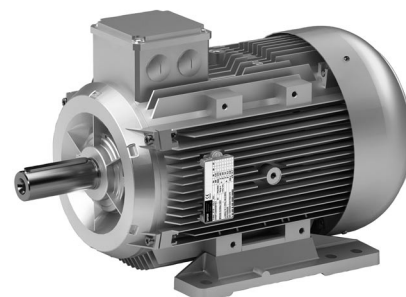


# AC motors

Three-phase AC motors



M20AP...; M24AP... |  
0.75 kW ... 45 kW

Operating instructions

EN



13510927

**Lenze**



Please read these instructions before you start working!  
Follow the enclosed safety instructions.



**Note!**

For safety-rated built-on accessories, the manufacturer's operating instructions have to be observed!

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## Contents

- The present documentation is intended for safe working on and with the drives. It contains safety instructions that must be observed.
- All persons working on and with the drives must have the documentation at hand during work and observe the information and notes relevant for it.
- The documentation must always be complete and in a perfectly readable state.

If the information and notes provided in this documentation do not meet your requirements, please refer to the gearbox documentation.



### Tip!

Information and tools concerning the Lenze products can be found in the download area at

[www.lenze.com](http://www.lenze.com)

## Validity

This documentation is valid for three-phase AC motors:

Type	Name
m200-P m240-P	Three-phase AC motors efficiency class IE3 (squirrel cage induction motor)

## Target group

This documentation is directed at qualified skilled personnel according to IEC 60364.

Qualified skilled personnel are persons who have the required qualifications to carry out all activities involved in installing, mounting, commissioning, and operating the product.

### 1.1 Document history

Material number	Version			Description
13493940	1.0	06/2015	TD09	First edition for the pilot series
13510927	2.0	03/2016	TD09	Extended by: 0.75kW; motor, B14 type and sizes 080...112 Supplementation of the approvals and Appendix chapter Change of the starting torques and power terminals






# 1 About this documentation

## Conventions used


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### 1.2 Conventions used

This documentation uses the following conventions to distinguish different types of information:

Type of information	Writing	Example/notes
Spelling of numbers		
Decimal	Normal spelling	Example: 1234
Decimal separator	Point	The decimal point is always used. For example: 1234.56
Icons		
Page reference		Reference to another page with additional information For instance:  16 = see page 16
Documentation reference		Reference to another documentation with additional information Example:  EDKxxx = see EDKxxx documentation
Wildcard		Wildcard for options, selection data

### 1.3 Terminology used


Term	Describes the following
Motor	Three-phase AC motor (squirrel cage induction motor) in versions according to motor code,  12 .
Drive system	Drive systems including three-phase AC motors and other Lenze drive components




## 1.4 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:




### Safety instructions

Layout of the safety instructions:

	<b>Danger!</b> (characterises the type and severity of danger) <b>Note</b> (describes the danger and gives information about how to prevent dangerous situations)
---	--

Pictograph and signal word	Meaning
 <b>Danger!</b>	<b>Danger of personal injury through dangerous electrical voltage</b> Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 <b>Danger!</b>	<b>Danger of personal injury through a general source of danger</b> Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 <b>Stop!</b>	<b>Danger of property damage</b> Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

### Application notes

Pictograph and signal word	Meaning
 <b>Note!</b>	Important note to ensure trouble-free operation
 <b>Tip!</b>	Useful tip for easy handling
	Reference to another document

## 2 Safety instructions

### General safety instructions for drive components

---

#### 2.1 General safety instructions for drive components

At the time of dispatch, the drive components are in line with the latest state of the art and can be regarded as operationally safe.

#### Scope

The following general safety instructions apply to all Lenze drive and automation components.

**The product-specific safety and application notes given in this documentation must be observed!**

#### General hazards



#### **Danger!**

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

- Lenze drive and automation components ...
  - ... must only be used for the intended purpose.
  - ... must never be operated if damaged.
  - ... must never be subjected to technical modifications.
  - ... must never be operated unless completely assembled.
  - ... must never be operated without the covers/guards.
  - ... can - depending on their degree of protection - have live, movable or rotating parts during or after operation. Surfaces can be hot.
- All specifications of the corresponding enclosed documentation must be observed.

This is vital for safe and trouble-free operation and for achieving the specified product features.
- Only qualified skilled personnel are permitted to work with or on Lenze drive and automation components.

According to IEC 60364 or CENELEC HD 384, these are persons ...

  - ... who are familiar with the installation, assembly, commissioning and operation of the product,
  - ... possess the appropriate qualifications for their work,
  - ... and are acquainted with and can apply all the accident prevent regulations, directives and laws applicable at the place of use.



### Transport, storage

- Transport and storage in a dry, low-vibration environment without aggressive atmosphere; preferably in the packaging provided by the manufacturer.
  - Protect against dust and impacts.
  - Observe climatic conditions according to the technical data.
- Use load carrying equipment for transport! (📖 17)
- Before the transport
  - check that all components are safely mounted,
  - check that all component parts with a loose fastening are secured or removed,
  - fasten all transport aids (eye bolts or support plates).



#### **Danger!**

##### **Danger due to toppling or falling loads!**

- The payload of the hoists and load handling devices must at least correspond to the weight of the load. For weights (📖) catalogue.
- The load must be secured in such a way that it cannot topple or fall down.
- Do not stay under a pending load!



#### **Danger!**

Completely screw in transport aids (such as eye bolts or bearing plates), they must be flat and applied over their entire surface!

If possible, the transport aids (such as eye bolts or bearing plates) must be stressed vertically in the direction of the screw axis! Angular tension or tension to the sides reduces the payload! Observe the information provided in DIN 580!

Use additional appropriate lifting aids, if required, to achieve a direction of loading which is as vertical as possible (highest payload). Secure lifting aids against shifting!

If you do not install the motor immediately, ensure proper storage conditions.

- Up to one year:
  - Shafts and uncoated surfaces are delivered with rust protection. Aftertreatment is required where the corrosion protection has been damaged.
- More than one year, up to two years:
  - Apply a long-term corrosion preventive (e.g. Anticorit BW 366 by Fuchs company) to the shafts and uncoated surfaces before storing the motor away.



#### **Stop!**

**Observe load carrying capacity!**

**Standing beneath floating loads is prohibited!**

## 2 Safety instructions

Application as directed

---

### Corrosion protection

Lenze offers paints with different resistance characteristics for drive systems. Since the resistance may be reduced when the paint coat is damaged, defects in paint work (e.g. through transport or assembly) must be removed professionally to reach the required corrosion resistance.

### Mechanical installation

- Provide for careful handling and avoid mechanical overload. During handling neither bend components, nor change the insulation distances.

### Electrical installation

- Carry out the electrical installation according to the relevant regulations (e. g. cable cross-sections, fusing, connection to the PE conductor). Additional notes are included in the documentation.
- Only plug in or remove pluggable terminals in the deenergised state!

### Commissioning

- If required, you have to equip the system with additional monitoring and protective devices in accordance with the respective valid safety regulations (e. g. law on technical equipment, regulations for the prevention of accidents).
- Before commissioning remove transport locking devices and keep them for later transports.

## 2.2 Application as directed

Low-voltage machines are not household appliances but are intended as components that are only applied for re-use for industrial or professional purposes in terms of IEC/EN 61000-3-2. They comply with the requirements of the Low-Voltage Directive and the harmonised standards of the IEC/EN 60034 series.

Low-voltage machines must only be operated under the operating conditions and power limits specified in this documentation.

The integrated brakes must not be used as safety brakes. It cannot be ruled out that interference factors which cannot be influenced cause a brake torque reduction.

m20AP three-phase AC motors are solely designed for operation at three-phase systems with a rated frequency of 50 Hz.

**Any other use shall be deemed inappropriate!**

## 2.3 Foreseeable misuse

- Do not operate the motors
  - ... in explosion-protected areas
  - ... in aggressive environments (acid, gas, vapour, dust, oil)
  - ... in water
  - ... in radiation environments
- Do not actuate motors on the inverter.

**Note!**

Increased surface and corrosion protection can be achieved by using adapted coating systems.

## 2.4 Residual hazards

### Protection of persons

- The motor surfaces can become very hot. Danger of burns when touching!
  - Provide protection against accidental contact, if necessary.
- Danger of unintentional starting or electrical shocks
  - Connections must only be made when the equipment is deenergised and the motor is at standstill.
  - Installed brakes are no fail-safe brakes.

### Motor protection

- Installed thermal detectors are **no full protection** for the machine.
  - Installed overload protection does not prevent an overload under any conditions.
- Installed brakes are **no fail-safe brakes**.
  - The torque may be reduced by disruptive factors that cannot be influenced such as contamination by oil.
- Fuses are no motor protection.
  - Use current-dependent motor protection switches at average operating frequency.
  - Use installed thermal detectors at high operating frequency.
- Too high torques cause a fraction of the motor shaft.
  - The maximum torques according to catalogue must not be exceeded.
- Lateral forces from the motor shaft may occur.
  - Align shafts of motor and driving machine exactly to each other.
- If deviations from normal operation occur, e.g. increased temperature, noise, vibration, determine the cause and, if necessary, contact the manufacturer. If in doubt, switch off the motor.

### Fire protection

- Fire hazard
  - Prevent contact with flammable substances.

## 2.5 Disposal

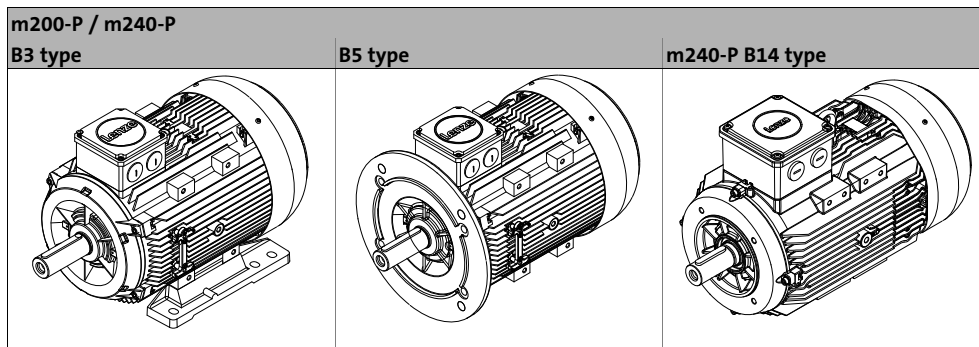
Sort individual parts according to their properties. Dispose of them as specified by the current national regulations.

# 3 Product description

Identification  
Motor name

## 3.1 Identification

### Three-phase AC motors ...



### 3.1.1 Motor name

Each motor has a motor name and a motor code. In the sales documents, the motors are identified by the motor name. The technical documentation and nameplate show the motor code.

The table below shows a list of the motor names and the first eleven digits of the corresponding motor code:

m200-P	
Motor name	Motor code
m200-P132M4	M20AP132M04
m200-P132L4	M20AP132L04
m200-P160M4	M20AP160M04
m200-P160L4	M20AP160L04
m200-P180M4	M20AP180M04
m200-P180L4	M20AP180L04
m200-P180V4	M20AP180V04
m200-P200M4	M20AP200M04
m200-P225M4	M20AP225M04
m200-P225L4	M20AP225L04

m240-P	
Motor name	Motor code
m240-P80/M4	M24AP080M04
m240-P90/M4	M24AP090M04
m240-P90/L4	M24AP090L04
m240-P100/M4	M24AP100M04
m240-P100/L4	M24AP100L04
m240-P112/M4	M24AP112M04
m240-P132/M4	M24AP132M04
m240-P132/L4	M24AP132L04
m240-P160/M4	M24AP160M04
m240-P160/L4	M24AP160L04
m240-P180/M4	M24AP180M04
m240-P180/L4	M24AP180L04
m240-P180/V4	M24AP180V04
m240-P200/M4	M24AP200M04
m240-P225/M4	M24AP225M04
m240-P225/L4	M24AP225L04

3.1.2 Motor code

m200/m240 three-phase AC motors

Example		M20A-	P	132	M	04	5	E	F	0	C	T	
Meaning	Variant												
Efficiency class	Premium - IE3		P										
Size				80									
				90									
				100									
				112									
				132									
				160									
				180									
				200									
				225									
Overall length	Very short				K								
	Short				S								
	Medium				M								
	Long				L								
	Very long				V								
Number of poles	4-pole					04							
Enclosure	IP5x						5						
	IP6x						6						
Cooling	Self-ventilation							E					
	No ventilation							S					
Brake attachment	Spring-applied brake								F				
	No brake								0				
Act. value encoder	No encoder									0			
Approvals	CE										C		
	None										N		
Internal key												T	

# 3 Product description

## Nameplate

### 3.1.3 Nameplate

m200 standard version									
<b>Lenze</b>		1		15					
2	14.2	14.1	23	Hz	16.1				
4				kW	16.2				
		13	14.3	r/min	16.3				
8.1	8.2	8.3	25	V	Y	16.4			
				Δ	16.4				
				A	Y	16.5			
				Δ	16.5				
10.1			18	cos φ	16.6				
10.2	10.3			η %	16.7				
11									

m200 for direct gearbox attachment									
<b>Lenze</b>		1		15					
				Hz	16.1				
2				kW	16.2				
3			18	V	Y	16.4			
4			17	Δ	16.4				
5.1	5.2			25			23		
5.3	5.4			A	Y	16.5		13	
6	7.1	7.2		Δ	16.5		14.1		
8.1	8.2	8.3		r/min	16.3		14.2		
				η %	16.7		14.3		
				cos φ	16.6				
10.1	10.2			C86	22		22		
11				20.1					

Pos.	Contents
1	Manufacturer / production location
2	Type of motor / standard
3	Gearbox type
4	Motor type
5	Technical data
5.1	Ratio
5.2	Rated torque
5.3	Rated speed
5.4	Rated frequency
6	Mounting position / position of the system blocks
7	Lubricant details
7.1	Lubricant amount
7.2	Lubricant type
8	Brake data
8.1	Type
8.2	AC/DC brake voltage
8.3	Braking torque, electrical power input
10	Production data
10.1	Order number
10.2	Material number
10.3	Serial number
11	Bar code
13	Information with regard to the operating mode
14	Additional motor specifications
14.1	Temperature class
14.2	Enclosure
14.3	Motor protection
15	Applicable conformities, approvals and certificates
16	Rated data for various frequencies
16.1	Hz = frequency
16.2	kW = motor power
16.3	rpm = motor speed
16.4	V = motor voltage
16.5	A = motor current
16.6	cos φ = motor power factor
16.7	η = motor efficiency: at a rated power of 100%
17	Application factor (specified if <1.0) / load capacity
18	Year of manufacture / week of manufacture
20	Customer data
20.1	Additional customer data
20.2	Customer order number
22	C86 = motor code for controller parameterisation (code 0086)
23	Efficiency class
25	Range A; Voltage tolerance range according to range A as specified by IEC/EN 60034-1

# 4 Technical data

## General data and operating conditions

### 4.1 General data and operating conditions

#### General data

Conformity and approval			
Conformity			
CE	2014/35/EU	Low-Voltage Directive	
	2009/125/EC	ErP Directive Ordinances No. 4/2014 and No. 640/2009 on the environmentally sound design of electric motors	
EAC	TP TC 004/2011 (TR CU 004/2011)	On safety of low voltage equipment	Eurasian Conformity TR CU: Technical Regulation of Customs Union
	TP TC 020/2011 (TR CU 020/2011)	Electromagnetic compatibility of technical means	Eurasian Conformity TR CU: Technical Regulation of Customs Union

The applicable approvals for the product you have ordered require labelling and are specified on the nameplate.

Protection of persons and devices		
Enclosure	IEC/EN 60034-5	See nameplate
		Degrees of protection only apply to horizontal installation All unused connectors must be closed with protection covers or blanking plugs.
Temperature class	F (155 °C) IEC/EN 60034-1	Exceedance of the temperature limit weakens or destroys the insulation

#### Operating conditions

Ambient conditions			
Climatic			
Transport	IEC/EN 60721-3-2	2K3 (-20 °C ... +70 °C)	
Storage	IEC/EN 60721-3-1	1K3 (-20 °C ... +60 °C)	< 3 months
		1K3 (-20 °C ... +40 °C)	> 3 months
Operation	IEC/EN 60721-3-3	3K3 (-20 °C ... +40 °C)	Without brake
		3K3 (-10 °C ... +40 °C)	With brake
		> +40 °C	With power reduction, see catalogue
Site altitude		< 1000 m amsl - without power reduction	
		> 1000 m amsl < 4000m amsl with power reduction, see catalogue	
Humidity		Relative humidity ≤ 85 %, without condensation	
Mechanical			
	IEC/EN60721-3-3	3M6	



## 5.1 Important notes



### Danger!

Some of the motors mounted to the gearboxes are equipped with transport aids. They are **only** intended for the mounting/dismounting of the motor to the gearbox and must **not** be used for the entire geared motor!

- Only move the drive with means of transport or hoists that have sufficient load-bearing capacity.
- Ensure safe fixing.
- Avoid shocks!

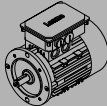

## Screw-on dimensions B14 flange



### Stop!

Observe the maximally permissible screw-in depth for B14 flange!



		c max.	s
		[mm]	[mm]
M24AP080□□□	FT100	10	M6
	FT130	12	M8
M24AP090□□□	FT115	16	M8
	FT130	12	M8
M24AP100□□□	FT130	12	M8
M24AP112□□□	FT130	12	M8

## 5.2 Preparation

Remove the corrosion protection from the shaft ends and flanges. If necessary, remove dirt using standard cleaning solvents.



### Stop!

Bearings or seals must not come into contact with the solvent - material damages.

After a long storage period (> 1 year) you have to check whether moisture has entered the motor. For this purpose, measure the insulation resistance (measuring voltage 500 V<sub>DC</sub>). In case of values  $\leq 1\text{k}\Omega$  per volt of rated voltage, dry the winding.

# 5 Mechanical installation

## Installation

---

### 5.3 Installation

- The mounting surface must be dimensioned for the design, the weight, and the torque of the motor.
- The foot and flange faces must rest flat on the mounting surface.
  - An insufficient alignment of the motor shortens the service life of the roller bearings and the transmission elements.

Blows to shafts can cause damage to the bearings.

- Do not exceed the permissible range of ambient operating temperature (📖 16).
- Securely fasten the motor.
- Ensure unobstructed ventilation. The exhaust air, also that of adjacent aggregates, must not be inlet again immediately.
- During operation, surface temperatures of up to 140 °C are possible! Protect against contact!



#### Note!

From the air inlet to other component parts, a minimum distance of 10% of the outer diameter of the fan cover must be complied with!

Ensure an even surface, solid foot or flange mounting and exact alignment if a direct clutch is connected. Avoid resonances with the rotational frequency and double supply frequency which may be caused during assembly.

Only mount or remove transmission elements using appropriate means. In order to facilitate handling, heat them beforehand. Cover belt pulleys and clutches with a touch guard.



#### Stop!

Ensure a correct belt tension!

The machines are halfkey balanced. The clutch must be halfkey balanced, too. The visible jutting out part of the key must be removed.

Designs with shaft end at the bottom must be protected with a cover at the N-end, preventing the ingress of foreign particles into the fan.

#### 5.4 Assembly of built-on accessories

Follow these instructions carefully. Please note that the warranty and product liability will become void in the event of impermissible alterations or modifications to the motors.

- Mount the transmission elements:
  - Shocks and impacts must be avoided! They could destroy the motor.
  - For mounting always use the centre bore in the motor shaft as specified by DIN 332-DR-M...
  - Tolerances of the shaft ends:
    - ≤ Ø 50 mm: ISO k6, > Ø 50 mm: ISO m6.
- Only use an extractor for the disassembly.
- When using belts for torque/power transmission:
  - Tension the belts in a controlled manner.
  - Provide protection against accidental contact! During operation, surface temperatures of up to 140°C are possible.

#### 5.5 Spring-applied brakes

##### Important notes

As an option, the motors can be fitted with a brake. The installation of brakes (in or on the motor) increases the length of the motor.



##### Note!

The brakes used are not fail-safe because interference factors which cannot be influenced (e.g. oil ingress) may lead to a reduction in torque.

The brakes are used as holding brakes and serve to hold the axes at standstill or in the deenergised state.

Emergency stops at higher speeds are possible but high switching energy increases wear on the friction surfaces and the hub, (📖 30).

The spring-applied brakes work on the basis of the closed-circuit principle, i.e. the brake is closed in the deenergised state. The brakes for DC supply can be fed with a bridge-rectified DC voltage (bridge rectifier) or with a smoothed DC voltage. The permissible voltage tolerance is ±10 %.

In case of long motor cables the voltage drop must be checked due to increasing conductor resistance and compensated for by higher input voltage if necessary.

# 5 Mechanical installation

## Spring-applied brakes

The following applies to Lenze system cables:

$U^* = U_B + \left[ \frac{0.08 \Omega}{m} \cdot L \cdot I_B \right]$	$U^*$ [V]	Resulting supply voltage
	$U_B$ [V]	Rated voltage of the brake
	$l$ [m]	Cable length
	$I_B$ [A]	Rated current of the brake



### Stop!

If no suitable voltage (incorrect value, incorrect polarity) is applied to the brake, the brake will be applied and can be overheated and destroyed by the motor continuing to rotate.

The shortest operating times of the brakes are achieved by DC switching of the voltage and an external suppressor circuit (varistor or spark suppressor). Without suppressor circuit, the operating times may increase. A varistor/spark suppressor limits the breaking voltage peaks. It must be ensured that the power limit of the suppressor circuit is not exceeded. This limit depends on the brake current, brake voltage, disengagement time and the switching operations per time unit.

Furthermore the suppressor circuit is necessary for interference suppression and for increasing the service life of the relay contacts (external, not integrated into the motor).

For permissible operating speeds and characteristics, please see the motor catalogue applicable in each case. Emergency stops at higher speeds are possible, but high switching energy increases wear on the friction surfaces and the hub.



### Stop!

The friction surfaces must always be free from oil and grease because even small amounts of grease or oil will considerably reduce the braking torque.

The formula below provides a simplified way to calculate friction energy per switching cycle which must not exceed the limit value for emergency stops that depends on the operating frequency (motor catalogue; Lenze drive solutions: formulas, dimensioning, and tables).

$Q = \frac{1}{2} \cdot J_{\text{tot}} \cdot \Delta\omega^2 \cdot \frac{M_K}{M_K - M_L}$	$Q$ [J]	Friction energy
	$J_{\text{tot}}$ [kgm <sup>2</sup> ]	Total mass inertia (motor + load)
	$\Delta\omega$ [1/s]	Angular velocity $\omega=2\pi \cdot n/60$ , n= speed [rpm]
	$M_K$ [Nm]	Characteristic torque
	$M_L$ [Nm]	Load torque

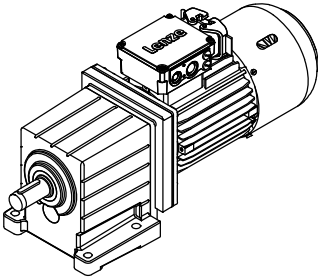
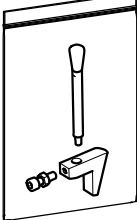
Depending on the operating conditions and possible heat dissipation, surface temperatures can be up to 130 °C.



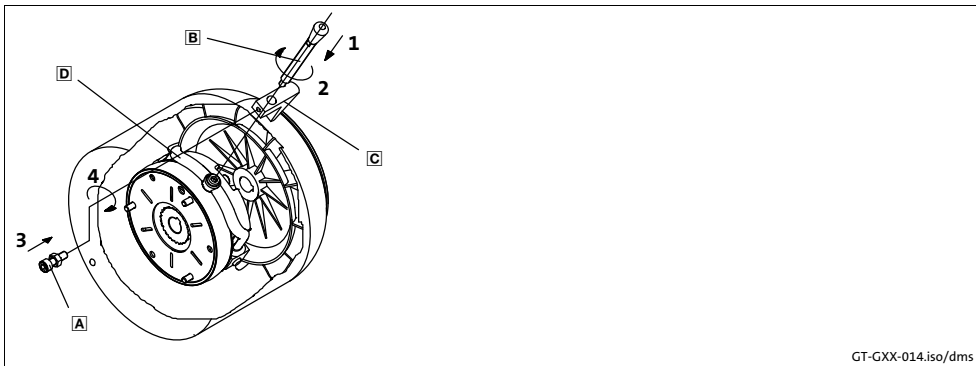
More detailed information on the used brakes is provided in the corresponding catalogues.

## 5.6 Locking of the manual release

### Scope of supply

Geared motor	Shipping bag
 <p style="text-align: right; font-size: small;">GT-GNG-GST-010.iso/dms</p>	 <p style="text-align: right; font-size: small;">GT-GXX-012.iso/dms GT-GXX-013.iso/dms</p> <ul style="list-style-type: none"> <li>• 1 Manual release lever with knob</li> <li>• 1 Terminal block</li> <li>• 1 Cheese head screw with nut</li> </ul>

### Mounting



- |   |   |
|---|---|
| <p><b>A</b> Cheese head screw with nut</p> <p><b>B</b> Manual release lever with knob</p> | <p><b>C</b> Terminal block</p> <p><b>D</b> Manual release shackle (brake)</p> |
|---|---|

# 5 Mechanical installation

Spring-applied brakes  
Locking of the manual release

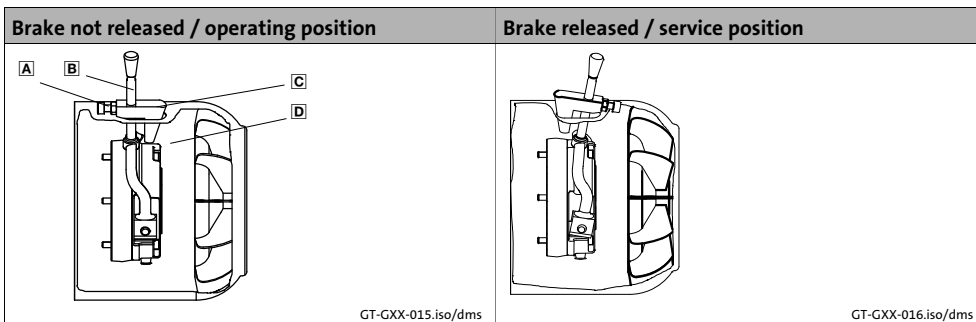
---

## Handling



### Stop!

- Lock the manual release only for service work!
- The manual release must not be locked during operation, otherwise the brake could be damaged!
- Always secure the terminal block against loosening in every position with cheese head screw and nut!



- |                                  |                  |
|----------------------------------|------------------|
| A Cheese head screw with nut     | C Terminal block |
| B Manual release lever with knob | D Fan cover      |

## 6.1 Important notes



### Danger!

Hazardous voltage on the power connections even when disconnected from mains: residual voltage >60 V!

Before working on the power connections, always disconnect the drive component from the mains and wait until the motor is at standstill. Verify safe isolation from supply!



### Stop!

Electrical connections must be carried out in accordance with the national and regional regulations!

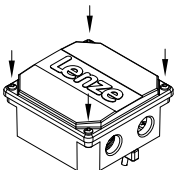
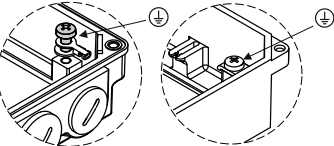
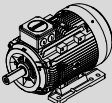
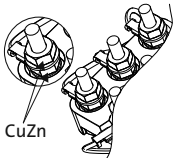
m20AP three-phase AC motors are solely designed for operation at three-phase systems with a rated frequency of 50 Hz.

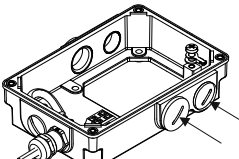
- Observe tolerances according to IEC/EN 60034-1:
  - Voltage  $\pm 10\%$
  - Frequency  $\pm 2\%$
  - Wave form, symmetry (increases heating and affects electromagnetic compatibility)
- Observe notes on wiring, information on the nameplate, and the connection scheme in the terminal box.
- The terminal box has to be free of foreign bodies, dirt, and humidity.
- All unused cable entries and the box itself must be sealed against dust and water.
- The connection must ensure a continuous and safe electrical supply, i.e.
  - no loose wire ends,
  - use assigned cable end fittings,
  - ensure good electrical conductivity of the contact (remove residual lacquer) if an (additional) PE connection on the motor housing is used,
  - establish a safe PE conductor connection,
  - tighten the plugin connector to the limit stop,
  - all connections at the terminal board are tightened.
- The smallest air gaps between uncoated, live parts and against earth must not be smaller than the minimum requirement for a basic insulation of 3.87 mm in compliance with IEC/EN 60664-1 (CE).

# 6 Electrical installation

Important notes  
Power connections on the terminal board

## Tightening torques

[Nm] +/- 10%	Ø				
	M4	M5	M6	M8	M10
	2.2	3.5	4.5	-----	-----
	2.5	3.5	-----	-----	-----
	063...080	090...112	132...160	180...200	225
	1.5	2.0	3.5	6.0	8.0

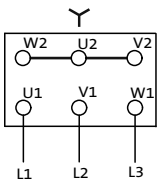
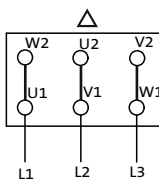
[Nm] +/- 10%	Ø						
	M12 x 1.5	M16 x 1.5	M20 x 1.5	M25 x 1.5	M32 x 1.5	M40 x 1.5	M50 x 1.5
 1)	0.7	1	1	2.5	3	3	3
2)	3	3	4	6	8	10	14

Tab. 1 Locking screws and cable glands

- 1) Plastics
- 2) Metal

### 6.1.1 Power connections on the terminal board

#### Motor

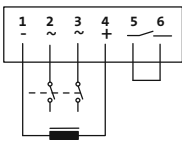

	L1/L2/L3	Power connection
	Δ	Delta connection
	Y	Star connection



## Temperature monitoring

Connection in the terminal box		
Meaning	Designation in accordance with EN 60034-8	Note
Thermal contact - TCO	TB1	Max. 250 V~
	TB2	Max. 1.6 A ~
PTC thermistor	TP1	
	TP2	

### 6.1.2 Brake connection to terminal

Contact	Meaning	Additional specifications
~	AC-excited brake (rectifier) 	Connection to L1 - mains
~		Connection to N - mains
+		Brake connection
-		Brake connection
		Switching contact, DC switching
BD1	Brake, DC operated	DC connection
BD2		
MS1	Brake microswitch, release control	Two-way switch
MS2		NC contact
MS4		NO contact
MS1	Brake microswitch, wear control	Two-way switch
MS2		NC contact
MS4		NO contact
MS1	Brake microswitch, manual release	Two-way switch
MS2		NC contact
MS4		NO contact

# 7 Commissioning and operation

## Important notes

---

### 7.1 Important notes

For trial run without output elements, lock the featherkey. Do not deactivate the protective devices, not even in a trial run.

Check the correct operation of the brake before commissioning motors with brakes.

### 7.2 Before switching on



#### Note!

Before switch-on, you must ensure that the motor starts with the intended direction of rotation.

Lenze motors rotate CW (looking at the driven shaft) if a clockwise three-phase field L1 → U1, L2 → V1, L3 → W1 is applied.

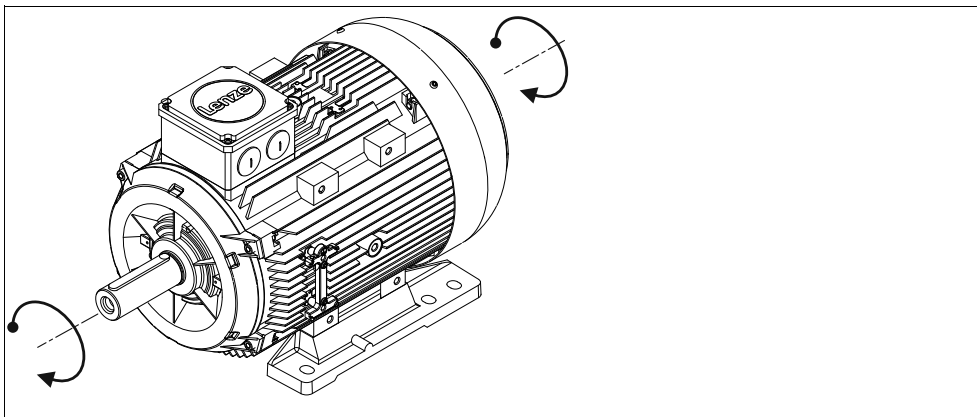


Fig. 1 Rotating direction of the driven shaft

Be absolutely sure to check the following before initial commissioning, before commissioning after a longer downtime, or before commissioning after the motor has been overhauled:

- Measure the insulation resistance; in the case of values  $\leq 1 \text{ k}\Omega$  per Volt of the rated voltage, dry the winding.
- Have all screwed connections of the mechanical and electrical parts been tightened?
- Is it ensured that the cooling air can be freely supplied and discharged?
- Has the PE conductor been connected correctly?
- Have the protective devices against overheating (temperature sensor evaluation) been activated?
- Are the electrical connections ok?
- Is the phase sequence of the motor connection correct?
- Is a protection against contact provided in front of rotating parts and in front of surfaces that can get hot?
- Is the contact of good electrical conductivity if a PE connection on the motor housing is used?

---

### 7.3 Functional test

- After commissioning, check all individual functions of the drive:
- Direction of rotation of the motor
  - Direction of rotation in the uncoupled state (observe "Electrical connection" section).
- Torque behaviour and current consumption

### 7.4 During operation



#### Stop!

- Fire hazard! Do not clean or spray motors with flammable detergents or solvents.
- Avoid overheating! Deposits on the drives impede the heat dissipation required and have to be removed regularly.



#### Danger!

During operation, motor surfaces must not be touched. According to the operating status, the surface temperature for motors can be up to 140°C. For the protection against burn injuries, provide protection against contact, if necessary. Observe coolingoff times!

During operation, carry out inspections on a regular basis. Pay special attention to:

- Unusual noises
- Oil spots on drive end or leakages
- Irregular running
- Increased vibration
- Loose fixing elements
- Condition of electrical cables
- Speed variations
- Impeded heat dissipation
  - Deposits on the drive system and in the cooling channels
  - Pollution of the air filter

In case of irregularities or faults: (📖 38).

# 8 Maintenance/repair

Important notes  
Motor

---

## 8.1 Important notes



### **Danger!**

Hazardous voltage on the power connections even when disconnected from mains: residual voltage >60 V!

Before working on the power connections, always disconnect the drive component from the mains and wait until the motor is at standstill.

Verify safe isolation from supply!

Shaft sealing rings and roller bearings have a limited service life.

Regrease bearings with relubricating devices while the low-voltage machine is running. Only use the grease recommended by the manufacturer.

If the grease drain holes are sealed with a plug, (IP54 drive end; IP23 drive and nondrive end), remove plug before commissioning. Seal bore holes with grease.

## 8.2 Maintenance intervals

### Inspections

- If the machine is exposed to dirt, clean the air channels regularly.

#### 8.2.1 Motor

- Only the bearings and shaft sealing rings become worn.
  - Check bearings for noise (after approx. 15,000 h at the latest).
- In order to prevent overheating, remove dirt deposits on the drives regularly.
- We recommend carrying out an inspection after the first 50 operating hours. In this way, you can detect and correct any irregularities or faults at an early stage.

#### 8.2.2 Spring-operated brakes

To ensure safe and trouble-free operation, spring-applied brakes must be checked and maintained at regular intervals. Servicing can be made easier if good accessibility of the brakes is provided in the plant. This must be considered when installing the drives in the plant.

Primarily, the necessary maintenance intervals for industrial brakes result from the load during operation. When calculating the maintenance interval, all causes for wear must be taken into account, (( 30)). For brakes with low loads such as holding brakes with emergency stop, we recommend a regular inspection at a fixed time interval. To reduce the cost, the inspection can be carried out along with other regular maintenance work in the plant if necessary.

If the brakes are not maintained, failures, production losses or damage to the system may occur. Therefore, a maintenance concept adapted to the particular operating conditions and brake loads must be defined for every application. For the spring-applied brakes, the maintenance intervals and maintenance operations listed in the below table must be provided. The maintenance operations must be carried out as described in the detailed descriptions.

Type	Service brake	Holding brake with emergency stop
Spring-applied brake	<ul style="list-style-type: none"> <li>• according to service life calculation</li> <li>• otherwise every six months</li> <li>• after 4,000 operating hours at the latest</li> </ul>	<ul style="list-style-type: none"> <li>• at least every two years</li> <li>• after 1 million cycles at the latest</li> <li>• provide shorter intervals in the case of frequent emergency stops</li> </ul>

### 8.3 Maintenance operations

#### 8.3.1 Motor



#### Stop!

- Make sure that no foreign bodies can enter the inside of the motor!
- Do not remove plugs when voltage is being applied!



#### Danger!

- Only work on the motor when it is deenergised!
- Hot motor surfaces of up to 140 °C. Observe cooling times!
- Remove loads acting on motors or secure loads acting on the drive!

#### 8.3.2 Spring-operated brakes

The brake is mounted to the N-end shield of the motor. Remove the fan cover to check, maintain, or set the brake.



#### Note!

Brakes with defective armature plates, cheese head screws, springs or counter friction faces must always be replaced completely.

Generally observe the following for inspections and maintenance works:

- Remove oil and grease linked impurities using brake cleaning agents, if necessary, replace brake after identifying the cause of the contamination. Dirt deposits in the air gap between stator and armature plate impair the function of the brake and must be removed.
- After replacing the rotor, the original braking torque will not be reached until the run-in operation of the friction surfaces has been completed. After replacing the rotor, run-in armature plates and counter friction faces have an increased initial rate of wear.

# 8 Maintenance/repair

Maintenance operations  
Spring-operated brakes

## Wear on spring-applied brakes

The used spring-applied brakes have a low rate of wear and are designed for long maintenance intervals.





However, the friction lining, the teeth between the brake rotor and the hub, and also the braking mechanism are naturally subject to function-related wear which depends on the application case (see table). In order to ensure safe and problem-free operation, the brake must therefore be checked and maintained regularly and, if necessary, replaced (see brake maintenance and inspection).

The following table describes the different causes of wear and their effect on the components of the spring-applied brake. In order to calculate the useful life of the rotor and brake and determine the maintenance intervals to be prescribed, the relevant influencing factors must be quantified. The most important factors are the applied friction energy, the starting speed of braking and the switching frequency. If several of the indicated causes of wear on the friction lining occur in an application, their effects are to be added together.


Component	Effect	Influencing factors	Cause
Friction lining	Wear on the friction lining	Applied friction energy	Braking during operation (impermissible, holding brakes!)
			Emergency stops
			Overlapping wear when the drive starts and stops
			Active braking by the drive motor with the help of the brake (quick stop)
		Number of start-stop cycles	Starting wear if motor is mounted in a position with the shaft vertical, even if the brake is open
Armature plate and flange	Running-in of armature plate and flange	Applied friction energy	Friction between the brake lining and the armature plate or flange e.g. during emergency braking or service brake operation
Teeth of the brake rotor	Teeth wear (primarily at the rotor end)	Number of start-stop cycles, Level of the braking torque, Dynamics of the application, Speed fins in operation	Relative movement and impacts between brake rotor and brake hub
Armature plate bracket	Armature plate, cap screws and bolts are deflected	Number of start-stop cycles, Level of braking torque	Load changes and impacts due to reversal error during interaction between armature plate, cap screws and guide bolts
Springs	Fatigue failure of the springs	Number of switching operations of the brake	Axial load cycle and shearing stress on the springs due to radial reversing error of the armature plate

Tab. 2 Causes for wear


### 8.3.3 Checking the component parts

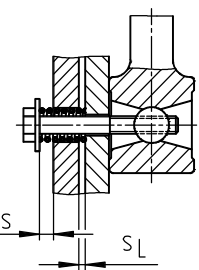
With a mounted brake	<ul style="list-style-type: none"> <li>• Check ventilation function and activation/deactivation  32</li> <li>• Check air gap (if required, re-adjust it)  32</li> <li>• Measure rotor thickness (if required, replace rotor)  31</li> <li>• Thermal damage of the armature plate or flange (tarnished in dark blue)</li> </ul>
With a dismantled brake	<ul style="list-style-type: none"> <li>• Check clearance of the rotor gear teeth (replace rotors that are damaged by vibration)  33</li> <li>• Damage by vibration of the torque support at the sleeve bolts, cylindrical pins, and armature plate</li> <li>• Check springs for damage</li> <li>• Check armature plate and flange or end shield                             <ul style="list-style-type: none"> <li>– Evenness for size 06...12 &lt; 0.06 mm</li> <li>– Evenness from size 14 &lt; 0.1 mm</li> <li>– Max. run-in depth = rated air gap of the design size</li> </ul> </li> </ul>

### Check the mounting dimension of the manual release




**Stop!**

Dimension "s" must be maintained! Check air gap "s<sub>L</sub>"!  
( operating instructions)



	Size	s <sub>L</sub> (mm)	s <sup>+0.1</sup> (mm)	s + s <sub>L</sub> (mm)
	06	0.2	1	1.2
	08			
	10			
	12	0.3	1.5	1.8
	14			
	16			
	18			
	20	0.4	2	2.4
	25	0.5	2.5	3

### 8.3.4 Checking the rotor thickness



**Danger!**

When the rotor thickness is checked, the motor must not run.

1. Remove fan cover and cover ring if attached.
2. Measure rotor thickness with calliper gauge. If a friction plate is attached, ensure a flanged edge at the outer diameter of the friction plate.
3. Compare measured rotor thickness with minimally permissible rotor thickness (values  33).
4. If required, exchange the entire rotor. Description  33.

## 8 Maintenance/repair

Maintenance operations  
Checking the air gap

---

### 8.3.5 Checking the air gap

1. Check the air gap " $s_L$ " near the fixing screws between the armature plate and stator using a feeler gauge (📖 33).
2. Compare air gap measured to maximally permissible air gap " $s_{L \max}$ ." (📖 33).
3. If required, set air gap to " $s_{LN}$ " (📖 32).

### 8.3.6 Release / voltage



#### **Danger!**

The rotating rotor must not be touched.



#### **Danger!**

Live connections must not be touched.

1. Observe the brake's function while the drive is being operated. The armature plate must be tightened and the rotor must move free of residual torque.
2. Measure the DC voltage on the brake.
  - The DC voltage measured after the overexcitation time (⌚ operating instructions, forced voltage rectifier) must equal the voltage for the holding. A deviation of up to  $\pm 10\%$  is permissible.

### 8.3.7 Adjusting the air gap



#### **Danger!**

The brake must be free of residual torque.



#### **Stop!**

For the flange design, please observe the following if the flange is mounted with additional screws:

Clearing holes in the end shield must be provided behind the threaded holes in the flange that are designed for the screws. Without clearing holes, the minimum rotor thickness cannot be utilised fully. In no case must the screws press against the end shield.

1. Loosen screws (10).
2. Screw the sleeve bolts further into the stator using an open-jawed spanner.  $\frac{1}{6}$  revolution reduces the air gap by approx. 0.15 mm.
3. Tighten screws, torques (📖 33).
4. Check air gap " $s_L$ " near the screws using a feeler gauge, " $s_{LN}$ " (📖 33).
5. If the deviation of " $s_{LN}$ " is too great, repeat the adjustment process.



### 8.3.8 Rotor replacement



#### **Danger!**

The brake must be free of residual torque.

1. Loosen the connecting cable.
2. Evenly release the screws and remove them completely.
3. Completely remove the stator from the end shield. Observe the connecting cables.
4. Completely remove the rotor from the hub.
5. Check the toothed part of the hub.
6. In case of wear, replace the hub, too.
7. Check the friction surface of the end shield. If the flange / friction plate is severely gouged, it must be replaced. If the end shield is severely gouged, the friction surface must be reprocessed.
8. Measure the rotor thickness (new rotor) and the height of head of the sleeve bolts using a caliper gauge.
9. The distance between the stator and the armature plate is calculated as follows:

**Distance = rotor thickness +  $s_{Lrated}$  - height of head**

” $s_{LN}$ ” (📖 33)

10. Evenly remove the sleeve bolts until the calculated distance is reached between the stator and the armature plate.
11. Mount and set new complete rotor and stator, (📖 34).
12. Connect the connecting cable again.

## 8.4 Installation of a spring-applied brake

### 8.4.1 Brake characteristics

Brake size	$s_{LN}$ +0.1 mm -0.05 mm [mm]	$s_{Lmax.}$ service brake [mm]	$s_{Lmax.}$ holding brake [mm]	Max. adjustment, permissible wear path [mm]	Rotor thickness		Tightening torque of the fixing screws [Nm]
					min. <sup>1)</sup> [mm]	max. [mm]	
06	0.2	0.5	0.3	1.5	4.5	6.0	3.0
08					5.5	7.0	5.9
10					7.5	9.0	10.1
12	0.3	0.75	0.45	2.0	8.0	10.0	10.1
14				2.5	7.5	10.0	24.6
16				3.5	8.0	11.5	24.6
18				3.0	10.0	13.0	24.6
20	0.4	1.0	0.6	4.0	12.0	16.0	48.0
25				4.5	15.5	20.0	48.0


Tab. 3 Characteristics of the spring-applied brake

- 1) The dimension of the friction lining allows for adjustment of the brake for at least five times.

# 8 Maintenance/repair

Installation of a spring-applied brake  
Installation of the brake

## 8.4.2 Installation of the brake



**Stop!**

- Check the state of the end shield (15). It must be free from oil and grease.

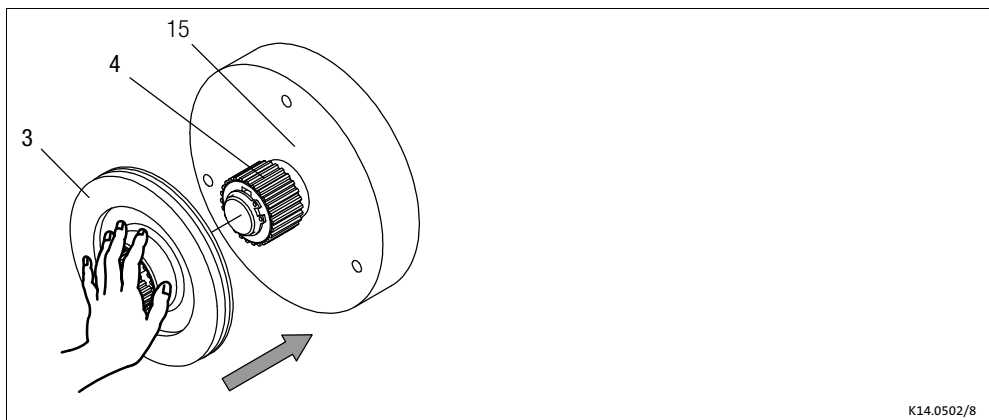



Fig. 2 Rotor mounting


- |         |       |               |
|---------|-------|---------------|
| 3 Rotor | 4 Hub | 15 End shield |
|---------|-------|---------------|

1. Push the rotor (3) onto the hub (4) and check whether it can be moved by hand (Fig. 2).



**Stop!**

Please note the following for the version "brake with shaft sealing ring in torque adjustment ring":

2. Lightly lubricate the lip of the shaft seal with grease.
3. When assembling the stator (1), push the shaft sealing ring carefully over the shaft.
  - The shaft should be located concentrically to the shaft seal.
4. Use the screws (10) to mount the stator (7) completely to the end shield (15) (Fig. 3).
  - Tighten the screws evenly, tightening torque ( 33).

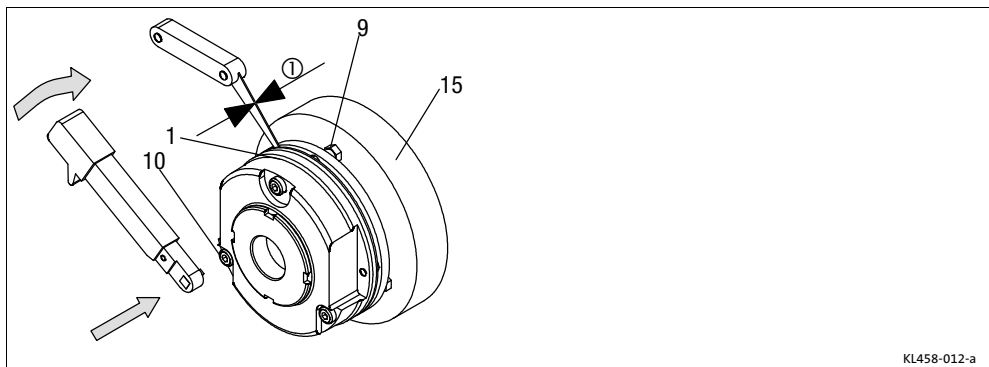



Fig. 3 Stator mounting

- |                      |               |                   |
|----------------------|---------------|-------------------|
| 1 Stator             | 9 Sleeve bolt | ① s <sub>LN</sub> |
| 10 Cheese head screw | 15 End shield |                   |

1. Check air gap near the screws (10) using a feeler gauge and compare the values to the data for "s<sub>LN</sub>" in the table,  33.



**Note!**

Do not insert feeler gauge further than 10 mm between the armature plate (2) and stator (1)!

If " $s_L$ " ( 33) is not within the tolerance, readjust the air gap.

**8.4.3 Adjusting the air gap**



**Danger!**

Disconnect voltage. The brake must be free of residual torque.

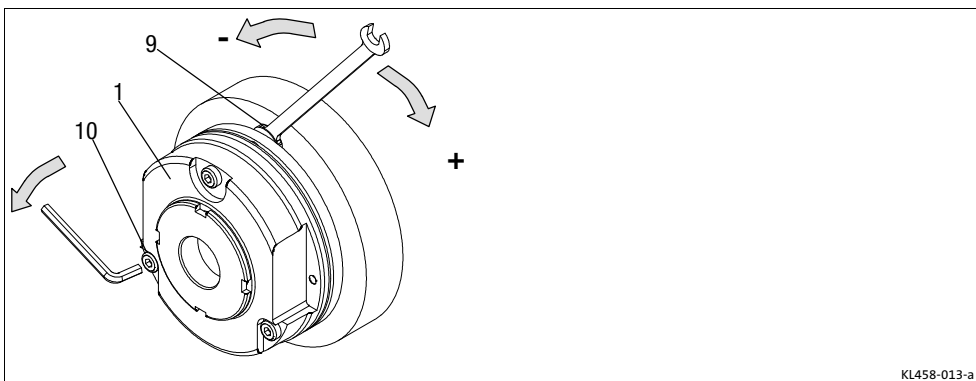


Fig. 4 Re-adjust air gap

- |                   |                      |
|-------------------|----------------------|
| 1 Complete stator | 10 Cheese head screw |
| 9 Sleeve bolt     |                      |

If the measured value " $s_L$ " is outside the tolerance of " $s_{LN}$ ", set the dimension:

**8.4.4 Assembly of the friction plate, sizes 06 to 16**

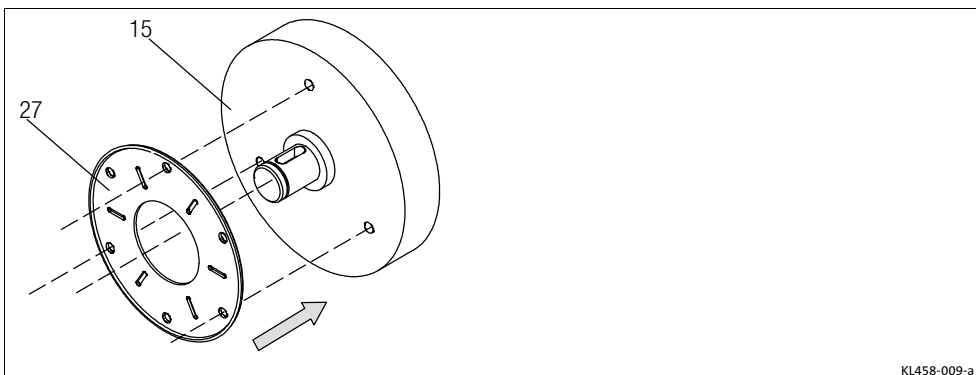


Fig. 5 Friction plate mounting

- |               |                   |
|---------------|-------------------|
| 15 End shield | 27 Friction plate |
|---------------|-------------------|

1. Put a friction plate (27) or flange (6) against the end shield (15).



**Note!**

The flanged edge of the friction plate must remain visible!

2. Align pitch circle and fastening bore hole thread.

## 8 Maintenance/repair

Installation of a spring-applied brake  
Assembly of the flange

### 8.4.5 Assembly of the flange

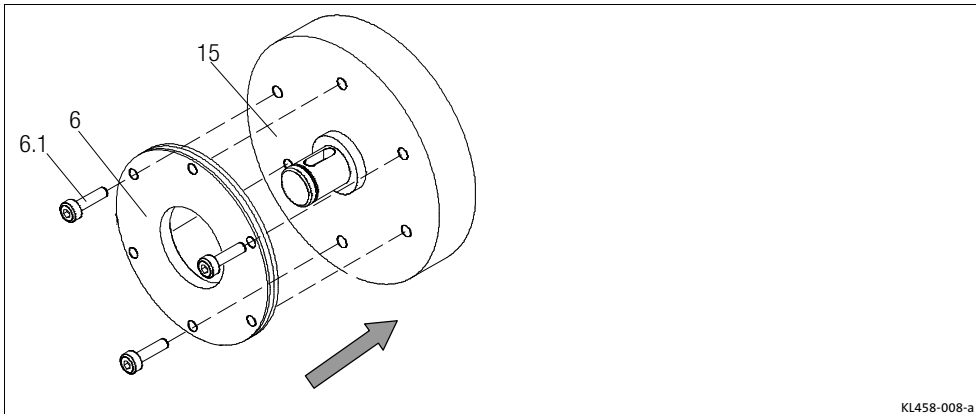


Fig. 6 Flange mounting

6 Flange  
6.1 Set of screws  
15 End shield

1. Hold the flange (6) against the end shield (15) and check the pitch circle and retaining screw drill hole threading.
2. Fasten the flange (6) on the end shield (15) with the screws (6.1).
3. Tighten the cheese head screws (6.1) evenly, (tightening torques (☞ 33)).
4. Check the height of the screw heads. The screw heads may not be higher than the minimum rotor thickness. We recommend using screws according to DIN 6912, dimensions (☞ 33).

#### Mounting the flange without additional screws

1. Apply the flange (6) to the end shield (15). Check pitch circle and thread of the screw-on bore holes.
2. Mount the brake.

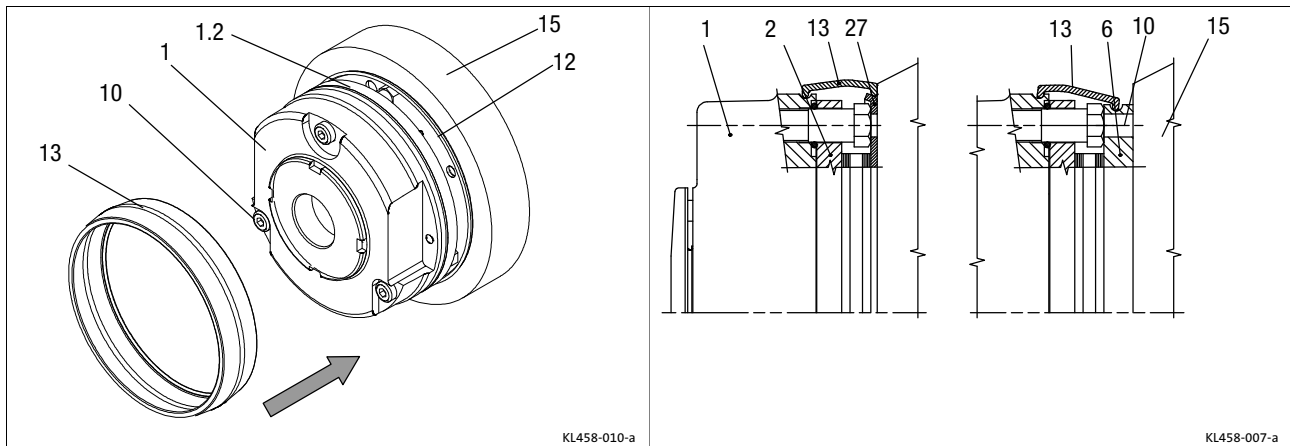
**8.4.6 Assembly of the cover seal**

Fig. 7 Cover ring mounting

1	Complete stator	10	Cheese head screw	15	End shield
2	Armature plate	27	Friction plate		
6	Flange	13	Cover ring		

1. Insert the cable through the cover ring.
2. Push the cover ring over the stator.
3. Press the lips of the cover ring into the groove of rotor and flange.
  - If a friction plate is used, the lip must be pulled over the flanged edge.

**8.5 Repair**

- We recommend having all repairs carried out by the Lenze customer service.

# 9 Troubleshooting and fault elimination

If faults occur during operation of the drive system:

- First check the possible causes of malfunction according to the following table.



### Note!

Also observe the corresponding chapters in the operating instructions for the other components of the drive system.

If the fault cannot be remedied using one of the listed measures, please contact the Lenze Service.



### Danger!

- Only work on the motor when it is deenergised!
- Hot motor surfaces of up to 140 °C. Observe cooling times!
- Remove loads acting on motors or secure loads acting on the drive!





Fault	Cause	Remedy
Motor too hot  Can only be evaluated by measuring the surface temperature: • Non-ventilated motors > 140 °C • Externally ventilated or self-ventilated motors > 110 °C	Insufficient cooling air, blocked air ducts.	Ensure unimpeded circulation of cooling air
	Preheated cooling air	Ensure a sufficient supply of fresh cooling air
	Overload, with normal mains voltage the current is too high and the speed too low	Use larger drive (determined by power measurement)
	Rated operating mode exceeded (S1 to S8 IEC/EN 60034-1)	Adjust rated operating mode to the specified operating conditions. Determination of correct drive by expert or Lenze customer service
	Loose contact in supply cable (temporary two-phase operation!)	Tighten loose contact
	Fuse has blown (two-phasing!)	Replace fuse
	Overload of the drive	<ul style="list-style-type: none"> <li>• Check load</li> <li>• Check winding temperature</li> </ul>
	Heat dissipation impeded by deposits	Clean surface and cooling fins of the drives
Motor does not start	Voltage supply interrupted	Check electrical connection,  23
	Fuse has blown	Replace fuse
	Brake does not release	Check electrical connection,  23 Check air gap,  brake documentation Check continuity of magnetic coil
	Drive blocks	Check components for easy movement, remove foreign particles if necessary
	Motor cable with reverse polarity	Check electrical connection,  23
Incorrect rotating direction of the motor Vibrations	Motor cable with reverse polarity Insufficiently balanced coupling elements or machine Inadequate alignment of drive train Loose fixing screws	Check and correct polarity Rebalance Realign machine unit, check foundation if necessary Check and tighten screw connections
Running noises Surface temperature > 140°C	Foreign particles inside the motor Bearing damage	Repair by manufacturer if necessary
	Overload of the drive Heat dissipation impeded by deposits	Check load Check winding temperature Clean surface and cooling fins of the drives

**10.1 Technical data as specified by ordinances (EU) No. 4/2014 and (EC) No. 640/2009**

This chapter includes the technical data in compliance with the specifications laid down by ordinances (EU) No. 4/2014 and (EC) No. 640/2009.





Annex 1 Clause 2 of ordinance (EC) No. 640/2009 stipulates the publication of the following technical data in the fixed order 1 ... 12:

No.	Meaning
1	Rated efficiency ( $\eta$ ) at 100 %, 75 % and 50 % of the rated load and rated voltage ( $U_{rated}$ )
2	Efficiency level: "IE2" or "IE3"
3	Year of manufacture
4	Name or trademark, official registration number and manufacturer's place of establishment
5	Model number of the product
6	Number of poles of the motor
7	Rated output power(s) or rated output power interval [kW]
8	Rated input frequency (frequencies) of the motor [Hz]
9	Rated voltage(s) or rated voltage interval [V]
10	Rated speed(s) or rated speed interval [rpm]
11	Relevant information for the disassembly, recycling or disposal after the final decommissioning
12	Information regarding the range of operating conditions for which the motor is specially designed:
	i) Altitudes above sea level
	ii) Ambient air temperatures, also for motors with air cooling
	iii) Cooling fluid temperature at the inlet of the product
	iv) Maximum operating temperature
	v) Hazardous areas

Technical data in compliance with ordinance (EC) No. 640/2009												
No.	m200-P/m240-P motors											
1	$\eta_{100\%}$	[%]	82.5	84.1	85.3	86.7	87.7	88.6	89.6	90.4	91.4	92.1
	$\eta_{75\%}$	[%]	81.8	83.5	84.2	85.7	86.2	87.5	90.3	90.5	91.2	91.9
	$\eta_{50\%}$	[%]	78	80.8	81.5	83.8	83.9	85.3	88.6	89.7	89.8	90.9
2			IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3
3			For year of manufacture and week of manufacture see nameplate:  14									
4			Lenze Drives GmbH, Breslauer Straße 3, D-32699 Extertal, GERMANY, HR Lemgo B 6478									
5	Motor code		M24AP 080M04	M24AP 090M04	M24AP 090L04	M24AP 100M04	M24AP 100L04	M24AP 112M04	M24AP 132M04 M20AP 132M04	M24AP 132L04 M20AP 132L04	M24AP 160M04 M20AP 160M04	M24AP 160L04 M20AP 160L04
6	Number of poles		4	4	4	4	4	4	4	4	4	4
7	$P_{rated}$	[kW]	0.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15
8	$f_r$	[Hz]	50	50	50	50	50	50	50	50	50	50
9	$V_{rated}$	[V]	400	400	400	400	400	400	400	400	400	400
10	$n_r$	[rpm]	1440	1445	1435	1446	1453	1450	1460	1477	1478	1470
11			Information regarding the disposal:  11									
12			Permissible installation height:  16									
	i)		Permissible ambient air temperatures:  16									
	ii)		Not relevant, since motors are not liquid-cooled.									
	iii)		Maximum operating temperature: 155 °C (temperature class F)									
	iv)		Operation in hazardous areas prohibited.									
	v)											

# 10 Appendix

Technical data as specified by ordinances (EU) No. 4/2014 and (EC) No. 640/2009

Technical data in compliance with ordinance (EC) No. 640/2009											
No.	m200-P/m240-P motors										
1	$\eta_{100\%}$	[%]	92.6	93	93.6	93.6	93.9	94.2			
	$\eta_{75\%}$	[%]	93.2	93.2	93.7	93.7	94.2	93.9			
	$\eta_{50\%}$	[%]	93.0	92.9	93.4	93.4	93.4	93.1			
2			IE3	IE3	IE3	IE3	IE3	IE3			
3			For year of manufacture and week of manufacture see nameplate:  14								
4			Lenze Drives GmbH, Breslauer Straße 3, D-32699 Extertal, GERMANY, HR Lemgo B 6478								
5	Motor code		M24AP 180M04 M20AP 180M04	M24AP 180L04 M20AP 180L04	M24AP 180V04 M20AP 180V04	M24AP 200M04 M20AP 200M04	M24AP 225M04 M20AP 225M04	M24AP 225L04 M20AP 225L04			
6	Number of poles		4	4	4	4	4	4			
7	$P_{rated}$	[kW]	18.5	22	30	30	37	45			
8	$f_r$	[Hz]	50	50	50	50	50	50			
9	$V_{rated}$	[V]	400	400	400	400	400	400			
10	$n_r$	[rpm]	1483	1480	1478	1478	1483	1482			
11			Information regarding the disposal:  11								
12											
i)			Permissible installation height:  16								
ii)			Permissible ambient air temperatures:  16								
iii)			Not relevant, since motors are not liquid-cooled.								
iv)			Maximum operating temperature: 155 °C (temperature class F)								
v)			Operation in hazardous areas prohibited.								







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