Operating manual for three-phase motors

Frame size 56...450

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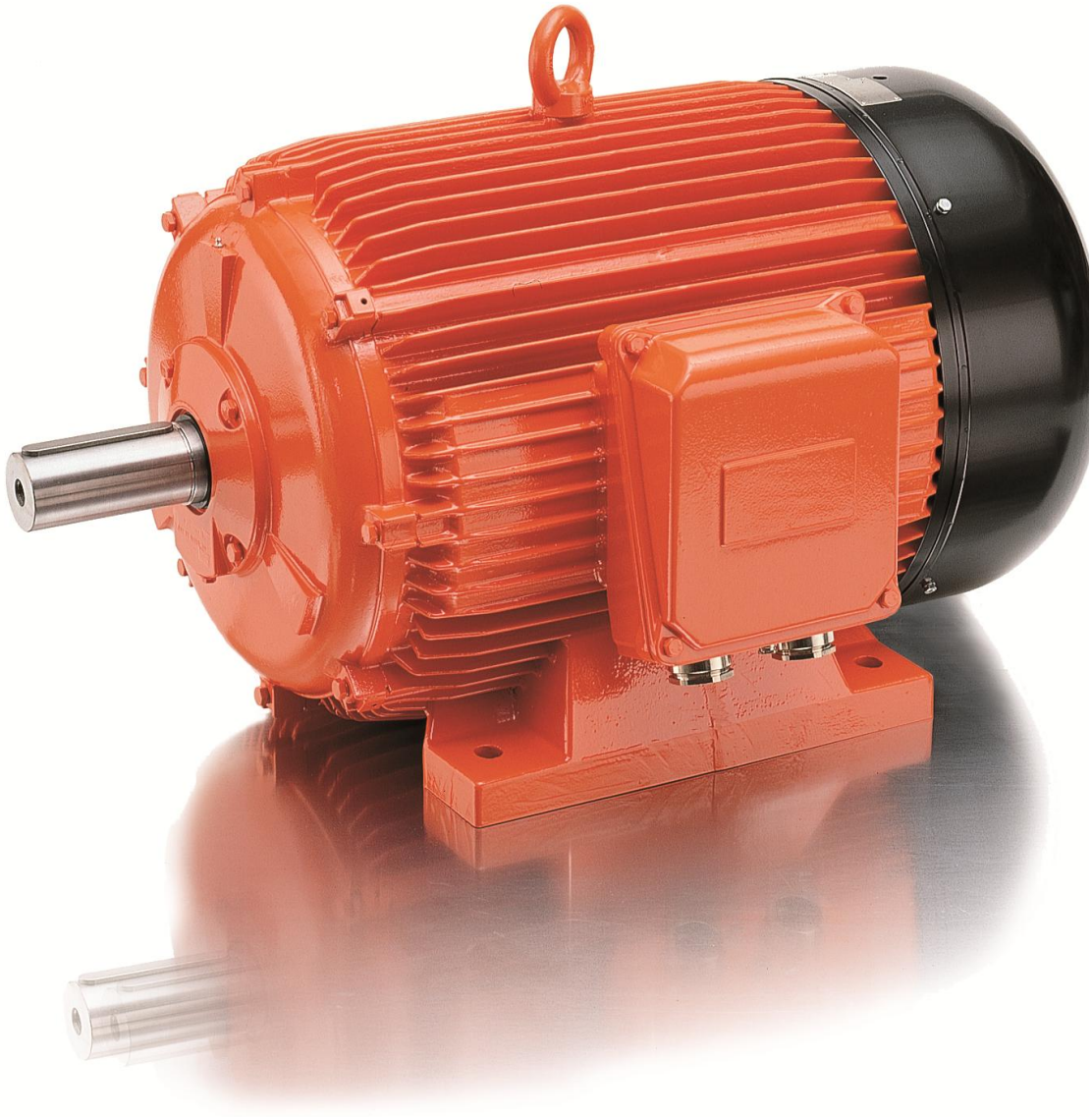

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1 General information

Note	
	**The safety instructions contained in this operating manual must be observed!** Special designs and structural variants may differ from the basic type in terms of technical details. If there are any uncertainties, we strongly advise you to contact EMOD Motoren GmbH. Always state the motor type and motor number.

1.1 Area of application

The motors can be used in accordance with the protection class stamped on the rating plate, the type of construction intended by the manufacturer according to the catalogue or the customer's information. When using custom motors, the information in the quote and order confirmation also applies.

1.2 Explanation of the labels used

Symbol	Meaning
Danger	Indicates an immediate danger to life and health. Results in death or serious injury if not prevented.
Warning	Indicates a possible danger to life and health. May result in death or serious injury if not prevented
Caution	Indicates a possible danger to life and health. May result in slight or minor injuries if not prevented.
Note	Indicates a potentially harmful situation. The system or things in the surrounding area may be damaged if not prevented.
	Warning of a danger (general). The type of danger is specified by the accompanying warning text.
	Warning of dangerous electrical voltage and its effect.
	Warning of hot surface.
	Warning of suspended load.
	Warning of explosive atmosphere.

1.3 List of safety and installation notes

Caution

Electric motors have dangerous, live and rotating parts. All work during connection, commissioning, maintenance and disposal may only be carried out by qualified professionals. (Observe EN 50110-1 and IEC 60364) Before beginning any work, any in particular before opening covers, the drive must be isolated according to regulations. In addition to the main circuit, any auxiliary circuits which may be present must be taken into account here.

Compliance with the 5 safety rules:

- Isolate
- Secure against being switched on again
- Establish the absence of voltage
- Earth and short-circuit
- Cover or block off adjacent live parts

The measures specified above may only be withdrawn after the work has been completed and the drive is fully installed. Improper conduct may result in injuries and property damage. The applicable national, local and system-specific provisions and requirements must be observed and complied with.

Warning

The proper and safe operation of the products assumes proper transportation, proper storage, positioning and installation, and careful operation and maintenance.

Caution

The surfaces of the motors may be ≥ 55 °C during operation! The hot surfaces should not be touched.

Note

Products with a weight of ≥ 20 kg should only be moved and lifted with appropriate lifting devices.

1.4 Limitation of liability

All information and instructions in this manual have been put together taking the applicable standards and regulations, the state of the art and our many years of knowledge and experience into account.

The manufacturer assumes no liability for damage resulting from:

- Failure to observe the manual
- Improper use
- Use of untrained personnel
- Unauthorised modifications
- Technical modifications
- Use of unapproved spare parts

The obligations agreed in the supply contract, the general terms and conditions, as well as the manufacturer's delivery conditions, and the applicable statutory provisions at the time of signing of the contract apply.

We reserve the right to make technical changes within the context of the performance characteristics and further development.

1.5 Safety

⚠ Warning	
	**Installation, commissioning and maintenance may only be carried out by personnel with suitable training and qualifications.**

In this respect, special attention should be paid to:

- the technical data and information concerning the proper use (commissioning, environmental and operational conditions), which are stated in the catalogue, the operation manual, the rating plates and the additional product documentation,
- the relevant construction and accident prevention regulations,
- the correct use of tools, lifting and transport devices,
- the implementation of protection measures against unintentional contact when installed to prevent endangerment of persons due to moving parts,
- the use of personal protective equipment.

2 Transportation and storage

⚠ Warning	
	**Danger due to heavy loads** severe injuries and property damage possible ► Products with a weight of ≥20 kg should only be moved and lifted with appropriate lifting devices ► Only use the intended lifting eyes for transportation of the fully assembled drive unit ► Do not lift the complete drive unit at the motor transport eyes

Note	
	**Only use the intended lifting eyes for transportation of the motors. Lift fully assembled drive units (motor with add-on pieces provided by the customer) by the motor transport eyes and by the attachments. Use suitable lifting means for this. Lifting and transporting the motor fastened solely at the motor shaft is not permissible (bearing damage)!**

2.1 Transportation

The motors must be inspected for transport damage upon receipt. Any possible damage should be documented in detail in writing.

Motors with cylindrical roller bearings are protected against bearing damage by transport protection. The transport protection must be removed before raising of the transfer elements and commissioning.

2.2 Storage

The storage location should be as dry, clean, stable in temperature and free from vibrations as possible.

So that the lubrication film in the motor bearings and the sealing systems is not stripped off, the motor shaft should be turned a few times by hand, e.g. at monthly intervals, during long storage periods.

The motor rolling bearings should be re-greased or replaced if the period between delivery and commissioning is more than 4 years. In unfavourable storage conditions, this period is significantly reduced.

3 Installation and commissioning

⚠ Danger	
	**Installations and work may only be carried out with the device deenergised (separated from the mains) and the motor shut down.** Death, cardiac arrhythmia ► Observe the 5 safety rules, see chapter List of safety and installation notes on page 6

3.1 Positioning

3.1.1 Location

The motors should be positioned and/or installed to be easily accessible, with ambient and/or coolant temperatures of between -20 °C and +40 °C (EN 60034). Higher coolant and/or ambient temperatures of up to max. 60 °C, with corresponding power reduction, are possible after consultation with the manufacturer.

The cooling air must be able to flow in and out unhindered and may not be immediately sucked in again. The air inlets and air outlets as well as the ducts between the cooling fins must be kept free from coarse dirt and cleaned regularly.

For installation with the shaft ends pointing up and down, care must be taken to ensure that no water can get into the upper bearing.

3.2 Mountings for motors

Foot-mounting motors must be positioned and mounted on an even, vibration-free surface. All mounting feet must lie flat; place thin sheets underneath for levelling if necessary.

For flange motors, care must be taken to ensure the axial run-out of the counterflange. Axial run-out errors may result in bearing damage and/or the failure of sealing systems.

3.3 Condensation drain holes

Care must be taken to ensure that the available condensation drain holes are located at the lowest point of the motor after installation and are kept free from dirt.

Closed condensation drain holes (if present) should be opened from time to time and closed again before each start-up.

3.4 Balancing

⚠ Danger	
	**Rotating parts** Severe injuries ► Secure feather keys against being ejected

The balancing type is indicated on the shaft end face of the motor shafts in accordance with DIN ISO 8821:

- Balancing with a half key “H”
- Balancing with a full key “F”

Observe the appropriate balancing type when installing the drive element!

3.5 Insulation resistance check

Before commissioning of the motor, or after a longer storage period or downtime (more than 6 months), the insulation resistance of the winding should be checked. Check the winding against mass by means of an insulation resistance measuring device (max. DC voltage 500 V). If the minimum insulation resistance at a winding temperature of 25 °C is smaller than 30 MΩ, or smaller than 1 MΩ at a winding temperature of 75 °C, the motor winding should be dried until the required minimum insulation resistance is reached. The winding temperature should not exceed 80 °C in this regard! Loosen the bearing plate, so that an air exchange can be carried out with closed motors. After the winding has been dried out, the bearing needs to be serviced (see corresponding chapter!).

3.6 Electrical connection

The mains voltage and frequency must match the data on the rating plate. Voltage differences of ±5% and/or frequency differences of ±2% are permissible as described in sector A in accordance with EN 60034-1. We ask that you note this when connecting the motors.

A connection diagram is enclosed with each motor upon delivery. Connection of the motor and the control system,as well as overload protection and earthing, must be done in accordance with the VDE and installation instructions and the EVU provisions.

The direction of rotation of the shaft end on the output side must be checked before commissioning. Reversal of the direction of rotation is possible by swapping any two voltage phases.

The insertion parts intended for tension relief or as anti-rotation protection for the supply lines must be used properly. Seal any openings which are not required.

Tightening torques for terminal board connection screw connections (see page 14)

3.7 Motor protection

3.7.1 Thermistor

Connect the built-in thermistor to the tripping device in accordance with the connection diagram in the terminal box cover or provided with the motor. Only carry out any continuity tests which may be required with a measuring bridge (max. 2.5 V).

3.7.2 Temperature switch NC

If a temperature monitor is provided as a temperature switch NC for motor protection, then this must be connected in series with the auxiliary circuit in accordance with the connection diagram (min. 25 ..... max. 250 V 1.6 A).

3.8 Commissioning

⚠ Caution	
	**The surface of the drive may reach high temperatures during operation.** Danger of burns ► Secure hot surfaces against operation or unintentional contact. To this end, attach covers or warning according to the regulations. ► Allow the motor to cool sufficiently before commencing any work.

Installation of the transmission elements

Only use appropriate tools and devices for fitting and removing the transmission elements. No pressure or impacts may be transmitted to the motor bearings.

Alignment during coupling operation

During coupling operation, the shafts must be axially and radially aligned against each other. Adjustment of the air between the coupling halves must be done in accordance with the coupling manufacturer's specifications.

Use only couplings which are flexible in terms of centre offset, angle, length and torsion. Rigid couplings are not permitted and may only be used in exceptional cases after consultation with the manufacturer.

Before commissioning, the following at a minimum must be checked:

- The runners can be turned without scraping,
- The motor is properly aligned and installed,
- The drive elements have the correct settings,
- All electrical connections, connection elements and mounting screws are properly tightened and implemented,
- Additional devices which are present (e.g. brakes) are functional,
- The coolant supply is not restricted,
- Measures have been taken to protect against contact with moving and live parts.

4 Maintenance

⚠ Danger	
	**Installations and work may only be carried out with the device deenergised (separated from the mains) and the motor shut down.** Death, cardiac arrhythmia ► Observe the 5 safety rules, see chapter List of safety and installation notes on page 6

4.1 Inspection

Depending on the level of the contamination, the entire surfaces of the motors should be cleaned.

In most cases, the first inspection should be carried out after approx. 500 operating hours, after 1 year at the latest. Follow-up inspections should be carried out within appropriate intervals based on application conditions, for instance re-lubrication or re-greasing, however at least once a year.

Accumulating dust should also be removed every now and then.

During inspection, it should be checked whether

- the technical data is observed in accordance with the rating plate,
- there are no leaks (oil, grease, water),
- the operating noises of the bearings as well as the smooth running of the motor have not deteriorated,
- all mounting screws for electrical and mechanical connections are tight,
- the connection of cable screws on the terminal box is fixed properly. If the cable screws are loose, the strain relief (if present) should be loosened and then, the cable screw should be tightened until the cable can no longer move. Tightening the cable screw too firmly will cause constrictions in the cable and should absolutely be prevented. After successful tightening, the strain relief (if present) should be refastened.
- the alignment of the motor is within the approved tolerances during coupling operation.
- any accumulated dust is removed.

4.2 Bearings

4.2.1 Bearings General

Utilising the maximum accepted load specified in our technical list, the nominal durability of the bearings (L10h) amounts to up to 20,000 operating hours.

L10h = nominal durability with 90% reliability (equivalent to 10% probability of failure) not including the lubrication effect in the calculation.

For permanent lubrication, the grease service life is attuned to the bearing durability. External influences reducing the grease service life are for example: dirt, moisture, abrupt or increased load, external temperature effects and vibrations. An exact evaluation of such reduction factors is virtually impossible. We therefore recommend to service the bearings after 3 years or after 5 years at the latest.

High speeds and the resulting increased vibrations, e.g. operation at the frequency inverter, alter smooth running and lead to increased strain on bearings and lubricant.

As a result, grease service life and bearing durability are reduced.

Bearings, which are not shielded by the bearing manufacturer, must be relubricated (in time) according to grease service life, so that the nominal bearing durability is not reached or exceeded.

4.2.2 Bearings with permanent lubrication

For motors with lifetime lubricated bearings and a speed up to 3600 min-1, the bearings should be renewed after 20.000 operating hours. We recommend to replace the bearing after 3 years or after 5 years at the latest.

Lubricants see page 14.

Mixing different grease types must be avoided!

4.2.3 Bearings with re-lubrication

For motors with a relubrication device, the relubrication interval, grease quantity and grease quality are specified on an additional label on the motor.

The prescribed lubrication intervals are shorter under extreme loads and/or at increased temperatures. If the number of operating hours specified on the lubrication plate is not reached within 3 years, then relubrication should be carried out early. Relubricate only when the rotor is rotating and the speed is reduced (e.g. 25 Hz) so that the old grease is displaced from the bearing and the bearing is not damaged.

Lubricants on page 14

Mixing different grease types must be avoided!

Caution

When relubricating the bearings, the grease discharge screws (if available) on the bearing plate DS and OS must be opened!

Cleaning intervals

The regular removal of used grease is necessary to avoid negatively affecting the expected bearing service life.

Note	
	It must be ensured that the running tracks of the bearing and the rolling elements are not damaged during the cleaning process. Do not use metal tools as aids. Make sure there is no dust or dirt near the rolling element or in the rolling element! This causes a drastic shortening in service life!

For further instructions, see chapter Repair

4.3 Repair

Spare parts lists and regular drawings do not contain the types and dimensions of the parts. Therefore, the type and dimensions of the concerned parts should be determined during disassembly and they should be marked for assembly.

4.3.1 Bearing replacement

Disassemble the motor to the required extent. Remove the rolling bearings with a suitable device and remove any contamination from the bearing positions!

Heat the new rolling bearing to approx. 80 °C and mount it.

Fill approx. 50% of the free spaces in the bearing, as well as of the grease chambers in the bearing plate or bearing cover, with grease of an approved quality level.

Before assembly, the sealing elements (for instance shaft seals) should be checked for functionality and damage and replaced if they no longer function properly.

4.3.2 Joint sealing

For motors with protection class IP56 or higher (see rating plate), the part joints between the motor housing and the bearing plates should be sealed with a suitable, non-hardening sealing mass.

5 Additional information for brake motors

Note	
	**After attachment of the motors, the proper functioning of the brakes must be checked!**

Note	
	**Motors with manual release:** The manual release is intended for emergency use only and must not be used to maintain provisional operation. Never use the manual release to release the brake during commissioning and normal operation!

5.1 General

The attached single-disc spring-loaded brake is a safety brake which brakes through spring force with the voltage switched off. The brake is ventilated using electromagnets.

5.2 Connection

The brake system is connected via a rectifier installed in the motor terminal box in accordance with the respective attached circuit diagram. The supply voltage to be established is specified on an additional label on the motor.

5.3 Maintenance

The attached brakes are maintenance-free apart from readjustment of the air gap “X” (see Table 1: Single-disc spring-loaded brake on page 14). If the maximum air gap “X max.” is exceeded, depending on the brake size around 0.5 - 1.3 mm, the brake response time increases significantly and/or the brake no longer ventilates with unfavourable strain ratios. The necessary air gap “X” can be readjusted by turning the readjustment sleeve (18.12) to the left with the cylinder screws (18.11) loosened.

5.4 Braking torque adjustment

Continuous braking torque adjustment is done by turning the adjustment nut (18.6) using a C-wrench. Turning it to the right, as seen looking towards the drive shaft, increases the braking torque. Turning it to the left reduces the braking torque.

6 Spare parts

For spare parts orders, the motor type and motor number (details can be found on the rating plate) must always be specified in addition to the exact part designation.

With the exception of standardised commercially available and equivalent parts, e.g. ball bearings, only original parts may be used.

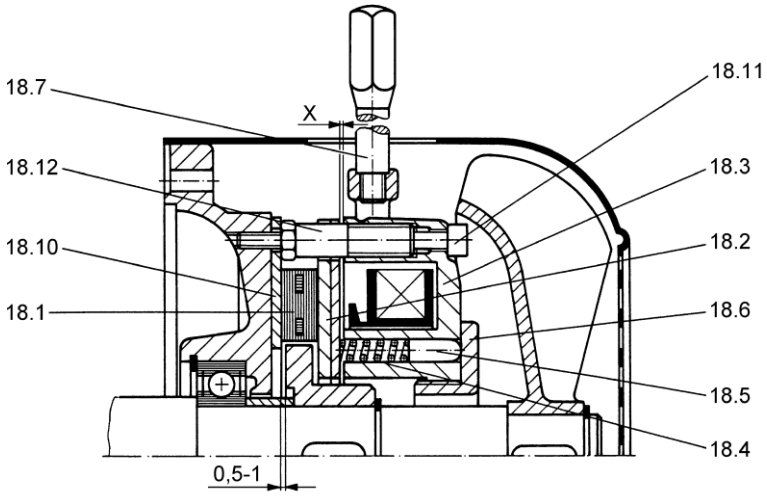
This applies in particular for seals and terminals.

7 Final decommissioning (disassembly, recycling, disposal)

Always disassemble motors in such a way that environmentally-friendly recycling and disposal of the motor components is possible.

When recycling and disposing of the disassembled motor components, always observe the legal regulations and provisions applicable at the time of the final decommissioning!

8 Appendix



Braking torque	(Nm)	2	4	8	16	32	60	80	150	240	360	400	800	1000
Air gap X	(mm)	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5

Table 1: Single-disc spring-loaded brake

Operating conditions	Insulation class	Roller bearing grease / area of application
Normal	F	High-temperature and long-term lubricant -40 °C to +180 °C
High temperatures, extreme operating conditions	H	High-temperature and long-term lubricant -20 °C to +180 °C
Low temperatures	F	Low-temperature lubricant -50 °C to +150 °C

Table 2: Lubricants

Thread ⌀	M4	M5	M6	M8	M10	M12	M16	M20
Tightening torque	1,2	2,0	3,0	6,0	10,0	15,5	30,0	52,0

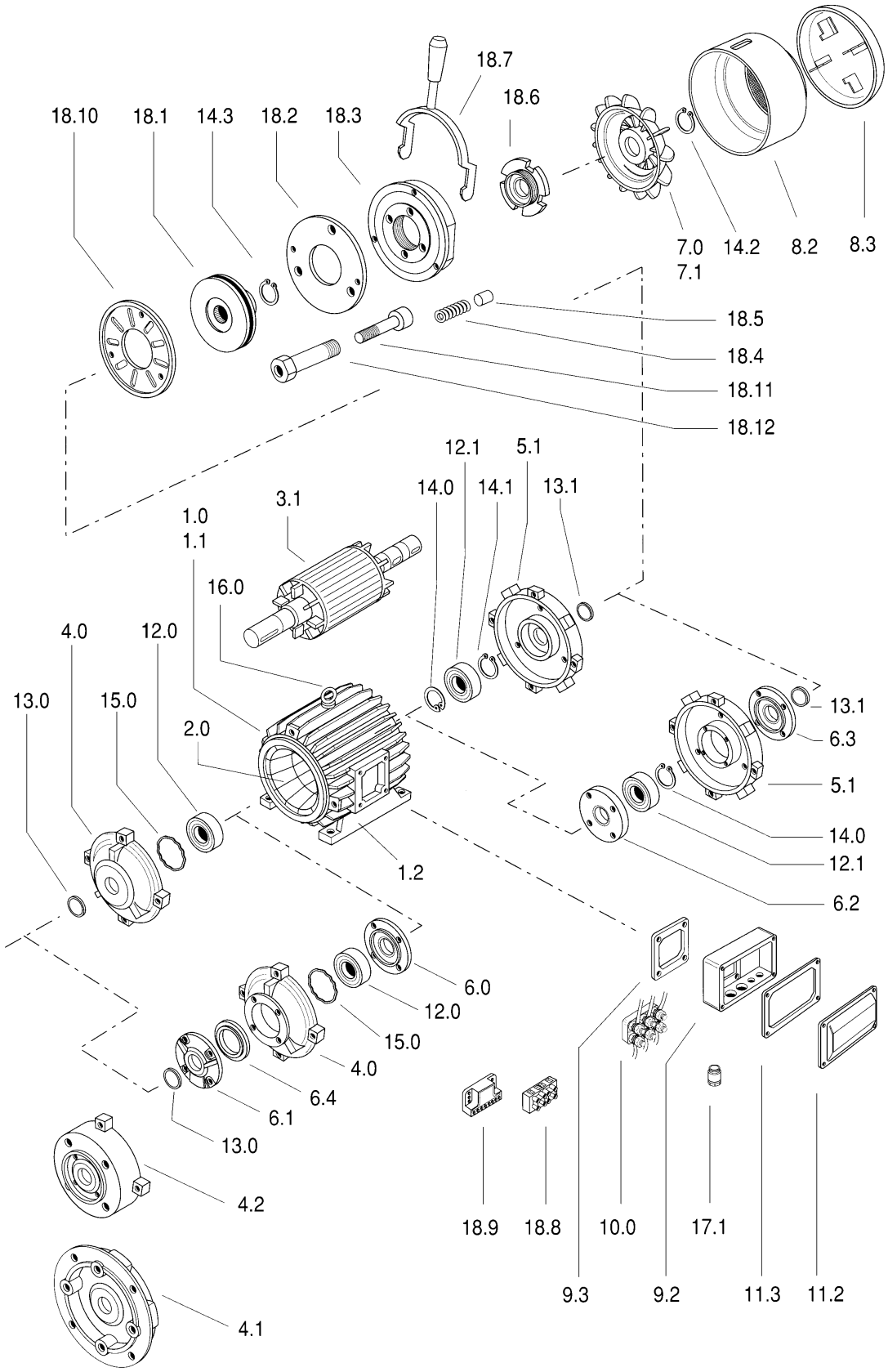
Table 3: Tightening torques for terminal board connection screw connections

The tightening torques apply provided no other values are specified!

Part no.	Description
1.0	Housing (IMB3)
1.1	Housing without feet (IMB5 / IMB14)
1.2	Motor feet
2.0	Stator package with winding
3.1	Rotor with shaft
4.0.	Bearing plate AS (IMB3)
4.1	Flange bearing plate (IMB5)
4.2	Flange bearing plate (IMB14)
5.1	Bearing plate BS
6.0	Bearing cover ASi
6.1	Bearing cover ASa
6.2	Bearing cover BSi
6.3	Bearing cover BSa
6.4	Centrifugal disc
7.0	Fan (thermoplastic)
7.1	Fan (aluminium alloy)
8.2	Fan cover
8.3	Protective roof (IMV1)
9.2	Terminal box frame
9.3	Terminal box frame sealing
10.0	Terminal board, complete
11.2	Terminal box cover
11.3	Terminal box cover sealing
12.0	Rolling bearing AS
12.1	Rolling bearing BS
13.0	Shaft seal ring
13.1	Shaft seal ring
14.0	Securing ring (rolling bearing)
14.1	Securing ring (rolling bearing)
14.2	Securing ring (fan)
14.3	Securing ring (brake)
15.0	Spring plate
16.0	Ring bolt
17.1	Cable screw
18.0	Brake, complete
18.1	Brake disc
18.2	Armature plate
18.3	Magnet part
18.4	Compression spring
18.5	Pressure piece
18.6	Adjustment ring
18.7	Manual ventilation, complete
18.8	Terminal strip
18.9	Rectifier
18.10	Friction plate
18.11	Cylinder screw
18.12	Re-adjustment sleeve

Table 4: Spare parts

Order example:	Frame size:	160L
	Motor no.:	3574507
	Part:	3.1 rotor with shaft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9 Declaration of conformity

EU Declaration of conformity

Document no./month/year	:	1.51.821.001/06.22
Manufacturer	:	EMOD Motoren GmbH
Address	:	Zur Kuppe 1 D-36364 Bad Salzschlirf
Product description	:	Three-phase motors
Type (frame size)	:	..56 S/L.. - ..560L.. ..B 56 S/L.. - ..B 560L..

The designated product is in compliance with the stipulations set forth in the following European directives:

2014/35/EU

Directive 2014/35/EU of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast)

2014/30/EU

Directive 2014/30/EU of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast)

The designated product has been developed and produced in compliance with the following standards:

EN 60034-1: 2010 + Cor.: 2010	EN IEC 60034-5: 2020	EN 60034-6: 1993
EN 60034-9: 2005 + A1: 2007	EN IEC 61000-6-1: 2019	EN IEC 61000-6-2: 2019
EN IEC 61000-6-3: 2021	EN IEC 61000-6-4: 2019	EN 60204-1: 2018

First establishment of the CE certification: 1996

Issuer:	:	EMOD Motoren GmbH
Place, date	:	Bad Salzschlirf, 28.06.2022

Management :

Roland Odenwald

This declaration certifies compliance with the above-mentioned directives and standards, but is no assurance of characteristics in the sense of the product liability.

The safety instructions in the operating manual supplied must be observed.