ABM Greiffenberger
Wir treiben Ideen an

Operating manual

for electric motor / gear motor

Status : January, 2013

Electric Motor

Spur Gear Motor

Flat Gear Motor

Table of contents

1. General safety information

1.1. General

Any work for the transport, storage, installation, commissioning and maintenance may be carried out with the personal protective equipment required for the work.

1.2. Explanation of symbols

Signal words:

Signal word field with signal word	Meaning
	Indicates a hazard with a high degree of risk which leads to death or severe injuries if it is not prevented.
	Indicates a hazard with a medium degree of risk, which can lead to death or severe injuries if it is not prevented.
	Indicates a hazard with a low degree of risk which can cause minor or moderate injuries if it is not prevented.

Table 1 : Signal words and their meaning

The safety instructions in this operating manual are structured as follows:

Signal word with illustration
HAZARD ➢ Actions to prevent the hazard

1.3. Personnel

Any work for the transport, storage, installation, commissioning and maintenance must only be carried out by qualified specialist personnel. The binding specifications for the qualification of electrically qualified persons and electrically skilled personnel apply as defined in DIN VDE 0105-100.

1.4. Mechanical hazard

Transport, assembly, commissioning and decommissioning, as well as maintenance and inspection work must only be carried out using the personal protective equipment required for the respective work, and only by trained specialist personnel while the machine is idle, de-energised and cooled off.

1.5. Thermal hazard

⚠ WARNING

HOT MACHINE PARTS

Hot machine parts can cause burns in case of skin contact

- Do not touch hot surfaces!
- If possible, the manufacturer of the complete machine has to provide suitable touch guards!
- Wear the personal protective equipment for maintenance or troubleshooting work!
- Observe the cool-down times!

Electric mains must not be in contact with hot surfaces.

1.6. Magnetic hazard

When using ABM **SINOCHRON®** motors, observe the following:

⚠ DANGER

MAGNETIC FIELD

Due to the strong magnetic field as well as the associated high magnetic attractive forces, hazards to the health especially to persons with a pacemaker can occur. Severe injuries or death can be the result.

- Any work on the drive is forbidden for persons with a pacemaker!

2. General

2.1. General instructions

Before working with the drive, carefully read the operating manual. This way, you ensure a risk-free and smooth function of the drive. The instructions of this operating manual must be observed.

Special designs can deviate in technical details! This operating manual and all associated special documentations must be kept in close proximity to the drive.

2.2. Used terms

Term	Hereinafter used for
Motor	Three-phase motor Single-phase motor Gear motor ABM **SINOCHRON®** motor
Gear	Spur gear Flat gears Special gears
Drive	Motor or gear motor

Table 2 : Used terms

2.3. Modification of the product

The drive itself must not be changed. Adjacent constructions by the customer must not obstruct the heat flow by means of convection and heat conduction. A heat input into the drive from the outside is not allowed.

2.4. Liability and warranty claims

The drive must only be operated in compliance with the specifications in the operating manual.

In case of property and personal damage caused by improper handling or noncompliance with the safety instructions, any liability and warranty claim expires.

2.5. *Addresses*

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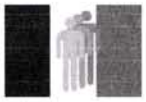

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email: infocn@abm-drives.com

3. Specification

3.1. Construction of the motor (schematic diagram)

Deviations are possible depending on the design.

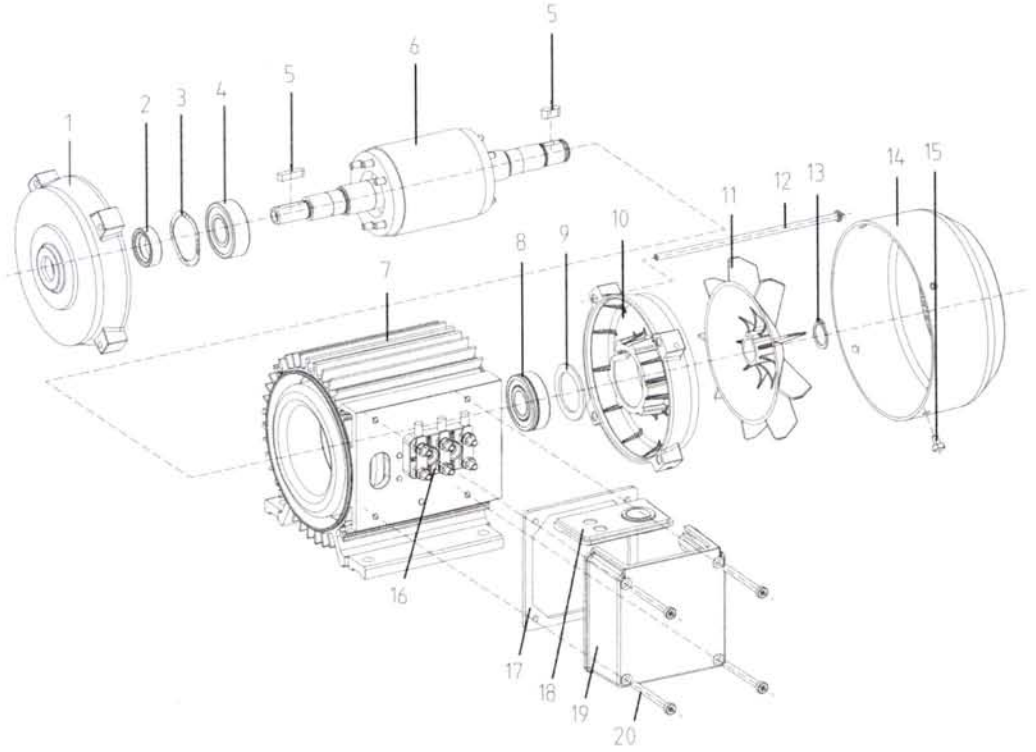
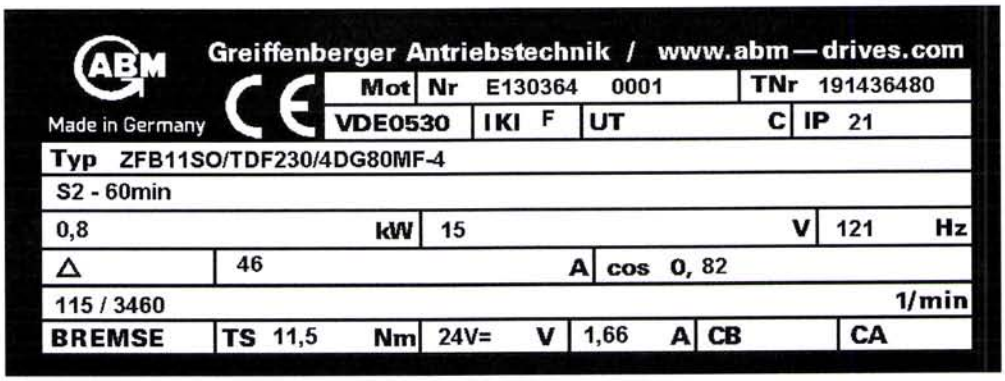


Image 1 : Construction of the motor

[1]	Bearing plate A-side	[11]	Fan
[2]	Shaft seal ring	[12]	Traction screw
[3]	Ball bearing shim	[13]	Locking ring
[4]	Grooved ball bearing	[14]	Fan cowl
[5]	Fitting key	[15]	Hexagon screw
[6]	Rotor	[16]	Terminal board
[7]	Stator	[17]	Seal
[8]	Ball bearing	[18]	Slider
[9]	Adjusting washer	[19]	Terminal box
[10]	Bearing plate B-side	[20]	Cylinder screw

3.2. *Name plate*

Name plate (Example)



Abbreviation		Unit	Designation
Mot			D = three-phase motor E = single-phase motor PM = SINOCHRON® motor
Nr			Serial number
TNr			ABM part number
IKL			Insulation class
UT		°C	Max. allowed ambient temperature
IP			Type of protection
Typ			ABM type designation
			Operating mode
		kW	Motor rated power
		V	Motor connection voltage
		Hz	Frequency motor voltage
			Switching type of the motor (Y / delta)
		A	Rated current of the motor
			Cos-Phi of the motor
		1/min	Rated speed at the motor shaft or gear shaft
Brake	TS	Nm	Braking torque
		V	Brake connection voltage
		A	Rated current of the brake
CB		µF	Operating capacitor for single-phase motors
CA		µF	Starting capacitor for single-phase motors

Table 3 : Field description at the name plate

3.3. *Type designation*

This documentation applies to ABM drives with the following type designation (example):

ZFB100	/	G200F	/	4D132Mc-4
Brake designation		Gear designation		Motor designation

Type designation brake		
See operating manual brake		
Type designation gear		
Gear type	Spur gear	Flat gear
Designation	G = 2-stage 3G = 3-stage GS = special	FG = normal gear FGS = special gear
1. addition	Axle height	A = attachment version
2. addition	V = reinforced	Output torque
3. addition	F = flange	F = flange version
Type designation motor		
Casing key	3 = die-cast case 4 = extruded casing - = bearing plate motor	
Motor type	D = three-phase motor E = single-phase motor PM = Permanent magnet motor	
Variants for single-phase motors	EK = with operating capacitor EKK = with operating and starting capacitor ERKK = with relay, operating and starting capacitor EWR = with auxiliary resistance phase and relay EZKK = with centrifugal switch, operating and starting capacitor DEK = with Steinmetz circuit	
1. addition	K= flywheel L= bearing plate motor (without casing) B= reinforced coil G= non-ventilated F = flange design	
2. addition	Motor size (peak height) and packet length	
3. addition	Number of pins	
4. addition for 1st addition "G"	FL: forced ventilated EL: external ventilation DL: open-circuit ventilated	

Table 4 : type designation ABM drives

3.4. Standards and guidelines

The motors comply with the following standards:

Standard	Title
IEC / EN 60034-1	Rotating electrical machines - part 1: Rating and performance
IEC / EN 60034-5	Rotating electrical machines - part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification
IEC / EN 60034-7	Rotating electrical machines - part 7: Classification of types of construction and mounting arrangements
IEC / EN 60034-8	Rotating electrical machines - part 8: Terminal markings and direction of rotation
IEC / EN 60034-9	Rotating electrical machines - part 9: Noise limits
IEC / EN 60034-14	Rotating electrical machines - part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity
IEC / EN 60204-1	Safety of machinery - Electrical equipment of machines - part 1: General requirements

Table 5 : Standards

If the products fall within their scope, the following guidelines and directives apply:

Number	Abbreviated designation
2006/95/EC	Low-Voltage Directive
2009/125/EC	Ecodesign Directive
2011/65/EU	RoHS directive
Directive EC 640/2009	Implementing directive 2005/32/EC
Directive EC 1907/2006	REACH

Table 6 : Guidelines

Asynchronous motor at sinusoidal mains are considered as electromagnetically passive components because they neither cause faults nor are they error-prone. According to chapter 1 paragraph 1 section 3 of the EMC directive (2004/108/EC), they are therefore excluded from the scope of this directive.

3.5. CE conformity

EU-Declaration of Conformity

Document-No./ Month . Year 01E / 01 . 2013

Hereby we declare for the following product

Electric motors of the series **D.., E.., PM..**	• poss. in combination with the frame size • poss. in combination with the number of poles • poss. in combination with additional components

are in conformity with the essential requirements, which are defined in the following directives:

DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits – in short: **Low Voltage Directive**
DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment – in short: **RoHS-Directive**
DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products – in short: **Ecodesign Directive** *

* where the products fall under the scope of the directive

Relevant harmonised standards used or references to the specifications in relation to which conformity is declared:

Reference	Date	Title
Harmonised standard for the Low Voltage Directive:		
EN 60204-1 +A1	2009-06 2009-02	Safety of machinery. Electrical equipment of machines. General requirements
EN 60034 All relevant parts	Diverse	Rotating electrical machines
Harmonised standard for the RoHS-Richtlinie:		
EN 50581	2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
Implementing measure for the Ecodesign Directive:		
EG 640/2009 + Corr.	2009-07-22 2009-07-23	COMMISSION REGULATION (EC) No 640/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for electric motors
Additional technical specifications applied:		
EN ISO 12100	2010-11	Safety of machinery. General principles for design. Risk assessment and risk reduction

This declaration is given for the manufacturer ABM Greiffenberger Antriebstechnik GmbH, Friedenfelser Str. 24, 95615 Marktredwitz by CEO Robert Lackermeier

Marktredwitz, 15.01.2013
Place, Date

Legal Signature

This declaration is in accordance with the above mentioned specified standards and directives. It does not include a guarantee of characteristics.

Additional information:

1. This declaration is valid for all specimens which are manufactured according the current production drawings – which are component of the technical documents.
2. Asynchronous motors connected to sinusoidal power supply systems are considered to be electromagnetically passive components since the neither cause electromagnetic disturbance no rare affected by such disturbance. According to chapter 1 Article 1(3) of the EMC Directive (2004/108/EG), they are thus excluded from the scope of the Directive.

3.6. *Intended use*

The drives serve the generation of a rotary movement and are intended for commercial plants.

Ambient conditions	Requirement
Ambient temperatures	-15° up to +40 °C
Installation height	≤ 1000 m above sea level
Humidity	Up to 50% (at +40°) Up to 90% (at room temperature)

Table 7 : Operating conditions according to EN 60034-1 or EN 60204-1

The use in explosive areas is forbidden.

An overload can cause damages to the drive. The maximum shaft load allowed for your gear is specified in Annex B.

In order to prevent an overheating of the drive, it must be ensured that sufficient space is available for the unobstructed ventilation. The fan cowls must not be covered. When using several drives in close proximity, it must be ensured that it is possible to prevent a suction of warm exhaust air.

The technical data on the name plate must be observed. The documentation must be complied with. For applications in which the failure of a gear or motor could cause a danger to persons, corresponding safety precautions must be provided.

The motor is no independently functional machine and it is intended for the integration into another machine. The commissioning is prohibited until it has been determined that the machine complies with the regulations of the EC directives.

3.7. *Optional modules*

If your drive is equipped with a brake, please observe the supplementary operating manual. This manual will also specify the B_{10d} characteristics pursuant to EN ISO 13849-1.

The safety characteristics for the variant with rotary encoder are specified in Annex E.

4. Preparation of the drives for operation

4.1. *Shipment and packaging*

The motor is delivered with suitable packaging. The outer packaging is taken back.

Incoming control:

- Check the completeness on the basis of the delivery note!

Is the packaging damaged?

- Check the delivery for damages (visual inspection)!

In case of complaints

If the delivery was damaged during transport:

- Contact the forwarding agent immediately!
- Keep the packaging (due to a possible inspection by the forwarding agent, or for the return of the goods)!

Packaging for the return of the goods

- Pack the motor shockproof.

4.2. *Transport and storage*

During transport, motors (from size 100) and all gear motors must only be suspended at the provided lifting eyes. Do not attach additional loads to the motor. Only use suitable **lifting means**. Improper execution, unsuitable or damaged devices and tools can cause injuries and/or property damage.

⚠ DANGER

FALLING OBJECTS

In case of improper transport, the drive could detach from the transport and lifting gear. Falling objects can cause severe injuries.

➢ Staying underneath the drive during transport is forbidden!

➢ Ensure secure fastening!

The following points must be observed for the storage:

- Storage in installation position, protect the drive against falling
- Slightly lubricate blank casing surfaces and shafts
- Store in dry, dust-free rooms
- Temperature without considerable fluctuations between -25°C and +55°C
- Relative humidity less than 60%
- No direct sunlight or UV light
- No aggressive, corrosive materials (contaminated air, ozone, gases, solvents, acids, lye, salts, radioactivity etc.) in the surroundings
- No shocks and vibrations.

4.3. *Mechanical installation*

The mechanical connection of the electric motor has to be carried out by a specialist. Only carry out work at the drive when it is switched off and secured against restart.

Before the installation, check the installation situation. Shearing and crushing points must be avoided when handling the drive.

Also observe the following when using ABM **SINOCHRON®** motors:

⚠ CAUTION

MAGNETIC FIELD

Due to the magnetic forces, injuries can be caused by attracted tools

- ➢ Hold on to the tools tightly!
- ➢ Bring them closer to the motor slowly!
- ➢ Wear work gloves!

Assembly

The following must be observed during assembly:

- Mount the drive on an even, vibration-free locating surface. All fastening bases and flanges must rest flush in order to prevent bracings of the motor casing or gear casing.

- Ensure a free cooling air supply. The distance between motor air inlet and walls, components etc. must be at least 40 mm.

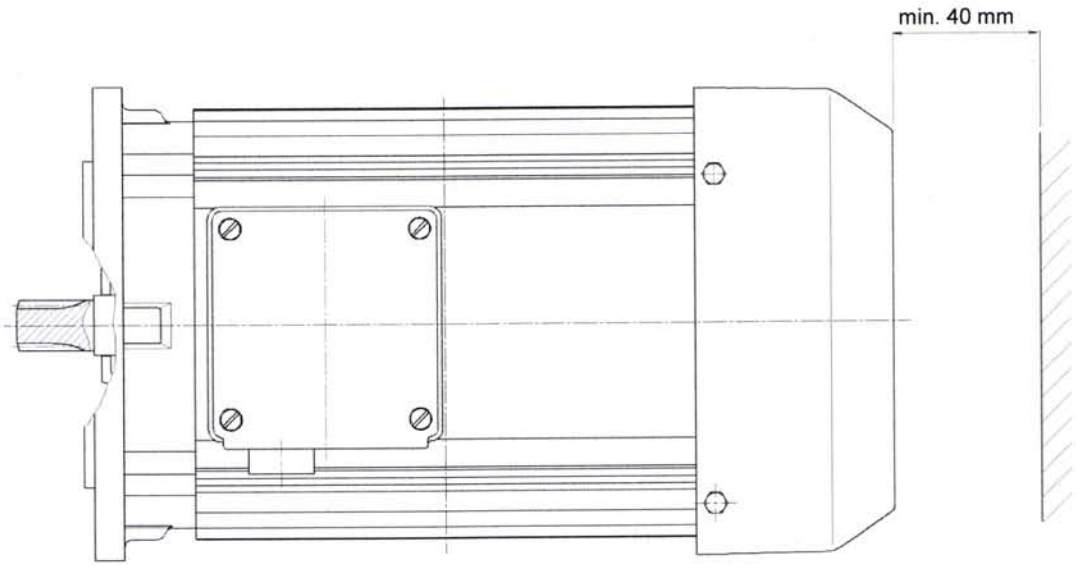


Image 2 : Minimum distance from the fan cowl

- The airflow direction is from the B-side towards the A-side. The escaping exhaust air must not be sucked in again immediately. The air inlets and outlets must be kept free from dirt.

- Ensure that existing condensate bores are located at the lowest point of the motor. Protect them against contaminations. If required, remove the plastic sealing plugs (if available).

- Remove the rust protection coating from the shaft ends. When removing the rust protection, no solvents may penetrate into the bearings.

- Mount the transmission element to the motor / gearbox drive shaft.

- The cylindrical shaft ends are equipped with a centring device whose thread enables the fitting of the transmission element. Always use suitable devices for the fitting and removal. Avoid vibrations and shocks during assembly. In case of a force effect, the bearings will be damaged.

- Only use elastic couplings. Rigid couplings require a precise alignment of the shafts.

- When using transmission elements which cause radial and axial shaft loads during operation, observe the allowed loads. If not specified in the data sheet, the specifications are stipulated in Annex B.

⚠ DANGER

MOVING PARTS

Rotating parts can cause injuries

- ➢ Equip the transmission elements with a safety device!
- ➢ Observe the design guidelines of "DIN EN ISO 12100" and the safety distances pursuant to "DIN EN ISO 13857"!

- Product-specific characteristics must be observed when selecting add-on components (fixtures) and for the later use of the complete machine:

Balancing

Only for the assembly of the drive element onto the motor shaft:

Ensure the correct balancing type of the drive element according to the balancing type of the motor shaft (F- or H-balancing). The shafts are balanced according to DIN ISO 1940-1.
The marking is indicated on the Name plate behind the product number.

Marking	Balancing type
F	Balanced with full fitting key
H	Balanced with half fitting key

Table 8 : Balancing type

Couplings, pulleys, gear wheels etc. must be balanced on an even shaft without fitting key (other balancing types only after previous agreement).

Alignment

In coupling operation, align the shafts axially and radially against each other.

Fit dial gauges.
Measure at four measuring points, which are each offset by 90°, while rotating **both** coupling halves at the same time.

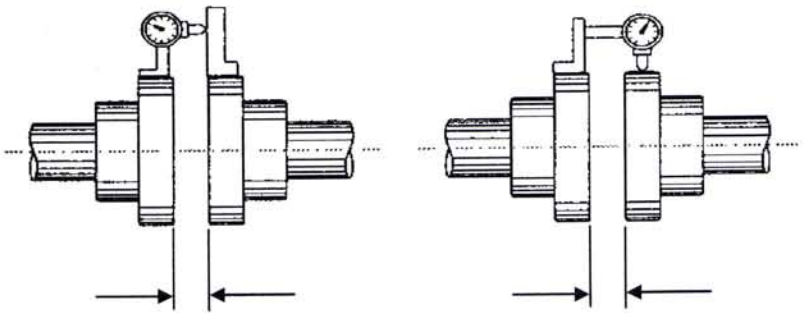
Check the alignment at **operating temperature**.

Axial measurement

- Balance the discrepancy by placing sheet metal plates underneath.
- Do not exceed remaining inaccuracies of 0.03 mm, based on a measuring circle of 200 mm.

Radial measurement

- Balance differences by displacement or by placing sheet metal plates underneath.
- Do not exceed remaining inaccuracies of 0.03 mm, based on a measuring circle of 200 mm.
- Carry out the adjustment of the axial air between the coupling halves according to the specifications of the coupling manufacturer.



Axial measurement
(angular offset)

Radial measurement
(angular offset)

Image 3 : Measurement of angular offset

4.4. *Electrical installation*

⚠ DANGER

ELECTRIC SHOCK

Electrical parts are energized with hazardous voltage. When touching these parts you will get an electric shock. Death or severe injuries are the result.

- Any work for electrical installations must only be carried out by qualified specialists!
- Connecting work must only be carried out in de-energized condition!

- Compare the mains voltage and mains frequency with the data on the rating plate. The allowed mains voltage fluctuation is ±10%.
- Adjust the cross-sections of the connecting cables to the nominal current pursuant to the regulations.
- Connect and arrange the connection terminals according to the connection plan on the inside of the terminal box.
- Ensure that all connections including ground wire are tightly screwed.
- In order to avoid a tensile load of the terminals, mount the connection cables strain-relieved.
- No foreign matters, dirt or humidity may enter the terminal box.
- In order to ensure the type of protection when closing the terminal box, use the original seals.
- Only use screw connections and locking screws made of insulating material for the bushing bores at the plastic terminal box.
- Close unused cable entries in a dust- and waterproof manner.

4.5. Commissioning

- Before commissioning, ensure that the drive is undamaged and non-choked. Ensure the proper installation of the safety devices.

- In order to check the rotational direction, switch the properly connected motor in uncoupled condition "On/Off" for a short time.

- In order to avoid inadmissible switching current and torque jerks, the switching from Y- to delta start-up may only be effected is the starting current of the Y-step has decayed.

- Connect integrated temperature sensors (PTC thermistor or bimetal temperature sensor) to the control device. If a continuity test of the temperature sensors is required, this must be carried out with a measuring bridge (max. 5 V).

- During the test run under maximum load, the gear must be checked for:
  4.1.1. Unusual noises such as milling, knocking or grinding noises
  4.1.2. Unusual vibrations, oscillations and movements
  4.1.3. Generation of steam and smoke
  The drive must be shut down and ABM must be contacted if an abnormality was determined during the aforementioned check tests.

- After the test run, the gear must be checked for leaks.

4.6. Commissioning after longer downtimes

- After longer downtimes (longer than 1 year), check the screw connections and bearings before the commissioning.

- Ensure that cooling airways, especially the openings of the fan cowls, are free from contaminations

- Before commissioning, replace the lubricant in the gear.

- Measure the insulation resistance. The maximum discharge current of the coil against the casing at 1500 V test voltage for the motors in supplied condition is 10 mA. The measurement must be carried out by a correspondingly qualified employee.

5. Operation

5.1. Safety instructions

⚠ DANGER

MOVING PARTS

Rotating parts can cause injuries

- Never reach into moving parts and keep foreign materials away from these parts!
- Safety devices must be provided by the manufacturer of the complete machine and must not be removed or put out of operation!
- Observe the safety distance!

During operation, motor surfaces must not be touched. The surfaces at the drives can become very hot. If required, provide a touch guard!

⚠ WARNING

HOT MACHINE PARTS

Hot machine parts can cause burns in case of skin contact

- Do not touch hot surfaces!
- Observe the cool-down times!

Carry out regular checks during the operation, depending on the operating conditions.
In doing so, pay special attention to:

- Unusual or excessive noise or temperature generation,
- Loose fixing elements,
- The condition of the electric mains,
- Stronger vibrations,
- Changes in the rotational speed,
- Problems with the heat removal due to depositions on the drive system.

In case of faults, contact the maintenance personnel immediately.

5.2. *Error diagnosis and fault removal*

⚠ DANGER

ELECTRIC SHOCK

Electric parts

Electrical parts are energized with hazardous voltage. When touching these parts you will get an electric shock. Death or severe injuries are the result.

- Any repair work must only be carried out by qualified specialists!
- Connecting work must only be carried out in de-energized condition!

Fault	Possible cause	Remedy
Motor does not start	Fuse has blown	Replace the fuse
	Motor protection has tripped	Check the motor protection for correct adjustment, readjust if necessary
	Motor protection does not switch, error in the control	Check the control of the motor protection, remove error
	Power supply interrupted	Check connections, adjust if necessary
	Counter torque of the load is too big	Check load and reduce if necessary (check application)
	Voltage or frequency deviate severely from the target value, at least when switching on	Provide better mains conditions; check the cross-section of the supply line
	Coil defective	Repair by manufacturer
	Rotor streaks	Repair by manufacturer
	Drive blocked	Check components for free movement; remove foreign materials from the motor, if necessary
Motor does not start in Y-connection but in delta connection	Torque in Y-connection not sufficient	Unless the delta starting current is too high, switch on directly; otherwise you need a larger motor or special equipment after consultation

Fault	Possible cause	Remedy
	Contact error on the Y-delta connection	Remove the error
Blow when switching on	Motor coupling defective	Replace elastomer gear rim,
	Gear fixture loose	Re-tighten the motor and gear fixture screws
	Rubber element defective	Replace rubber element
Wrong rotational direction	Motor connected incorrectly	Interchange the two phases
Gearbox drive shaft does not rotate although the motor is rotating	Breakage in the gear	Contact ABM-Service
	Motor coupling defective	Contact ABM-Service
	Shrink disc slips through	Contact ABM-Service
Motor hums and has a high power consumption	Coil defective	Repair by manufacturer
	Rotor streaks	Repair by manufacturer
Running noises	Foreign materials inside the motor	Cleaning of the interior, possibly by the manufacturer
	Bearing damage	Installation of new grooved ball bearings, possible repair by manufacturer
	Gearing damage	Contact ABM-Service
	Oil deficiency	Contact ABM-Service
	Vibrations	Remove cause, balance if necessary
Motor gets too hot	Motor switched in delta instead of Y, as intended	Correct the switching
	Overload of the drive	Check load and reduce if necessary
	Insufficient cooling air, cooling airways blocked	Ensure free inlet and outlet of the supply air

Fault	Possible cause	Remedy
Motor gets too hot	Cooling air is preheated	Provide fresh air
	Ambient temperature too high	Provide fresh air
	Heat removal impaired due to deposits	Clean the surface of the drives
	Power supply deviates from the rated motor voltage by more than 5%. Higher voltage is particularly unfavourable for multi-pin motors because for these motors, the no-load current is already close to the nominal current at a normal voltage.	Provide the correct power supply
Gear gets too warm	Unfavourable installation conditions	Contact ABM-Service
	Gear damage	Contact ABM-Service
Oil escapes from the gear or motor	Seal defective	Contact ABM-Service
Oil escapes from pressure ventilation	Incorrect oil level	Oil change
	Dirty oil	Oil change

Table 9 : Error diagnosis

6. Maintenance

6.1. Safety instructions

⚠ DANGER

ELECTRIC SHOCK

Electrical parts are energized with hazardous voltage. When touching these parts you will get an electric shock. Death or severe injuries are the result.

- Any maintenance work must only be carried out by qualified specialists!
- Maintenance work must only be carried out if the system is de-energised and secured against restart!

⚠ WARNING

HOT MACHINE PARTS

Hot machine parts can cause burns in case of skin contact

- Do not touch hot surfaces!
- Observe the cool-down times!

Please also observe the following when using ABM **SINOCHRON®** motors:

⚠ CAUTION

MAGNETIC FIELD

Due to the magnetic forces, injuries can be caused by attracted tools

- Hold on to the tools tightly!
- Bring them closer to the motor slowly!
- Wear work gloves!

Please also ensure that no foreign materials reach the inside of the motor during repair work.

6.2. *Maintenance*

⚠ WARNING

FUMES

Chemical cleaning agents can be corrosive or develop hazardous fumes. Breathing difficulties, irritation or poisoning can be the result.

- Use the personal protective equipment!
- Observe the warning notices of the cleaning agent producer!

⚠ CAUTION

DUST

When cleaning with compressed air or steam jet, dirt particles can be raised and inhaled, or they can reach into the eyes

- Use the personal protective equipment!
- Ensure proper extraction!

Maintenance intervals	Maintenance work
	Maintenance work for the machine operator:
Regularly	Depending on the dirt, clean the motor regularly along the entire cooling airway.
	Maintenance work for specialist personnel:
Every 3000 operating hours, at least every six months	• Check oil level • Visual check for leakages • Check the coupling • Re-lubricate • Check the gear for abnormal running noises and / or vibrations
Every 3 years	• Oil change (for mineral oil)
Every 5 years	• Oil change (for synthetic oil)

Table 10 : Maintenance work

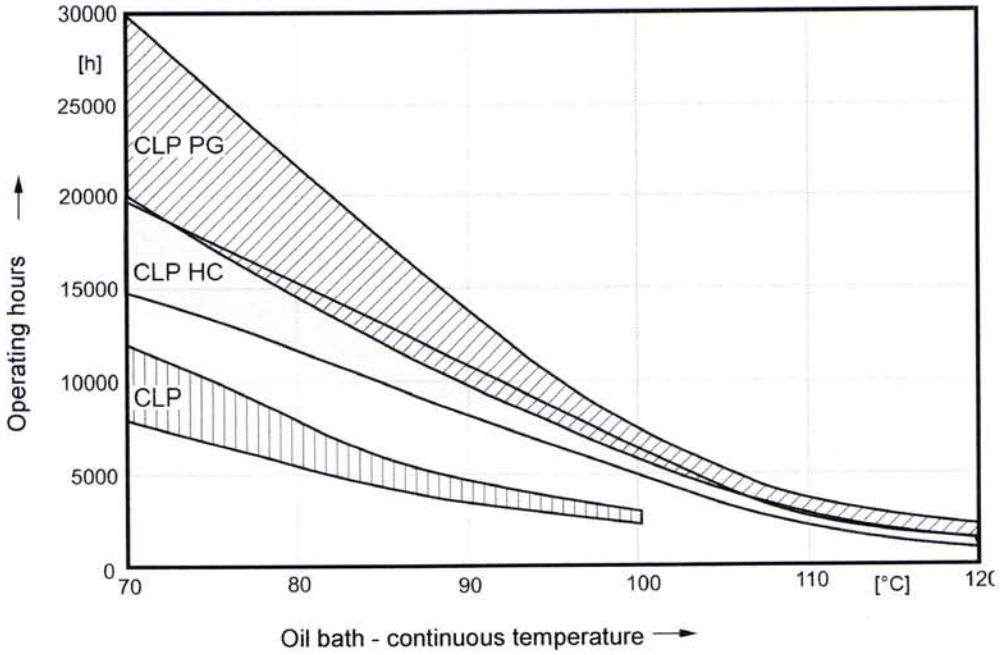


Image 4 : Oil change interval for normal operating conditions

We recommend shortened change intervals in case of particularly difficult operating conditions such as high humidity, aggressive environment, severe temperature fluctuations, etc.

Our gear motors are delivered ready-to-use. The first lubricant filling ex works lasts for approx. 10,000 operating hours for oil filling, for grease filling approx. 8,000 operating hours.

For quantity and type of the lubricant, please see Annex C. In doing so, observe the instructions in your data sheet. When changing the lubricant, the gear must be cleaned thoroughly.

⚠ DANGER

HOT OIL

In case of contact with hot oil, there is a risk of scalding

- Open the discharge carefully!
- Wear the personal protective equipment!

Ensure that no dirt reaches the inside of the gear when changing the lubricant. Remove bypassing oil immediately using an oil binding agent.

6.3. *Spare parts*

We expressly point out that spare and equipment parts, which were not delivered by ABM, were also not tested and approved by ABM.

The installation and / or use of such products could therefore have a negative impact on the constructive properties of your drive. The liability of the manufacturer is excluded for damages arising from the use of non-original spare parts and non-original equipment.

Request a separate spare parts drawing and list for your drive.

7. Decommissioning and disposal

7.1. Decommissioning

- First, remove the electrical connections

⚠ DANGER

ELECTRIC SHOCK

Electrical parts are energized with hazardous voltage. When touching these parts you will get an electric shock. Death or severe injuries are the result.

- ➢ Any electrical work for the decommissioning must only be carried out by qualified specialists!
- ➢ Electrical work must only be carried out if the system is de-energised and secured against restart!

- For gear with oil filling: remove the lubricant
- Remove the drive from the machine
- Transport the drive to the work station prepared for the disassembly. Observe the Instruction in the chapter "Transport"
- Protect the drive and the components against falling when disassembling

⚠ DANGER

FALLING OBJECTS

Falling objects can cause severe injuries.

- ➢ Ensure secure fastening!

7.2. *Recycling and disposal*

Divide the components into the following category for recycling:

- Electronic scrap
- Iron scrap
- Aluminium
- Non-ferrous metal such as motor coil
- Insulation material, cables
- Permanent magnets (for ABM **SINOCHRON®** motor)

Divide the auxiliary materials into the following category for recycling:

- Oil
- Grease
- Anticorrosive agents

The permanent magnets must be demagnetised before the disposal. This prevents hazards which are caused by the permanent magnets during and after the disposal. Permanent magnets are demagnetized by heating up.

Dispose of the components in compliance with the national and local regulations.

8. List of images

9. List of tables

10. Index

Annex

A Constructions

A1 Electric motors

The constructions of the ABM electric motors comply with the standardization regulations DIN EN 60034-7.

Terminal box position:

The illustrations (image A-1 and A-2) show the terminal box position A, B, C and D.

If no specification is made upon order placement, the motor is delivered in terminal box position A. Terminal box positions B, C and D are delivered upon customer request.

The cable inlet can only be rotated by 90° for terminal boxes made of plastic. It is only partly possible for aluminium boxes (request).

Foot design:

Example for terminal box position and cable inlet

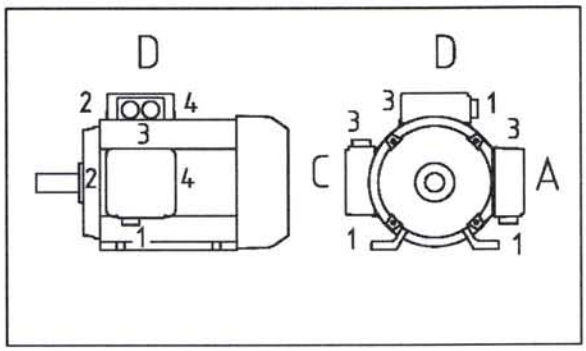


Image 5 : Terminal box position, foot design

Flange design:

Example for terminal box position and cable inlet

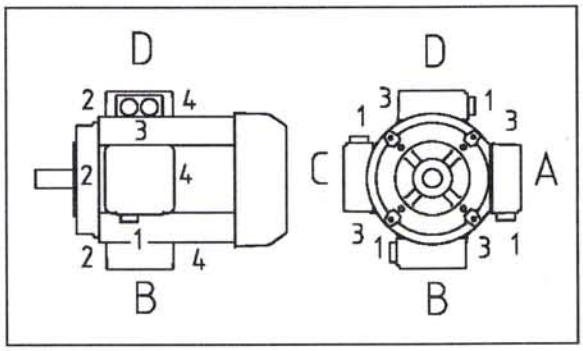


Image 6 : Terminal box position, flange design

Constructions with horizontal shaft arrangement

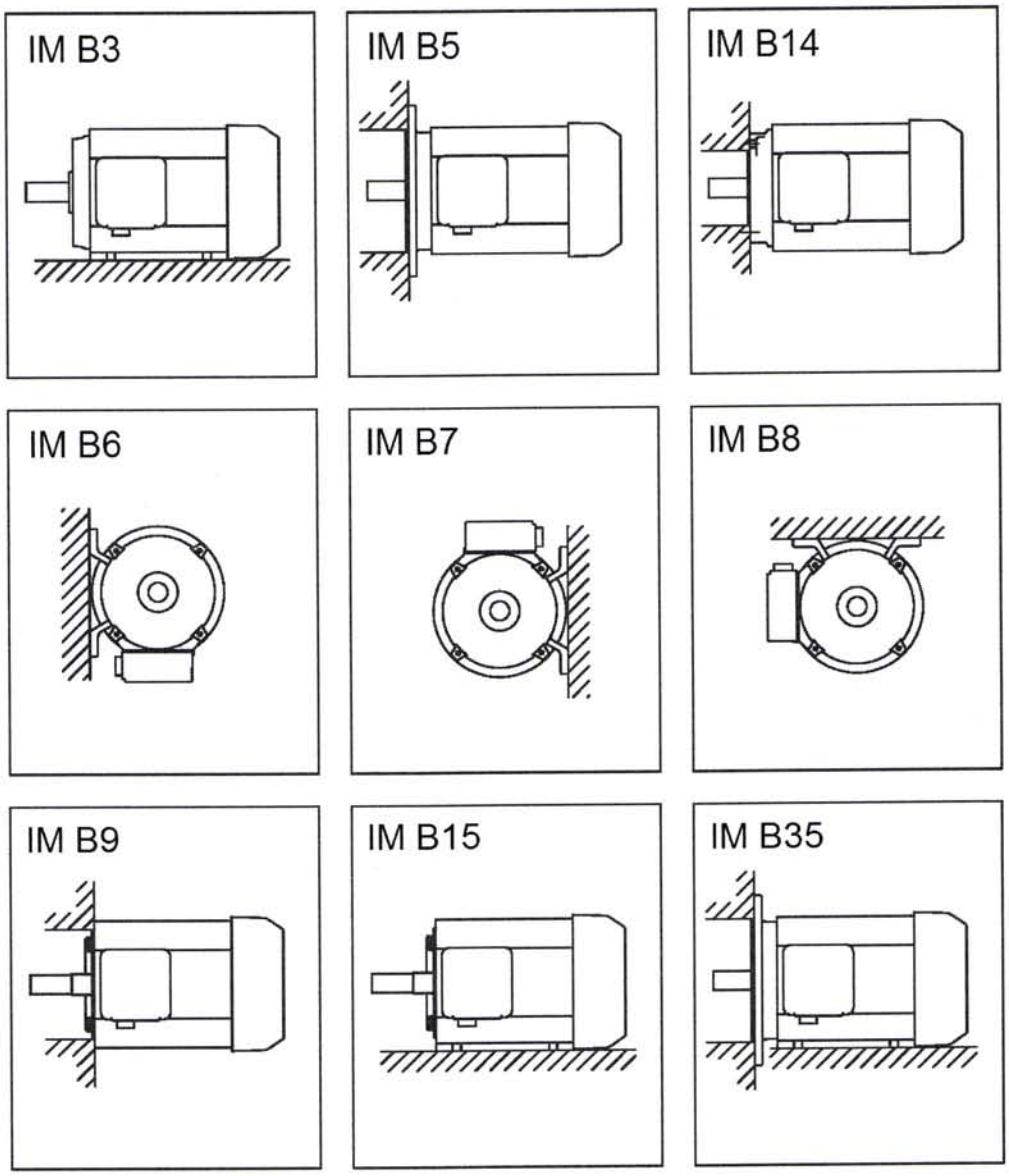


Image 7 : Constructions electric motors with horizontal shaft arrangement

Constructions with vertical shaft arrangement

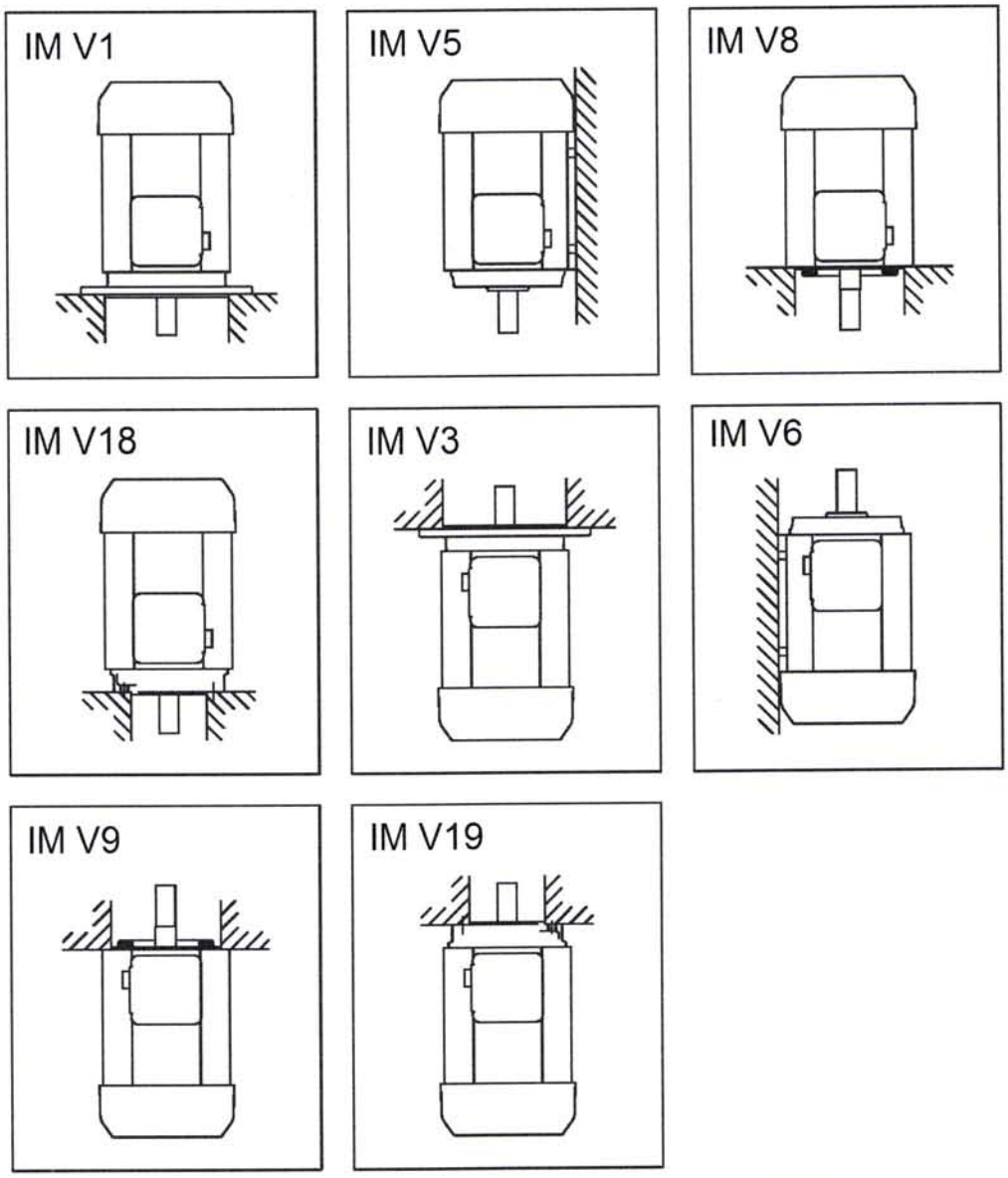


Image 8 : Constructions electric motors with vertical shaft arrangement

A2 Spur gear motors

For the constructions of the ABM electric motors, see A1, image 7

Marking:

 = Oil fill plug

 = Oil level check plug

 = Oil drain plug

Constructions with horizontal shaft arrangement

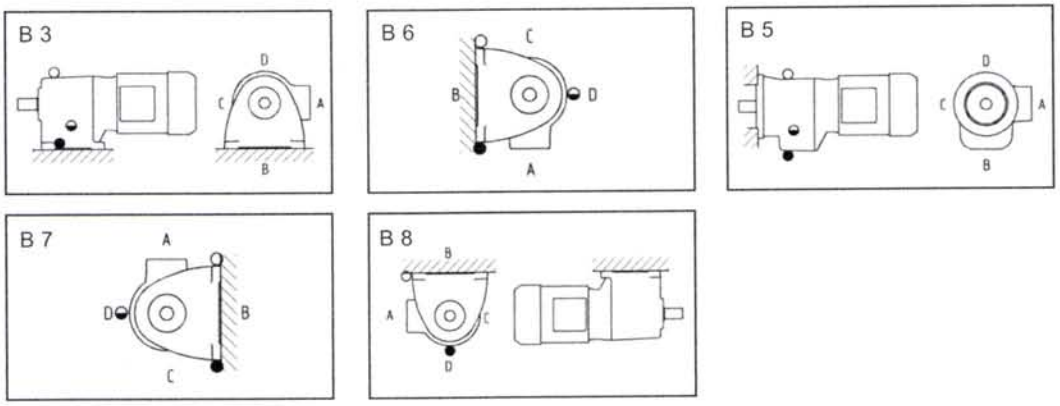


Image 9 : Constructions spur gear motors with horizontal shaft arrangement

Constructions with vertical shaft arrangement

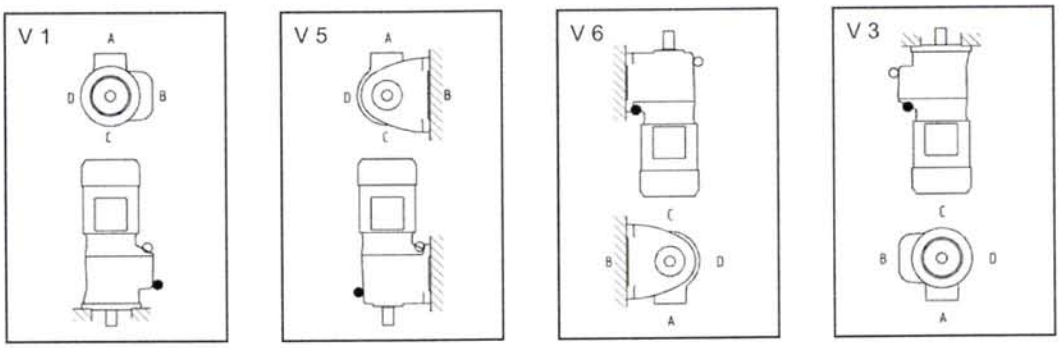


Image 10 : Constructions spur gear motors with vertical shaft arrangement

A3 Flat gear motors

For the constructions of the ABM electric motors, see A1, image 7

The illustration shows the standard design. The shown constructions are also valid for flange and journal shaft design.

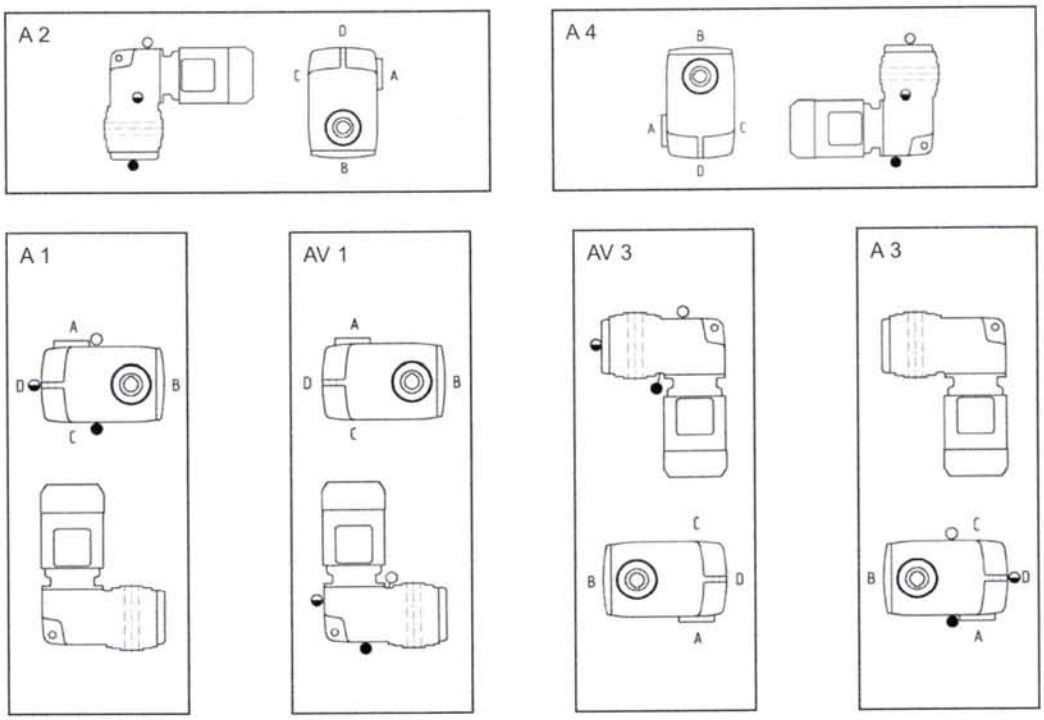


Image 11 : Constructions of flat gear motors

The oil drain plug is always located at the bottom and corresponds to the installation position of the gears.

B Allowed radial forces

B1 Electric motors

The data refer to the centre of the standard shaft end at the drive side, for operation with 50 Hz

Design size	Fr [N]			
	2-pin	4-pin	6-pin	8-pin
56	230	270	310	-
63	230	300	350	380
71	260	320	370	400
80	350	450	520	560
90	550	750	860	920
100	770	950	1090	1170
112	900	1110	1270	1360
132	1140	1400	-	-
160	-	2500	2800	3100

Table 11 : Allowed radial forces for electric motors

B2 *Spur gear motors*

Radial forces refer to the centre of the short shaft end. Valid for 90°. Axial forces traction or pressure at level towards the output shaft. If radial and axial forces occur simultaneously, please check back.

For normal bearing:

Gear		Motor output in kW							
		0.12	0.18	0.25	0.37	0.55	0.75	1.1	1.5
G71	Fr	700	700	700	700	600	500	-	-
	Fa	500	500	500	500	400	300	-	-
G80	Fr	1600	1400	1400	1400	1100	1100	1100	1000
	Fa	1000	1000	1000	1000	1000	1000	1000	1000
G90	Fr	3000	3000	3000	2500	2000	2000	1500	1500
	Fa	2500	2500	2500	2000	2000	2000	1500	1500
G100	Fr	3000	3000	3000	2800	2000	2000	2000	1500
	Fa	2500	2500	2500	2000	2000	2000	1500	1500
G112	Fr	4500	4500	4500	4500	4000	4000	3000	2500
	Fa	3500	3500	3500	3500	2500	2500	2000	2000
G132	Fr	8000	8000	8000	8000	7000	7000	6000	5000
	Fa	5000	5000	5000	5000	4000	4000	3000	3000
G160	Fr	10000	10000	10000	10000	10000	10000	7500	7000
	Fa	7000	7000	7000	7000	7000	7000	5500	4500
G180	Fr	17500	17500	17500	17500	17500	17500	15000	13000
	Fa	10000	10000	10000	10000	10000	10000	9000	8000
Gear		Motor output in kW							
		2.2	3.0	4.0	5.5	7.5	11.0	15.0	18.5	22.0
G90	Fr	1000	1000	-	-	-	-	-	-	-
	Fa	1000	1000	-	-	-	-	-	-	-
G100	Fr	1500	1000	1000	-	-	-	-	-	-
	Fa	1500	1000	1000	-	-	-	-	-	-
G112	Fr	2000	2000	1500	1500	-	-	-	-	-
	Fa	2000	1500	1500	1500	-	-	-	-	-
G132	Fr	5000	4000	3500	3000	3000	-	-	-	-
	Fa	2500	2000	2000	1500	1500	-	-	-	-
G160	Fr	6000	5000	4000	4000	3000	2000	1500	-	-
	Fa	3500	3000	2500	2000	1500	1000	1000	-	-
G180	Fr	12000	10000	9000	8000	7000	5500	4500	4000	3000
	Fa	8000	8000	8000	7000	6000	3000	2500	2000	1500

Table 12 : Permissible forces for spur gear motors (standard bearing)

For reinforced bearing (possible from G90):

Gear		Motor output in kW							
		0.12	0.18	0.25	0.37	0.55	0.75	1.1	1.5
G90	Fr	3000	3000	3000	3000	3000	2500	2500	2500
	Fa	3000	3000	3000	3000	3000	2500	2500	2500
G100	Fr	3200	3200	3200	3200	3200	3000	3000	3000
	Fa	3000	3000	3000	3000	3000	3000	2500	2500
G112	Fr	6000	6000	6000	6000	5000	5000	4000	4000
	Fa	5000	5000	5000	5000	4000	4000	3000	3000
G132	Fr	9000	9000	9000	9000	9000	8000	7000	6000
	Fa	7000	7000	7000	7000	7000	7000	6000	5000
G160	Fr	12500	12500	12500	12500	12500	12500	12500	11000
	Fa	10000	10000	10000	10000	10000	10000	10000	9000
G180	Fr	24000	24000	24000	24000	24000	24000	22000	20000
	Fa	15000	15000	15000	15000	15000	15000	14000	12000
G200	Fr	27000	27000	27000	27000	27000	27000	25000	23000
	Fa	18000	18000	18000	18000	18000	18000	16000	14000
G225	Fr	30000	30000	30000	30000	30000	30000	30000	30000
	Fa	20000	20000	20000	20000	20000	20000	20000	20000

Gear		Motor output in kW								
		2.2	3.0	4.0	5.5	7.5	11.0	15.0	18.5	22.0
G90	Fr	2500	2000	-	-	-	-	-	-	-
	Fa	2500	2000	-	-	-	-	-	-	-
G100	Fr	3000	2500	2000	-	-	-	-	-	-
	Fa	2500	2000	2000	-	-	-	-	-	-
G112	Fr	3000	3000	3000	3000	-	-	-	-	-
	Fa	3000	2000	2000	2000	-	-	-	-	-
G132	Fr	6000	5000	4000	3500	3000	-	-	-	-
	Fa	5000	4000	3000	2500	2500	-	-	-	-
G160	Fr	10000	9000	7000	6000	5000	4000	3000	-	-
	Fa	8000	7000	5000	5000	4000	3500	3000	-	-
G180	Fr	18000	15000	12000	12000	10000	9500	8000	7000	6000
	Fa	10000	10000	9000	8000	7000	6000	5000	5000	4000
G200	Fr	21000	17000	14000	13000	12000	11000	10000	9000	8000
	Fa	13000	13000	12000	11000	10000	9000	8000	6000	5000
G225	Fr	30000	27000	25000	22000	20000	19000	18000	17000	15000
	Fa	20000	17000	15000	12000	10000	9000	8000	7000	5000

Table 13 : Permissible forces for spur gear motors (reinforced bearing, up to G225)

B3 *Flat gear motors*

The permissible radial force is stated based on the nominal service life for normal running conditions of the hollow shaft bearing according to DIN ISO 281. Fr is dependent on the output torque T_2 [Nm], on the output speed n_2 [min^{-1}], and on the distance x [mm]. The calculation applies to the least favourable force application angle and is dependent on the rotational directions. Fr is applied on the non-motor side.

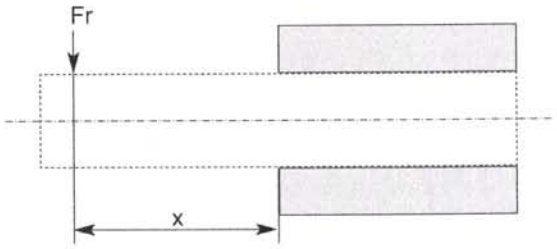


Image 12 : Radial force and distance X

The calculation of Fr is only valid for $n_2 > 9\ min^{-1}$.

$$Fr = \frac{K_1 * \frac{1}{\sqrt[3]{n_2}} - K_2 * T_2}{x + K_3} (N)$$

Gear type	K_1	K_2	K_3
FGA53	$6.9 * 10^5$	600	61.5
FGA103	$9.8 * 10^5$	644,5	68
FGA252 / FGA253	$2.4 * 10^6$	1259	111.5
FGA422 / FGA424.3	$2.3 * 10^6$	908	94
FGA423 / FGA424.4	$2.3 * 10^6$	540	94
FGA453	$2,3 * 10^6$	908	94
FGA952 / FGA954.3	$5.9 * 10^6$	900	131.5
FGA1353 / FGA1354.3	$5.9 * 10^6$	490	131.5

Table 14 : Factors for the calculation of the radial force for the flat gear

C Lubrication

C1 *Lubricant amounts*

Spur gear with horizontal shaft arrangement

Type		Construction								
		Foot B3, B6, B7 Oil filling in cm³			Foot B8 Grease filling in cm³			Flange B5 Oil filling in cm³		
Two-stage	Three-stage	Two-stage	Three-stage		Two-stage	Three-stage		Two-stage	Three-stage	
			Main stage	Pre-stage		Main stage	Pre-stage		Main stage	Pre-stage
G 71		100			80			100		
G 80		130			100			140		
G 90	3 - G90 / 71	200	200	60	160	160	50	180	180	60
G 100	3 - G100 / 71	280	280	100	220	220	80	250	250	100
G 112	3 - G112 / 80	400	400	100	320	320	80	400	400	100
G 132	3 - G132 / 90	600	600	160	480	480	120	550	550	160
G 160	3 - G160 / 100	1000	1000	250	800	800	200	800	800	250
G 180	3 - G180 / 100	1400	1400	250	1100	1100	200	1200	1200	250
G 200	3 - G200 / 132	2100	2100	450	1600	1600	350	1800	1800	450
G 225	3 - G225 / 132	3000	3000	450	2400	2400	350	2500	2500	450

Table 15 : Lubricant amounts for spur gears (1)

Spur gears with vertical shaft arrangement

Type		Construction					
		Foot B3, B6, B7 Grease filling in cm³			Foot B8 Grease filling in cm³		
Two-stage	Three-stage	Two-stage	Three-stage		Two-stage	Three-stage	
			Main stage	Pre-stage		Main stage	Pre-stage
G 71		100			100		
G 80		230			230		
G 90	3 - G90 / 71	340	340	100	340	340	100
G 100	3 - G100 / 71	420	420	150	420	420	150
G 112	3 - G112 / 80	800	800	150	800	800	150
G 132	3 - G132 / 90	1000	1000	200	1100	1100	200
G 160	3 - G160 / 100	1600	1600	270	1700	1700	270
G 180	3 - G180 / 100	2100	2100	270	2500	2500	270
G 200	3 - G200 / 132	3200	3200	650	3500	3500	650
G 225	3 - G225 / 132	4800	4800	650	5000	5000	650

Table 16 : Lubricant amounts for spur gears (2)

Flat gears

Type	Construction											
	A1		A2		A3		A4		AV1		AV3	
	Oil	Grease	Oil	Grease	Oil	Grease	Oil	Grease	Oil	Grease	Oil	Grease
FG 103★	400	450	400	450	400	450	400	450	400	450	400	450
FG422	900	1100	1000	1200	900	1100	800	1000	900	1100	1100	1300
FG423	900	1100	1000	1200	900	1100	800	1000	900	1100	1100	1300
FG424	900	1100	1000	1200	900	1100	800	1000	900	1100	1100	1300
FG453	900	1100	1000	1200	900	1100	800	1000	900	1100	1100	1300
FG424 / FG424 Primary gear stage	100	120	100	120	100	120	100	120	100	120	100	120
FG952 / FG954	1300	1500	2800	3200	1900	2200	1800	2100	1800	2100	3000	3500
FG1353 / FG1354	1300	1500	2800	3200	1900	2200	1800	2100	2200	2500	2500	2900
FG954 / FG1354 Primary gear stage	170	200	170	200	170	200	170	200	170	200	170	200

Table 17 : Lubricant amounts for flat gears

★ Preferred lubricant for FG 103: ISO VG 680 CLP

C2 Lubricants

Gear oils								
Type	Temp.*	ISO VG	ARAL	bp	Castrol	FUCHS	Mobil	
CLP	0...40°C	220	Degol BG 220	Energol GR-XP 220	Alpha EP 220	Renolin CLP 220	Mobilgear 600 XP 220	Omala S2 G 220
CLP	-10...25°C	100	Degol BG 100	Energol GR-XP 100	Alpha EP 100	Renolin CLP 100	Mobilgear 600 XP 100	Omala S2 G 100
CLP	0 ... 40°C	680	Degol BG 680	Energol GR-XP 680	Alpha EP 680	Renolin SEW 680	Mobilgear 600 XP 680	Omala S2 G 680
PG	-35...80°C	220	Degol GS 220	Enersyn SG-XP 220	Alphasyn GS 220	Renolin PG 220	Glygoyle HE 220	Tivela S 220
PG	-30...80°C	460	Degol GS 460	Enersyn SG-XP 460	Alphasyn GS 460	Renolin PG 460	Glygoyle HE 460	Tivela S 460
HC	-30...60°C	220	Degol PAS 220	-	Optigear Synthetic X220	Renolin Unisyn CLP 220	Mobil SHC 630	Omala 220 HD
			Observe the instructions on the data sheet of your drive!					

Getriebefette								
Type	Temp.*	NLGI	ARAL	LEU Energie	Castrol	FUCHS	Mobil	
min.	-25...60°C	00	FDP 00	-	Olit CLS 00	Renolit S2	Mobiltemp SHC 32	Aero Shell Grease 16
PAO	-30...130°C	00	-	EP 00	-	-	-	-
			Observe the instructions on the data sheet of your drive!					

Table 18 : Lubricant table

*Temp = recommended temperature range – can be surpassed or under passed depending on the application

Notes:

- CLP : Mineral oil, lubricating oil
- PG : Synthetic oil (polyglycol)
- HC : Synthetic oil I (Lubricant on the basis of poly-alpha-olefin - PAO)

D Screw tightening torques

Thread	Strength class of screw connection			Terminal board / steel nuts	Terminal board / brass nuts
	8.8	10.9	12.9		
M4	3.2	5	6	1,5	1,5
M5	6.4	9	11	2,4	3
M6	11	16	19	3,75	5
M8	27	39	46	7,5	10
M10	53	78	91		
M12	92	135	155		
M16	230	335	390		
M20	460	660	770		
M24	790	1150	1300		
Tolerance of all tightening torques = ±15% Delivery status for teminal boards: upper nut tightened with reduced moment					

Table 19 : Screw tightening torques in Nm

Tightening torques for traction screws of motors

Thread	M4	M5	M6	M8	M10
Tightening torque	1,8	3,8	6,5	16	32
Tolerance of all tightening torques = ±15%					

Table 20 : Tightening torques for traction screws of motors in Nm

Tightening torques for motors with frame size 160 and 180 (flange mounting)

Motor frame size	160	180
Tightening torque	25	35
These screws have to be additionally secured with Loctite 243		

Table 21 : Tightening torques for motors with frame size 160 and 180

E Safety parameters for rotary encoder

Definition of the safety parameter $MTTF_d$:

$MTTF_d$ (Mean Time To Dangerous Failure) is a statistical variable and is defined in the standard EN ISO 13849-1 as "Expected value of the mean time until the dangerous failure".

This emphasizes that it is a statistical variable, which is an empirically generated value. This value is not related to a "guaranteed service life" or a "failure-free time".

Type	Company	Designation	$MTTF_d$ [hours]
Sensor bearing	SKF	BMB/BMO	166,000,000
Rotary encoder	Baumer IVO	GM400 / 401	722,126
	Hengstler	AC 58	1,400,000
	Leine Linde	RSA 698	1,875,000
	VS Sensorik	HMX 2	1,042,000
	VS Sensorik	HDI 2 - NE - M142	1.226.400

Table 22 : Safety parameters for rotary encoders