.

Stop up any unused cable feeds apertures with the special plugs provided.

# Stipulated Usage in Explosive Areas

## 8.1.4 Protective Measures against Impermissible Heating

Protect each machine against impermissible heating on all phases by using a current-dependent cut-out switch or equivalent device corresponding to DIN EN 60439-5. When used on electrical machines the protective device should be set to the rated current so that the current will also be switched off (within the  $t_E$ -time period specified for the respective temperature class) if the rotor is blocked.

This requirement is considered to be fulfilled if the trigger time, which can be deduced from the characteristic trigger curve (initial temperature 20°C) for the relationship  $I^A/I_N$ , is no greater than that heating time  $t_E$  specified for the relevant temperature class.

Protect  $\Delta$ -connection windings against phase failure. To do this connect the trigger or relay in series with the winding strands and set to 0.58 of the rated current. If such a wiring arrangement is not possible, then additional protective measures are required besides the use of cut-out switches.

Protecting the windings solely by means of direct temperature monitoring (using temperature sensors) is only permissible if this has been specially authorized and is specified on the rating plate.

The thermal engine protection comprises temperature sensors under DIN 44081 or DIN 44082, guaranteeing the explosion protection only in connection with activation devices, allowed by a testing body accredited in the EU and bearing test mark (e.g.) PRB 3.53 - PTC/A.

Pole-reversible engines for each speed-count stage require separate, mutually locked, approved protective devices.

Unless otherwise certified, the electrical machines may only be used for continuous operation and only for normal, infrequently repeated commissionings, in which no appreciable commissioning heating occurs.

Use a starter monitor to protect electrical machines which start slowly (starting time  $\geq 1.7 \cdot t_E$  - time) in accordance with the information of the conformity or construction-sample test certificate.

Should the certificate number of an explosion-protected machine be supplemented by a „B“ or an „X“, then special measures are to be carried out in correspondence with the test certificate.

# Stipulated Usage in Explosive Areas

## 8.1.5 Maintenance and Repair



**When repairing and maintaining explosion-protected machines observe the safety requirements, instructions and descriptions contained in chapters „5 Maintenance“, and „7 Repairs“!**

**When maintaining, repairing and / or altering plant where there is a risk of explosion, observe the requirements of the „Ordinance on electrical Plant in Areas with a Risk of Explosion“ (ElexV or ExVO)!**

Maintenance or repair affecting the explosion protection (especially all repair activities to the stator and rotor coils, terminals and ventilation system) should be carried out by the manufacturer.

When carrying out maintenance, repair or adjustment activities, designate the machine by means of an additional shield, on which

- date,
- company carrying out the work and
- type and extent of the maintenance, repair or alteration.

In addition, this work must be inspected by a recognized expert and then authorized by his written confirmation of checking.

## 8.1.6 Spare Parts

With the exception of standard, off-the-shelf parts (roller bearings etc.), only original replacement parts may be used.

Please note chapter „9 Spare Parts“, when ordering parts.

# Stipulated Usage in Explosive Areas


## 8.2 Electrical machine for the use of device group II for category 3 (zone 2)

Explosion-protected 3-phase asynchronous machines with short-circuit rotor of ignition-protection type EEx nA II under EN 50021 (IEC 79-15). Suitability for the use of device group II for category 3 is governed by the following supplement to the operating manual:

 **The machines may be used in explosive spaces and operating plants in accordance with the stipulations laid down by the responsible monitoring body (for ignition protection type and temperature class → rating plate)**

The competent supervisor official is responsible for establishing the degree of explosion danger posed by an operating site.

### 8.2.1 Assembly


 **When assembling machines which are explosion protected observe the safety requirements, instructions and descriptions contained in chapter 4 „Assembly and Commissioning“.**

### 8.2.2 Installation

For national installation, i.e. installation within the area of jurisdiction of VDE requirements, observe the following requirements and ordinances:

- **DIN EN 60079 or VDE 0165- „Setting up electrical Plant in Areas with a Risk of Explosion“ and**
- **ElexV or ExVO - „Ordinance on electrical Plant in Areas with a Risk of Explosion“**

For installation in other countries the respective relevant national standards and regulations governing set-up are applicable.

 **Machines fitted with external fans should be installed so that the inflow and outflow of cooling air is not obstructed.**

**For a position other than horizontal, prevent solid objects from falling into the ventilation aperture install a suitable cover.**

**Models equipped with a downward-facing shaft end are already fitted with a protective cover over the ventilation aperture by the manufacturer.**

# Stipulated Usage in Explosive Areas

## 8.2.3 Connection

Compare the mains supply voltage with the specifications given on the rating plate. Power cable dimensions should accord to VDE 0100 and be suitable for the rated current strength taking into account an ambient temperature.

Connect up the machines in accordance with the circuit diagrams located in the terminal box.

Freely arrange the connection leads in the terminal box, so that the earth lead is longer than the others and that the insulation of the feeds is not damaged. Clamp the cable ends in such a way that the minimum air gaps are maintained.

Use form-flush securing elements or industrial stickers to protect allowed power entries against rotation. Standardly supplied entry-screw connections may only be used with permanently installed pipes.

Unused cable-entry opening must be closed off by plugs that are allowable for the purpose.

## 8.2.4 Protective Measures against Impermissible Heating

Protect each machine against impermissible heating on all phases by using a current-dependent cut-out switch or equivalent device corresponding to VDE 0660. When used on electrical machines the protective device should be set to the rated current so that the current will also be switched off (within the  $t_E$ -time period specified for the respective temperature class) if the rotor is blocked.

This requirement is considered to be fulfilled if the trigger time, which can be deduced from the characteristic trigger curve (initial temperature 20°C) for the relationship  $I_A/I_N$ , is no greater than that heating time  $t_E$  specified for the relevant temperature class.

Protect  $\Delta$ -connection windings against phase failure. To do this connect the trigger or relay in series with the winding strands and set to 0.58 of the rated current. If such a wiring arrangement is not possible, then additional protective measures are required besides the use of cut-out switches.

Protecting the windings solely by means of direct temperature monitoring (using temperature sensors) is only permissible if this has been specially authorized and is specified on the rating plate.

# Stipulated Usage in Explosive Areas

The thermal engine protection comprises temperature sensors under DIN 44081 or DIN 44082, guaranteeing the explosion protection only in connection with activation devices, allowed by a testing body accredited in the EU and bearing test mark (e.g.) PRB 3.53 - PTC/A.


Pole-reversible engines for each speed-count stage require separate, mutually locked, approved protective devices.

Unless otherwise certified, the electrical machines may only be used for continuous operation and only for normal, infrequently repeated commissionings, in which no appreciable commissioning heating occurs.

Use a starter monitor to protect electrical machines which start slowly (starting time  $\geq 1.7 \cdot t_E$  - time) in accordance with the information of the conformity or construction-sample test certificate.

Should the certificate number of an explosion-protected machine be supplemented by a „B“ or an „X“, then special measures are to be carried out in correspondence with the test certificate.

## 8.2.5 Maintenance and Repair

 **When repairing and maintaining explosion-protected machines observe the safety requirements, instructions and descriptions contained in chapters „5 Maintenance“, and „7 Repairs“!**

**When maintaining, repairing and / or altering plant where there is a risk of explosion, observe the requirements of the „Ordinance on electrical Plant in Areas with a Risk of Explosion“ (ElexV or ExVO)!**

Maintenance or repair affecting the explosion protection (especially all repair activities to the stator and rotor coils, terminals and ventilation system) should be carried out by the manufacturer.

When carrying out maintenance, repair or adjustment activities, designate the machine by means of an additional shield, on which

- date,
- company carrying out the work and
- type and extent of the maintenance, repair or alteration.

In addition, this work must be inspected by a recognized expert and then authorized by his written confirmation of checking.

# Stipulated Usage in Explosive Areas

## 8.2.6 Spare Parts


With the exception of standard, off-the-shelf parts (roller bearings etc.), only original replacement parts may be used.

Please note chapter „9 Spare Parts“, when ordering parts.

# Spare Parts

## 9 Spare Parts

### 9.1 Order Details

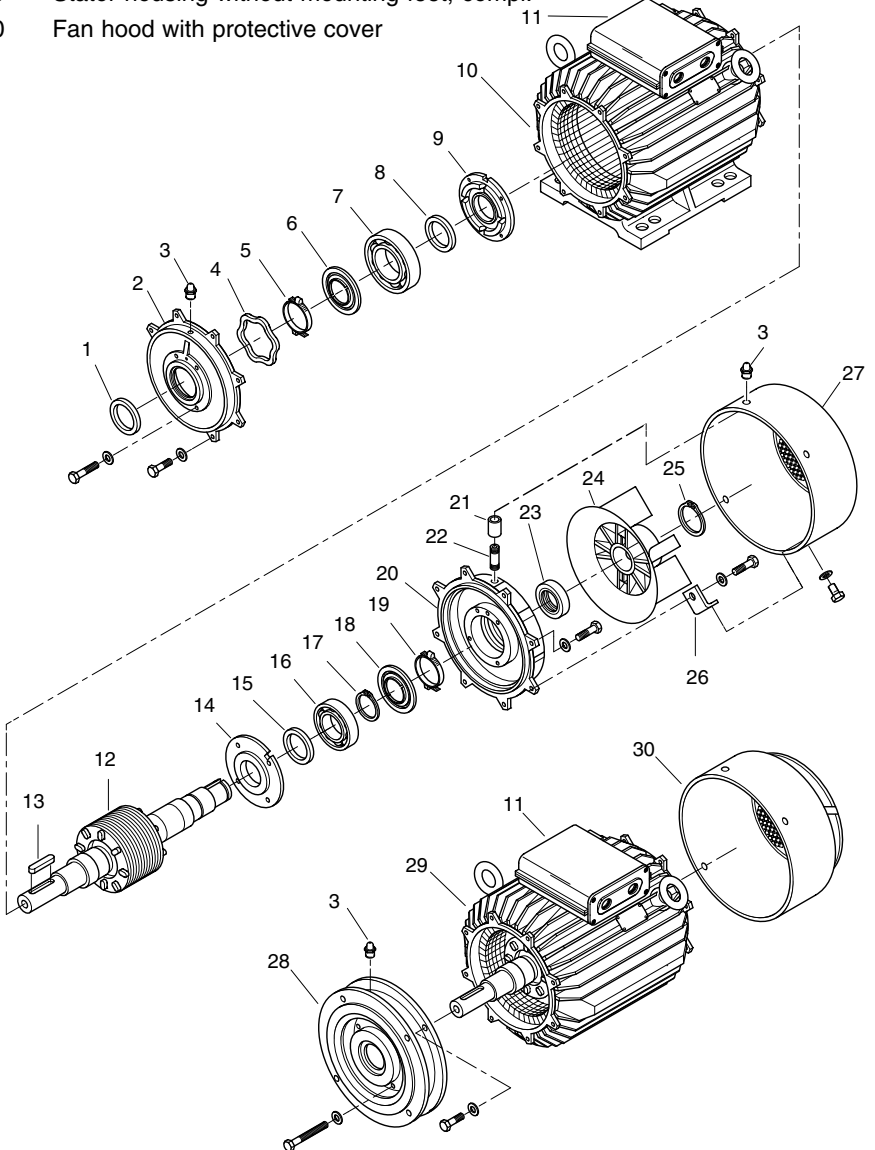
 Be sure to specify the electrical machine type and number (→ rating plate) and give a precise description of the part (part number if applicable) when ordering spare parts.

When ordering replacement bearings, take note not only of the bearing type but also the engraved symbol which gives the bearing model (this can be read off from the fitted bearing, e.g. C3 or C4)!

### 9.2 Exploded View, IP55, Model Size 180M-315L

- 1 Sealing ring DS, outer or labyrinth seal
- 2 Bearing shield DS
- 3 Grease nipple
- 4 Compensating washer
- 5 Spring clip, DS and shaft nut
- 6 Collar oiler DS
- 7 Roller bearing DS
- 8 Sealing ring DS, inner
- 9 Bearing cover, DS inner
- 10 Stator housing IMB3 with plates and winding
- 11 Terminal box, complete
- 12 Rotor with plates and winding
- 13 Key
- 14 Bearing cover NS, inner
- 15 Sealing ring NS, inner
- 16 Roller bearing NS
- 17 Circlip for NS bearing
- 18 Collar oiler NS
- 19 Spring clip NS and shaft nut
- 20 Bearing shield NS
- 21 Bush
- 22 Lubricating pipe
- 23 Sealing ring NS, outer or labyrinth
- 24 Fan
- 25 Circlip for fan


- 26 Securing angle-plate
- 27 Fan hood
- 28 Flange bearing shield
- 29 Stator housing without mounting feet, compl.
- 30 Fan hood with protective cover



Diag. 16: Exploded view, IP55, model size 180M-315L.

# Instructions for Electrical machines Which Are To Be Stored

## 10 Instructions for Electrical machines Which Are To Be Stored

 Electrical machines which will be stored for long periods of time before use are to be dealt with as follows:

### 10.1 Storage Site

Store the machine (complete with its transportation packing) in a dry place which can be heated and which is free from shock, and protect it from mechanical damage.



After long periods of standing (more than 1 year) check the bearings for corrosion damage. Even the smallest amount of corrosion damage can reduce the bearing's serviceable life.

### 10.2 Securing the Machine for Transportation

If the electrical machine is fitted with cylindrical roller bearings, fix the rotor by means of a suitable transportation securing device (for protection against scoring of the rotor by shock see chapter 3.3).

If the electrical machines are despatched on vibration dampers, then they should not be removed during the period of standing.

If drive sprockets, couplings etc. are already assembled onto the shaft ends, then fit the transportation securing devices where possible or place the machine onto vibration dampers.



Any further transportation should only be carried out using transportation securing devices or by placing the machine onto vibration dampers.

# Instructions for Electrical machines Which Are To Be Stored

## 10.3 Checks before Commissioning

### 10.3.1 Bearings

After long periods of standing (> 1 year) check the bearings. For dismantling and assembly of the bearings → pages 28-40.



**The slightest corrosion damage will considerably reduce the lifespan of the bearing.**



The specifications for type / amount of grease can be taken from the rating plate or lubricating plate (on the electrical machine). Observe the specifications given in the operating instructions on page 26, Bearing Lubrication, Lubricants. The measures specified above can be ignored if the period of standing has been relatively short (< 1 year) and storage has been carried out in the proper manner.

### 10.3.2 Insulating Resistance



**All work on the electrical machine's electrical connections may only be carried out by electricians (as defined in DIN VDE 0105 and IEC 364)!**



**Do not touch the connection terminals either during or after measurement. The connection terminals can carry high-voltages! After checking, earth the connection terminals for a short time (5 seconds).**

- Using a hand generator (max. DC voltage = 630V), measure the insulating resistance of each individual phase to earth continuously until the measured value is constant.



The insulating resistance of new windings is > 100 MΩ. Dirty and damp windings demonstrate considerably lower resistance values.

## Instructions for Electrical machines Which Are To Be Stored

A coil is regarded as sufficiently dry and clean if the insulation resistance at 75 °C is at least **1MΩ je 1kV** (see table).

If the values drop below the table values, the coil must be dried or cleaned. The coil temperature must not exceed 75 °C.

Rated voltage	Windings temperature when cold			Operational temperature
	15°C	25°C	35°C	
$U_N$	15°C	25°C	35°C	75°C
0,5 kV	30 M	15 M	8 M	0,5 M
1,0 kV	60 M	30 M	15 M	1,0 M



Dry the coil using the space heater or another heater or by applying an alternating voltage of 5-6% of the rated voltage (make a delta circuit) to the stator connection clamps U1 and V1.



Insulation resistance values are temperature dependent. Guide values: a coil temperature increase or decrease of 10 K leads to the insulation resistance value being halved or doubled.

Remove the condensate water plug before drying the coil. Reclose it tightly once the condensate water openings have been dried.

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