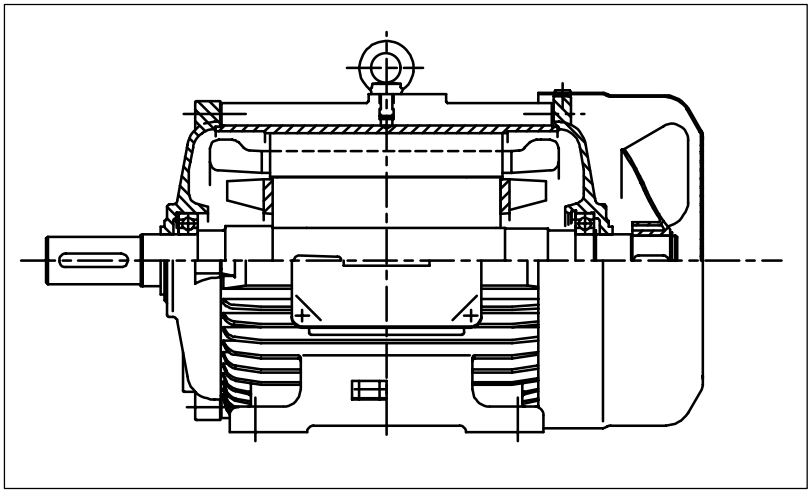
Operating Instructions

N – R 435 en 08.99

for totally enclosed fan–cooled (TEFC)
and internally cooled (ODP)
three–phase motors with squirrel cage
for low voltage, with antifriction bearings and
including motors in protection type ”n” Ex nA II



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Safety and commissioning instructions



General

Low voltage motors have dangerous, **live** and **rotating** parts, and probably **hot** surfaces. All work for transport, connection, commissioning and maintenance is to be made by **qualified, responsible** specialists (prEN50110–1/VDE 0105; IEC 364 must be observed). An inadequate behaviour can cause severe **damages to persons and property.**

Specified use

These low voltage motors are only meant for use in **industrial** plants. They are in accordance with the harmonized standards of the series **EN 60 034 (VDE 0530)**. Their use in **hazardous areas** is **prohibited**, if not **explicitly** indicated (observe additional instructions).

Protection types ≤ IP 23 are **never** allowed for outdoor use. Air–cooled types are suitable for ambient temperatures from **–20 °C (68 °F) to +40 °C (104 °F)** as well as altitudes ≤ **1000 m** above mean sea level. It is **imperative** to observe differing data on the rating plate. Conditions at the site of application must comply will **all** indicated data on the rating plate.

Low voltage motors are **components** to be installed into machines in accordance with Directive 89/392/EC. **Commissioning** is not allowed as long as the conformity of the end product with this directive is not established (also observe EN 60 204–1).

Transport, storage

The carrier is immediately to be informed on **damages** found upon delivery; **commissioning must not be admitted**, if required. Screwed–in lifting eyes are to be tightened. They are only suitable for the weight of the low voltage motors, **no** additional loads are allowed to be attached. If required, sufficiently dimensioned means of transport (e.g. rope guides) are to be used. Prior to commissioning the **transport locking devices** are to be **removed**. Reuse for further transports. For storage of low voltage motors, take care of a **dry**, **dustfree** and **low–vibration** (v_{eff} ≤ 0,2 mm/s) ambience (bearing damages with motor at standstill).

Before commissioning the insulation resistance is to be measured. In case of value ≤ 1kΩ per Volt of rated voltage the winding must be dried. Observe ”Storage instructions”.

Installation

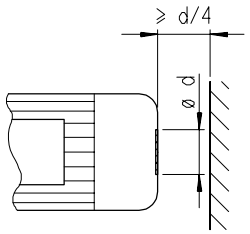
Take care of an even ground, suitable fastening of feet or flange and an exact alignment for direct coupling. Avoid that structure–dependent natural frequencies occur within the rotary frequency and the double mains frequency. Turn rotor **by hand**, listen to abnormal frictioning noises. **Check direction of rotation** before coupling (see section ”Electrical Connection”).

Pulleys and couplings are **only** allowed to be installed or removed with suitable devices (Heating!) and to be covered with **protection against accidental contact.** Avoid excessive belt tensions (Technical List). The **balance** of the low voltage motor is indicated on the shaft end face or on the rating plate (H = half key, F = full key). In case of a half key (H), the coupling must also be balanced with a half key. Remove any **protruding and visible** part of the key.

If required, make the necessary pipe connections. Mounting types with the shaft end facing upwards are to be provided with a cover by **the customer**, avoiding that foreign bodies fall into the fan.

Safety and commissioning instructions

Ventilation must **not be hindered** and the outgoing air – also from adjacent units – must not be directly sucked in again.



Electrical connection

All work is only allowed to be done by **qualified** personnel with the low voltage motor and driven machine at **stand-still**, **electrically dead** and **locked against restart**. This is also applicable to auxiliary circuits (e.g. space heater).

Check de–energizing!

A non–observance of the tolerances indicated in EN 60 034–1/VDE 0530, part 1 – voltage ± 5%, frequency ± 2%, curvature, symmetry – will result in an excessive heating and is influencing the electromagnetic compatibility.

Observe data on the rating plate as well as wiring diagram in the terminal box.

Connection is to be made in such a way that a **durably safe**, electrical connection is maintained (no uncovered wire ends); especially provided cable end equipment is to be used. A safe **earthing** is to be made.

The minimum air gaps between uninsulated and live parts themselves and to earth must not be lower than the following values: 8 mm at $U_N \leq 550$ V, 10 mm at $U_N \leq 725$ V, 14 mm at $U_N \leq 1000$ V.

The terminal box must be **free of** foreign bodies, dirt as well as humidity. Unused cable entries and the box itself are to be sealed against **dust** and **water.** For trial operation without driving elements the **key** is to be **secured.** For motors with brake it is to be **checked** before putting into operation, if the **brake** is perfectly functioning.

Operation

Vibration severities $v_{eff} \leq 3{,}5$ mm/s ($P_N \leq 15$ kW) or 4,5 mm/s ($P_N > 15$ kW) at coupled operation are safe. In case of changes compared with normal operation – e.g. **higher temperatures, noises, vibrations** – the cause is to be found, if required, consult the manufacturer. Even for trial operation the safety devices are not allowed to be put out of function. In **case of doubt** switch off the low voltage motor.

In case of heavy dirt accumulation, the air ducts must be cleaned at regular intervals.

Bearings with regreasing devices are to be regreased with low voltage motor **running**. Observe saponification class! **If** grease drainholes are sealed with a plug (IP54 DE; IP 23 DE and NDE), **remove these plugs** before putting into operation. Replacement of bearings in case of permanent lubrication (2Z bearings) after approx. 10.000 hours (bipolar) or 20.000 hours (more poles), however, after 3 – 4 years at the latest or according to manufacturer data.

Warranty

The **Warranty** is only applicable if all of these instructions for safety and putting into operation as well as information on possible additional units are strictly observed. Further details are included in following sections of the operating instructions.

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Description

1. Description

1.1 Overall construction and design

Mounting arrangement acc. to EN 60 034–7:	see dimension drawing or rating plate
Mounting dimensions for surface cooling (TEFC) up to frame size 315 M acc. to	
DIN 42 673 (foot mounted)	
DIN 42 677 (flange mounted)	
from frame size 315 L acc. to dimension drawing,	
all frame sizes acc. to IEC 72–1 or IEC 72–2:	see dimension drawing
Mounting dimensions for internal cooling (ODP) up to frame size 315 M acc. to	
DIN 42 672 (foot mounted)	
DIN 42 676 (flange mounted)	
from frame size 315 L acc. to dimension drawing,	
all frame sizes acc. to IEC 72–1 or IEC 72–2:	see dimension drawing
Connection designations acc. to	
DIN 0530 part 8	
IEC 34–8:	see wiring diagram
Enclosure acc. to	
EN 60 034–5:	see rating plate
Cooling acc. to EN 60 034–6:	
IC 411 surface cooling or	
IC 511 hollow–fin cooling or tube cooling or	
IC 01 internal cooling or	
IC 81 W water cooling with air–water circuit cooler	
Details of the motor design are indicated in the valid technical catalogues.	

1.2 Bearings

The motors are equipped with grease–lubricated antifriction bearings. The standard version of the bearings in surface–cooled motors up to frame size 280 and in internally cooled motors up to frame size 225 is permanently lubricated.
The bearings of totally enclosed fan–cooled (TEFC) motors from frame size 315 and the internally cooled open–drip proof (ODP) motors from frame size 250 are equipped with regreasing devices and automatic grease quantity control.

1.3 Cooling

1.3.1 Surface cooling

Design for fin–, hollow–fin– or tube cooling, where an external fan takes in the cooling air through the openings in the fan cover and presses the air over the surface or through the cooling tubes of the stator housing. In case of hollow–fin or tube cooling the heat dissipation is supported by a closed cooling air circuit inside the motor.

1.3.2 Internal cooling

In case of motors with enclosure IP 23 the cooling air (ambient air) is taken in by internal fans through air inlet openings, is led over the heat–generating elements in the motor and is blown out through air outlets.

1.3.3 Water cooling

The motors are equipped with air–water closed–circuits coolers. The cooling air led through heat exchanger and motor is recooled in the heat exchanger and the heat loss is dissipated through the cooling water. The heat exchangers are equipped with special fin tubes.

1.4 Motor frame

Construction for surface cooling (TEFC):
Depending on the frame size the stator frame and end shields are made of aluminium alloy, cast iron or steel. The fan cover is made of sheet steel. The stator frame surface is provided with cooling fins, hollow fins or tubes and an attached terminal box.
Construction for internal cooling (ODP):
Depending on the frame size the stator frame and end shields are made of cast iron or steel. The stator frame has an even surface with attached terminal box. There are distance fins between stator jacket and stator pack allowing the internal cooling.
Construction for water cooling:
Same as for internal cooling, however, with an air–water closed–circuit cooler attached onto the air openings.

1.5 Stator winding

The stator winding is executed in insulation class (see rating plate) acc. to EN 60 034–1. High–quality enamelled wires, suitable surface insulating materials and the type of insulation provide a high level of mechanical and electrical stability with a high utilization factor and a long service life.
If required, the winding heads are sealed with a silicon–rubber compound. This sealing offers special advantages in combination with the insulation classes F and H, when the motors are operated under severe starting– and braking conditions. Furthermore, the sealing provides an increased mechanical short circuit resistance and the motor inside (in case of surface cooling) is protected against condensed water.

1.6 Rotor

The rotor in motors of small frame sizes is equipped with a squirrel cage made of aluminium die cast, in case of larger frame sizes and for special starting– and braking conditions a brazed rotor version is also available. The rotor is dynamically balanced.
The balance is indicated on the shaft end or the rating plate, see section 3.1 ”Installation”.
The motors in standard design meet the requirements of vibration level N acc. to DIN VDE 0530–14 / IEC 34–14, in special cases level R (reduced) or S (special).

1.7 Terminal boxes

If required, additional terminals for the monitoring devices are available inside the terminal box. On special order an additional terminal box will be installed for larger motors (see dimension drawing).
The number of available terminals is indicated in the wiring diagrams.

1.8 Monitoring devices

Monitoring devices are only available on special request. See wiring diagram.

2. Transport



For handling during transport the stator construction of the motor is equipped with lifting eyes, where the lifting hooks can be fixed.

Check whether screwed lifting eyes are securely tightened.

Lift motors only by using these lifting eyes. Several lifting eyes must always be used together.



Lifting of the motors on other parts (e.g. shaft ends) is not permitted, since this might result in considerable damages.

The lifting eyes are only suitable for the motor weight. Additional loads attached to the motor must never be lifted using these eyes.

2.1 Check before installation

Check whether the motor has been damaged during transport. If the packing is damaged to such an extent that a motor damage is to be assumed, the packing should be removed in the presence of a representative agent of the carrier.

2.2 Bearing lock

(for motors with cylindrical roller bearings only.)



The rotor of the motor is locked in order to avoid damages to bearings caused by vibrations at standstill:

– by red marked locking screws in the bearing cap

– or by a transport locking mechanism fixed to the shaft end.

Before the motor is mounted, the locking screws must be loosened and turned back by 10 mm and the transport locking device must be removed (see instruction plate on the motor).

After this, it must be possible to turn the shaft by hand.

We recommend loosening of the bearing lock only after having fitted the drive element.

The transport locking mechanism **has to be** reused for further transports.

Prevent failures and thus avoid damages to persons and property.



The person responsible for the installation has to make sure, that

– safety– and operating instructions are available and observed

– operating conditions and technical data acc. to the order are observed

– protective equipment is used and

– specified maintenance work is carried out.

3. Installation and commissioning



Maximum permissible coolant temperature (room temperature on site) acc to EN 60034-1 /IEC 34-1 is 40 ^{o}C (104 ^{o}F) max. and a permissible altitude up to 1000 m above mean sea level (other values see rating plate).
Care must be taken that the cooling air can flow without hindrance into the air inlet openings and freely pass through the air outlet openings and cannot be directly sucked in again. Suction and outlet openings must be protected from obstructions and coarse dust. When installing the surface–cooled motors from frame size 200 it must be observed that the condensation water drain holes are located at the lowest point of the motor. Careful mounting of the motors on an absolutely level surface in order to avoid distortions when screws are tightened. For machines which are to be coupled a careful alignment is to be observed. As elastic as possible couplings should be used. For larger 2–pole motors we recommend double–gear couplings, which are evenly supporting due to the high number of teeth and have the lowest moment of inertia as a result of their low weight. In case of using e.g. pulleys, gears etc. care must be taken that the permissible radial and axial shaft loads are not exceeded.

3.1 Mounting

Fitting of pulley or couplings.
First the shaft end should be cleaned (not with emery cloth) and then greased. Pulley or coupling should be fitted only with the aid of a fitting device. For this purpose the threaded centering hole in the shaft end can be used. Insert a threaded bolt into the threaded hole. Then place the steel washer, the diameter of which is large enough to cover the hub borehole of the pulley or coupling. The pulley and coupling is to be fitted onto the shaft end by means of a nut or a suitable hydraulic device.



The fitting of the drive elements by means of hammer blows is not permitted because of the risk of bearing damages.
When replacing the bearings those must only be removed and reinstalled by means of suitable devices using the shaft centering. Only original spare parts must be used.

The rotor of the motor is dynamically balanced. **Balance** is indicated on the shaft end face or the rating plate. (**H** = half key, **F** = full key). Take care of the balance for installation of the driving element.!
The balancing of the transmission elements to be fitted must be adapted to the rotor balancing. In case of half key balancing any **protruding and visible** part of the key has to be removed.

The motor must only be mounted and operated according to the specified mounting arrangement (see rating plate).

3.2 Connection, insulation resistance

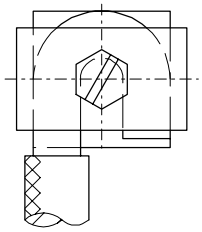
Connection must only be made by an expert and in accordance with the valid safety regulations. The relevant installation– and operating instructions as well as national and international rules have to be observed.

Observe data on the rating plate!
Compare type of current, mains voltage and frequency!
Check wiring diagram!
Observe rated current for setting of the protective switch!
Connect motor in accordance with the wiring diagram provided in the terminal box!
The motor must be protected against excessive heating, e.g. by means of a motor protective switch.

For earthing the motor is provided with an earthing terminal, which depending on the mounting arrangement is either located on the frame resp. on the flange end shield. In addition all motors have a protective conductor terminal inside the terminal box.

As protection against dust and humidity unused cable entries in the terminal box must have a torsionproof seal. All terminal screws and nuts have to be securely tightened to avoid excessive transition resistances.

Protective measures are to be taken.



In case of terminal boards with U–shaped terminal washers the conductors to be connected have to be bent in U–shape and placed underneath the terminal washers. See sketch!

In case of motors with terminal boxes which have ground surfaces between cover and base a thin grease film is to be applied for sealing and against corrosion.
After longer storage periods or standstill (see page 18) the insulation resistance of the winding must be measured phase against phase and phase against ground before putting into operation.
Humid windings might cause creeping currents, arcing and ruptures. In case of values $\leq$ 1 kΩ per Volt of rated voltage measured at a winding temperature of 20 °C (68 °F) the winding must be dried.

3.3 Rotational direction and designation of the terminals acc. to DIN VDE 0530–8/IEC 34–8

3.3.1 In standard design surface cooled (TEFC) motors up to frame size 355 and internally cooled (ODP) motors up to frame size 315 are suitable for both directions of rotation.
Motors suitable for one rotational direction only are identified by an arrow on the motor for the correct direction. Terminals U1, V1, W1 connected to phase L1, L2, L3 (in alphabetical sequence or natural sequence) always result in clockwise rotation. This rule applies to all motors, even if they are not suitable for clockwise direction.

3.3.2 Change of rotational direction:
For DOL (direct on–line) starting and in pole–changing motors with separate windings the direction of rotation can be reversed by exchanging two mains conductors on the terminal board of the motor.
For motors with star/delta starting and pole–changing motors with Dahlander winding, 2 (two) mains conductors at the input to the motor switch have to be exchanged.
For a machine with one shaft end only or with two shaft ends of different diameters, that rotational direction of the rotor is considered as the direction of rotation, being noticed by anybody when looking at the front end or thicker shaft end.

3.3.3 With forced ventilation the direction of rotation is separately marked by an arrow on the forced ventilation itself.

3.4 Air–water circuit coolers

(only in case of water–cooled motors)
For connection and commissioning the instructions for air–water circuit coolers must be considered.

3.5 Check before commissioning



– Check whether the bearing lock has been removed!
  See section 2.2 ”Bearing lock”!
– Observe data on the rating plate!
– Check whether voltage and frequency of the motor comply with the mains data!
– Check whether the rotational direction is correct and for inverter operation, that the limit speed is not exceeded!
– Check whether the motor is protected as specified in the regulations!
– Check and make sure that in case of star/delta–starting, because of the risk of inadmissible operational loads, the switching from star to delta can only be executed after fading of starting current of the star step!
– Check whether the electrical connections are securely tightened and whether the monitoring devices are correctly connected and adjusted!
– Check coolant temperature!
– Check whether the additional equipment – if any – is functioning!
– In case of water–cooled motors, check whether the cooling water circuit is in operation!
– Check whether the cooling air inlet openings and cooling surfaces are clean!
– Check whether protective measures have been taken: earthing!
– Check whether the motor is securely fixed!
– In case of a belt drive, check the belt tension!
– Check whether the cover of the terminal box is closed and whether the cable entries are properly sealed.

4. Maintenance

4.1 Bearings and greasing

4.1.1 The bearings in totally enclosed fan–cooled (TEFC) motors up to frame size 280 and of internally cooled open drip–proof (ODP) motors up to frame size 225 are permanently lubricated. In case of differences (see e.g. Chapter 6) this is marked by indication plates on the motor.
For normal coolant temperatures (see EN 60 034–1 or page 1 of these instructions) motors are greased in our plant, which under normal operating conditions must only be replaced after several years (see Appendix 1).

4.1.2 Bearings of totally enclosed fan–cooled (TEFC) motors from frame size 315 (upon customer request also for the range from frame size 160 to 280) and of internally cooled open drip–proof (ODP) motors from frame size 250 as well as the water–cooled motor with air–water circuit cooler are equipped with regreasing devices and automatic grease quantity control. The regreasing of the bearings is done by means of a grease gun through the nipples provided on the end shields. Overfilling of the bearing chambers is not possible since in case of an extended regreasing the used grease will be thrown off by a rotating disk in the outer grease chamber through an aperture in the end shield.



Regreasing during operation only!
Regreasing intervals, grease quantity and grease quality are indicated on the instruction plates at the motor. Regreasing, however, is to be made at least once a year.

If the motor is equipped with **grease removal rams**, the used grease must be removed after re-greasing by pulling the ram at the bearing several times to the stop, with the motor in operation.

If the motor is equipped with **grease collecting chambers**, these chambers are to be dismounted at motor standstill acc. to the intervals on the instruction plate and the used bearing grease is to be removed. If this is not done, the grease piles up and the bearings are overheated.



Extending the regreasing intervals endangers the bearing and might risk a deterioration of the sealing provided by the grease and thus the ingress of dust into the bearing. If the motors have not been operated for a longer period we recommend even for new motors to regrease the bearings before putting into operation, especially if due to congealing grease in the bearing there are noises which are caused by vibrations of the bearing cage. In the course of running–in increased bearing noises might occur for a short period. The bearing noise is not critical as long as the operating temperature of the bearing is not yet reached and if the noise is caused by the dynamic viscosity of the bearing grease.

The temperature of the bearings is continuously to be checked. Up to an ambient temperature of 40 °C/104 °F a heating–up of 80 K is acceptable if the recommended grease quality is used.

Maintenance

We would like to point out that the grease quantity regulation can only work properly if the grease types specified by us are used. Decisive is the plate fixed on the motor!
Only use antifriction bearing grease as specified for regreasing on the motor plate, i.e. for the ambient temperature range from –35 °C (–31 °F) to +70 °C (158 °F) lithium based grease (e.g. Shell Alvania R3), for the ambient temperature range from –60 °C (–76 °F) to +80 °C (176 °F) special grease (e.g. Isoflex Alltime SL2).
Motors for special operating conditions are supplied with a separate greasing plate stating the grease quality to be used as well as the regreasing intervals.



Relubrication with grease of a different saponification basis. e.g. sodium saponified grease, might cause a deterioration and elimination of the grease effect and thus a total damage of the bearings.

In case of 2 and 4 pole motors it might happen that by the use of unsuitable grease the grease quantity regulation fails and when pressing new grease into the bearings they get abnormally hot due to overfilling. In such cases the bearings have to be cleaned thoroughly by using cold–degreasing agent, and be refilled with suitable grease.

4.2 Terminal locations, terminals and ventilating passages



Depending on the operating conditions, the following should be done in certain intervals
– checking the cleanliness of terminal locations and terminals
– checking of the electrical connections with regard to tightness
– cleaning of the ventilating passages.
  Both the cooling air inlets and the cooling surfaces must be protected against obstruction and contamination.
  Never use sharp–edged tools for cleaning.

4.3 Air–water circuit cooler

(for water–cooled motors only)
For maintenance please consider the instructions for the air–water circuit cooler.

5. Additional equipment

On special order only.

5.1 Temperature monitoring *)

The temperature sensors for monitoring e.g. of the stator winding temperature, the bearings, the coolant must be connected to the additional terminals in the main terminal box or by one or several terminal boxes.
The temperature sensors have to be connected according to the relevant connection diagram. For connection the specifications and instructions acc. to section 3.2.”Connection” are applicable.

5.2 Electronic speed monitoring *)

This one is essentially consisting of the slot–type initiator and the control segment. The electronic speed monitoring is maintenance–free.

5.3 Space heater *)

Heating capacity and connection voltage: See special plate on the motor. The space heater has to be connected to the terminals provided in the main terminal box or by an additional terminal box acc. to the relevant connection diagram.
For connection the specifications and instructions acc. to section 3.2 ”Connection” are applicable.
An operation of the space heater is only allowed when the motor is switched off. The space heater must never be switched on during motor operation.

5.4 Forced ventilation *)

Observe direction of rotation! (see arrow for directional rotation.)
Forced ventilation is to be connected acc. to the wiring diagram inside the terminal box.
During operation of the main motor the forced ventilation must be switched on!
The forced ventilation is dissipating the heat loss during operation of the main motor. When switching off the main motor a temperature–dependant follow–up run of the forced ventilation is required.

5.4.1 To be checked when commissioning the main motor:
Check whether the forced ventilation works and is in operation when the main motor is switched on!

*) On special order only.

6. Three–phase motors as centrifugal drive for heavy starting Special requirements for a safe application

For mounting and removal of the motor the corresponding operating instructions of the centrifuge must be observed.
Starting– and braking conditions of the motor in accordance with the corresponding operating instructions must be observed.
Even for trial operation the control and safety devices as well as the motor monitoring (thermal motor protection, speed monitoring and others) are not allowed to be put out of function.
The motor must only be mounted and operated according to the specified mounting arrangement. Any other application is prohibited.

It has to be secured that the servicing personnel is informed at once or the electrical machine is immediately stopped to find the causes, if contrary to the rated operation higher temperatures, noises, vibrations etc. occur.

Direction of rotation:
The centrifuge is only suitable for one direction of rotation. The relating arrow on the centrifuge must be observed.
Bearing and greasing:
For permanently lubricated motors (also see bearing and greasing data sheet on request) the grease life, grease quantities and grease qualities as indicated in Appendix 1 of these operating instructions are applicable. Motors with regreasing device are equipped with an automatic grease quantity control. Regreasing intervals, grease quantity, grease quality and the exact bearing type are indicated on the motor plate or in the bearing– and greasing data sheet to be requested.

A lack of regreasing, an extension of the regreasing intervals or the use of a wrong grease quality might endanger the bearing. This can result in a deterioration of the bearing and the motor shaft, also entailing consequential damages on the centrifuge.
For this reason it is recommendable to maintain an inspection– and maintenance plan where regreasing and possible bearing replacements are documented.

Replacement of bearing:
See safety instructions, section ”Operation”.
The service life of the bearings depends on many influences. Therefore, the operation of the low–voltage motor has continuously to be checked and the intervals for bearing replacement to be determined accordingly.

Protection type ”n” Ex nA II

7. Protection type ”n” Ex nA II

For motors of protection type ”n” Ex nA II according to IEC 79–15 the following points must be observed:

7.1 **For operation** and installation, the decree for electrical apparatus in hazardous areas (”Verordnung über elektrische Anlagen in explosionsgefährdeten Räumen” – Elex V) and the regulations acc. to DIN VDE 0165 are applicable in Germany. On site, the valid local provisions for installation and operation must be observed.
Ex nA II motors must only be used in zone 2 (IEC–79–10).

7.2 **When the motors are being connected**, the connections inside the terminal boxes must be given special care and attention. The nuts of the connecting bolts must be securely tightened without using excessive force. (also see point 3.2).

7.3 **When the leads are inserted into the terminal box**, care must be taken that the leads are strain–relieved. All the cable entries which are not used must be closed tightly with separate screw plugs made of metal or with certified plugs and must be locked against turning.

7.4 **The inside of the terminal boxes** must always be kept clean. The seals must be intact and fit correctly.



In operation the terminal box must always be tightly closed.

7.5 **For operation and installation of the motors**, the provisions of EN 60947 must be observed. In particular, each motor must be protected by means of a monitoring device against overheating due to overload. The following notes must be observed:

7.5.1 If the motor is to be monitored by a circuit breaker with a current–dependent delay element as specified in VDE 0660 (e.g. motor protection switch), an all–pole protection must be provided. The current–dependent delay elements must be adjusted to the rated current of the motor. Furthermore, they must be selected in such a way that the motor is thermally protected even in the event of a short circuit (e.g. with locked rotor).
Windings with delta–connection must be protected in such a way that the circuit breakers are connected in series with the winding phases. For selection and adjustment of the circuit breakers, the rated value of the phase current, i.e. 0,58 times the rated current of the motor must be taken as basis. If such a connection is not possible, suitable circuit breakers, e.g. with phase–failure monitoring, must be used.
For pole–changing motors, current–dependent delay elements or relays must be provided for each speed step, which are to be interlocked.

7.5.2 If the motor protection for Ex nA II motors is to be realized by means of temperature sensors exclusively using a direct temperature monitoring device, the design of the motor must be separately certified for this.

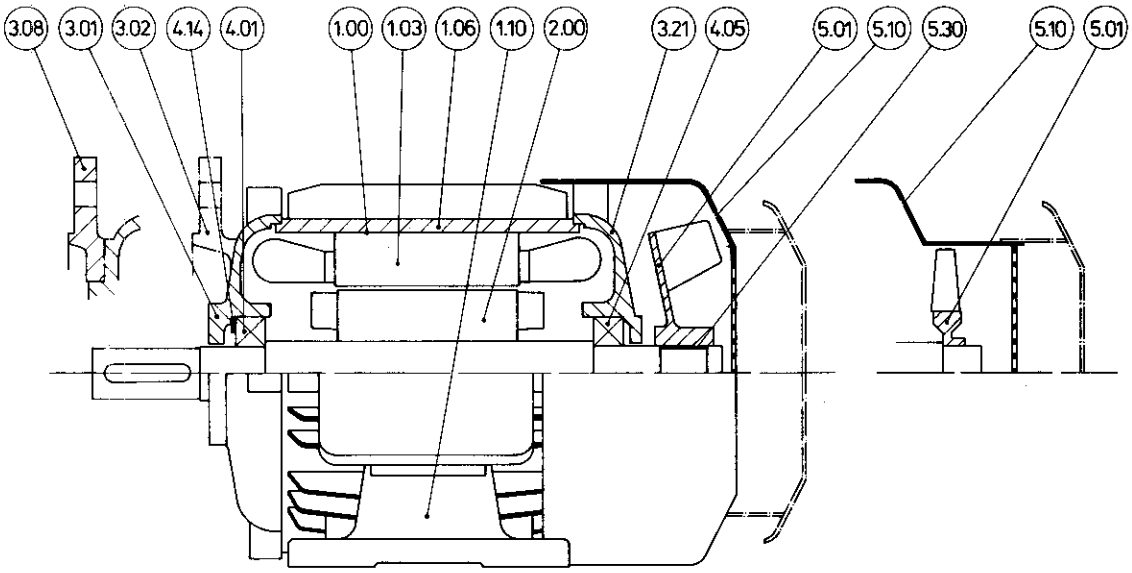
7.5.3 The motors must only be used for the duty type stated on the rating plate.

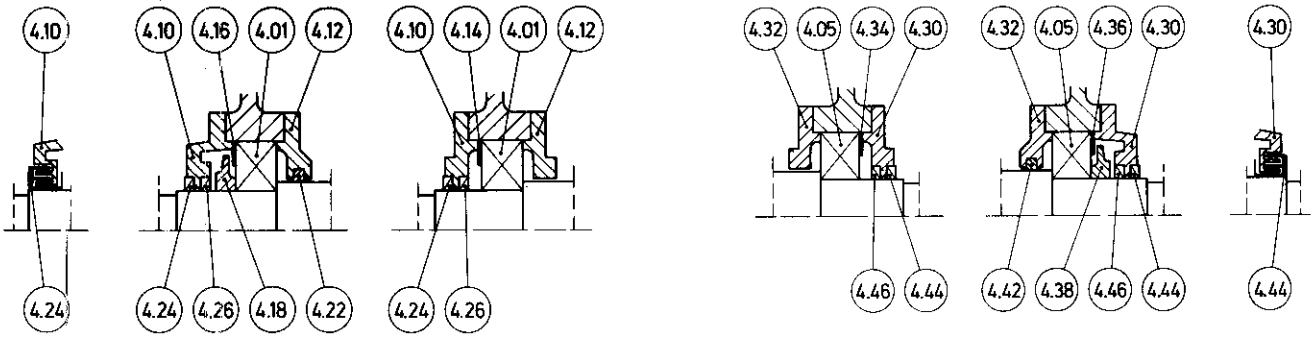
7.6 Explosion–proof motors must only be repaired in our workshops unless the repair is carried out by an authorized specialist. **Only original spare parts are allowed to be used.**

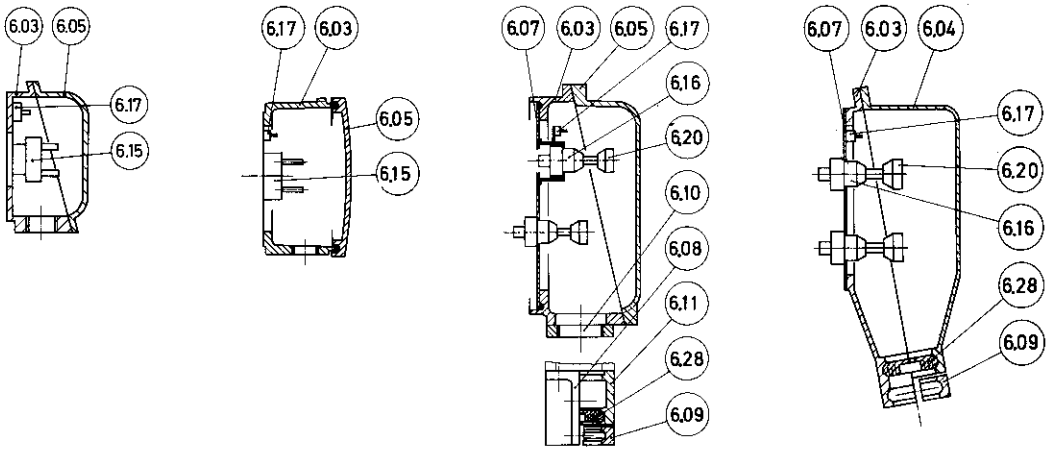
8. Spare parts

When ordering spare parts or components please state the type, serial number of the motor. Both data can be taken from the rating plate.

Standard version:

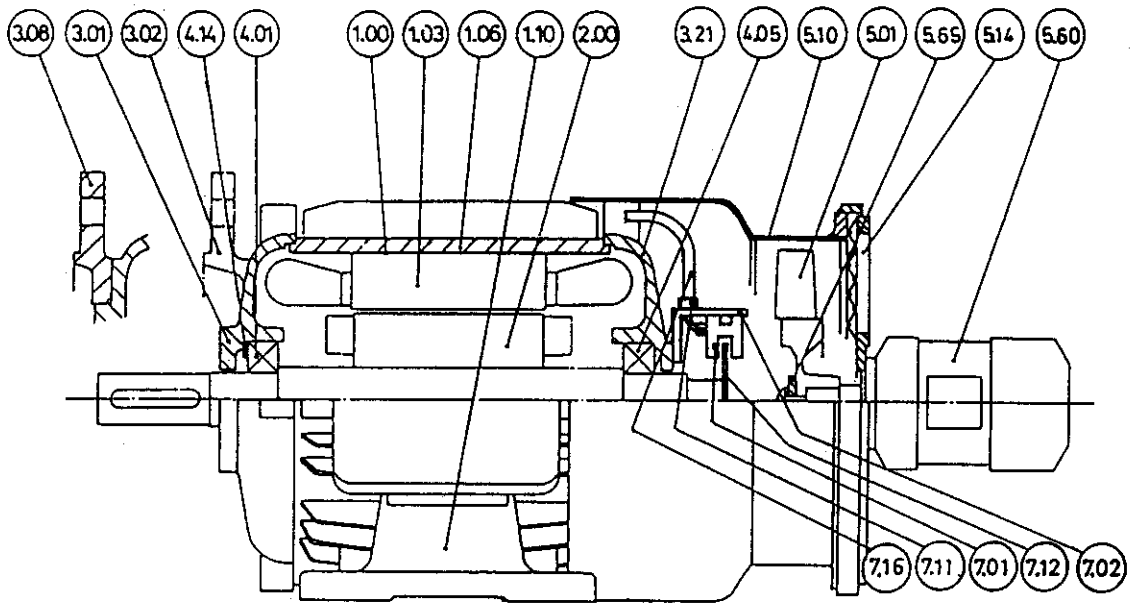






Spare parts

Design with forced ventilation and electronic speed monitoring:



1.00	Stator, complete	4.34	Resilient preloading ring, NDE
1.03	Stator core with winding	4.36	Grease guide disk, NDE
1.06	Stator housing	4.38	Centrifugal disk, NDE
1.10	Mounting feet, unmachined (1 pair)	4.42	Felt packing ring, NDE
		4.44	Outside gasket, NDE
2.00	Rotor, complete (balanced)	4.46	Inner gasket, NDE
3.01	End shield, DE	5.01	External fan, complete
3.02	Flange shield, DE	5.10	Fan cover, complete
3.08	Flange disk, DE	5.14	Protective grid, complete
3.21	End shield, NDE	5.30	Spring fastener
		5.60	Motor for forced ventilation
4.01	Bearing, DE	5.65	Front shim
4.05	Bearing, NDE		
4.10	Outside bearing cap, DE	6.03	Base of terminal box
4.12	Inner bearing cap, DE	6.04	Upper part of terminal box
4.14	Resilient preloading ring, DE	6.05	Terminal box cover
4.16	Grease guide disk, DE	6.07	Bushing plate
4.18	Centrifugal disk, DE	6.08	Cable gland, lower part
4.22	Felt packing ring, DE	6.09	Cable clamp
4.24	Outside gasket, DE	6.10	Cable entry
4.26	Inner gasket, DE	6.11	Cable gland, upper part
4.30	Outside bearing cap, NDE	6.15	Terminal board, complete
4.32	Inner bearing cap, NDE	6.16	Bushing terminal

Spare parts

6.17	Accessory terminal
6.20	Clamping
6.28	Cable gasket
7.01	Slot–type initiator
7.02	Mounting angle
7.11	Bolted connection
7.12	Segmental disk
7.16	Metal tube

The parts shown are available in different sets depending on type, size, mounting and enclosure. They are available from our works. All other parts such as bolts, spring washers etc. are available anywhere.

When ordering spare parts, please state:

Spare part designation
Motor type
Serial number

Example:
3.01 End shield, DE
ANLA–200LB–08
8 386 388

Storage instructions

9. Storage specifications

9.1 For motors which have to be stored for a period of up to 2 years, the following is to be observed:

9.1.1 Storage

9.1.1.1 The motors are to be stored dry, dustfree and at room temperature. In this case no special packing is required. Otherwise the motors must be packed into plastic foil with humidity–absorbing substances (e.g. Branogel) or into an air–sealed foil. Protective cover against sun and rain is to be provided.

9.1.1.2 In order to avoid secondary failures at the bearings caused by vibrations at standstill, for example by adjacent running machines, the motors are only allowed to be stored in vibrationless rooms.



9.1.1.3 For transport the TEFC, ODP and water–cooled motors with roller bearings have to be equipped with a bearing lock at the driving end. It is to remain locked until commissioning resp. to be re–installed after an inspection or a trial operation. A locking device is not necessary and not available, if the bearing is axially preloaded.



9.1.1.4 On motors with sealed condensation water drain holes it might be necessary to have the condensation water flow out. Afterwards the boreholes are to be sealed again.



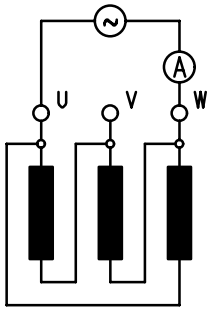
9.1.2 Commissioning

9.1.2.1 Before commissioning the insulation resistance of the winding must be measured by qualified personnel phase against phase and phase against mass. Damp windings may cause leakage currents, arcing and ruptures. In case of values ≤ 1 kΩ per Volt of rated voltage measured at a winding temperature of 20 °C (68 °F) the winding must be dried. Drying is possible by feeding of the winding with single phase a.c. current. The voltage has to be adjusted in a way that the recommended values of the heating current in accordance with Illustrations a) and b) are not exceeded.
The temperature should reach approx. 80 °C (176 °F) and being active for several hours. Drying is also possible in a drying kiln.

Storage instructions

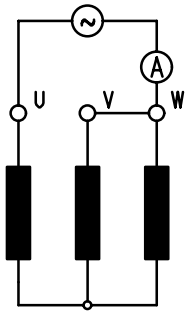
Recommended heating circuits and maximum heating currents

a) Δ



I_{MAX} = 65 % I_r

b) Y



I_{MAX} = 75 % I_r

9.1.2.2 On motors with bearing lock this one has to be removed before commissioning.

9.1.2.3 Antifriction bearings, lubrication
If adequately stored for a longer time it can be assumed that within 2 years the lubricating grease in the bearings is not affected. Motors with permanent lubrication can be put into operation after having checked the insulation resistance of the winding and a short trial run.
For motors with insulation class F a lithium–saponified antifriction bearing grease with a dripping point of at least 180 °C (356 °F) is used for normal ambient temperatures.
For the motors with insulation class H and certain special motors, the used special lubricating grease is indicated on an instruction plate attached to the motor.

9.1.2.4 For motors with a regreasing device it is advisable to regrease both bearings shortly after commissioning at running motor.
Grease type, grease quantity and regreasing intervals are marked on an additional plate attached to the motor.
The data for grease service life with regreasing intervals can surely be expected for motors in enclosure IP 55. The bearing is protected against the ingress of fine dust and of water in all directions, e.g. for outdoor installation without additional protection.
For motors with enclosure IP 44 and IP 54 these data apply with the restriction that the environmental load by dust and water is not exceeding the limits of DIN IEC 34–5 with tests according to DIN IEC 34–5.

9.1.3 **For motors which are transported and stored in assembled condition with the machine to be driven the following must be observed:**

9.1.3.1 Storage
a) The free shaft ends must be greased before installation of the motors as well as all of the other blank metal parts, e.g. foot– and flange surfaces or supporting faces of terminal boxes and covers. As protection against dust and humidity grease seals with antifriction bearing grease are to be installed at the shaft opening.

b) A humidity–absorbing substance (e.g. Branogel) is to be filled into the terminal boxes of the motors.

c) The machines are to be stored dry, dustfree and at room temperature.

d) For further measures the specifications according to the items 9.1.1.2 – 9.1.1.4 are applicable.

A bearing lock is not necessary, if the bearings are preloaded by means of belt drive (9.1.1.3).

9.1.3.2 Commissioning
Before commissioning the humidity–absorbing substance (e.g. Branogel) is to be removed from the terminal boxes and the measures according to 9.1.2 are to be performed.

9.1.3.3 For outdoor storage it is additionally to be observed:
Protective cover against the influence of sun and rain is to be provided, exchange of air must be possible to avoid condensation water.



A trial run has to be made once a month approx. After 2 months it must always be checked if the protective measures acc. to 9.1.3.1a are still given and operative.

9.2 For motors which are stored for more than 2 up to 4 years before commissioning additionally applies:

9.2.1 Storage

9.2.1.1 The manufacturer must be informed on the storage time in the purchase order.

9.2.1.2 Shaft opening and terminal box cover are to be provided with grease seals of antifriction bearing grease. The motor shafts are not allowed to be rotated, as otherwise the protective grease coating is destroyed. If a movement of rotating parts is unavoidable, the protective grease coating has to be renewed.

9.2.1.3 A humidity–absorbing substance (e.g. Branogel) must be in the terminal boxes.

9.2.1.4 Due to the long standstill the antifriction bearings must be greased with the special grease ”Staburags NBU 8 EP”.

9.2.2 Commissioning

9.2.2.1 Before commissioning the humidity–absorbing substance (e.g. Branogel) is to be removed from the terminal boxes and the measures according to 9.1.2 are to be performed.

9.2.2.2 Antifriction bearings, lubrication
Motors with regreasing device must be relubricated immediately after commissioning with about the double grease quantity, until the used grease has been thrown out. Further greasing can be made then with the bearing grease indicated on the lubrication plate. During the running–in period increased bearing noises may occur, which are not dangerous, when the operating temperature of the bearing has not been reached and is caused due to the dynamic viscosity of the bearing grease.

Storage instructions

9.3 If motors are stored at temperatures till –50 °C (–58 °F) the following must be observed in addition to the instructions according to point 9.1 and 9.2:

9.3.1 The standard antifriction bearing grease for the motors as per catalogue is suitable for operating temperatures between –30 °C (–22 °F) and +130 °C (+266 °F). Temperatures till –50 °C (–58 °F) are harmless for the antifriction bearing grease, when the motors are at standstill or stored. (For an operation at –50 °C (–58 °F) a special grease, e.g. Isoflex Alltime SL2, is available for the bearings).

9.3.2 Motors with regreasing device are to be relubricated with the double grease quantity when put into operation.

9.4 If motors with direct water jacket cooling or with air–water cooler are stored at temperatures up to –20 °C (–4 °F) the following must be observed in addition to the instructions of point 9.1 and 9.2:

The water has to be removed completely from the air–water coolers.

In any case the coolers have to be dried completely with hot air of max. 60 °C (140 °F) and then to be sealed.

Motors with coolers have to be stored in a dry and dustfree room.

At commissioning the motors with regreasing device have to be relubricated with the double grease quantity.

9.5 Further to these storage instructions all data of these operating instructions are to be considered.
The manufacturer’s warranty is only applicable if all of the above mentioned items are strictly observed.

10. Faults and remedies

Fault			Possible causes	Remedy
Bearing is too hot	Bearing noise *)	Motor runs unevenly		
■			Too much grease in bearing	Remove excess grease
■			Bearing dirty	Replace bearing
■			Belt tension too high	Reduce belt tension
■		■	Coupling forces are pulling or pushing	Realign motor, correct coupling
■			Coolant temperature above 40 °C (104 °F)	Adjust temperature of cooling air
■	■		Not enough grease in the bearing	Grease according to specifications
■	■	■	Motor incorrectly mounted	Check mounting type of motor
■			Bearing grease dark coloured	Check bearing currents
	■		Scoring at bearing inner race, e.g. caused by motor start with locked bearing	Replace bearing, avoid vibrations at standstill
		■	Unbalance caused by coupling	Exact balancing
		■	Motor fastening unstable	Check fastening

*) If remedies described are insufficient, we recommend to replace the bearings.

Fault				Possible causes	Remedy
Motor does not start	Motor is too hot	High decrease in speed	Protective device triggers		
■		■		Countertorque too high	Check motor– and load torque
■		■		Mains voltage too low	Check mains conditions
■		■	■	Phase interruption	Check mains supply
■	■	■	■	Wrong winding connection	Observe wiring diagram and rating plate
	■	■	■	Overload	Compare data on rating plate
	■		■	Too many starts per hour	Observe rated duty type
	■			Insufficient ventilation	Check ventilation passages, check direction of rotation
	■			Ventilation passages dirty	Clean
			■	Short–circuit of winding or terminal board	Measure insulation resistance
			■	Starting time exceeded	Check starting conditions

Operating instructions for brake motors with spring–loaded single–disk brake

11. Operating instructions for brake motors with spring–loaded single–disk brake Not for protection type Ex nA II

Description

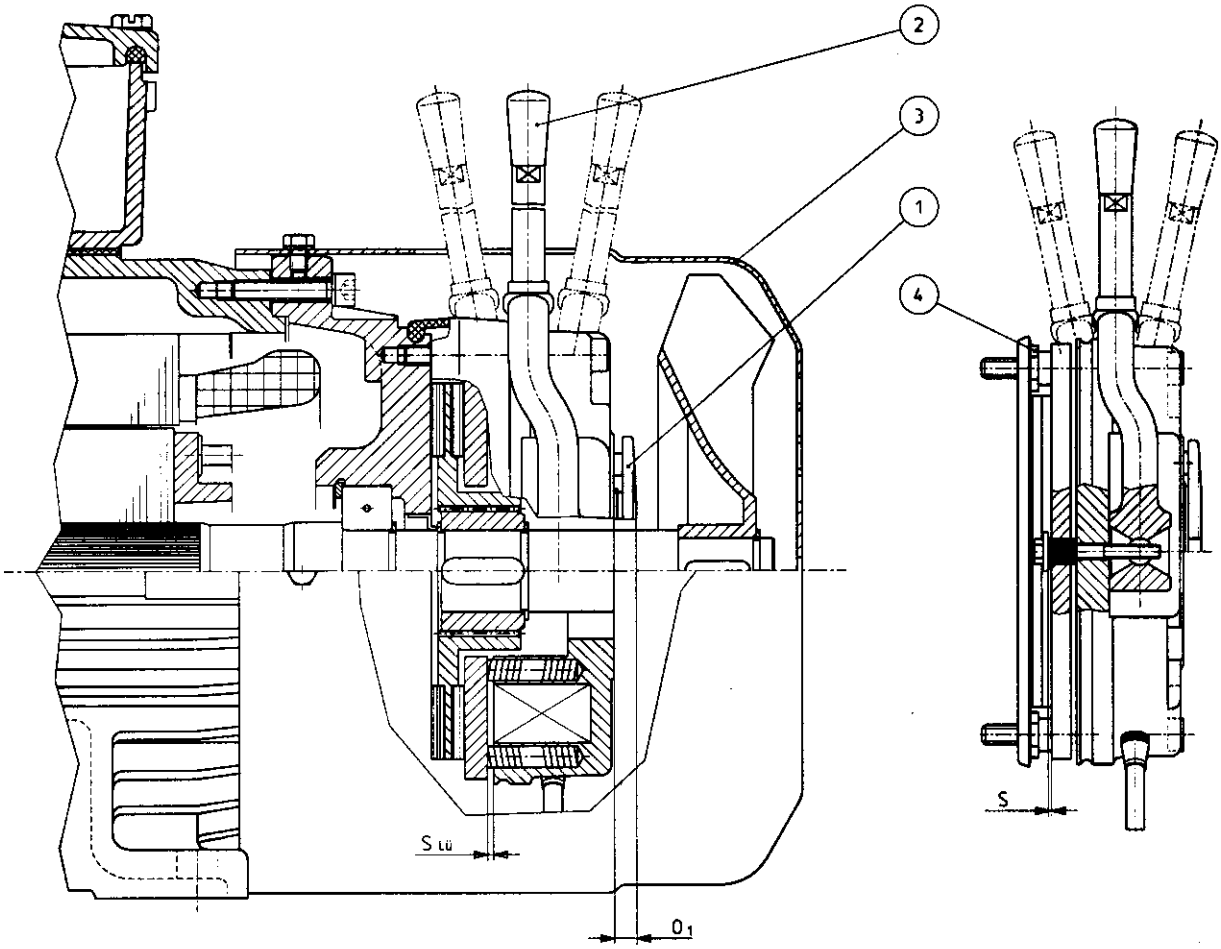
The maintenance–free brake is rest current–operated and in released condition it is operable in any fitted position as long as required and is suitable for both directions of rotation. The asbestos–free brake linings are highly wear–resistant.

Attention! The friction surfaces must not get into contact with oil or grease.

Air gap adjustment

Air gap "$S_{Lü}$" is adjusted according to Table 1. If a readjustment should be required, the correct air gap "$S_{Lü}$" is restorable by turning the readjusting bushes (4).

If the motor is designed with a manual release, it must be observed that dimension "S" between the self–locking nuts and the armature disk is equally adjusted on both sides. If the air gap "$S_{Lü}$" is required to be readjusted, however, nothing may be changed on the manual release.



Operating instructions for brake motors with spring–loaded single–disk brake

Braking torque adjustment

As delivered the brake is adjusted to the rated braking torque. A reduction of the braking torque is possible by unscrewing the adjusting ring (1) up to Dimension ”O_1”.

For braking torque adjustment it is required to remove the fan cowl (3). In case of the design with manual release part (2) must be unscrewed before.

Reduction of braking torque per detent according to Table 1

Table 1: Lenze brakes Type BFK 458

Brake size		**06**	**08**	**10**	**12**	**14**	**16**	**18**	**20**	**25**
Rated braking torque	[Nm]	4	8	16	32	60	80	150	260	400
$S_{Lü}$	[mm]	0,2	0,2	0,2	0,3	0,3	0,3	0,4	0,4	0,5
S	[mm]	1,0	1,0	1,0	1,5	1,5	1,5	2,0	2,0	2,5
Reduction per detent	[mm]	0,2	0,35	0,8	1,3	1,7	1,6	3,6	5,6	6,2
$O_{1\ max}$	[mm]	4,7	4,7	7,6	9,6	11	10	14,9	16,4	18,3

Please request the operating and maintenance instructions for spring–loaded single–disk brakes, if required.

Appendix 1

Grease life and grease quantities

for antifriction bearings of explosion–proof three–phase motors with squirrel cage for low voltage, with permanent lubrication, in protection type ”Increased safety”.

<table>
<tr><th rowspan="2">Frame size</th><th colspan="6">Grease life for permanent lubrication [1]) in operation hours at rated speed 1/min:
horizontal mounting (IM B)</th><th rowspan="2">Grease quantities in g per bearing for permanent lubrication</th></tr>
<tr><th>3600</th><th>3000</th><th>1800</th><th>1500</th><th>1200</th><th>≤ 1000</th></tr>
<tr><td>63</td><td rowspan="4">33000</td><td rowspan="5">33000</td><td rowspan="9">33000</td><td rowspan="10">33000</td><td rowspan="14">33000</td><td rowspan="14">33000</td><td>4</td></tr>
<tr><td>71</td><td>5</td></tr>
<tr><td>80</td><td>9</td></tr>
<tr><td>90</td><td>11</td></tr>
<tr><td>100</td><td rowspan="3">24000</td><td>15</td></tr>
<tr><td>112</td><td>25</td></tr>
<tr><td>132</td><td rowspan="4">24000</td><td>50</td></tr>
<tr><td>160</td><td rowspan="5">17000</td><td>70</td></tr>
<tr><td>180</td><td>80</td></tr>
<tr><td>200</td><td>60</td></tr>
<tr><td>225</td><td rowspan="3">17000</td><td>70</td></tr>
<tr><td>250</td><td rowspan="2">24000</td><td>90</td></tr>
<tr><td>280</td><td>12000</td><td>24000</td><td>120</td></tr>
<tr><td></td><td colspan="6">vertical mounting (IM V)</td><td></td></tr>
<tr><td></td><td>3600</td><td>3000</td><td>1800</td><td>1500</td><td>1200</td><td>≤ 1000</td><td></td></tr>
<tr><td>63</td><td rowspan="4">24000</td><td>33000</td><td rowspan="4">33000</td><td rowspan="4">33000</td><td rowspan="7">33000</td><td rowspan="11">33000</td><td>4</td></tr>
<tr><td>71</td><td>5</td></tr>
<tr><td>80</td><td rowspan="3">24000</td><td>9</td></tr>
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<tr><td>132</td><td rowspan="5">12000</td><td rowspan="3">24000</td><td>50</td></tr>
<tr><td>160</td><td>70</td></tr>
<tr><td>180</td><td rowspan="3">12000</td><td rowspan="3">24000</td><td>80</td></tr>
<tr><td>200</td><td>60</td></tr>
<tr><td>225</td><td rowspan="3">17000</td><td rowspan="3">24000</td><td>70</td></tr>
<tr><td>250</td><td rowspan="2">9000</td><td rowspan="2">17000</td><td rowspan="2">24000</td><td>90</td></tr>
<tr><td>280</td><td>9000</td><td>120</td></tr>
</table>

The indicated grease life is applicable for an ambient temperature of max. 40 °C (104 °F).
For a temperature rise of 10 °C (50 °F) each the grease life is to be reduced by factor 0,7 of the chart value (max. 20 °C/68 °F = factor 0,5).

At an ambient temperature of 25 °C (77 °F) the double grease life can be expected.

[1]) Independently of the operation hours the antifriction bearing grease resp. the bearing (2Z bearings) have to be replaced after 3 – 4 years at the latest.

FLENDER
LOHER

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