rexroth
A Bosch Company

Project Planning Manual

MKE
Synchronous Servomotors

acc. to ATEX Directive 2014/34/EU

R911411017, Edition 01

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DOK-MOTOR*-MKE*GEN3***-PR01-EN-P DC-AE/EPI5 (jw, mb)

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1 About this documentation

1.1 Editions of this documentation

This documentation explains the product characteristics, application possibilities, operating conditions and the operational limits of the motors, contains the technical data of the available motors and provides information on product selection, handling and operation.

Table 1: Record of Revisions

Edition	Release date	Notes
DOK-MOTOR*-MKE*GEN3***-PR01-EN-P	04/2021	First edition

1.2 Presentation of information

Safety instructions

The safety instructions in this documentation include signal words (danger, warning, caution, note) and a signal symbol (acc. to ANSI Z535.6-2006).

The signal word is intended to draw your attention to the safety instructions and describes the seriousness of the danger. The warning triangle with exclamation mark indicates the danger for persons.

⚠ DANGER	Non-compliance with this safety instructions **will** result in death or severe personal injury.
⚠ WARNING	Non-compliance with this safety instructions **can** result in death or severe personal injury.
⚠ CAUTION	Non-compliance with this safety instructions **can** result in moderate or minor personal injury.
NOTICE	Non-compliance with this safety instructions **can** result in material damage.

Safety symbols

In the documentation, the following internationally standardized safety signs and graphic symbols are used. The meaning of the symbols is described in the table.

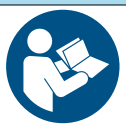
Table 2: Meaning of safety signs

Safety symbols	Meaning
	Warning against dangerous electric voltage
	Warning against hot surfaces
	Warning against rotating machine parts
	Warning against overhead load
	Electrostatic sensitive devices
	No access for persons with cardiac pacemakers or implanted defibrillators.
	Do not carry along metal parts or clocks.

Safety symbols	Meaning
	Hammer scales are forbidden

Meaning of symbols

Table 3: Meaning of symbols

Symbol	Meaning
	Reference to supplementary documentation
	Explosion protection identification
	The UL Recognized Component Mark identifies recognized component parts which are components of a bigger product or system.
	The letters “C” and “E” stand for “Conformité Européenne”. The CE-marking expresses the conformity of a product with relevant EC-regulations.
SI	Components for the use in systems for “integrated safety technique” prepared.
	The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

Markup

The following markups are used for a user-friendly text information representation:

Reference to supplementary documentation

Remark

This note gives important information, which must be observed.

- Listings on the first level contain a bullet point
  - Listings on the second level contain a dash

Instruction

Instruction

➡ Result of one instruction

Instruction multilevel

1. Action step one
2. Action step two

➡ Result of an instruction

Please comply with the order of the handling instructions.

2 Safety instructions

2.1 Important directions on use

2.1.1 Intended use

Prerequisites for proper and safe use of the motors are proper transport, appropriate storage, proper assembly and connection, careful maintenance, operation and overhaul.

The motors are suited for proper use in hazardous areas according to **ATEX Directive 2014/34/EU**.

The motors have been designed for installation in industrial machinery. The motors are according to the following standards.

Standards	
EN IEC 60079-0	Potentially explosive areas – Part 0: Equipment – General requirements
EN 60079-1	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”
EN 60079-31	Potentially explosive atmosphere – Part 31: Equipment dust ignition protection by enclosure “t”

The machine manufacturer must evaluate the electric and mechanic safety as well as environmental influences in the assembled state of the machine according to the Machine Directive 2006/42/EC and DIN EN 60204-1 (safety of machines).

The electrical installation must comply with the protection requirements of EMC Directive 2014/30/EU. The plant manufacturer is responsible for appropriate installation (for example: physical separation of signal and power cables, using shielded cables, ...). The EMC instructions of the converter manufacturer must be observed.

The machine may not be commissioned before conformity with these directives has been confirmed.

2.1.2 Electrostatic sensitive devices (ESD)

The motors contain parts which underlie an electrostatic danger. These components, especially temperature sensors of the motor winding can be destroyed by improper use.

Avoid, e.g. direct contact of open wires or contacts of the connection cable of temperature sensors without being electrostatically discharged or grounded.

Remark

Do suitable ESD protective measures before you handle imperiled components (e.g. ESD protective clothes, wristlets, conductive floor, grounded cabinets and working surfaces).

2.2 Qualification of personnel

Any work with or on the described product may only done by qualified or skilled personnel. For the purpose of this manual, qualified personnel means persons who are familiar with transporting, installing, mounting, commissioning and operating the components of the electrical drive and control system and the associated hazards and have an appropriate qualification for their job. Qualification of personnel contains knowledge and observance of the specifications in DIN EN 60079-14.

All persons working on, with or in the vicinity of an electrical system must be informed of the relevant safety requirements, safety guidelines and internal instructions (EN 50110-1).

2.3 General safety instructions

Do not install or operate motors or components of the electric drive and control system before you have not carefully read all delivered documents.

Please observe the particular applicable national, local and system-specific regulations, the safety instructions in the documentation and the warning and informative labels on the motors.

Improper use of the motors and failure to follow the safety instructions in this document may result in material damage, personal injury, electric shock or, in extreme cases, to death!

In the case of damage due to non-observance of the safety notes, Bosch Rexroth assumes no liability.

Applications for functional safety are only allowed if the motors have the SI sign on the rating plate.

2.4 Product- and technology-dependent safety instructions

2.4.1 Protection against explosion hazard

Product use only in hazardous areas according to the specified labeling on the product

This product is only allowed to be used in an area of use which is specified on the type plate according to the explosion protection standards. In the case of several ATEX designations labelled on the type plate, likelike gas and dust protection, please observe that during operation only one hazardous atmosphere occurs (no combination of several). Simultaneous occurrence of gas and dust Ex atmospheres is not permitted.

Do any maintenance in non-hazard atmosphere.

Observe the conditions on use

Observe the notes in the application conditions and do not exceed the specified limit values.

Observe residual risks

Specified residual risks and special using conditions must be evaluated by the plant manufacturer and operator according to the product application. This makes own measures necessary to prevent risks.

2.4.2 Protection from electric voltage

Work required on the electric system may only be carried out by skilled electricians. Tools for electricians (VDE tools) are absolutely necessary.

Before working:

- Enable.
- Secure against reactivation.
- Ensure de-energization.
- Ground and short-circuit.
- Cover or shield any adjacent live parts.

After completing the job, cancel the measures in reverse order.

Dangerous voltage occurs during operation! Danger to life, risk of injury by electric shock!

- Before start-up, connect the protective conductors on all electric components according to the connection plan.
- Operation, even for short measuring purposes is only allowed with fixed connected protective conductor on the specified points of the components.

2.4.3 Protection from mechanical danger

Dangerous movements! Danger to life, risk of injury, heavy injury or material damage.

- Do not stay within the motion zone of the machine. Avoid unauthorized access into the danger zone.
- Additionally secure vertical axes to prevent them from sinking or descending after having shutdown the motor, for instance as follows:
  - Mechanically lock the vertical axis,
  - providing an external braking / catching / clamping device, or
  - ensure sufficient weight compensation of the axes.

  Only using the serially delivered **motor holding brake** or an external holding brake activated by the drive controller **is not suitable for personal protection!**

Rotating parts! Danger to life, risk of injury, heavy injury or material damage.

- Secure key and/or transmission elements against ejection.
- Install covers on dangerous rotating machine parts before start-up.

2.4.4 Protection against magnetic and electromagnetic fields

Health hazard for persons with active body aids or passive metallic implants and for pregnant women.

Magnetic and electromagnetic fields are created in the direct environment of live conductors or permanent magnets of electro motors and are a serious danger for persons.

Observe the country-specific regulations. For Germany, please observe the specifications of the occupational insurance association BGV B11 and BGR B11 regarding “electromagnetic fields”.

- For persons with active body aids (like heart pacemakers), passive metallic implants (like hip prosthesis) and pregnant women possible hazards exist due to electro magnetic or magnetic fields in direct environment of electric drive and control components and the corresponding live conductors.

  Access into these areas can be dangerous for these persons:
  - Areas, in which components of electrical drive and control systems and corresponding live conductors are mounted, activated or operated.
  - Areas in which motor parts with permanent magnets are stored, repaired or assembled.
- Above mentioned persons must contact their attending physician before entering these areas.
- Please observe the valid industrial safety regulations for plants which are fitted with components of electrical drive and control systems and corresponding live conductors.

Crushing hazard of fingers and hands due to strong attractive forces of the magnets!

- Handle only with protective gloves.

Risk of destruction of sensitive parts! Data loss!

- Keep watches, credit cards, check cards and identity cards and all ferromagnetic metal parts, such as iron, nickel and cobalt away from permanent magnets.

2.4.5 Protection against ignitable electrostatic discharges

Danger of explosion due to electrostatic discharge

Electrostatic discharges may ignite gases, vapors and dust. Electrostatic charges may be caused e.g. by the following processes:

- electrostatic painting
- pneumatically conveyed dust or bulk material
- hydraulically conveyed or flowing liquids and droplets
- mechanically driven belts, brushes and films, etc.

Danger of explosion due to highly charge-generating processes

Highly charge-generating processes may cause bush discharges or propagating bush discharges and lead to explosions. This must be prevented. This, in turn, may lead to death, severe injury and damage to property.

Carry out cleaning work only with a moist cloth

Clean the motor with a moist cloth to avoid electrostatic charge. Rubbing with non-conductive materials must be avoided to prevent electrostatic charges resulting in ignition hazards.

2.4.6 Protection against burns

Risk of burns due to hot motor surfaces!

- Avoid contact with hot motor surfaces. **Temperatures may rise over 60 °C**.
- Allow the motors to cool down long enough before touching them.
- Temperature-sensitive components may not come into contact with the motor surface. Ensure appropriate mounting distance of connection cables and other components.

2.4.7 Electrostatic sensitive devices (ESD)

The motors contain parts which underlie an electrostatic danger. These components, especially temperature sensors of the motor winding can be destroyed by improper use.

Avoid, e.g. direct contact of open wires or contacts of the connection cable of temperature sensors without being electrostatically discharged or grounded.

Remark

Do suitable ESD protective measures before you handle imperiled components (e.g. ESD protective clothes, wristlets, conductive floor, grounded cabinets and working surfaces).

3 Explosion protection

3.1 Product description

Three-phase synchronous motors of type MKE037, -047, -098, -118 operate with drive systems and are designed in the ignition protection flameproof enclosure "db" and "tb". These motors are fitted with three temperature sensors within the winding to keep the temperature class.

The housing is made of aluminum / aluminum die casting. Cooling is done via heat exchange of the open coolant circuit by temperature difference between housing and surrounding coolant (air).

The motors can be fitted with a holding brake and with a Multiturn or Singleturn encoder.

MKE motors are supplied with dummy plugs without sealings. The electrical connection is made via connecting cables, which are fed into the terminal box via Ex cable glands (Ex-KLE) and connected to terminals. The terminal box has threaded openings for Ex-KLE for connecting power and encoder cables. The Ex cable and line entries as well as the connection cables must be selected by the machine manufacturer or operator on the basis of the applicable regulations and installed according to the manufacturer's specifications.

3.2 ATEX labeling for MKE motors (gas)

Designation for use in areas with gas-hazardous:

⟨Ex⟩ II 2G Ex db IIB T4 Gb

Code	Meaning
⟨Ex⟩	Symbol Ex
II	Equipment group II which is suitable for all potentially explosive areas other than firedamp-endangered excavations
2	Equipment in category 2 is intended for use in areas which has to be calculated that an explosive atmosphere of gas, dust, fog, or dust/air mixtures can occur occasionally.
G	G = gas
Ex	The European standard for explosion protection has been applied.
db	Flameproof enclosures (for EPL Gb)
IIB	Group II electrical equipment is intended for use in areas where explosive gas atmospheres ("B": typical gas is ethylene) are likely to occur, except for firedamp-prone mine workings.
T4	Maximum surface temperature 135 °C
Gb	Equipment Protection Level (EPL) Classification Gb for equipment with "high" level of protection for use in gas explosive atmospheres where there is no risk of ignition during normal operation or foreseeable failures/malfunctions.

3.3 ATEX labeling for MKE motors (dust)

Designation for use in potentially explosive dust atmospheres:

⟨Ex⟩ II 2D Ex tb IIIC T135°C Db

Code	Meaning
⟨Ex⟩	Symbol Ex
II	Equipment group II which is suitable for all potentially explosive areas other than firedamp-endangered excavations
2	Equipment in category 2 is intended for use in areas which has to be calculated that an explosive atmosphere of gas, dust, fog, or dust/air mixtures can occur occasionally.
D	D = dust
Ex	The European standard for explosion protection has been applied.
tb	Protection by housing (for EPL Db);

IIIC	Electric devices of group IIIC are intended for use in areas where an explosive dust atmosphere (C: conductive dust) must be expected, excerpt areas susceptible to fire damp.
T135°C	Maxmimum surface temperature 135 °C
Db	Equipment Protection Level (EPL) Classification Db for equipment with "high" level of protection for use in combustible dust atmospheres where there is no risk of ignition during normal operation or foreseeable failures/malfunctions.

3.4 Specific conditions

⚠ WARNING

Explosion hazard and danger to life, or substantial property damage!

All used **components and accessory parts** must fulfill the requirements for explosion protection according to the 2014/34/EU directive.

The **conditions on use** given in this documentation must be taken into account for any project planning and be observed during operation.

Notes about test number

The EC type test certificate number for MKE motors is designated by the "X" in the declaration of conformity and on the type plate. This marking is an indication of special conditions that must be observed in conjunction with the safety and health requirements specified in the underlying standards. The following special conditions must be observed for the safe operation of the motors in the plant:

- The permissible ambient temperature range is 0 ... 40°C.
- The gap width and length acc. to EN 60079-1, were exceed or fall below.
- A repair of flameproof gaps must be done regarding the specifications of the manufacturer. A repair according to the values in EN 60079-1 is not allowed.
- Maintenance and repair of motors must exclusively be done by the certified Rexroth service.
- Screws with at least strength class 8.8 must be used to close off the flameproof enclosure (housing, terminal box, ...).
- Only those components required for the installation and mounting of components (Ex cable glands, connecting parts, ...) are approved which technically comply with the standards of the Declaration of Conformity, are suitable for the operating conditions and have a separate certificate. Observe the special conditions of the components.

3.5 Application conditions ATEX device group II, category 2

3.5.1 Maximum housing temperature

The maximum housing temperature is 115 °C on the motor housing at an ambient temperature of 40 °C. The ignition temperatures of substances coming into contact with the motors must not fall below 135 °C. Observe external heat and cooling sources when determining the operation temperature. Project-specific electrical/thermal evaluations must be carried out by the customer if they deviate from the Bosch Rexroth specification. If necessary, project-specific metrological verifications are required that reflect the actual ambient conditions at the place of use.

3.5.2 Connection conditions

The motors can be operated with Bosch Rexroth controllers. In the case of using drive controllers of other manufacturers, the following special conditions must be fulfilled➥Chapter 10.2 “Operation on foreign converters ”

on page 84. Depending on the drive controller or third-party converter used, function-tested tripping devices with the Ex II 2 G or Ex II 2 D designation may be required to evaluate the temperature sensors.

3.5.3 Grounding

The motors must be grounded via a motor cable and via a second separate ground conductor with minimum **4 mm²** cross section. Check the proper installation of the protective and ground conductor connection before startup.

- Protective conductor motor cable
- Ground conductor see ➦Chapter 9.7 “Ground connection” on page 80

The redundant protective conductor installation ensures a safe drain of occurring discharge currents even in error case (e. g.. at interrupted protective conductor).

3.5.4 Corrision

Prevent motor corrosion which can occur due to aggressive substances like certain coolants and lubricants as well as cutting oils or salt mist.

3.5.5 Switch-off

Energies stored in the intermediate circuit have to be reduced or insulated as soon as possible through the activation of the emergency stop device, so that in the case of a failure the risk of an effect into the danger zone is reduced directive 2014/34/EU).

For example, this can be achieved as follows:

- Reduce the energy via an intermediate short circuit. For information on the DC link short-circuit function, refer to the documentation of the control device; when using third-party inverters, contact the manufacturer.
- Isolation of the energies before they are transferred into the potentially explosive atmosphere by isolating the voltage of the lines and motors present in the potentially explosive atmosphere.

3.5.6 Residual risks

The existing residual risks are to be observed by the user, when the installation is designed.

- Overstress
  - When the motor is overloaded, including cases where errors in the mechanical or electrical equipment of the machine cause such overloading, high temperatures may occur that result in explosion hazards.
- Operation in explosive dust atmosphere.
  - An operation in explosive dust-atmosphere can built a layer on the motor during a residence time, which does no longer ensure a sufficient motor cooling.
- Grounding and discharge currents
  - Variable-speed drive systems cause unavoidable discharge currents. Please observe a proper installation of protective conductor and potential equalization line. In the case of interrupted protective conductor and potential equalization line due to occurring error cases during operation or faulty connections, for example, can raise sparks on transition points.
- Temperature monitoring
  - The failure of the single-channel temperature monitor in the device system may occur, as the result of an error, and might not be detected, even if the motor is operated within the normal temperature range and load cycle.

3.5.7 Emergency stop

Accumulated energy in the drive controller must be dispersed or isolated as quickly as possible when the **emergency shutdown system** is actuated, so that the risk of an effect into the danger zone is reduced in the event of a failure. (Directive 2014/34/EU,, appendix II, chapter 1.6.2)

The user has the following possibilities:

- The isolation of the energy from the drive unit output is ensured if, in addition to switching off the power, the drive control unit is electronically disabled in the event of an emergency shutdown. This is done by switching off the mains contactor with subsequent fault reaction of the actuator due to the mains failure (see F281). The user must set the required drive-side fault response on the drive unit using the drive parameters (see P-0-0119) in accordance with the functional description.
- To ensure that the encoder supply lines are also voltage-free, the control voltage of the drive unit must also be switched off.

If the control voltage and power are switched off at the drive unit, the output on the motor side is automatically electronically interlocked via the output stage and possible stored energies in the DC link are thus isolated on the output and motor side.

- If it is possible, the DC link short-circuit can be used to quickly dissipate the energies in the DC link of the drive unit after disconnection from the mains.

Irrespective of these possibilities, the user must always check with a suitable measuring device whether parts of the system are still under residual voltage (e. B. caused by residual energies of capacitors in filters and drive units, etc.) before working on the system - as specified in the safety instructions. Wait for their discharging time.

Other environmental factors

Observe the notes regarding the dangers due to external interference such as , for example:

- Operation within the permissible ambient conditions
- Vibration and shock load
- Protection of protective conductor connections against dirt, corrosion, moisture and/or aggressive materials, etc.

4 Identification

4.1 Type plate

The type plate is provided for identification of the motor and contains all significant electric data, serial number, manufacturing date, mark of conformity, manufacturer information and the classification according to ATEX directive 2014/34/EU.

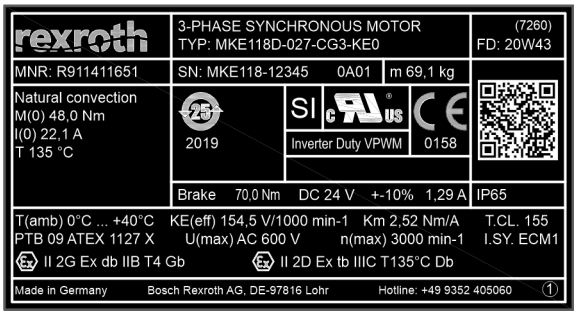


Fig. 1: Type plate MKE (example)

Remark

Before installing the motor, make sure that it is marked accordingly and has a sufficiently high protection class for your application.

Table 4: Type plate specification MKE

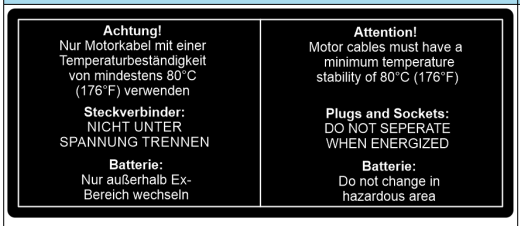
Symbol	Meaning
3-PHASE SYNCHRONOUS MOTOR	Type of machine / product
TYPE	Type designation
FD	Manufacturing date
MNR	Material number (Rexroth product)
SN	Serial number
m	Mass
Natural convection	Cooling mode, natural convection
M(0)	Standstill torque - 60K
I(0)	Standstill current - 60K
T 135 °C	Maximum surface temperature
SI	Use in systems for “Integrated Safety Technology” prepared.
Inverter Duty VPWM	Supply by converter (**V** = Voltage-indirect converter) and PWM control process (**P**ulse **W**idth **M**odulation)
Brake	Holding brake data (optional)
IP65	Degree of protection IPxx
Tamb	Ambient temperature during operation
KEeff	R.m.s. voltage constant
Km	Torque constant
T.CL.	Thermal class
PTB...	EC type test certificate number (ATEX) of the notified body
U(max)	Maximum voltage UL
n(max)	Maximum speed
I.SY.	Insulation system identification
Ex	ATEX labeling explosion protection (gas) II 2G ATEX labeling explosion protection (dust) II 2D
Manufacturer information	Made in Germany / Bosch Rexroth AG, 97816 Lohr, Germany / Hotline +49 9352 405060

Table 5: Meaning of marks of conformity

Certification mark	Meaning
c UL us	The UL Recognized Component Mark (UL recognized) identifies recognized component parts which are components of a bigger product or system. The recognition refers to the UL standards 1004-1 „Rotating electrical machines –General requirements“, UL 1004-6 „Servo and stepper motors“, CSA C22.2 No. 100 „Motors and generators“.
CE 0158	The CE-marking confirms the conformity of a product with relevant EC-regulations. The conformity of MKE motors is confirmed according to low voltage directive 2014/35/EU, ATEX directive 2014/34/EU, EN 60034–1 and EN 60034–5. In addition, the (4-digit) identification number of the notified body is indicated
25 2021	Motors labelled with the symbol EFUP 25 (enviromental-friendly use period) can be used for 25 years as intended before substances limited in their concentration according to China RoHS2 may leak and subsequently pose a risk to environment and health. The year of manufacturing is notified under the symbol.

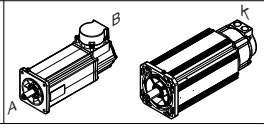
4.2 Safety instructions on the product

Please note the safety and prohibitive sign on the motor. The sign significance is explained in the following.

Information	Meaning
	**Caution** Use motor cables with a thermal stability of at least 80°C (176°F). **Plug connector** Never disconnect plug connectors under load **Battery** Change only outside of hazardous areas.
	**Motor damage due to strikes onto the motor shaft** Do not strike the shaft end and do not exceed the allowed axial and radial forces of the motor.
	**Hot surfaces with temperatures over 60 °C may cause burns** Let the motors cool down before working on the motors or in close proximity to the motors. The thermal time constant stated in the technical data is a measure for the cooling time. Cooling down can require up to 140 minutes. - Wear safety gloves. - Do not work on hot surfaces.

5 Features and functions

5.1 Basic data

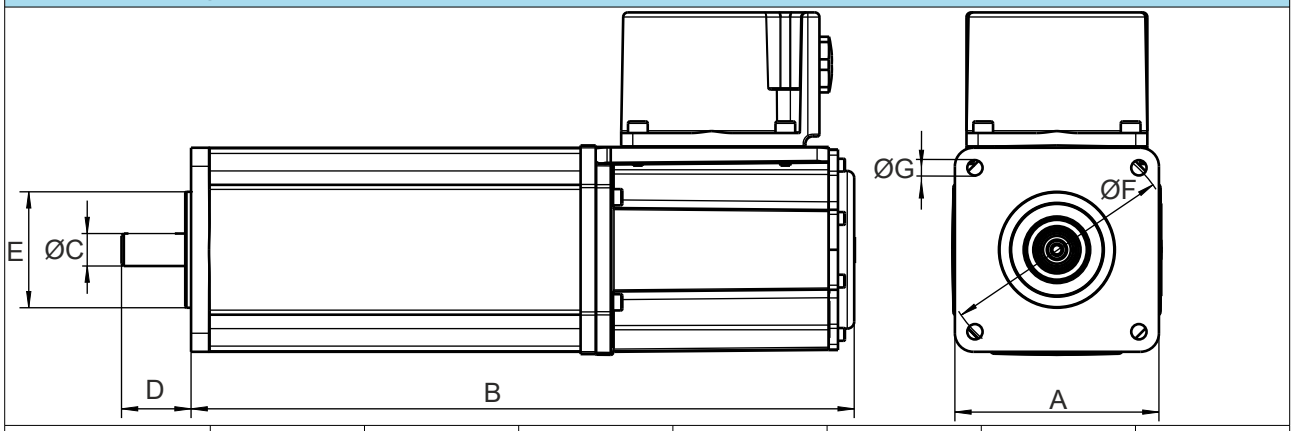
Product	3~ PM motor
Type	MKE
Ambient temperature during operation	0 ... 40 °C (without de-rating)
Degree of protection (IEC 60529)	IP65 with shaft sealing ring
Cooling mode (EN 60034-6)	IC410, Self-cooling
Motor design (EN 60034-7)	IM B5
Coating	Varnish RAL 9005
Flange	similar to DIN 42948
Shaft end	Cylindrical (DIN 748 part 3), centering hole with thread “DS” (DIN 332 part 2), Optional with keyway (full-key balancing)
Concentricity, run-out, alignment	Standard tolerance N (DIN 42955)
Oscillating quantity level	Level A (EN 60034-14) up to the rated speed
Installation altitude	0 ... 1000 m above MSL (without derating)
Sound pressure level	MKE037 ... MKE1180: < 75 dB(A) +3 dB(A)
Thermal class	155 (F) (EN 60034-1)
Encoder system	A (optically, Singleturn Hiperface, 128 signal periods) B (optical, Singleturn EnDat 2.1, 2,048 signal periods) C (optically, Multiturn Hiperface, 128 signal periods) D (optical, Multiturn Hiperface, 2,048 signal periods)
Electrical connection	Terminal box
Holding brake (option)	Electrically released U_N 24V DC (±10%)
Motor ends, position of the electrical connection	 A: A side (Drive End **DE**) B: B side (Non Drive End **NDE**) K: Terminal box

Remark

In the case of special design, details named in the operating instructions can deviate. In this case, order the supplementary documentation.

5.2 Mechanical interface

Dimensions (flange)



Type	A □ Flange [mm]	B Length [mm]	C Shaft Ø [mm]	D Shaft length [mm]	E Centering collar [mm]	F Hole circle [mm]	G Mounting holes [mm]
MKE037	60	283 +5	9	20	40	70	4.5
MKE047	88	287 +5	14	30	50	100	6.6
MKE098	144	383 +5	24	50	110	165	11
MKE118B	194	489 +5	32	60	130	215	14
MKE118D	194	662 +5	32	60	130	215	14

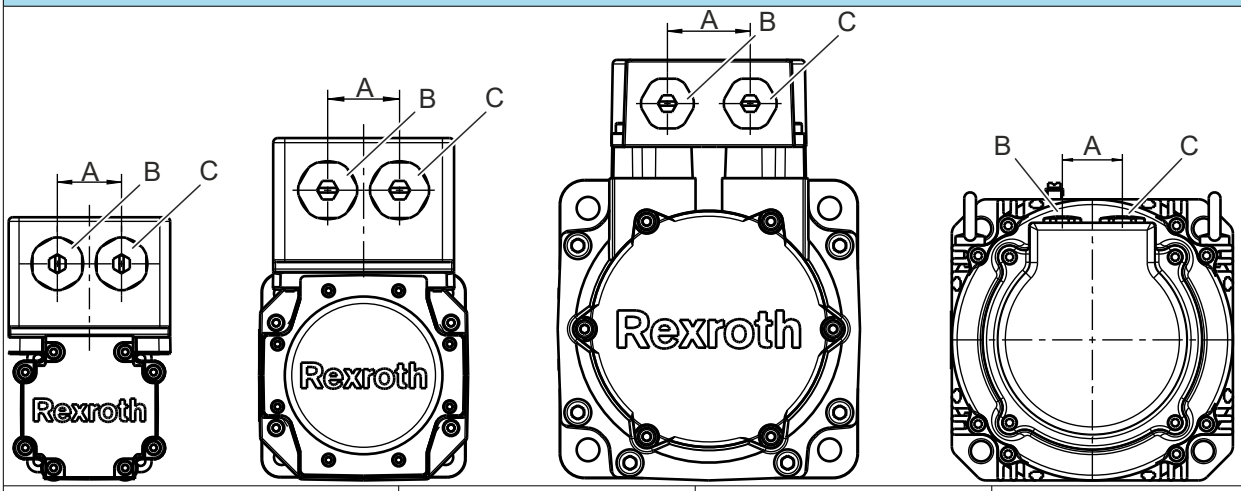
Use the following screws and washers for flange and foot assembly.

Table 6: Tightening torque of mounting screws

Screw [1)]	M4	M6	M8	M10	M12	M16
Mounting holes Ø [mm]	4.5	6.6	9	11 / 12	14	18
Tightening torque M_A[Nm] at μ_K= 0.12	3.0	10.1	24.6	48	84	206
Washer	-	-	yes	yes	yes	yes

[1)] Screws according to DIN EN ISO 4762 or DIN EN ISO 4014. Property class 8.8. The screw lengths depend on the material and the assembly situation. The specified tightening torque must be ensured.

Dimensions KLE connection thread



Type	A	B	C
MKE037	31	M20 × 1.5	M20 × 1.5
MKE047	31	M20 × 1.5	M20 × 1.5
MKE098	40	M20 × 1.5	M20 × 1.5
MKE118	41	M20 × 1.5	M25 × 1.5

5.3 Thermal motor protection

The motor temperature is monitored by two systems that are operated independently of each other. The mounted **temperature sensor** and the drive-internal **temperature model** ensure the best protection of motors against thermal overload.

MKE motors are protected against impermissible heating by a PTC drilling integrated in the motor winding.

A series circuit of three PTC thermistors (one PTC resistor per string) is installed in each motor. Triggering devices or control devices monitor the resistance to a maximum value. Voltage disconnection occurs when only one PTC is heated up to nominal tripping temperature (130 °C±5 °C) by the winding.

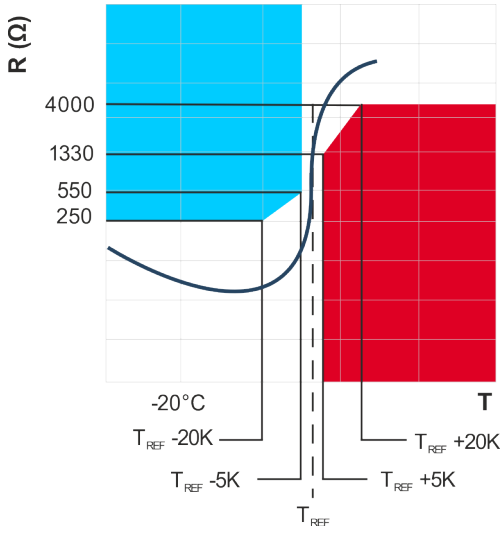


Fig. 2: Temperature-resistance diagram according to IEC60034-11:2004, DIN 44081 (single), DIN 44082 (drilling).

Temperature range	Resistance	Measuring voltage [V_{DC}]
-20 °C to T_{REF} -20K	20 Ω to 250 Ω	≤2.5 V

Temperature range	Resistance	Measuring voltage [V_{DC}]
Temperature range 90 °C - 160 °C		
T_{REF} -5K	≤550 Ω	≤2.5 V
T_{REF} +5K	≤1,330 Ω	≤2.5 V
T_{REF} +15K	≤4,000 Ω	≤7.5 V pulsed

The resistance rises sharply in the range of the nominal response temperature. This change can be made via an electronical evaluation within the drive controller or with an additional evalutation device. Depending on the converter used, function-tested triggering devices with the ⟨Ex⟩ II 2 G or ⟨Ex⟩ II 2 D designation may be required to evaluate the temperature sensors. For supplementary information on temperature monitoring, see EN 60079-14:2014.

Safe disconnection of the load circuit must be ensured.

The threshold values for motor temperature monitoring are contained in the encoder data memory and are read in and monitored automatically during the operation with compatible Rexroth controllers. Threshold values for MKE motors are:

- Motor-warning temperature (125 °C)
- Motor-disconnection temperature (130 °C)

The temperature signal is transmitted via the motor interface -X2 (T1, T2).

Monitoring for a maximum value of the resistance ensures that any cable breakage that may occur is detected as a fault.

5.4 Cooling mode

5.4.1 Self-cooling (IC410)

In case of self-cooling motors, the heat dissipation is realized via natural convection and radiation to the ambient air as well as by heat conduction to the machine construction.

The specified nominal data is reached at ambient temperatures of 0 ... 40 °C. Unhindered vertical convection has to be ensured by a sufficient distance of 100 mm to adjacent components. The allowed limit temperatures must be kept in the case of deviating minimum distances.

Pollution of the surface of the motor reduces heat dissipation and can result in thermal overload. The availability of the system can be increased by regular checks and cleaning of the motors. Please ensure access to the motors for maintenance purposes.

5.5 Encoder

Optical encoder Singleturn option A, B

The encoders allow an absolute, indirect position recording within **one** mechanical rotation. The encoders replace additional separate incremental encoders on the motor.

Remark

After a voltage drop or after the first POWER ON, the axis must always be moved to its reference point first.

Exception: Applications where the maximum travel is within one mechanical revolution of the motor.

Optical encoder Multiturn absolute option C, D

The encoders enable absolute, indirect position sensing within **4,096** mechanical revolutions. The encoders replace a separate absolute value encoder at the motor. The absolute axis position at this encoder variant is retained by the battery buffering.

Table 7: MKE - Technical data of encoder

Designation	Symbol	Unit	Encoder			
			A	B	C	D
Protocol			Hiperface	EnDat 2.1	Hiperface	EnDat 2.1
Encoder design			Singleturn absolute	Singleturn absolute	Multiturn absolute	Multiturn absolute
Distinguishable rotations			1	1	4,096	4,096
Encoder resolution			12 bit	13 bit	12 bit	13 bit
Number of impulse			128	2,048	128	2,048
System accuracy		"	± 120	± 20	± 120	± 20
Incremental signals			1Vss			
Max. current consumption	$I_{Encoder}$	mA	60	150	60	250
Supply voltage	$VCC_{Encoder}$	V	7 ... 12	3.6 ... 14	7 ... 12	3.6 ... 14

The actual **position resolution** can be determined for each encoder type.

Example: MKE037B with encoder option "**C**"

Position resolution = Number of impuls x encoder resolution x distinguishable revolutions
Position resolution = $128 \times 2^{12} \times 4{,}096$
Position resolution = **2.147.483.648** information

5.6 Degree of protection

The protection type according to IEC 60529 is determined by the abbreviation IP (International Protection) and two code numbers for the degree of protection. The first reference number stands for the degree of protection against contact and ingress of foreign bodies, the second one stands for the degree of protection against ingress of water.

Standard motors (specification according to type plate)

- **IP65** with shaft sealing ring

5.7 Output shaft, balancing and extension elements

5.7.1 Shaft end

Table 8: Options according to type code

Shaft	Type
Smooth	G
Keyway, with shaft sealing ring	P

Smooth shaft

Cylindrical shaft end according to DIN 748-3 with frontal centering hole with "DS" thread according to DIN 332-2.

The standard design for a non-positive shaft-hub connection without play and excellent smooth running. Use clamping sets, pressure sleeves or clamping elements for coupling the machine elements to be driven.

Shaft with keyway

Cylindrical shaft end according to DIN 748-3 with frontal centering hole with "DS" thread according to DIN 332-2 and keyway.

The keyway design allows form-locking transmission of torques with constant direction and low requirements on the shaft-hub connection.

The machine elements to be driven have to be secured in axial direction via the centering hole.

Table 9: Keys and centering hole for MKE motors

Type	Key DIN 6885-A	Centering hole DIN 332 Part 2
MKE037	3×3×16	DS M3
MKE047	5×5×20	DS M5
MKE098	8×8×40	DS M8
MKE118	10×8×45	DS M10

Remark

Keys are not included in the scope of delivery.

We recommend regular visual inspections on shaft sealing rings. Depending on operating conditions, signs of wear may appear after 5,000 operating hours. If necessary, replace the shaft sealing rings. **Repairs must be carried out by Rexroth Service.**

5.7.2 Winding

MKE motors are balanced with the “complete key”.

5.7.3 Attachment of drive elements

Observe the notes about mounting drive elements.

Explosion protection

When mounting drive elements, check their suitability and keep the ATEX directives during operation. Selecting of all mounting components underlies the sole responsibility of the plant manufacturer or operator.

⚠ WARNING	**Explosion hazard and danger to life, or substantial property damage!**
	The totality of a motor-machine combination must comply with the specifications for explosion protection according to Directive 2014/34/EU.
	Please observe the notes within the product documentation of the used components when projecting and during operation.

Gearboxes with approvals for use in hazardous areas according to Directive 2014/34/EU for the attachment to MKE motors are delivered by Rexroth neither separately nor mounted on motors.

The mounting of gear units in the explosion protection area, including selection and certification underlies the sole responsibility of the plant manufacturer or operator.

⚠ CAUTION	**Ingressing fluid may damage the motor!** Fluids (e.g., cooling lubricants, gear oil, etc.) may not be present at the output shaft. When attaching gearboxes, only use gearboxes with a closed (oil-tight) lubrication system. Gearbox oil should not be in permanent contact with the shaft sealing ring of the motors.

Overdetermined bearing

When installing drive elements, avoid overdetermined bearing as impermissibly high bearing reactions can be generated due to unfavorable tolerance ratios.

Remark

If overdetermined arrangement of bearings cannot be avoided, please contact Bosch Rexroth.

Couplings

The machine construction and the drive elements used must be carefully adapted to the motor type so as to make sure that the load limits of the shaft and the bearing are not exceeded.

Remark

When extremely stiff couplings are attached, the revolving radial force may cause an impermissibly high load on the shaft and bearing.

Bevel gear pinion or helical drive pinion

Due to thermal expansion, the DE side of the drive shaft can be displaced by up to 0.6 mm in relation to the motor housing. If helical drive pinions or bevel gear pinions directly attached to the output shaft are used, this change in the lengths will lead to

- a shift in the position of the axis, if the driving pinions are not axially fixed on the machine side.
- a thermally dependent component of the axial force, if the driving pinions are axially fixed on the machine side. This causes the risk of exceeding the maximum permissible axial force or of the gear backlash increasing to an impermissible degree.
- Damage of the NDE bearing by exceeding the maximum permissible axial force.

Remark

It is recommended to use drive elements with integrated bearings and mount them on the motor shaft via axially compensating couplings.

5.8 Holding brake

⚠ WARNING	**Danger to life or high damage to property, ignition and explosion hazard due to inappropriate use!**
	In order to prevent danger due to ignitable gases or explosive dust-air mixtures in the vicinity of the motors, the user must make sure that the holding brake does not present a source of ignition in the normal service. For this reason, the holding brake must never be used outside the design parameters and operating conditions! – Any commissioning and maintenance works must only be carried out in non-explosive environments. – The brakes must be designed so as to fulfill their function in normal service, if they are installed and used as intended. – The holding brake integrated in the motor must only be used at standstill and never as EMERGENCY STOP brake to stop the motor, see P-0-0119, Optimal shutdown(IndraDrive firmware - functional description). – The holding brake must not be used to brake or stop the motor or coupled loads from higher speeds or velocities.

MKE motors can optionally be provided with permanent magnet brakes. The backlash-free holding brakes are operated according to the “electrically-released” principle (closed-circuit principle) and open upon applying the switching voltage.

- Number of operating cycles ≥ 5,000,000
- The holding brakes with emergency stop function are intended to secure motor shafts at standstill (normal operation). **The holding brakes are no operation brakes to decelerate motors in operation from speed**.
- Emergency stop situations are not a normal operation.
- In case of an emergency stop or voltage drop, the brake operation is only allowed to a limited extend. Up to 500 breaking cycles from speed 3000 1/min can be performed, whereas the maximum switched energy per emergency stop of the brake must not be exceeded. The number of brake applications per hour is 20, whereas a uniform scheduling is a precondition. Specifications about the maximum switched energy per emergency stop on demand.
- Idle time after an emergency stop before restarting ≥ 3 minutes.

⚠ CAUTION	**Malfunctions due to wear**
	Impermissibly high wear due to breaking from speed by exceeding the specified emergency stop properties.

Ensure the functionality of the brake in normal operation, due to voltage control, current monitoring, cyclic control of the brake holding torque, for example.

The rated voltage to apply the brakes is 24 V DC (±10%).

The voltage supply of the holding brake has to be designed so as to guarantee under the worst installation and operation conditions that a sufficient voltage **24 V ±10%** is available at the motor in order to release the holding brake.

The voltage drop ΔU on the brake supply can approximately be calculated for copper conductors using the following formula:

$$\Delta U = \rho_{Cu} \cdot \left(\frac{2 \cdot l}{q} \right) \cdot I_N$$

Fig. 3: Voltage drop of brake supply

ΔU Voltage drop [V]
ρ Cu Specific resistance of copper [Ω*mm²/m]
l Cable length [m]
q Conductor cross-section [mm²]
I N Rated current [A]

⚠ CAUTION	**Malfunction in case of exceeded tolerance of the rated voltage (switching voltage)**
	For safe switching of the holding brake, a rated voltage of **24 V DC ±10%** is required at the motor.
	Ensure correct dimensioning of the supply wires (wire length and cross-section) for the holding brake.

The control voltage can be reduced using the energy saving function after safely releasing the brake, see ➦ Chapter 5.8.3 “Energy saving function for holding brakes” on page 29.

The holding brake in the motor is intended for direct connection to the Bosch Rexroth controller.

The protective circuit for switching holding brakes (inductive load) is not integrated in the MKE motors; in Bosch Rexroth drive systems it is integrated in the control units.

5.8.1 Technical data holding brakes

Table 10: Holding brake data (optional)

Type	Holding torque	Rated voltage 1)	Rated current	Maximum connection time	Maximum disconnection time
	M_4 [Nm]	U_N [V]	I_N [A]	t_1 [ms]	t_2 [ms]
MKE037B-__-_1-___	1.00	24	0.40	3	4
MKE047B-__-_1-___	2.20	24	0.34	14	28
MKE098B-__-_1-___	11.00	24	0.71	13	30
MKE118B-__-_1-__	32.00	24	0.93	15	115
MKE118D-__-_3-__	70.00	24	1.29	53	97
1) Tolerance ± 10%					

5.8.2 Sizing holding brakes

Static sizing

Check the load torque (M_6) with the available holding torque (M_4). The load torque has to be smaller than the holding torque. In case of unsafe assumed load, use a sufficient safety factor.

$$M_4 \geq S \cdot M_6$$

Fig. 4: Static load torque

M 4 Brake torque [Nm]
M 6 Load torque [Nm]
S Safety factor

Dynamic sizing if emergency stop

In case of an emergency stop, the load torque (M_6) has to be smaller than the minimum dynamic torque (M_1) of the brake. Otherwise the dynamic brake torque is not sufficient to set the axis to standstill.

$$M_1 \geq S \cdot M_6$$

Fig. 5: Dynamic load torque
M_1 Dynamic torque [Nm]
M_6 Load torque [Nm]
S Safety factor

If a mass has to be decelerated within a specified time or after a certain distance, the additional mass moment of inertia of the complete system (J_{ges}) has to be taken into consideration.

$$t_{Br} = \frac{J_{ges} \cdot n}{9{,}55 \cdot (M_1 \pm M_6)}$$

$$J_{ges} = J_{rot} + J_{fremd}$$

Fig. 6: Shutdown time
t_{Br} Deceleration time [s]
n Nominal speed [1/min]
M_1 Dynamic torque [Nm]
M_6 Load torque [Nm]
J_{ges} Moment of inertia of complete system [kgm²]
J_{rot} Moment of inertia of motor [kgm²]
J_{fremd} External inertia [kgm²]

The specified formula refers to idealized, linear correlations and can thus only be used for estimation purposes. A load torque M_6 inhibiting the brake application is displayed with “-”, a brake application supporting the load torque M_6 is displayed with “+”.

Thermal dimensioning

The brake can be thermally overexerted due to multiple repetitive brake applications (breaking capacity).

$$W_{max} > \frac{M_1}{M_1 - M_6} \cdot \frac{J_{ges} \cdot n^2}{182{,}5}$$

Fig. 7: Maximum switched energy
W_{max} Maximum switched energy [J]
n Nominal speed [1/min]
M_1 Dynamic torque [Nm]
M_6 Load torque [Nm]
J_{ges} Moment of inertia of complete system [kgm²]

5.8.3 Energy saving function for holding brakes

Decrease brake voltage

The control voltage of the holding brake in MKE holding brakes can be reduced after executing the switching operation “Open brake” by using suitable control modules (e.g. IndraDrive brake control module HAT02.1-003). By decreasing the control voltage, energy can be saved of up to 50% and the self-heating of the motor can be reduced.

To decrease the control voltage of MKE holding brakes, the following conditions apply:

- Maximum decrease of control voltage to U_N ≥17 V DC at the motor.
- Waiting time after releasing the holding brake is at least 200 ms
- Decreasing the control voltage by voltage control or pulse width modulation with a PWM cycle frequency ≥ 4 kHz
  Decreasing the controlled voltage or PWM cycle frequency of the control voltage ≥ 4 kHz
- Ensure the functionality of the holding brake.

Refer to the instructions in the control module documentation.

Refer to the notes for dimensioning of the cable length and cable cross-section of brake cables.

5.8.4 Safety and personal protection

The permanent magnet brakes of the MKE motors are not safety brakes, since a holding torque reduction can occur due to uninfluenceable disturbance factors. Especially for use in vertical axes.

⚠ WARNING	**Grievous bodily harm due to dangerous movements from falling or dropping axes!**
	Secure vertical axes against dropping or sinking after switching off by e.g.: – Mechanical locking of the vertical axis – External brake, arrestor, clamping device. – Weight compensation of the axes

The holding brake itself is not suitable for personal protection. Ensure protection of persons by superordinate fail-safe measures, like block danger zones via safety fences.

For European countries, additionally comply with the following standards and guidelines, e.g.

- EN 954; ISO 13849-1 and ISO 13849-2 Safety-related parts of control units
- Information sheet no. 005 “Gravity-loaded axes (vertical axes)” published by: DGUV Fachbereich Holz und Metall (German Employer's Liability Insurance Association Wood and Metal)

Determine the complete safety requirements valid for the specific case of application and observe them during plant design. Comply with all applicable national regulations!

5.8.5 Functionality test

⚠ WARNING	Danger of explosion at maintenance work and check operation Do maintenance work only outside of hazardous areas. Ensure that no hazardous gas or dust atmosphere exists during grind in procedures.

That is why the function and the holding brakes have to be checked in regular intervals and malfunctions must be removed in an appropriate period.

The braking effect can be reduced by

- Corrosion on friction surfaces, vapor and sediment
- Over voltages and too high temperatures
- Wear (increasing the air gap between armature and pole)

The holding brake functionality can be checked mechanically by hand or automatically by means of the software function.

Manually check holding torque (M4)

1. De-energize the motor and ensure it cannot be restarted.
2. Measure the transferable holding torque (M4) of the holding brake with a torque wrench.

Check holding torque (M4) using the software function

For Bosch Rexroth drive controller

- Start the P-0-0541, C2100 Command Holding system check in drive controller. The efficiency of the holding brake and the opened state are checked by starting the routine.
  - ➡ If the holding torque (M4) **is not achieved**, the resurfacing routine can be used to reconstitute the holding torque. If you have any questions about grind in parameters, contact Bosch Rexroth service.

5.9 Flange exactness

The properties concentricity, run-out and alignment comply with the tolerance class N for MKE motors. Also refer to ➥Chapter 5.7 “Output shaft, balancing and extension elements ” on page 23.

5.9.1 Concentricity tolerance of the shaft end

Table 11: Concentricity tolerance regarding the shaft diameter for MKE motors

Diameter shaft end [d]	Concentricity tolerance in [mm]
	N
9	0.03
14	0.035
24	0.04
32	0.05

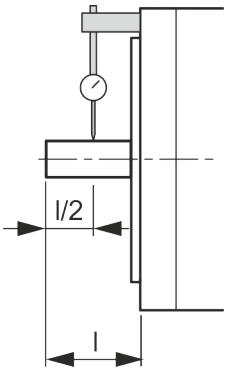


Fig. 8: Measuring system of concentricity tolerance

Measurement takes place in distance *l/2* (shaft end center), rectangular to the motor flange.

5.9.2 Concentricity and alignment

Table 12: Concentricity and alignment tolerances regarding the centerin diameter for MKE motors.

Centering diameter [mm]	Concentricity and alignment tolerance in [mm]
	N
40, 50	0.08
110, 130	0.1

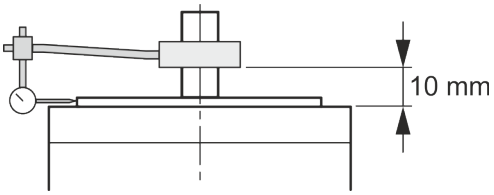


Fig. 9: Measuring system of coaxiality

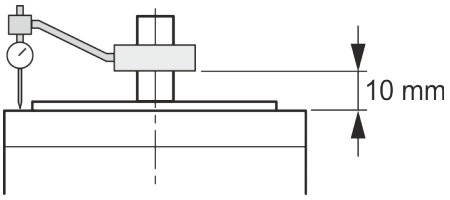


Fig. 10: Measuring system of alignment

The coaxiality and the alignment are measured in vertical motor position to exclude the influence of gravitational forces.

5.10 Vibration behavior

The oscillation behavior corresponds to oscillating quantity level A according to DIN EN 60034-14 up to the rated speed.

5.11 Bearing

The motors are equipped with a deep-groove ball bearing with high-temperature grease for prelubrication.

5.11.1 Bearing service life

The bearing lifetime is an important criterion for the availability of motors. The operating conditions influence the bearing service life L_{10h} considerably.

The following boundary conditions apply to the bearing service life L_{10h}:

- Operation within the specified permissible loads (radial and axial force)
- Operation within the permissible ambient conditions (temperature range 0 ... 40 °C, vibration, and so on).
- Operation within the thermally permissible operating characteristic curve

The bearing lifetime also depends on the service life of the grease. A calculated grease service life was used for the mentioned specifications, taking into consideration the following boundary conditions.

- Horizontal installation
- Low vibration and impact loads
- No oscillating bearing movement < 180°
- Mean speed according to the following table

Table 13: Mean speed - basis of calculated grease service life

Type	Mean speed
MKE037	≤ 3,500 1/min
MKE047	≤ 3,500 1/min
MKE098	≤ 3,000 1/min
MKE118	≤ 2,000 1/min

The following standard values apply under the specified preconditions:

L_{10h} = 30.000 h, in case of utilization after S1-60K and max. load factor 95% during the runtime.

Remark

When exceeding or not complying with these conditions, a reduced service life is to be expected.

5.11.2 Explanation of radial and axial force

During operation, both radial and axial forces act upon the motor shaft and the motor bearing. The permissible radial force F_R in distance x from the shaft shoulder and the mean speed is specified in the radial force diagrams.

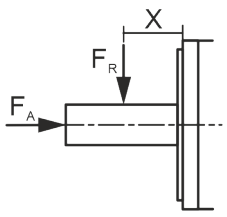


Fig. 11: Point of action of radial force F_R and axial force F_A

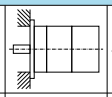
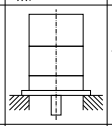
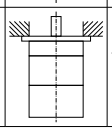
The axial force values are the minimum permissible axial forces F_A without limitations. A detailed dimensioning is only possible if more boundary conditions are known:

- Occurring radial force and axial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

For radial force diagrams, refer to the technical data

5.12 Frame size, installation type

The motors can be installed horizontally and vertically with the shaft end pointing to the top or bottom. The mounting variants comply with the IM code according to EN 60034-7 for design and installation type.

Code I / Code II (EN 60034-7)		
IM B5 / IM 3001		Flange attachment on the drive side of the flange
IM V1 / IM 3011		Flange attachment on the drive side of the flange, drive side facing down
IM V3 / IM 3031		Flange attachment on the drive side of the flange, drive side facing up

Avoid liquid at the drive shaft or the shaft sealing ring in case of vertical installation according to IM V3.

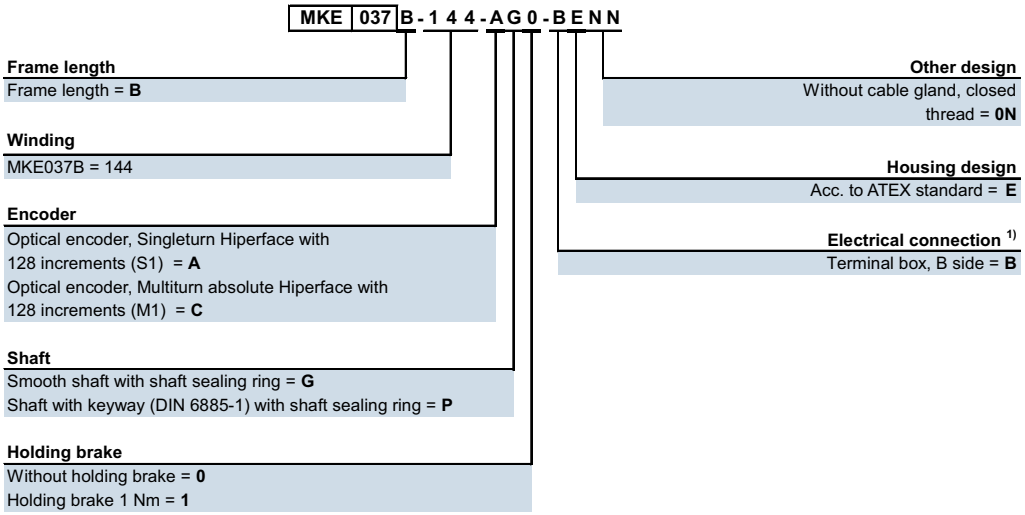
5.13 Noise emission

The typical sound pressure level Lp(A) is specified for the speed range 0 rpm up to the rated speed in the chapter “Technical data”. The installation situation affects the noise emission.

6 Type codes

6.1 MKE037 Type code

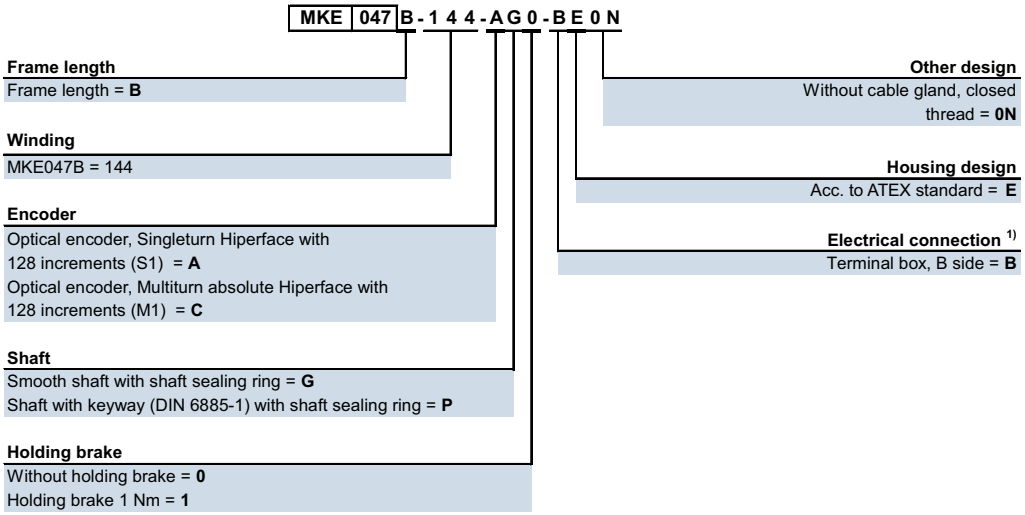
Features



1) When looking at the drive shaft from the front

6.2 MKE047 Type code

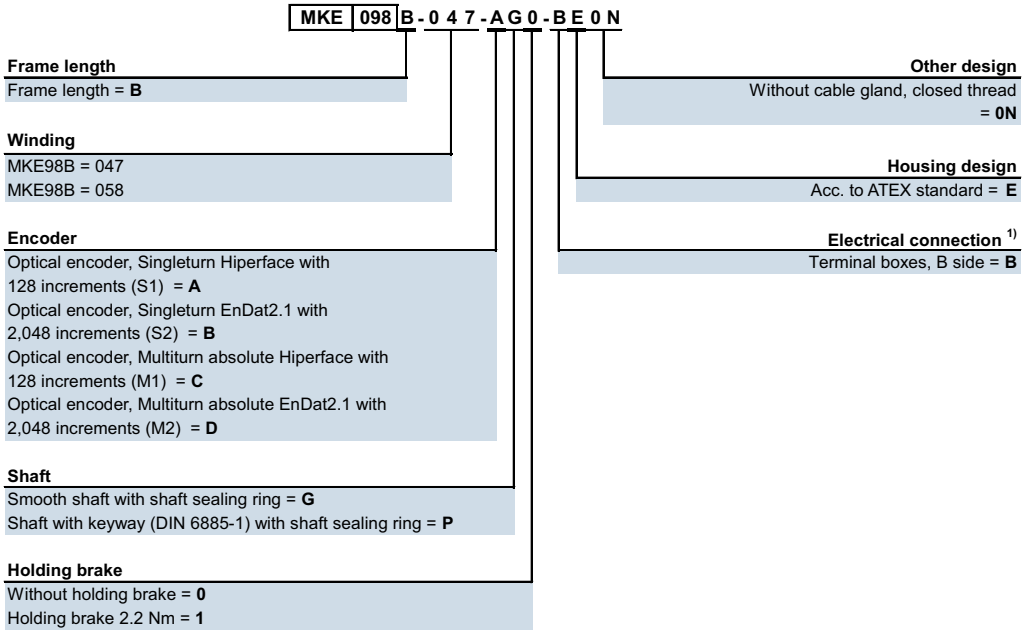
Features



1) When looking at the drive shaft from the front

6.3 MKE098 Type code

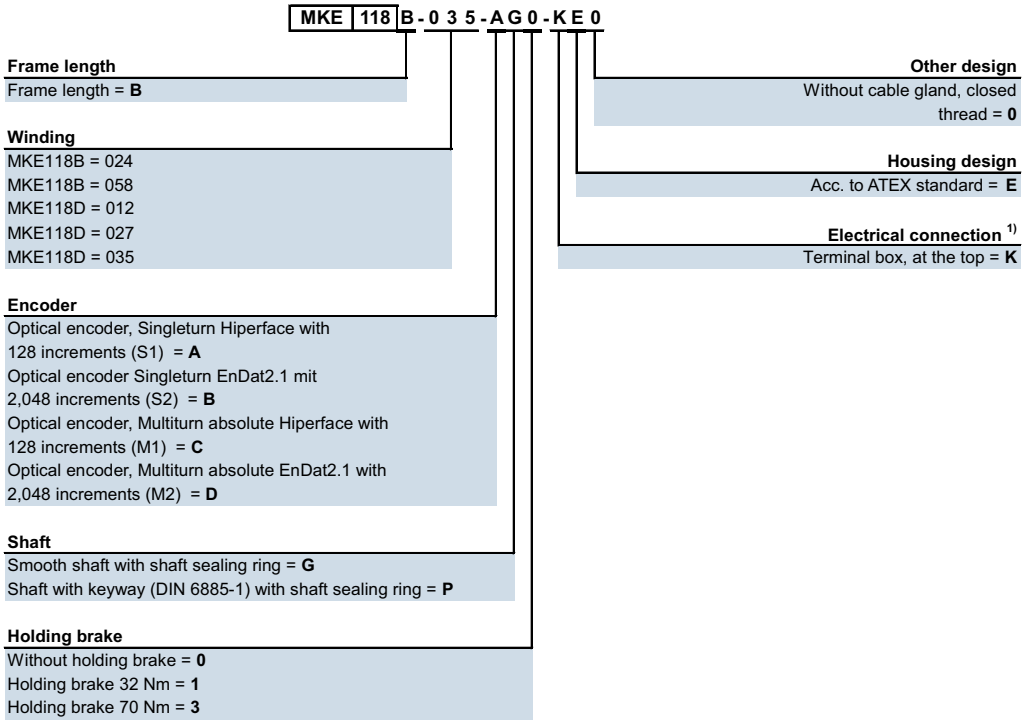
Features



1) When looking at the drive shaft from the front

6.4 MKE118 Type code

Features



1) When looking at the drive shaft from the front

7 Operating areas and characteristic curves

7.1 Operating area

The permissible operating ranges for MKE motors are defined for ambient temperatures of 0 ... 40 °C and installation altitudes up to 1,000 m above MSL. The operating areas are characterized by characteristic curve fields.

The individual characteristic curves are described in the following figure.

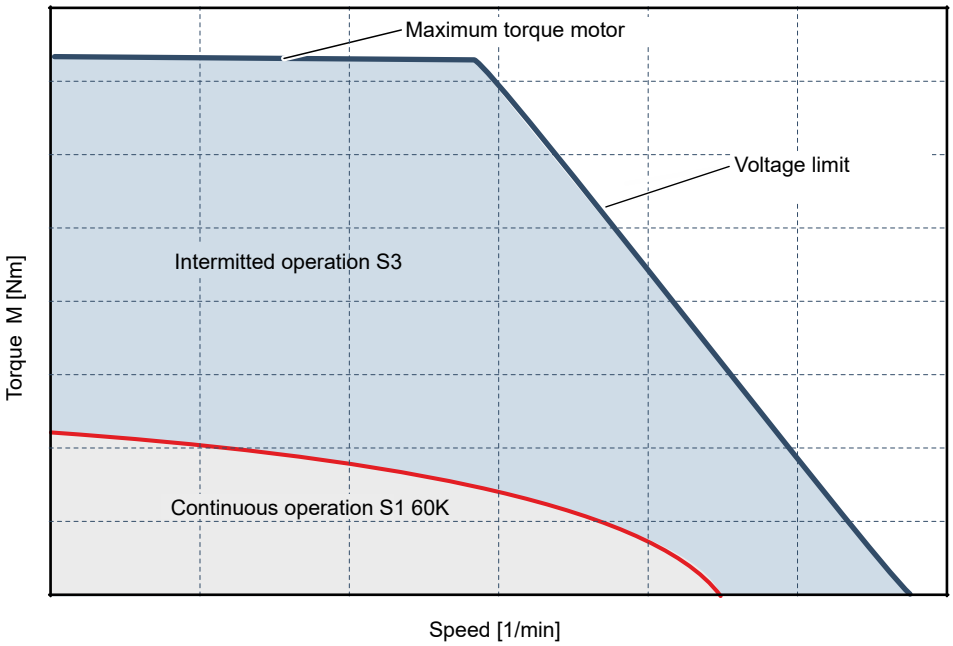


Fig. 12: Operating area of MKE motors

The thermal motor installation determines the degree of power loss, discharged via the flange. The rated data for 60K specified in the technical data apply to thermally isolated installation.

Remark

In case of ambient temperatures above 40 °C and installation altitudes of 1,000 m above MSL, the high performance data have to be reduced (see).

7.1.1 Continuous operation S1

The S1-60K characteristic curve specifies the thermal limit of the motors. To increase the machine availability, Bosch Rexroth recommends to project with a safety factor to the S1-60K characteristic curve.

Project with a safety factor regarding the thermal utilization of the motors to

- compensate unfavorable heat of the flange mounting.
- limit the housing temperature.
- avoid unfavorable machine heating due to the motor.
- increase the reliability of the motor (e.g. motor / encoder bearing).

NOTICE	**Property damage due to thermal overload** Motors in continuous operation application must not be operated above the specified characteristic curve limits S1-60K.

7.1.2 Periodic intermitted operation S3

During periodic intermittent operation, the motor can tolerate a higher load depending on the ON time.

7.1.3 Motor torque during operation at standstill

In applications such as joining or press machines, where motors have to produce torque continuously asymmetrical currents when the motor is in standstill (close angular range) will flow in the motor windings. This can result in motor overload during continuous operation. The values specified in the technical data for the continuous torque that can be applied to the motor output shaft are valid at speed n ≥ 0.1 Hz.

7.2 Characteristic curves for DC bus voltage

The technical data sheets contain characteristic curves for two typical DC bus voltages. Depending on the DC bus voltage, the characteristic curves are offset.

Remark

S1 continuous operation curves depend on the DC bus voltage. The rated data on the type plate are defined with U_{ZK2} for the worst case scenario.

The characteristic curve apply to:

Table 14: DC bus voltages

Controller	Line voltage	DC bus
ctrlX IndraDrive	3 × 400 V ($U_{ZK\,1}$)	uncontrolled
	3 × 400 ... 480 V ($U_{ZK\,2}$)	controlled

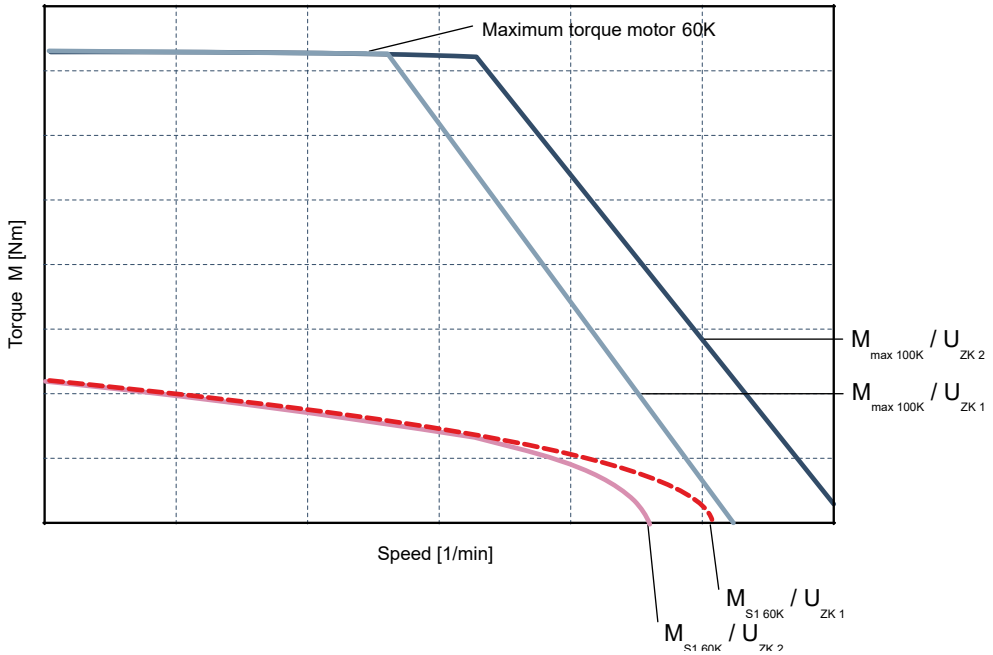


Fig. 13: Characteristic curve specifications

The specified characteristic curves are typical standard values. The actual performance data of a drive axis are subject to manufacturing-related tolerances.

7.3 Tolerances

The values specified in the technical data are subject to a natural dispersion. Observe the tolerance specifications for the following parameters.

Table 15: Tolerance specifications of the motor data

Designation	Symbol	Tolerance value
Standstill torque - 60K	$M_{0\ 60K}$	±5 %
Moment of inertia of rotor	J_{rot}	± 10 %
Maximum torque	M_{max}	±5 %
Torque constant at 20 °C	K_m	±5%
Voltage constant at 20 °C	K_E	±5 %

7.4 IndraSize

By using the IndraSize software, drive controllers, motors and mechanic gearboxes can be easily sized. The engineering tool covers the entire product family of IndraDrives and motors. Calculate the characteristic curves for your application by using the sizing tool IndraSize: ➦www.boschrexroth.com/.../IndraSize

8 Technical data

8.1 MKE037

8.1.1 MKE037B-144

Designation	Symbol	Unit	MKE037B-144-__0-_E	MKE037B-144-__1-_E
Continuous torque at standstill 60K [1]	M_{0_60}	Nm	0.9	0.8
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	3.3	3.0
Maximum torque [1]	M_{max}	Nm	4.0	
Maximum current	I_{max}	A	15.0	
Torque constant at 20 °C [1]	Km	Nm/A	0.30	
Voltage constant at 20 °C [1]	K_{EMK_1000}	V/1000 min^{-1}	18.2	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	2.7	
Winding inductance	L_{12}	mH	3.7	
Leakage capacitance of the component	C_{ab}	nF	1.0	
Number of pole pairs	p		3	
Moment of inertia of the rotor [1] [2]	J_{rot}	kgm^2	0.00003	
Thermal time constant	T_{th}	min	15.0	
Maximum speed (electrical)	n_{max}	1/min	9,000	
Mass	m	kg	2.5	2.8
Sound pressure level	LP	dB[A]	61.8 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (IEC 60529)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	1.00
Rated voltage[1]	U_N	V	0	24
Rated current	I_N	A	0	0.40
Maximum connection time	t_1	ms	0	3
Maximum disconnection time	t_2	ms	0	4
Moment of inertia of the holding brake [1] [2]	J_{br}	$kg*m^2$	0	0.0000070

1) For tolerance details refer to ➥Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

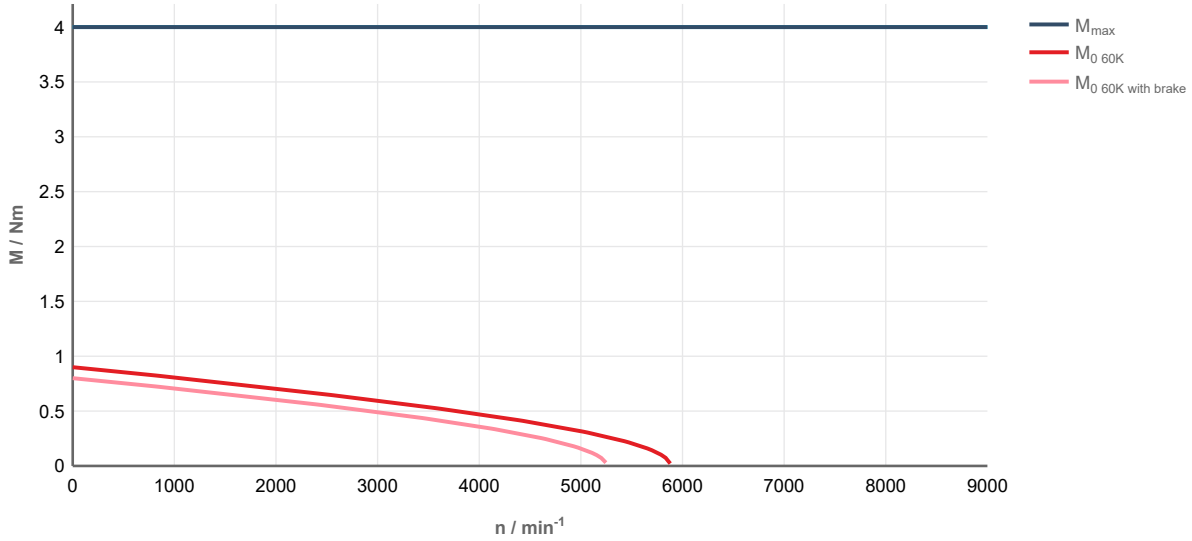


Fig. 14: MKE037B-144-__-___, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

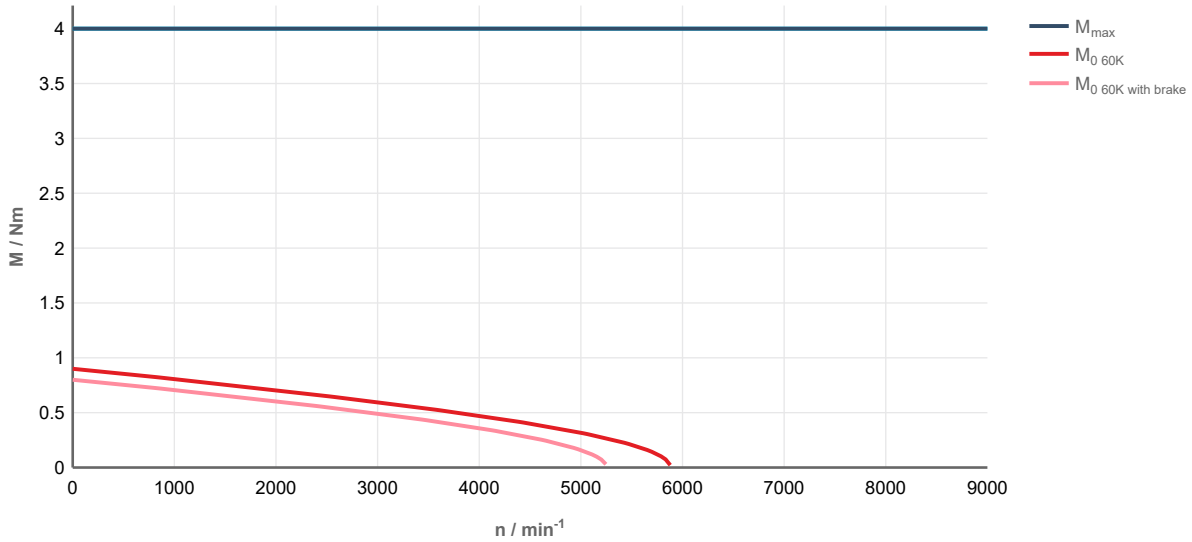


Fig. 15: 1. MKE037B-144-__-_-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.1.2 MKE037 Specifications

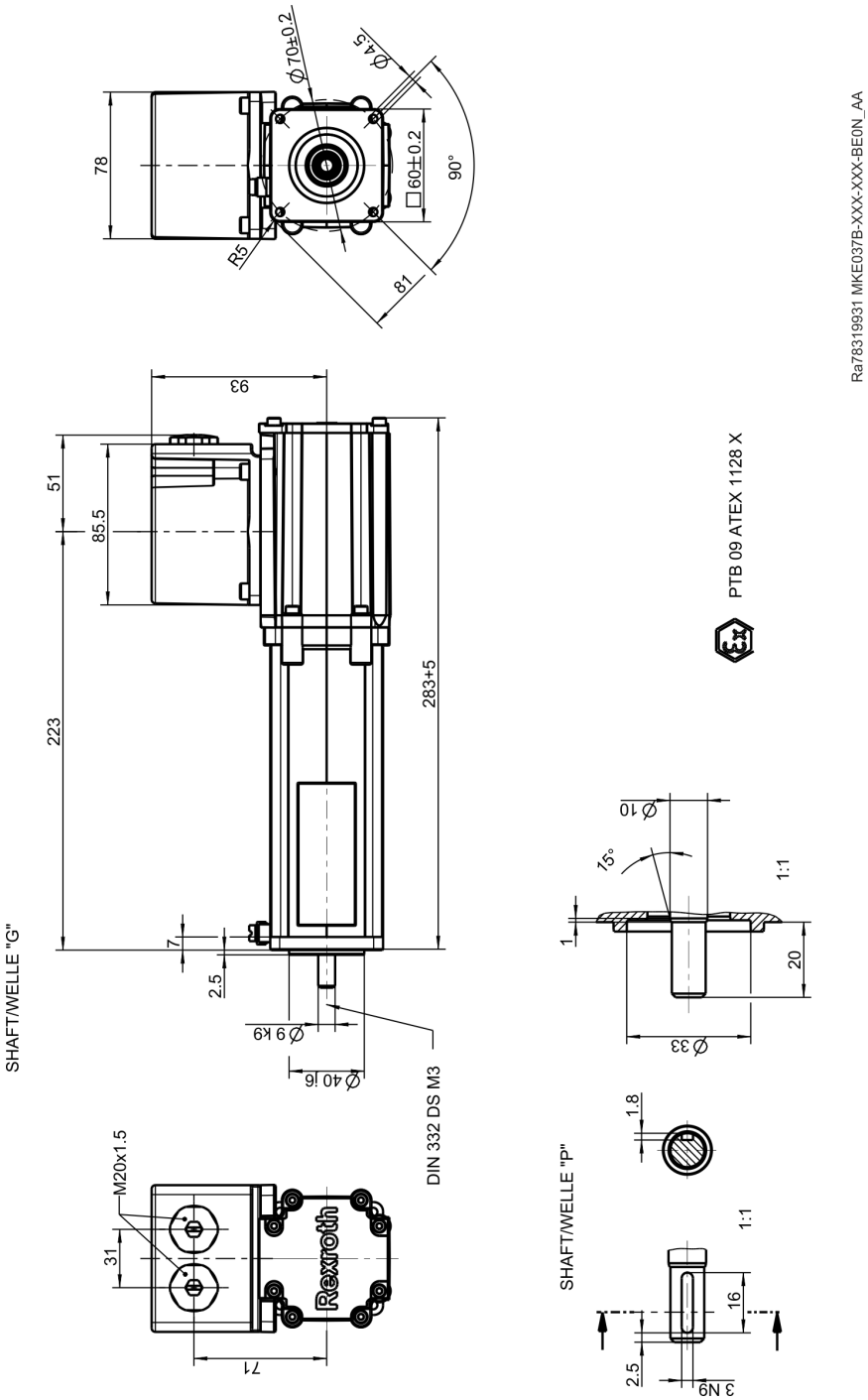


Fig. 16: Specifications MKE037B

8.1.3 MKE037 Radial force

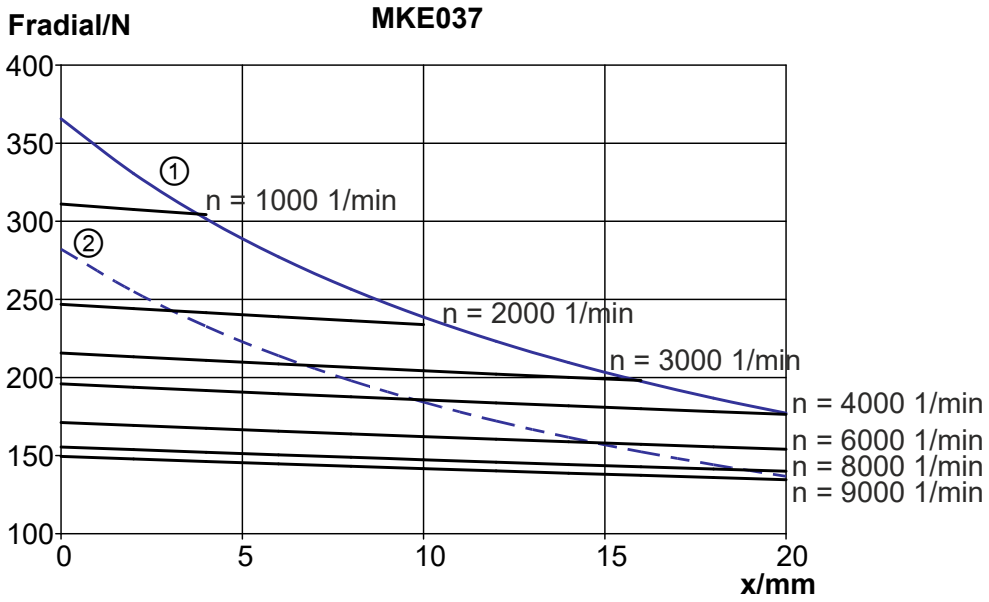


Fig. 17: MKE037: permissible radial force (shaft and bearing load)
① Shaft plain
② Shaft with keyway

8.1.4 MKE037 Axial force

MKE037: **Axial force not permitted**.

8.2 MKE047

8.2.1 MKE047B-144

Designation	Symbol	Unit	MKE047B-144-__0-_E	MKE047B-144-__1-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	2.7	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	5.0	
Maximum torque 1)	M_{max}	Nm	11.3	
Maximum current	I_{max}	A	22.6	
Torque constant at 20 °C 1)	Km	Nm/A	0.59	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	36.3	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	1.8	
Winding inductance	L_{12}	mH	5	
Leakage capacitance of the component	C_{ab}	nF	1.6	
Number of pole pairs	p		3	
Moment of inertia of the rotor 1) 2)	J_{rot}	kgm^2	0.00017	
Thermal time constant	T_{th}	min	30.0	
Maximum speed (electrical)	n_{max}	1/min	7,000	
Mass	m	kg	5.5	5.8
Sound pressure level	LP	dB[A]	63.0 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	2.20
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	0.34
Maximum connection time	t_1	ms	0	14
Maximum disconnection time	t_2	ms	0	28
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0000100

1) For tolerance details refer to ➥Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

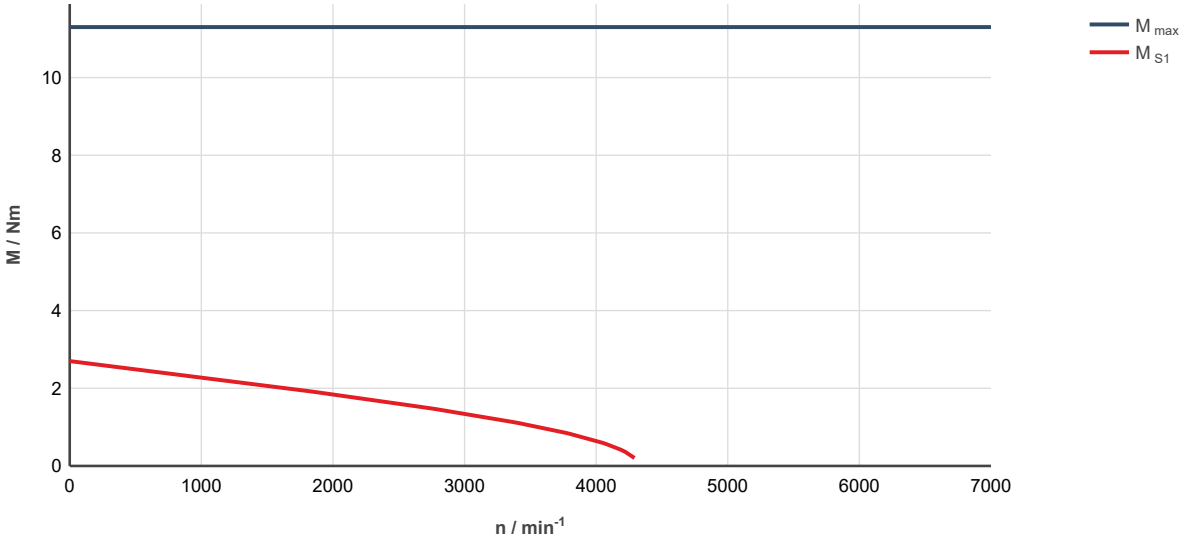


Fig. 18: MKE047B-144-__-_-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

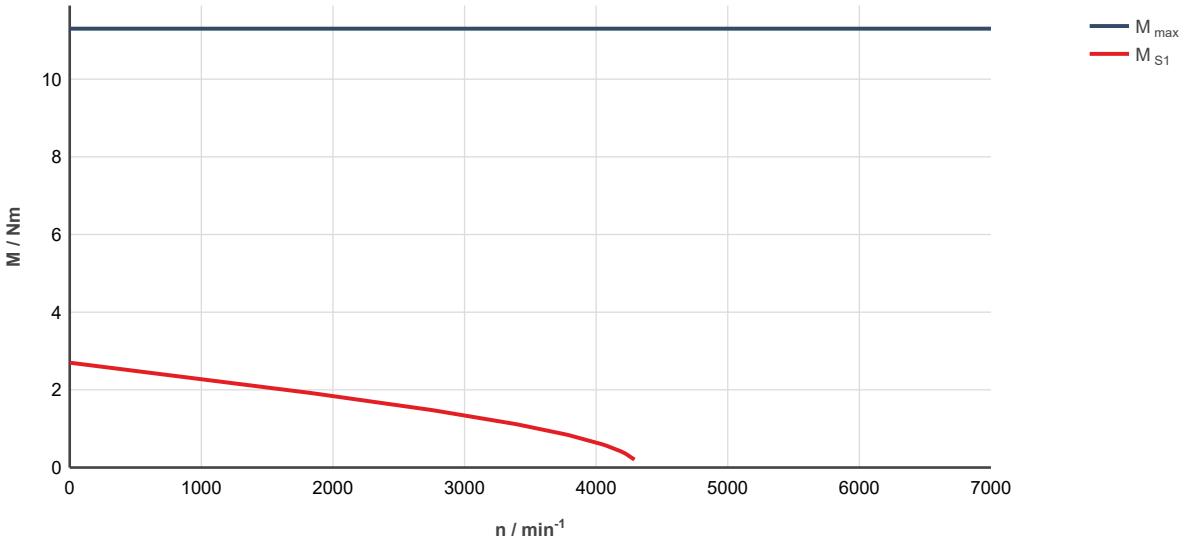


Fig. 19: MKE047B-144-__-___, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.2.2 MKE047 Specifications

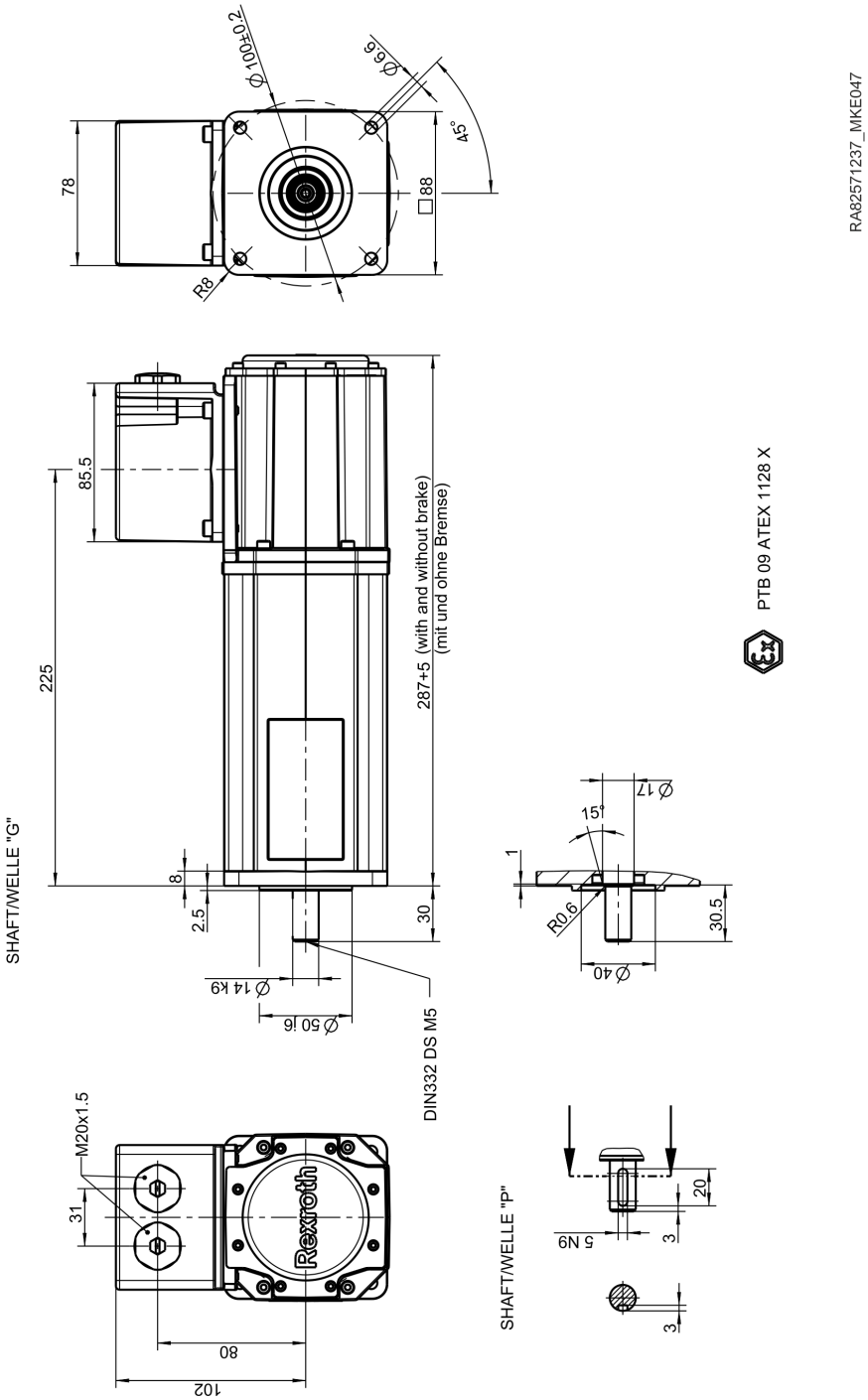


Fig. 20: Specifications MKE047

8.2.3 MKE047 Radial force

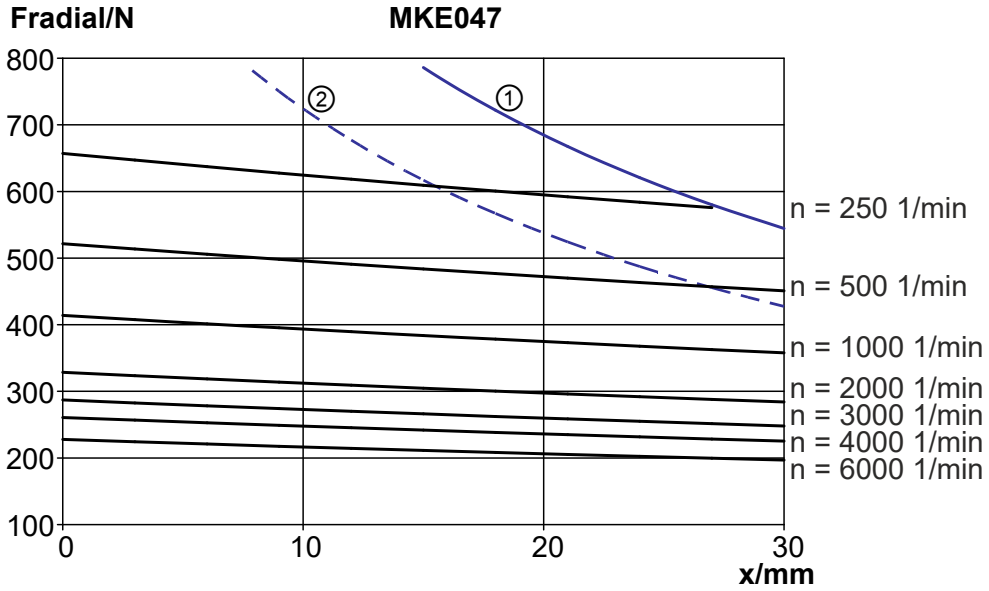


Fig. 21: MKE047: permissible radial force (shaft and bearing load)
① Shaft plain
② Shaft with keyway

8.2.4 MKE047 Axial force

MKE047: **allowed axial force 30 Nm**.

8.3 MKE098

8.3.1 MKE098B-047

Designation	Symbol	Unit	MKE098B-047-__0-_E	MKE098B-047-__1-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	12.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	9.8	
Maximum torque 1)	M_{max}	Nm	43.5	
Maximum current	I_{max}	A	44.3	
Torque constant at 20 °C 1)	Km	Nm/A	1.41	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	91.0	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	1.2	
Winding inductance	L_{12}	mH	8.4	
Leakage capacitance of the component	C_{ab}	nF	6.7	
Number of pole pairs	p		4	
Moment of inertia of the rotor 1) 2)	J_{rot}	kgm^2	0.00430	
Thermal time constant	T_{th}	min	60.0	
Maximum speed (electrical)	n_{max}	1/min	4,500	
Mass	m	kg	18.0	19.1
Sound pressure level	LP	dB[A]	61.8 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	11.00
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	0.71
Maximum connection time	t_1	ms	0	13
Maximum disconnection time	t_2	ms	0	30
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0003600

1) For tolerance details refer to ➥Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

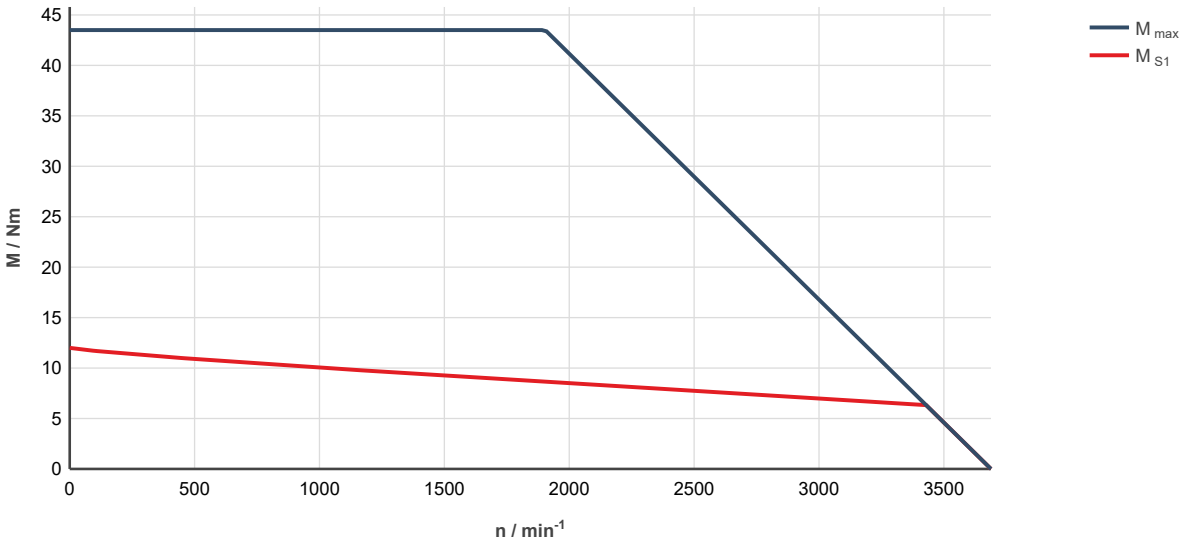


Fig. 22: MKE098B-047-__-___, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

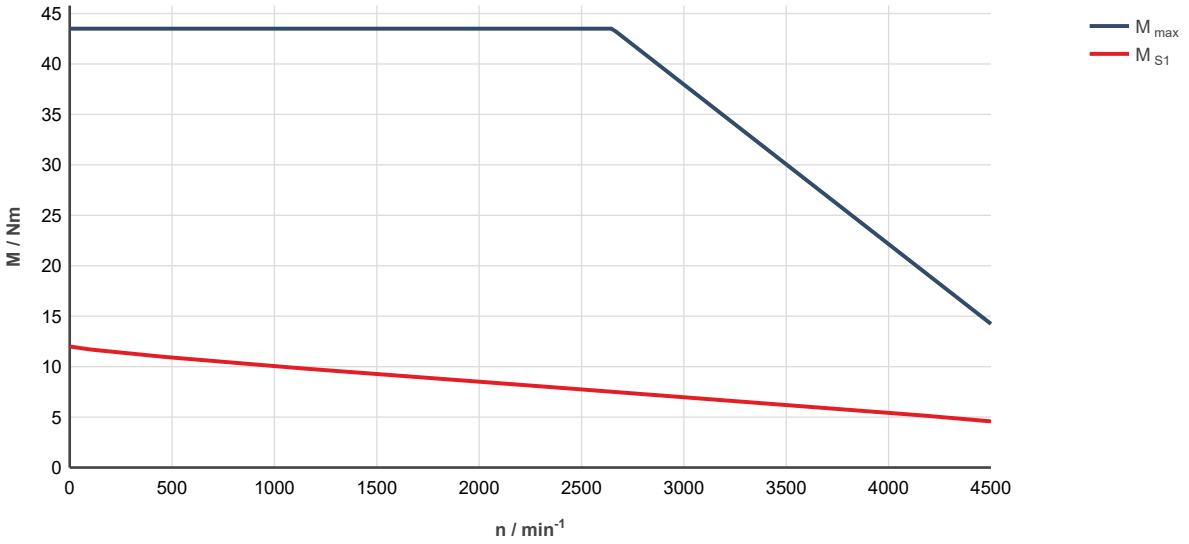


Fig. 23: MKE098B-047-__-___, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.3.2 MKE098B-058

Designation	Symbol	Unit	MKE098B-058-__0-_E	MKE098B-058-__1-_E
Continuous torque at standstill 60 K [1]	M_{0_60}	Nm	12.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	12.4	12.3
Maximum torque [1]	M_{max}	Nm	43.5	
Maximum current	I_{max}	A	55.9	
Torque constant at 20 °C [1]	Km	Nm/A	1.09	
Voltage constant at 20 °C [1]	K_{EMK_1000}	V/1000 min^{-1}	70.0	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	0.74	
Winding inductance	L_{12}	mH	5.8	
Leakage capacitance of the component	C_{ab}	nF	6.7	
Number of pole pairs	p		4	
Moment of inertia of the rotor [1] [2]	J_{rot}	kgm^2	0.00430	
Thermal time constant	T_{th}	min	60.0	
Maximum speed (electrical)	n_{max}	1/min	5,000	
Mass	m	kg	18.0	19.1
Sound pressure level	LP	dB[A]	61.8 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	11.00
Rated voltage[1]	U_N	V	0	24
Rated current	I_N	A	0	0.71
Maximum connection time	t_1	ms	0	13
Maximum disconnection time	t_2	ms	0	30
Moment of inertia of the holding brake [1] [2]	J_{br}	$kg*m^2$	0	0.0003600

1) For tolerance details refer to ➥ Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

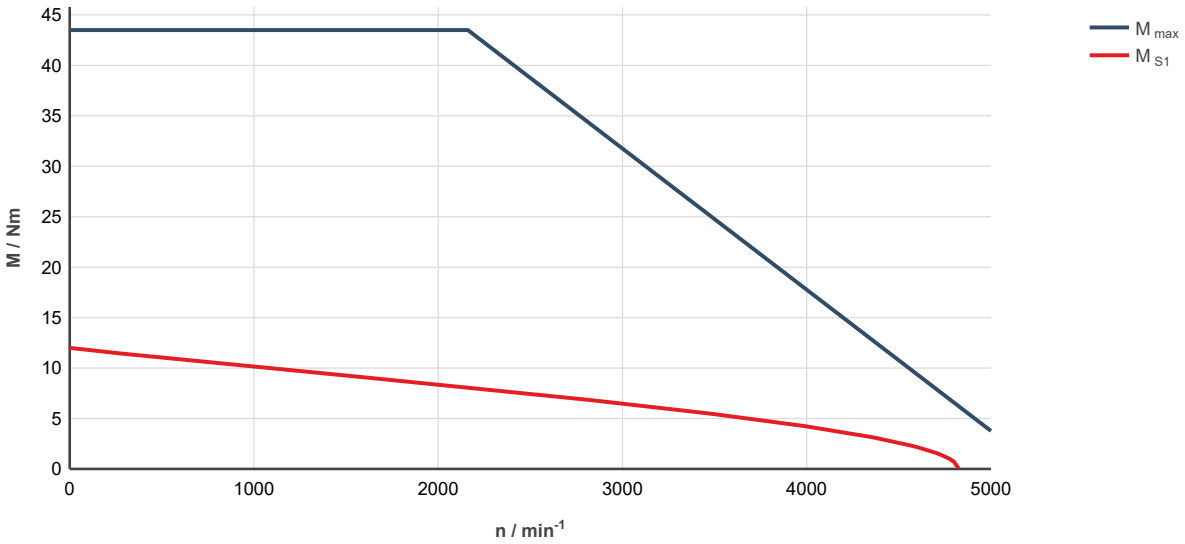


Fig. 24: MKE098B-058-___-___, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

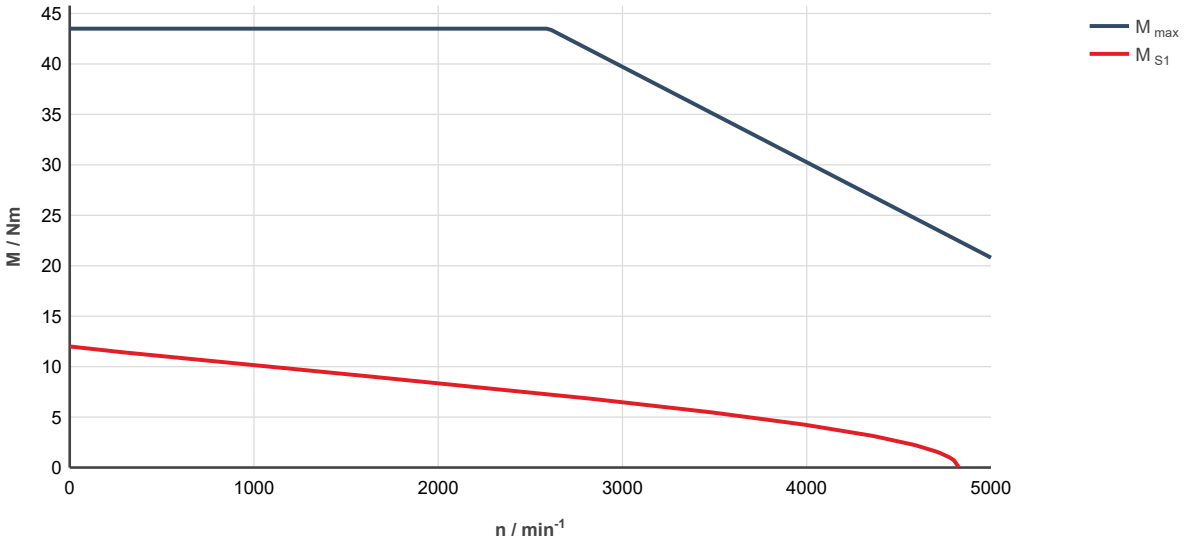


Fig. 25: MKE098B-058-___-___, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.3.3 MKE098 Specifications

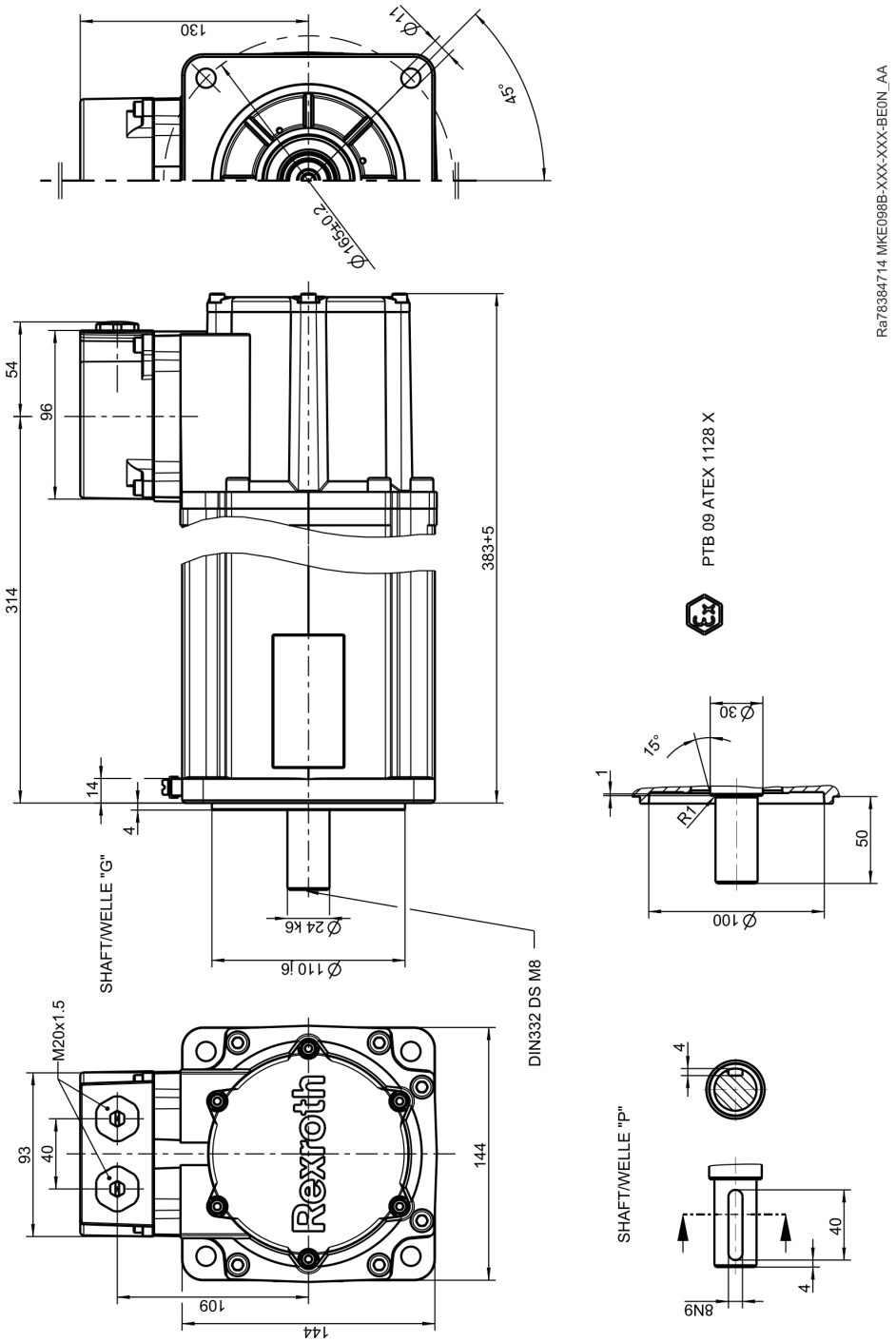


Fig. 26: Specifications MKE098B

8.3.4 MKE098 Radial force

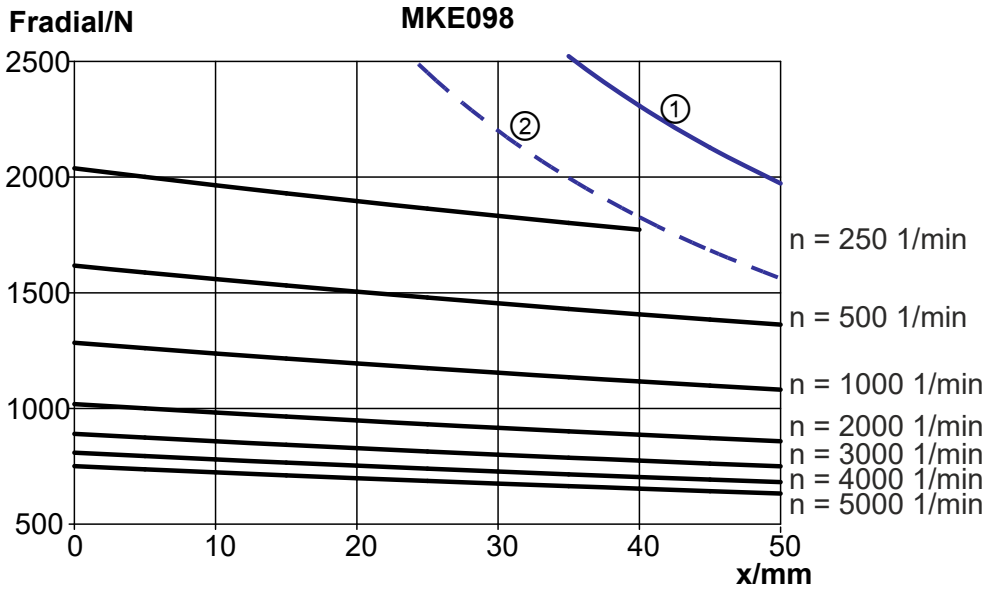


Fig. 27: MKE098: permissible radial force (shaft and bearing load)
① Shaft plain
② Shaft with keyway

8.3.5 MKE098 Axial force

MKE098:Permissible axial force 60 Nm.

8.4 MKE118

8.4.1 MKE118B-024

Designation	Symbol	Unit	MKE118B-024-__0-_E	MKE118B-024-__1-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	28.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	15.3	
Maximum torque 1)	M_{max}	Nm	102.0	
Maximum current	I_{max}	A	69.1	
Torque constant at 20 °C 1)	Km	Nm/A	2.12	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	130.0	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	0.58	
Winding inductance	L_{12}	mH	7.6	
Leakage capacitance of the component	C_{ab}	nF	10.3	
Number of pole pairs	p		4	
Moment of inertia of the rotor 1) 2)	J_{rot}	kgm^2	0.01940	
Thermal time constant	T_{th}	min	90.0	
Maximum speed (electrical)	n_{max}	1/min	4,000	
Mass	m	kg	45.0	46.0
Sound pressure level	LP	dB[A]	61.1 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	32.00
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	0.93
Maximum connection time	t_1	ms	0	15
Maximum disconnection time	t_2	ms	0	115
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0012420

1) For tolerance details refer to ➥Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

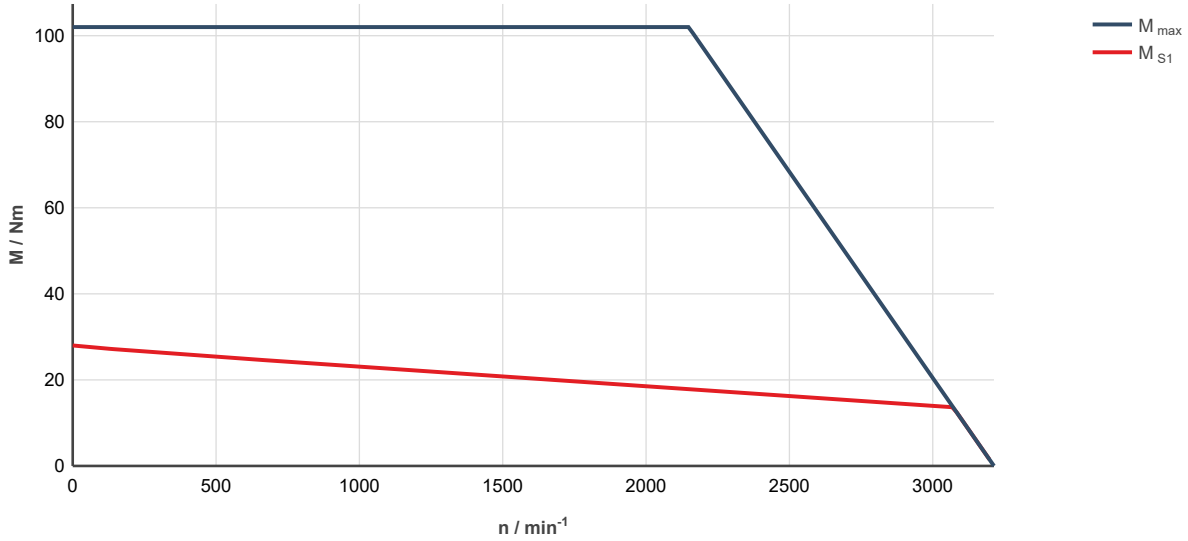


Fig. 28: MKE118B-024-__-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

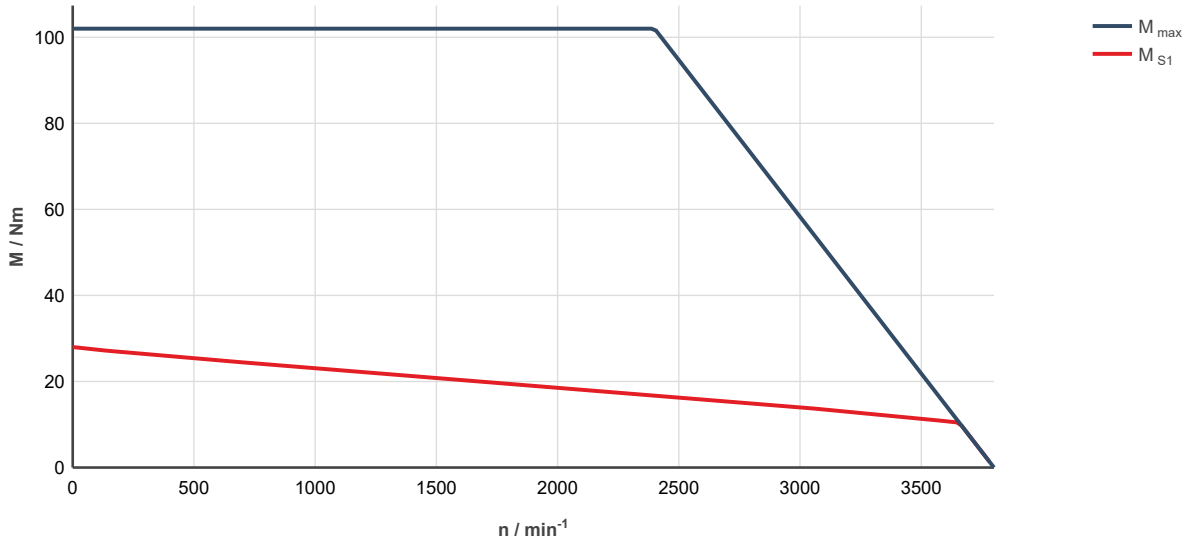


Fig. 29: MKE118B-024-__-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.4.2 MKE118B-058

Designation	Symbol	Unit	MKE118B-058-__0-_E	MKE118B-058-__1-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	28.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	28.4	
Maximum torque 1)	M_{max}	Nm	102.0	
Maximum current	I_{max}	A	127.6	
Torque constant at 20 °C 1)	Km	Nm/A	1.15	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	70.0	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	0.17	
Winding inductance	L_{12}	mH	2.2	
Leakage capacitance of the component	C_{ab}	nF		
Number of pole pairs	p		4	
Moment of inertia of the rotor 1) 2)	J_{rot}	kgm^2	0.01940	
Thermal time constant	T_{th}	min	90.0	
Maximum speed (electrical)	n_{max}	1/min	4,500	
Mass	m	kg	45.0	46.0
Sound pressure level	LP	dB[A]	61.1 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	32.00
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	0.93
Maximum connection time	t_1	ms	0	15
Maximum disconnection time	t_2	ms	0	115
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0012420

1) For tolerance details refer to ➥ Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

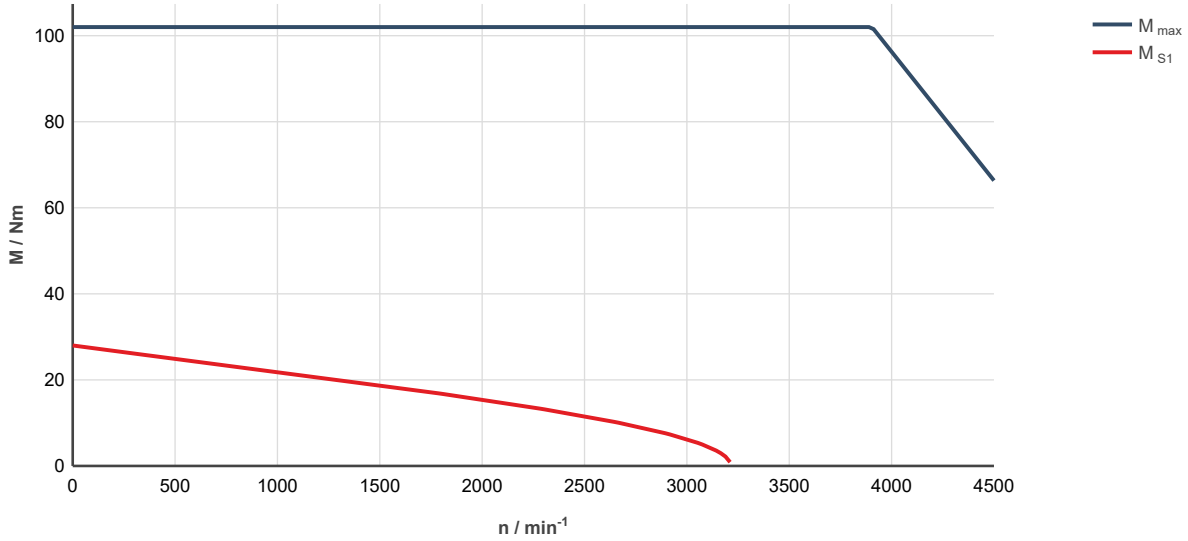


Fig. 30: MKE118B-058-__-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

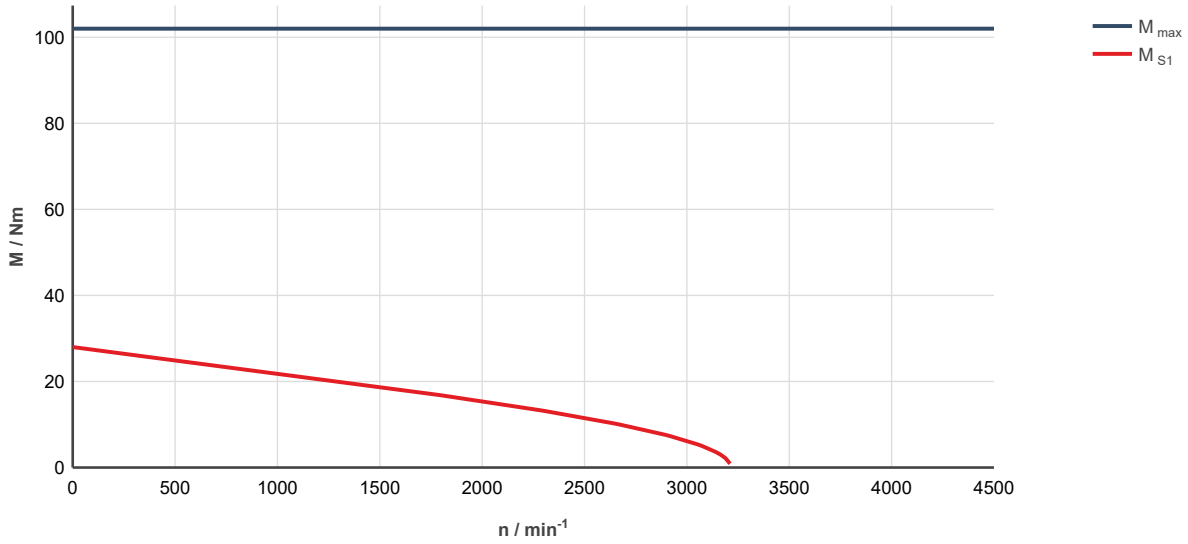


Fig. 31: MKE118B-058-__-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.4.3 MKE118D-012

Designation	Symbol	Unit	MKE118D-012-__0-_E	MKE118D-012-__3-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	48.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	13.0	
Maximum torque 1)	M_{max}	Nm	187.0	
Maximum current	I_{max}	A	58.5	
Torque constant at 20 °C 1)	Km	Nm/A	4.29	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	263.5	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	0.98	
Winding inductance	L_{12}	mH	15	
Leakage capacitance of the component	C_{ab}	nF	20.2	
Number of pole pairs	p		4	
Moment of inertia of rotor 1) 2)	J_{rot}	kgm^2	0.03620	
Thermal time constant	T_{th}	min	90.0	
Maximum speed (electrical)	n_{max}	1/min	2,100	
Mass	m	kg	65.0	69.1
Sound pressure level	LP	dB[A]	61.1 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	70.00
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	1.29
Maximum connection time	t_1	ms	0	53
Maximum disconnection time	t_2	ms	0	97
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0031800

1) For tolerance details refer to ➥ Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

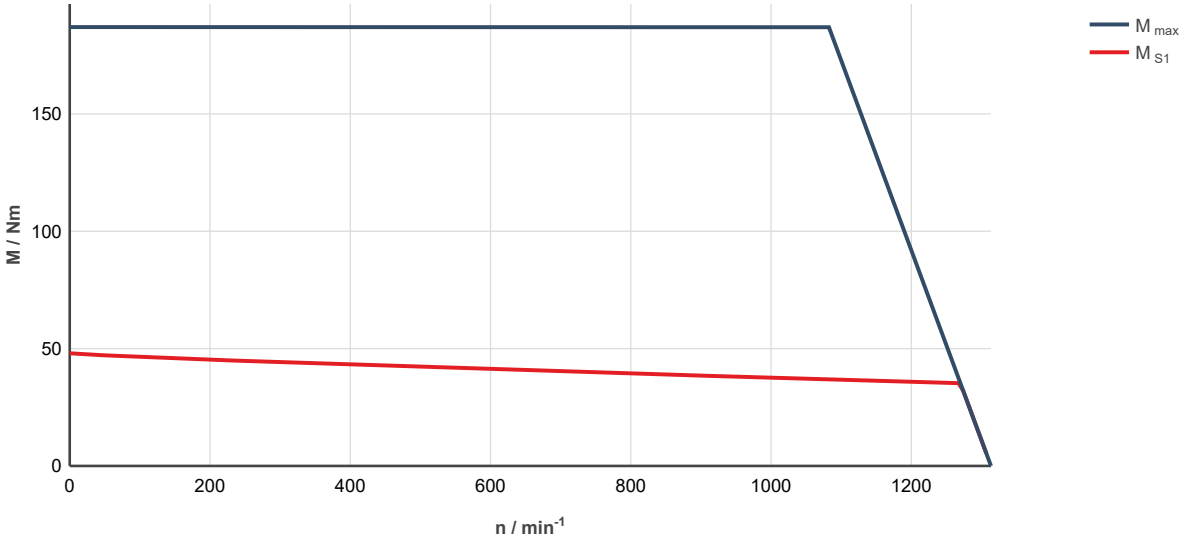


Fig. 32: MKE118D-012-__-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

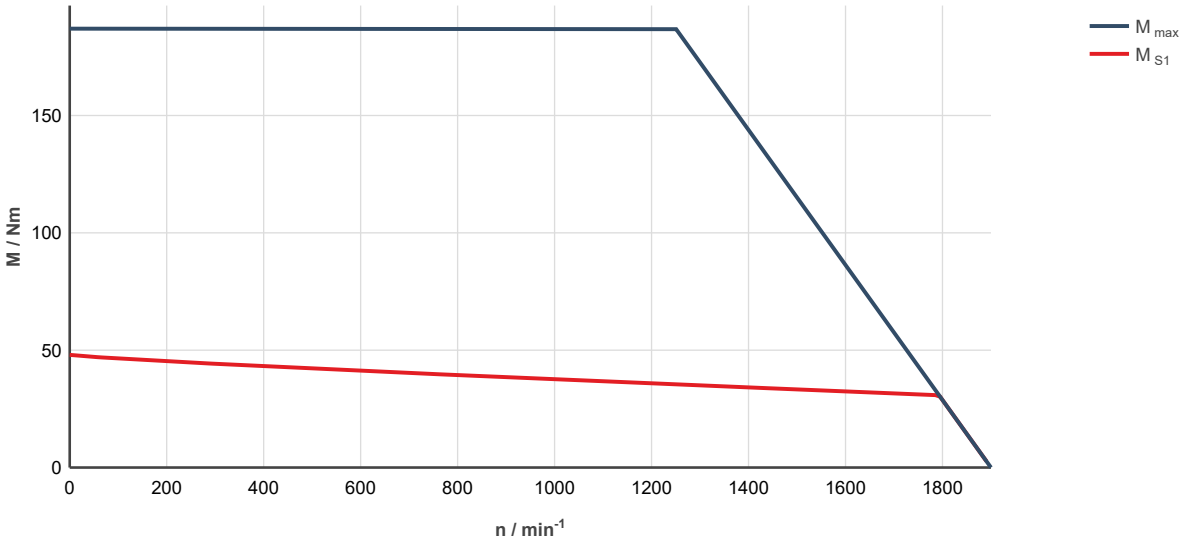


Fig. 33: MKE118D-012-__-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.4.4 MKE118D-027

Designation	Symbol	Unit	MKE118D-027-__0-_E	MKE118D-027-__3-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	48.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	22.1	
Maximum torque 1)	M_{max}	Nm	187.0	
Maximum current	I_{max}	A	99.6	
Torque constant at 20 °C 1)	Km	Nm/A	2.52	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	154.5	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	0.35	
Winding inductance	L_{12}	mH	5.7	
Leakage capacitance of the component	C_{ab}	nF		
Number of pole pairs	p		4	
Moment of inertia of the rotor 1) 2)	J_{rot}	kgm^2	0.03620	
Thermal time constant	T_{th}	min	90.0	
Maximum speed (electrical)	n_{max}	1/min	3,000	
Mass	m	kg	65.0	69.1
Sound pressure level	LP	dB[A]	61.1 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	70.00
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	1.29
Maximum connection time	t_1	ms	0	53
Maximum disconnection time	t_2	ms	0	97
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0031800

1) For tolerance details refer to ➥ Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

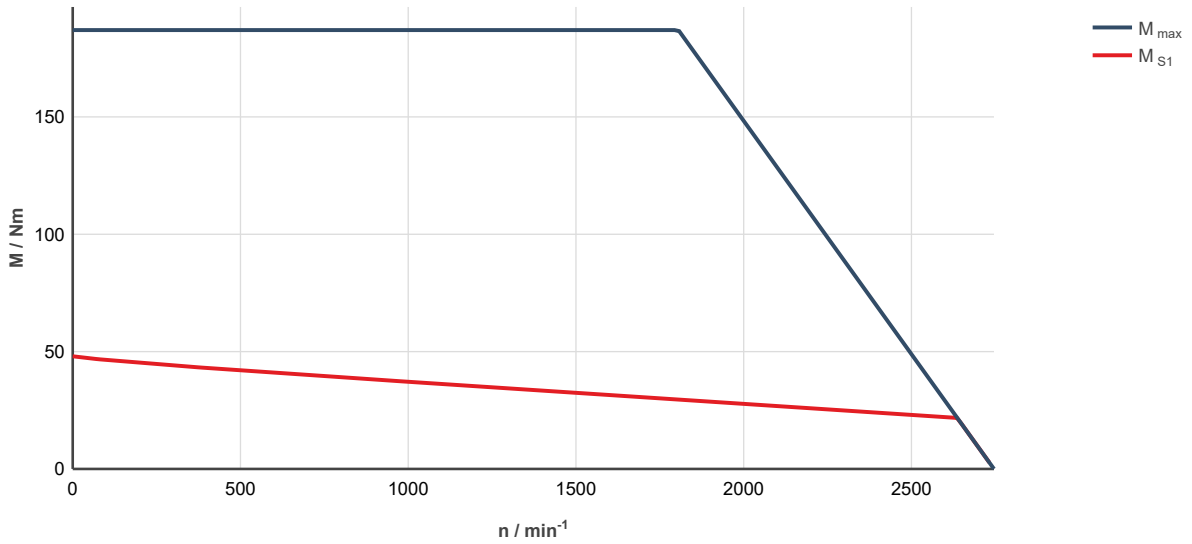


Fig. 34: MKE118D-027-__-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

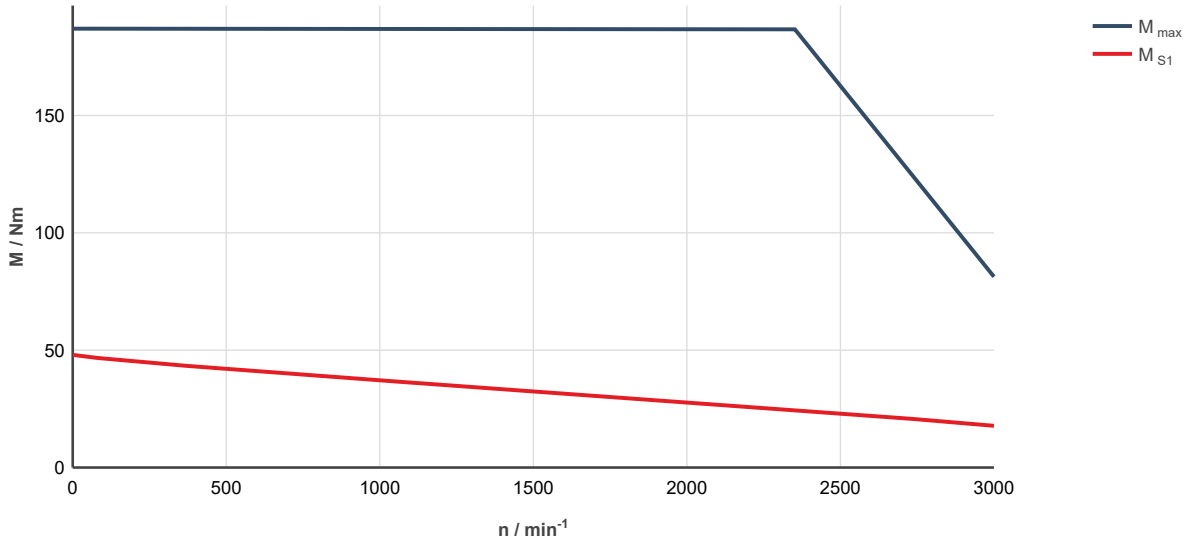


Fig. 35: MKE118D-027-__-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.4.5 MKE118D-035

Designation	Symbol	Unit	MKE118D-035-__0-_E	MKE118D-035-__3-_E
Continuous torque at standstill 60 K 1)	M_{0_60}	Nm	48.0	
Continuous current at standstill 60K	$I_{0\_60(eff)}$	A	29.8	
Maximum torque 1)	M_{max}	Nm	187.0	
Maximum current	I_{max}	A	134.3	
Torque constant at 20 °C 1)	Km	Nm/A	1.87	
Voltage constant at 20 °C 1)	K_{EMK_1000}	V/1000 min^{-1}	114.5	
Winding resistance at 20 °C	R_{12}	Ω (Ohm)	0.21	
Winding inductance	L_{12}	mH	3.2	
Leakage capacitance of the component	C_{ab}	nF		
Number of pole pairs	p		4	
Moment of inertia of the rotor 1) 2)	J_{rot}	kgm^2	0.03620	
Thermal time constant	T_{th}	min	90.0	
Maximum speed (electrical)	n_{max}	1/min	3,000	
Mass	m	kg	65.0	69.1
Sound pressure level	LP	dB[A]	61.1 (±3)	
Ambient temperature during operation	T_{um}	°C	0...40	
Degree of protection (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.		155	
Holding brake				
Holding torque	M_4	Nm	0	70.00
Rated voltage1)	U_N	V	0	24
Rated current	I_N	A	0	1.29
Maximum connection time	t_1	ms	0	53
Maximum disconnection time	t_2	ms	0	97
Moment of inertia of the holding brake 1) 2)	J_{br}	$kg*m^2$	0	0.0031800

1) For tolerance details refer to ➥ Chapter 7.3 “Tolerances” on page 38

2) For motors with holding brake, the moment of inertia of the holding brake must be added to the moment of inertia of the motors to determine the total moment of inertia.

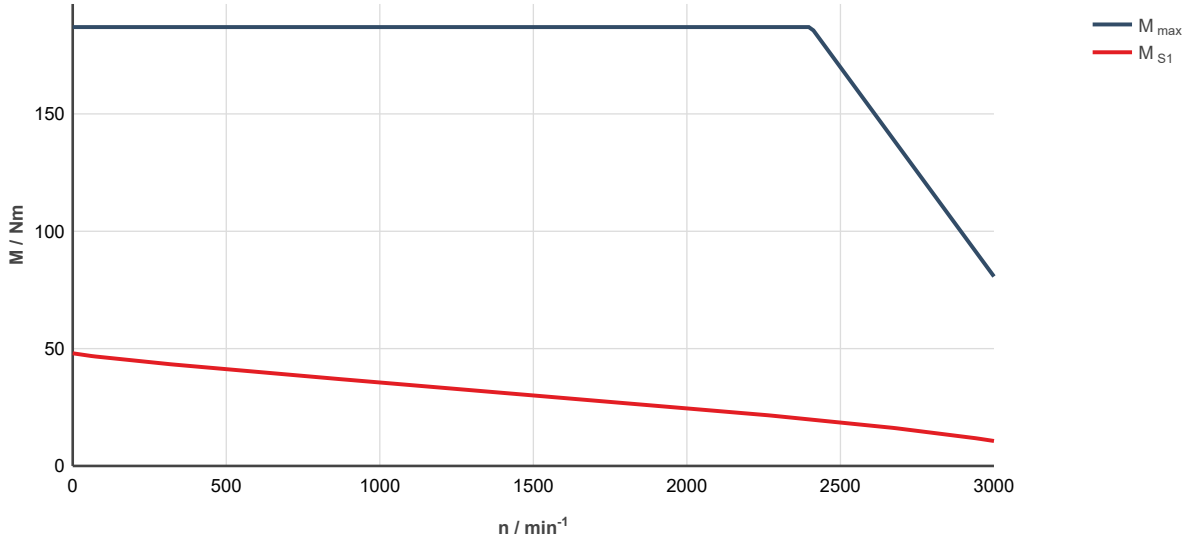


Fig. 36: MKE118D-035-__-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

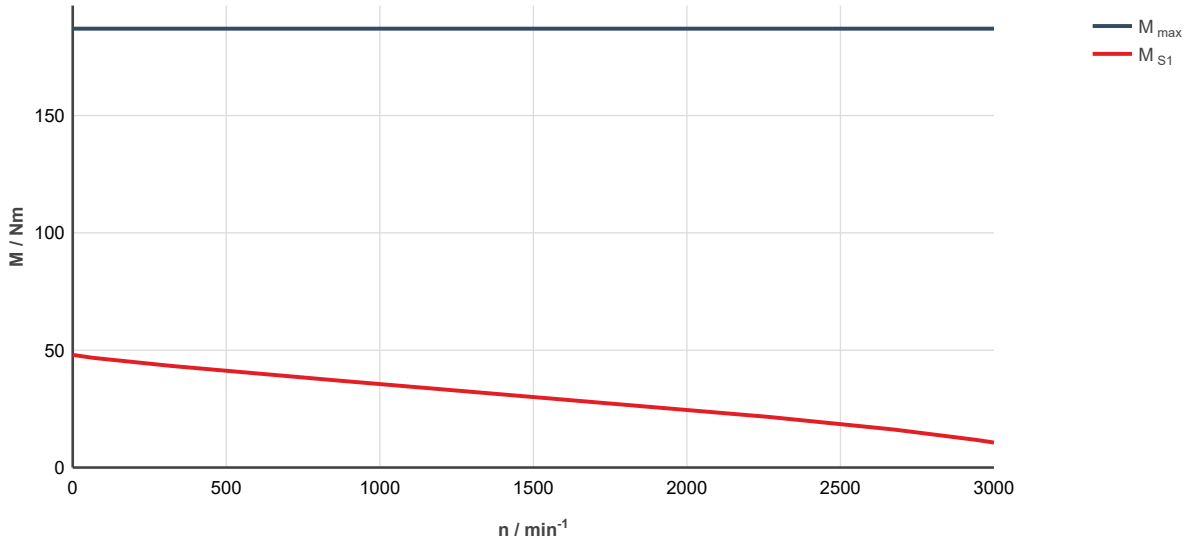


Fig. 37: MKE118D-035-__-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

8.4.6 MKE118 Specifications

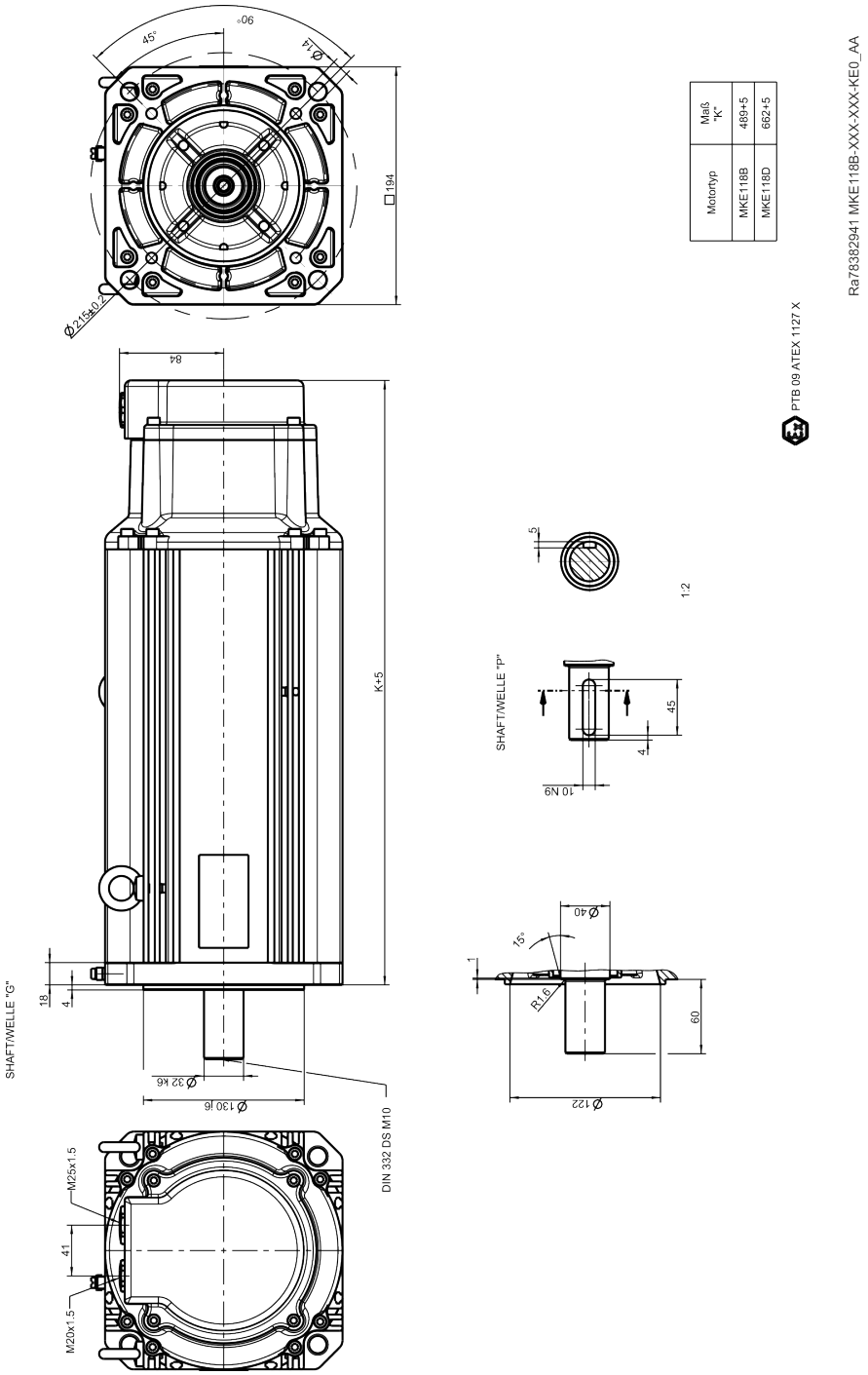


Fig. 38: Specifications MKE118

8.4.7 MKE118 Radial force

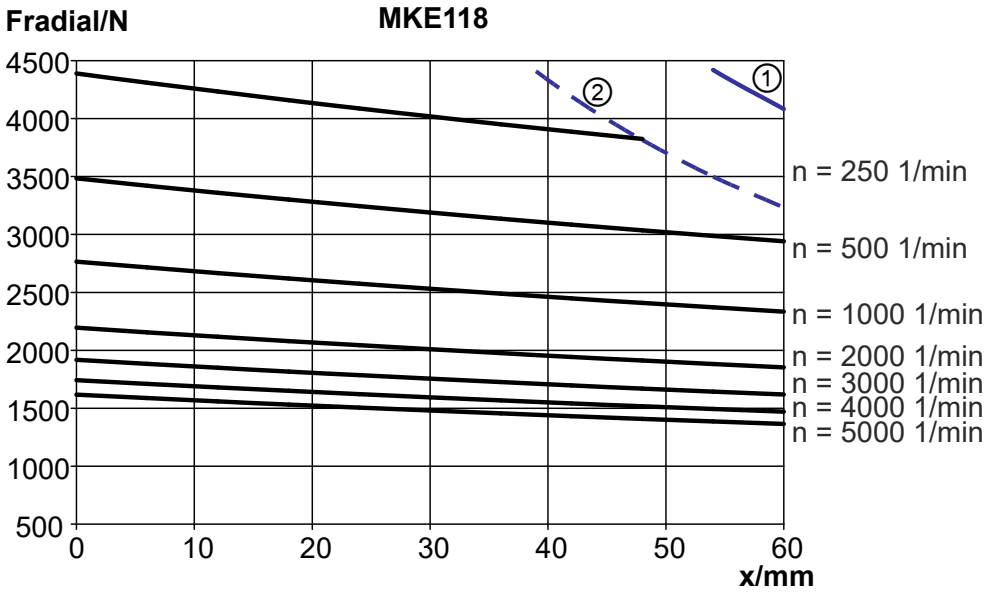


Fig. 39: MKE118: permissible radial force (shaft and bearing load)
① Shaft plain
② Shaft with keyway

8.4.8 MKE118 Axial force

MKE118:**Permissible axial force 200 Nm** .

9 Electrical connection

9.1 Electrical connection general notes

⚠ WARNING	**Risk of explosion due to improper handling during motor connection!** Make sure that the motor is only connected in de-energized state and a non-explosive atmosphere. Before working on the system, always use a suitable measuring device (e.g. multimeter) to check whether any parts of the system are still under residual voltage (e.g. caused by residual energies of capacitors in filters and drive units etc.) their discharge times are to be waited for. The connection between the protective conductor terminal and the operating ground must be made before any other connections. The connection or terminal points to or on the control unit must be located outside the potentially explosive atmosphere or must be approved for use in potentially explosive atmospheres.
⚠ WARNING	**Danger! Electric voltage! Operations in the vicinity of live parts are extremely dangerous.** – Work required on the electric system may only be carried out by skilled electricians. Tools for electricians (VDE tools) are absolutely necessary. – Isolate (even auxiliary circuits). – Secure against reactivation. – Ensure de-energization. – Ground and short-circuit. – Cover or shield any adjacent live parts.
⚠ WARNING	**High electric voltage! Danger to life, risk of injury by electric shock.** While the rotor is rotating, motors with permanent magnet excitation create a voltage > 60 V at the motor connections. Any work may only be carried out while the motor is at standstill. Never connect or disconnect plug connectors under load!
NOTICE	**Never touch the connection points of electrostatic sensitive devices!** – Mounted components e.g. temperature sensor, encoder) can contain parts susceptible to electrical discharge (ESD). Observe ESD safety measures.

The electrical connection of MKE motors (EU) consists of the following components:

- Power connection (terminal box)
- Encoder connection (terminal box)
- Equipotential bonding conductor (ground conductor)

Power and encoder connection cables are connected within the ATEX terminal box. The openings for the cable entries (Ex-KLE) are closed with dummy plugs on delivery. Use certified Ex cable and line entries (EN 60079-14:2014). The Ex cable and line entries are not included in the scope of delivery.

Mount the cable glands (Ex-KLE) according to the manufacturer's specifications.

All connection variants must comply with the specifications according to EN 60079-14:2014 point 10.6 ff "Additional requirements for type of protection "d" - Flameproof enclosure".

Observe the manufacturer's operating instructions as well as DIN EN 60079-14 and corresponding regional standards.

Remark

“Only use suitable Ex cable glands (Ex-KLE) in accordance with EN 60079-14:2014 Explosive atmospheres. The manufacturer or machine operator is in the sole responsibility for project planning, selection and installation of electric devices (assembly).

A seal in accordance with EN IEC 60079-0 must be used between the Ex-KLE and the terminal box cover to ensure the necessary IP protection of the motor in accordance with EN 60079-31.

Remark

Flat gaskets or O-rings must be used to ensure suitable sealing of the Ex-KLE to the motor housing (IP protection).

Use shielded connection lines. The shield connection -X5 for encoder and power cables is located in the terminal box lid.

The protective conductor connection is made via the protective conductor routed in the power cable in the terminal box of theMKE motors.

An additional connection of a protective or equipotential bonding conductor is mandatory for Ex motors according to EN IEC 60079-0. MKE motors must be grounded via the additional connection part (protective earth terminal on the motor flange). Ground terminal cross section see ➥ Chapter 9.7 “Ground connection” on page 80.

Connection thermo controller

The motor temperature can be evaluated via Rexroth drive controllers when MKE motors are used in potentially explosive atmospheres.
The connection of the PTC resistors, for the motor temperature evaluation, is shown in the respective connection diagrams of the drive control units.

⚠ WARNING	**Risk of explosion due to impermissible temperature increase in case of faulty temperature evaluation!**
	The connections [1] and [2] of the PTC resistor (triplet PTC thermistor) must be connected to the temperature monitoring of the drive controller! Depending on the drive controller or third-party converter used, function-tested tripping devices with the Ⓔx II 2 G or Ⓔx II 2 D designation may be required to evaluate the temperature sensors.

The maximum permissible surface temperature of the MKE motors is ≤ 135 °C, which corresponds to temperature class T4. The triplet thermistors installed in the MKE motors, in conjunction with the evaluation circuits of the drive controllers, ensure reliable and safe overtemperature shutdown.

9.2 Wiring diagram

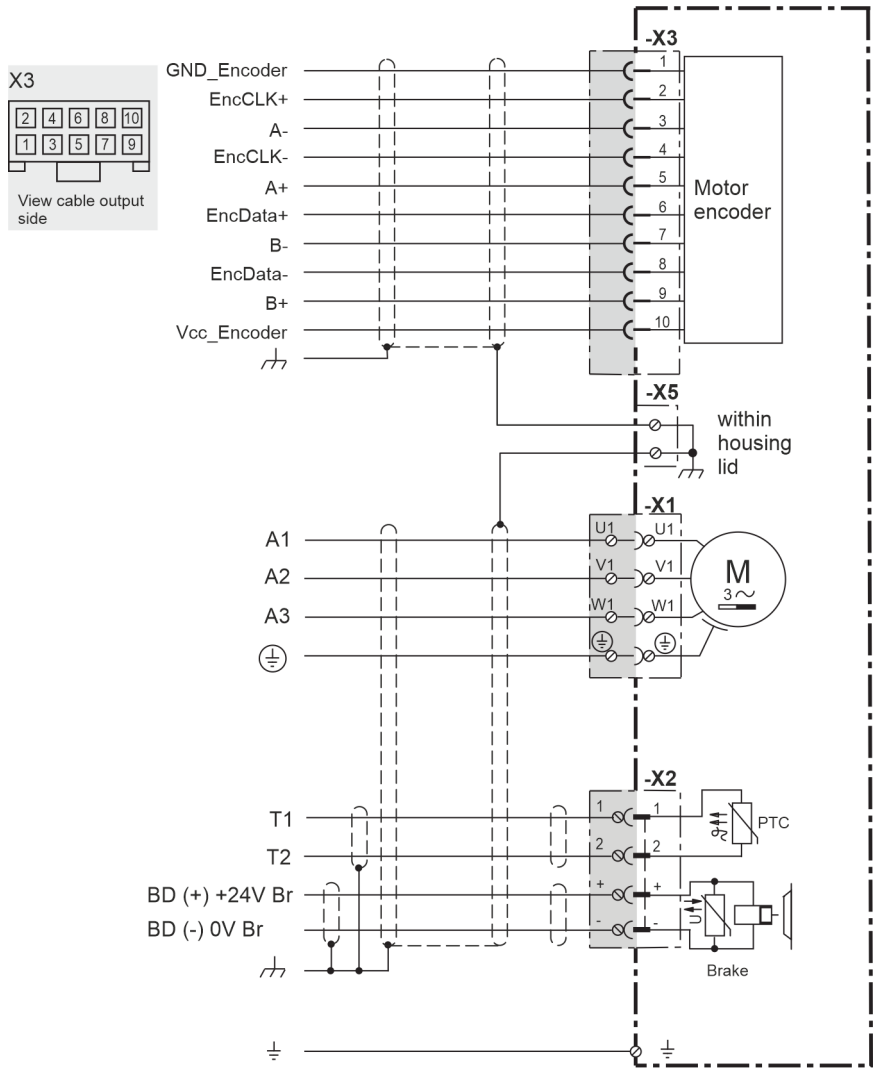


Fig. 40: Connection MKE EU with EnDat2.1

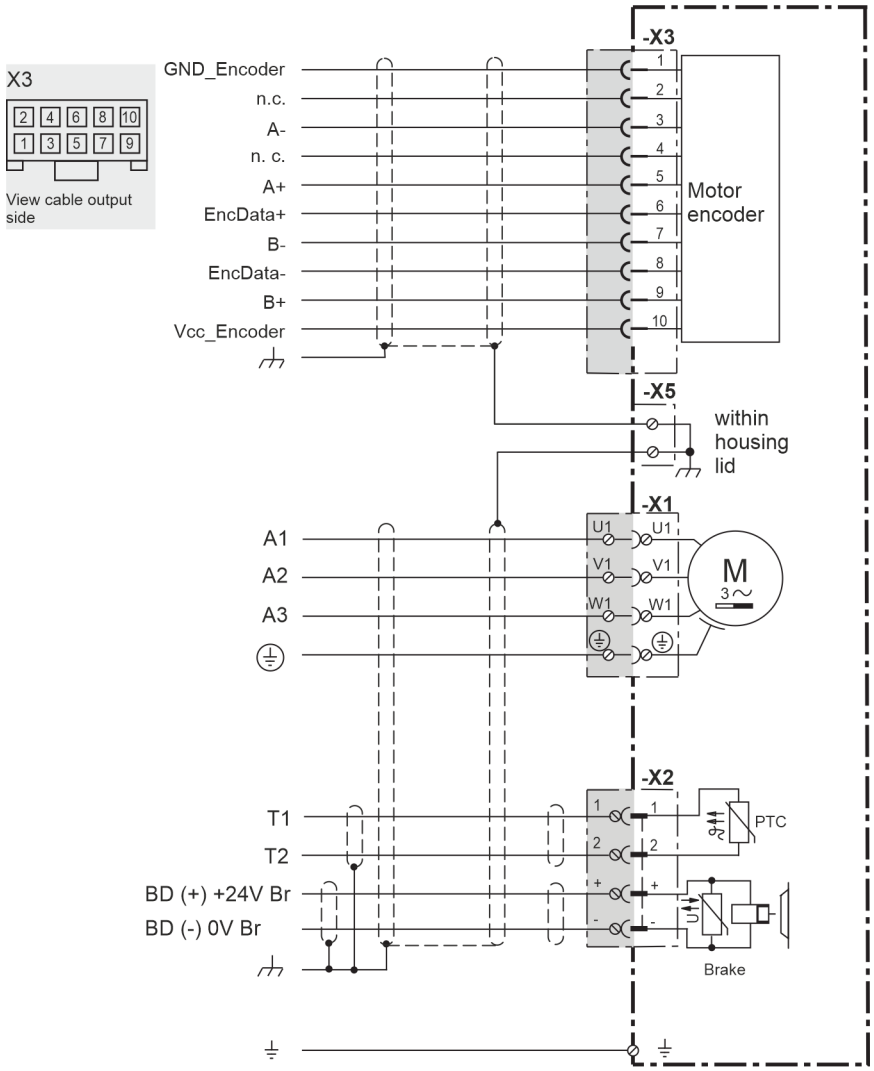
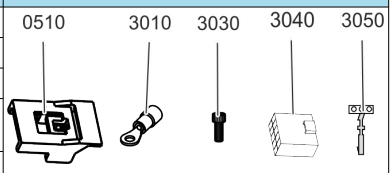


Fig. 41: Connection MKE EU with Hiperface

9.3 Terminal boxes (MKE037-E) electrical connection

The accessory kit **SUP-M04-MKE0XX** is necessary to connect the motor. The accessory kit is included with the motors at delivery.

Pos	Material number	Designation	Quantity	View
0500	R911400167	DOK-MOTOR*-MKE0XX*****-ISRS-D0-P	1	
0510	R911278283	LOCKING CONNECTOR 2X5 POL.	1	
3010	R911211410	TERMINAL END KQ-M3_/0.25-01.5RD16&	2	
3030	R911282226	CYLINDER HEAD SCREW ISO4762-M5X14-8.8-MK	4	
3040	R911286371	Connector housing 10pol. 87613-005	1	
3050	R911260765	CONTACT KON-EF-0.32/0.52-NNN&	10	

⚠ WARNING

Danger of explosion by using improper cable glands.

– The Ex cable glands and cables must be evaluated, selected and assembled by the machine builder and always in combination with the cables used in accordance with DIN EN 60079-14 "Potentially explosive atmospheres - Planning, selection and installation of electrical systems".

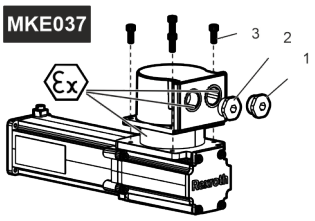


Fig. 42: Electrical connection MKE037 Housing design E

1 Remove M20 screw-type blank cap and replace it by Ex cable gland
2 Remove M20 screw-type blank cap and replace it by Ex cable gland
3 Tightening torque 6.3 Nm (use enclosed screws 3030)
Ex Ignition gap, assembly damage not permissible

Notes for assembly

- In the case of mounting procedures, flameproof gaps must be opened and jointed. Avoid damages on the ignition gaps. Do not remove existing mounting grease, leave it on the O-rings as delivered. Work in a clean environment.
- In the case of mounting damages on the flameproof joints, let the motor be repaired with origin components by the Rexroth service.
- For mounting, use the delivered pre-coated screws.
- Use shielded connection cables.
- Use Ex cable glands.

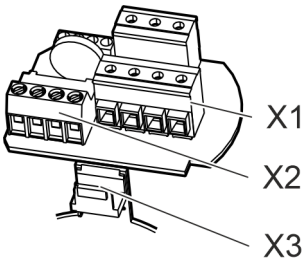


Fig. 43: MKE037 EU Clamps

Assembly -X1

Pin	Signal
1	U1
2	V1
3	W1
4	PE

Technical data -X1	
Clamping range	0.5 ... 4 mm²
Wire stripping length	5 mm, use wire end ferrules
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Assembly -X2

Pin	Signal
1	T1
2	T2
3	BR+
4	BR-

Technical data -X2	
Clamping range	2.5 mm²
Wire stripping length	5.5 mm, use wire end ferrules

Technical data -X2	
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Notes about assembly:

- Insert the plug terminal X2 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly -X3

Pin	Signal [Encoder A, C]	Signal [Encoder B, D]
1	ENC_ Encoder	ENC_ Encoder
2	n.c.	ENC_CLK-.
3	A-	A-
4	n.c.	ENC_CLK-+
5	A+	A+
6	EncData+	EncData+
7	B-	B-
8	EncData-	EncData-
9	B+	B+
10	VCC_ Encoder	VCC_ Encoder

Technical data -X3	
Contact	R911260765, Bosch Rexroth
Crimping area	0.32 ... 0.52 mm²
Wire stripping length	3 mm
Crimping tool	R911262293, Bosch Rexroth

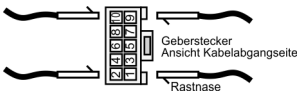


Fig. 44: MKE-X3 Pin assembly

Fig. 45: MKE-X3 Plug-in interlock

Notes about assembly:

- A hand crimping tool to handle the clamp terminal X3 can be ordered at Bosch Rexroth. **Order number: R911262293**.
- Assemble the contacts within X3 connector housing as decribed in the following picture.
- Assemble the plug-in interlock (0510) on the connector housing X3.
- Insert the plug terminal X3 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly shield connection

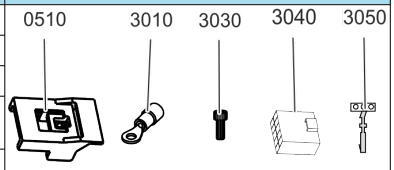
Technical data terminal ends	
Terminal end M3	R911211410, Bosch Rexroth
Crimping area	0.25 ... 1.5 mm²
Wire stripping length	5 mm
Crimping tool	Standard
Tightening torque	1.3 Nm (M3 screw within housing lid)

Notes about assembly:

- Use terminal ends to connect the shield connection to the motor housing.

9.4 Terminal box (MKE047-E) electrical connection

The accessory kit **SUP-M04-MKE0XX** is required to connect the motors. The accessory kit is included with the motors at delivery.

Pos	Material number	Designation	Quantity	View
0500	R911400167	DOK-MOTOR*-MKE0XX*****-ISRS-D0-P	1	
0510	R911278283	LOCKING CONNECTOR 2X5 POL.	1	
3010	R911211410	TERMINAL END KQ-M3_/0.25-01.5RD16&	2	
3030	R911282226	CYLINDER HEAD SCREW ISO4762-M5X14-8.8-MK	4	
3040	R911286371	Connector housing 10pol. 87613-005	1	
3050	R911260765	CONTACT KON-EF-0.32/0.52-NNN&	10	

⚠ WARNING

Danger of explosion by using improper cable glands.

– The Ex cable glands and cables must be evaluated, selected and assembled by the machine builder and always in combination with the cables used in accordance with DIN EN 60079-14 "Potentially explosive atmospheres - Planning, selection and installation of electrical systems".

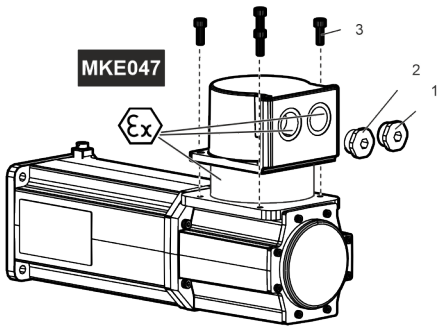


Fig. 46: Electric connection MKE047 housing design E

1 Remove M20 screw-type blank cap and replace it by Ex cable gland
2 Remove M20 screw-type blank cap and replace it by Ex cable gland
3 Tightening torque 6.3 Nm (use enclosed screws 3030)
Ex Ignition gap, assembly damage not permissible

Notes for assembly

- In the case of mounting procedures, flameproof gaps must be opened and jointed. Avoid damages on the ignition gaps. Do not remove existing mounting grease, leave it on the O-rings as delivered. Work in a clean environment.
- In the case of mounting damages on the flameproof joints, let the motor be repaired with origin components by the Rexroth service.
- For mounting, use the delivered pre-coated screws.
- Use shielded connection cables.
- Use Ex cable glands.

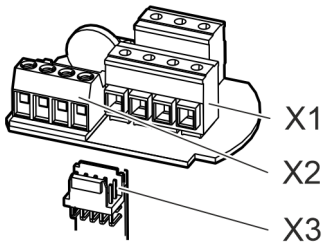


Fig. 47: MKE047 EU clamps

Assembly -X1

Pin	Signal
1	U1
2	V1
3	W1
4	PE

Technical data -X1	
Clamping range	0.5 ... 4 mm²
Wire stripping length	5 mm, use wire end ferrules
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Assembly -X2

Pin	Signal
1	T1
2	T2
3	BR+
4	BR-

Technical data -X2	
Clamping range	2.5 mm²
Wire stripping length	5.5 mm, use wire end ferrules
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Notes about assembly:

- Insert the plug terminal X2 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly -X3

Pin	Signal [Encoder A, C]	Signal [Encoder B, D]
1	ENC_ Encoder	ENC_ Encoder
2	n.c.	ENC_CLK-.
3	A-	A-
4	n.c.	ENC_CLK-+
5	A+	A+
6	EncData+	EncData+
7	B-	B-
8	EncData-	EncData-
9	B+	B+
10	VCC_ Encoder	VCC_ Encoder

Technical data -X3	
Contact	R911260765, Bosch Rexroth
Crimping area	0.32 ... 0.52 mm²
Wire stripping length	3 mm
Crimping tool	R911262293, Bosch Rexroth

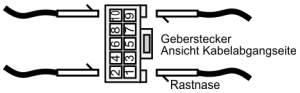


Fig. 48: MKE-X3 Pin assembly

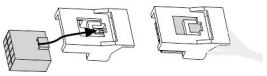


Fig. 49: MKE-X3 Plug-in interlock

Notes about assembly:

- A hand crimping tool to handle the clamp terminal X3 can be ordered at Bosch Rexroth. **Order number: R911262293**.
- Assemble the contacts within X3 connector housing as decribed in the following picture.
- Assemble the plug-in interlock (0510) on the connector housing X3.
- Insert the plug terminal X3 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly shield connection

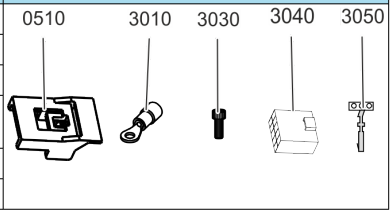
Technical data terminal ends	
Terminal end M3	R911211410, Bosch Rexroth
Crimping area	0.25 ... 1.5 mm²
Wire stripping length	5 mm
Crimping tool	Standard
Tightening torque	1.3 Nm (M3 screw within housing lid)

Notes about assembly:

- Use terminal ends to connect the shield connection to the motor housing.

9.5 Terminal boxes (MKE098-E) electrical connection

The accessory kit **SUP-M04-MKE0XX** is necessary to connect the motor. The accessory kit is included with the motors at delivery.

Pos	Material number	Designation	Quantity	View
0500	R911400167	DOK-MOTOR*-MKE0XX*****-ISRS-D0-P	1	
0510	R911278283	LOCKING CONNECTOR 2X5 POL.	1	
3010	R911211410	TERMINAL END KQ-M3_/0.25-01.5RD16&	2	
3030	R911282226	CYLINDER HEAD SCREW ISO4762-M5X14-8.8-MK	4	
3040	R911286371	Connector housing 10pol. 87613-005	1	
3050	R911260765	CONTACT KON-EF-0.32/0.52-NNN&	10	

⚠ WARNING

Danger of explosion by using improper cable glands.

– The Ex cable glands and cables must be evaluated, selected and assembled by the machine builder and always in combination with the cables used in accordance with DIN EN 60079-14 "Potentially explosive atmospheres - Planning, selection and installation of electrical systems".

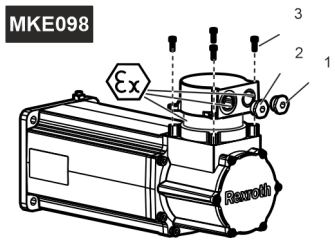


Fig. 50: Electrical connection MKE098 Housing design E

1 Remove M20 screw-type blank cap and replace it by Ex cable gland
2 Remove M20 screw-type blank cap and replace it by Ex cable gland
3 Tightening torque 6.3 Nm (use enclosed screws 3030)
Ex Ignition gap, assembly damage not permissible

Notes for assembly

- In the case of mounting procedures, flameproof gaps must be opened and jointed. Avoid damages on the ignition gaps. Do not remove existing mounting grease, leave it on the O-rings as delivered. Work in a clean environment.
- In the case of mounting damages on the flameproof joints, let the motor be repaired with origin components by the Rexroth service.
- For mounting, use the delivered pre-coated screws.
- Use shielded connection cables.
- Use Ex cable glands.

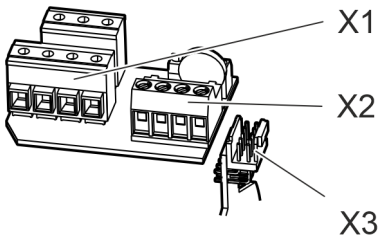


Fig. 51: MKE098 Clamps

Assembly -X1

Pin	Signal
1	U1
2	V1

Pin	Signal
3	W1
4	PE

Technical data -X1	
Clamping range	0.5 ... 4 mm²
Wire stripping length	5 mm, use wire end ferrules
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Assembly -X2

Pin	Signal
1	T1
2	T2
3	BR+
4	BR-

Technical data -X2	
Clamping range	2.5 mm²
Wire stripping length	5.5 mm, use wire end ferrules
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Notes about assembly:

- Insert the plug terminal X2 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly -X3

Pin	Signal [Encoder A, C]	Signal [Encoder B, D]
1	ENC_ Encoder	ENC_ Encoder
2	n.c.	ENC_CLK-.
3	A-	A-
4	n.c.	ENC_CLK-+
5	A+	A+
6	EncData+	EncData+
7	B-	B-
8	EncData-	EncData-
9	B+	B+
10	VCC_ Encoder	VCC_ Encoder

Technical data -X3	
Contact	R911260765, Bosch Rexroth
Crimping area	0.32 ... 0.52 mm²
Wire stripping length	3 mm
Crimping tool	R911262293, Bosch Rexroth

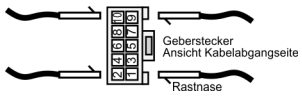


Fig. 52: MKE-X3 Pin assembly

Fig. 53: MKE-X3 Plug-in interlock

Notes about assembly:

- A hand crimping tool to handle the clamp terminal X3 can be ordered at Bosch Rexroth. **Order number: R911262293**.
- Assemble the contacts within X3 connector housing as decribed in the following picture.

- Assemble the plug-in interlock (0510) on the connector housing X3.
- Insert the plug terminal X3 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly shield connection

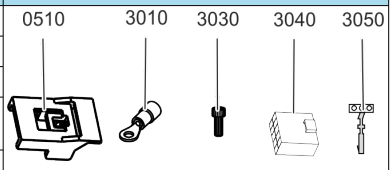
Technical data terminal ends	
Terminal end M3	R911211410, Bosch Rexroth
Crimping area	0.25 ... 1.5 mm²
Wire stripping length	5 mm
Crimping tool	Standard
Tightening torque	1.3 Nm (M3 screw within housing lid)

Notes about assembly:

- Use terminal ends to connect the shield connection to the motor housing.

9.6 Terminal boxes (MKE118-E) electrical connection

The accessory kit **SUP-M04-MKE1XX** is necessary to connect the motor. The accessory kit is included with the motors at delivery.

Pos	Material number	Designation	Quantity	View
0500	R911400168	DOK-MOTOR*-MKE1XX*****-ISRS-D0-P	1	
0510	R911278283	LOCKING CONNECTOR 2X5 POL.	1	
3010	R911211410	TERMINAL END KQ-M3_/0.25-01.5RD16&	2	
3030	R913018334	CYLINDER HEAD SCREW ISO4762-M6X25-8.8-CM&	4	
3040	R911286371	Connector housing 10pol. 87613-005	1	
3050	R911260765	CONTACT KON-EF-0.32/0.52-NNN&	10	

⚠ WARNING

Danger of explosion by using improper cable glands.

– The Ex cable glands and cables must be evaluated, selected and assembled by the machine builder and always in combination with the cables used in accordance with DIN EN 60079-14 "Potentially explosive atmospheres - Planning, selection and installation of electrical systems".

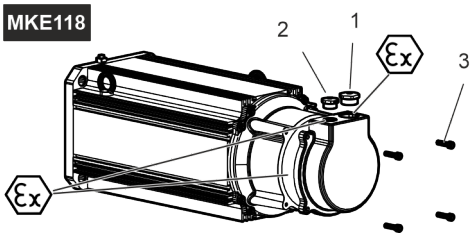


Fig. 54: Electrical connection MKE118 Housing design E

1 Remove M25 screw-type blank cap and replace it by Ex cable gland
2 Remove M20 screw-type blank cap and replace it by Ex cable gland
3 Tightening torque 6.3 Nm (use enclosed screws 3030)
Ex Ignition gap, assembly damage not permissible

Notes for assembly

- In the case of mounting procedures, flameproof gaps must be opened and jointed. Avoid damages on the ignition gaps. Do not remove existing mounting grease, leave it on the O-rings as delivered. Work in a clean environment.
- In the case of mounting damages on the flameproof joints, let the motor be repaired with origin components by the Rexroth service.
- The lid screws are coated. For mounting, use the delivered pre-coated screws. Clean the screw-in threads before screwing in the screws.
- Use shielded connection cables.
- Use Ex cable glands.

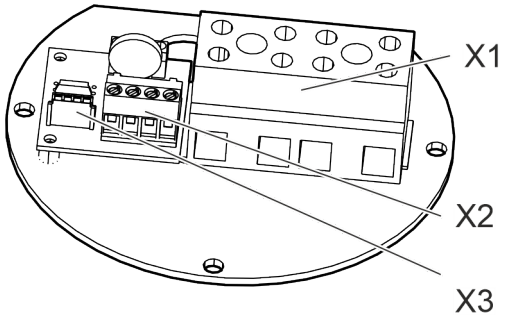


Fig. 55: MKE118 Clamps

Assembly -X1

Pin	Signal
1	U1
2	V1
3	W1
4	PE

Technical data -X1	
Clamping range	0.5 ... 10 mm²
Wire stripping length	12 mm Use wire end ferrules
Clamping screws (size)	M4
Tightening torque clamping screws	1.8 Nm

Assembly -X2

Pin	Signal
1	T1
2	T2
3	BR+
4	BR-

Technical data -X2	
Clamping range	2.5 mm²
Wire stripping length	5.5 mm, use wire end ferrules
Clamping screws (size)	M3
Tightening torque clamping screws	0.5 Nm

Notes about assembly:

- Insert the plug terminal X2 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly -X3

Pin	Signal [Encoder A, C]	Signal [Encoder B, D]
1	ENC_ Encoder	ENC_ Encoder
2	n.c.	ENC_CLK-.
3	A-	A-
4	n.c.	ENC_CLK-+
5	A+	A+
6	EncData+	EncData+
7	B-	B-
8	EncData-	EncData-
9	B+	B+
10	VCC_ Encoder	VCC_ Encoder

Technical data -X3	
Contact	R911260765, Bosch Rexroth
Crimping area	0.32 ... 0.52 mm²
Wire stripping length	3 mm
Crimping tool	R911262293, Bosch Rexroth

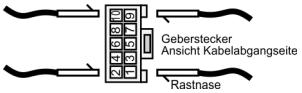


Fig. 56: MKE-X3 Pin assembly

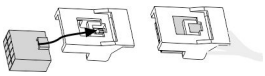


Fig. 57: MKE-X3 Plug-in interlock

Notes about assembly:

- A hand crimping tool to handle the clamp terminal X3 can be ordered at Bosch Rexroth. **Order number: R911262293**.
- Assemble the contacts within X3 connector housing as decribed in the following picture.
- Assemble the plug-in interlock (0510) on the connector housing X3.
- Insert the plug terminal X3 onto the printed circuit board and observe correct latch of the plug-in interlock.

Assembly shield connection

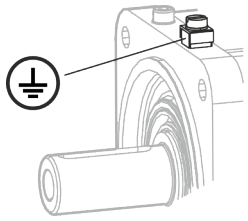
Technical data terminal ends	
Terminal end M3	R911211410, Bosch Rexroth
Crimping area	0.25 ... 1.5 mm²
Wire stripping length	5 mm
Crimping tool	Standard
Tightening torque	1.3 Nm (M3 screw within housing lid)

Notes about assembly:

- Use terminal ends to connect the shield connection to the motor housing.

9.7 Ground connection

Motors for hazardous areas must be grounded via a separate ground conductor and a grounding conductor within the motor power cable. An additional connection clamp is provided on the motor flange to connect the grounding conductor.



Ground connection	M5 screw
Nominal cross-section	4 mm²
Clamping range	4 mm² (fine-wired); 6 mm² (single stranded)
Tightening torque	maximum 2 Nm

10 Ambient conditions

10.1 Ambient conditions during operation

Climatic conditions are defined in classes according to DIN EN IEC 60721. The classes are differentiated in the areas storage, transport and operation. They are based on long-term experiences and take all influencing variables into account, e.g., air temperature and air humidity.

A permanent use of the motors is possible when the specified class 3K22 according to DIN EN IEC 60721-3-3 is observed. Deviations and enhancements according to the follwing table must be observed.

Table 16: Ambient conditions

Operation	
Installation altitude	0 ... 1,000 m above sea level
Ambient conditions	0 ... +40 °C
Relative humidity	5 ... 95 %
Absolute humidity	1 ... 29 g/m ^{3}

10.1.1 Vibration load during operation

Vibrations are sine-wave oscillations in operation, which vary in their effect on the resistance of the motors depending on their intensity.

The specified limit values are valid for frequencies of 10-2000 Hz during stimulation on the motor flange. Limitations can be necessary for occurring resonances depending on the application and installation situation.

The following limit values apply according to EN 60068-2-6 for MKE motors:

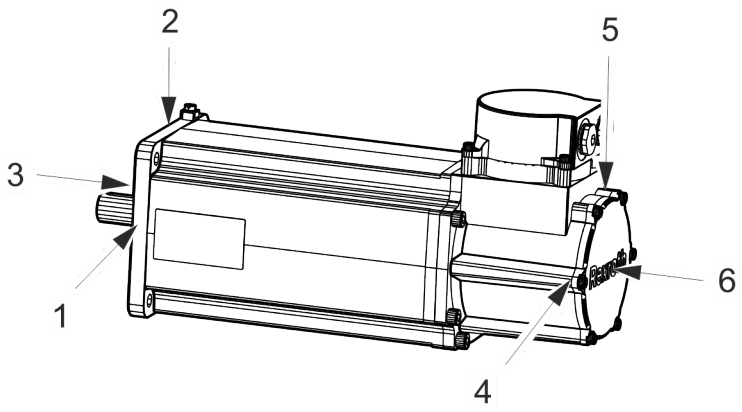


Fig. 58: Vibration load on measuring points

Table 17: Allowed vibration load MKE motors.

Direction	Measuring point	Limit value (10-2000 Hz)	
		Encoder	
		A, C	B, D
radial	1, 2 (radial motor flange)	30 m/s²	10 m/s²
	4, 5 (radial, bearing shield)	50 m/s²	50 m/s²
Axial	3 (axial motor flange)	10 m/s²	10 m/s²
	6 (axial bearing shield)	25 m/s²	25 m/s²

The specified values must not be exceeded.

10.2 Operation on foreign converters

Principally, operating MKE motors on foreign converters is possible, but the following requirements and limitations on foreign converters must be observed.

⚠ WARNING	**Danger of explosion or material damage due to overload!** Observe the following requirements for safe motor operation on foreign converters. Connection of all necessary sensors and additional devices for a safe operation and their evaluation lies in the sole responsibility of the plant manufacturer or operator.

Requirements on the power output stage

- Converter with pulse width modulation
- Pulse frequency 4 kHz ...16 kHz

Voltage load of the motor

During converter operation, the motor underlies a higher voltage load (insulation system, bearing) than on a sinusoidal source voltage only.

Standard values for peak voltage and rate of rise of voltage:

- Peak voltage U_{pk} on motor clamps ≤ 1.56 kV
- Rate of rise of voltage du/dt ≤ 5 kV/µs

Maximum allowed limit load:

In the case of critical rate of rise of off-state voltage du/dt ≥ 5 kV/µs, the limit values (peak voltage, voltage rise time) according to limit curves A according to **DIN VDE 0530-25 (VDE 0530-25):2009-08 (Figure 14 Limit curve A)** must be kept. Therefore, observe the limit values for voltage rise time and critical rate of rise of off-state voltage.

Limit values for voltage rise time and critical rate of rise of off-state voltage:

- Voltage rise time > 0.17 µs
- Critical rate of rise of off-state voltage du/dt < 8 kV/µs

Monitoring functions

- Speed monitoring of maximum permissible speed
- The motor load must not exceed the allowed continuous operation characteristic curve. The converter setting data for controlling and monitoring must comply with the type code data.
- Connect and evaluate the temperature sensor of the motor winding (ensure monitoring function, limit switch-off temperature).
  Depending on the converter used, function-tested triggering devices with the Ⓔx II 2 G or Ⓔx II 2 D designation may be required to evaluate the temperature sensors. For supplementary information on temperature monitoring, see EN60079-14:2014.
  Safe disconnection of the load circuit must be ensured.
- Temperature model or I^2t-monitoring within converter. Due to the coupling time of the temperature sensor, an additional suitable temperature model or an I^2t-monitoring must be used.

Shutdown

- Please observe the notes in section ➥Chapter 3.5.5 “ Switch-off” on page 15.

Requirements for motor operation with holding brake

- Ensure the brake functionality during normal operation due to voltage control, current monitoring, cyclic control of the brake holding torque, for example.
- Provide an external or an integrated protective circuit within the foreign converter to switch the holding brake (inductive load).

- Never use the holding brake of the motor as an operating brake.
- Idle time after an emergency stop before restarting ≥ 3 minutes.
- **Do not** do the grinding procedure in hazardous ambience.

General notes

- The motors must be grounded via a motor cable and via a second separate ground conductor with minimum **4 mm²** cross section. Check that the position of the grounded conductor is fixed before commissioning.
- Use cables with a thermal stability of at least 80°C (176°F).
- **Plug connector:** Never connect or disconnect plug connectors under load!
- Operate MKE motors only with origin connection accessories.
- Observe the limit values for bearing load. If necessary, change the bearing according to ➦Chapter 5.11 “Bearing” on page 31.

After maintenance and repair work, Bosch Rexroth always recommends to do a safety and functionality test on basis of the risk analysis provided by the customer (e.g. for thermal protection, holding brake).

10.3 Transport

The motors must be transported in their original package taking classes 2K11, 2B1, 2C1, 2S5, 2M4 specified acc. to DIN EN 60721-3-2 into account.

Please observe the following classification limitations:

Table 18: Classification limitation (DIN EN IEC 60721-3-2)

Transport	
Ambient conditions	-25 ... +70 °C
Relative humidity	5 ... 75 %
Shock load	➦Chapter 10.5 “Shock load during transport und storage ” on page 87

10.3.1 Instructions on machine transport

Do not remove factory-fitted transport protection devices such as dust protection, shaft protection, blind screw fittings until the motors are used. Keep the transport protection devices for later use.

NOTICE

Never touch the connection points of electrostatic sensitive devices!

- Mounted components (e.g. temperature sensors, encoder) can contain parts susceptible to electrical discharge (ESD).
  Observe the ESD safety measures.

⚠ WARNING

Risk of injury and material damage due to improper handling during transport!

- Only use hoisting gear suited for the weight of the motors. Use lifting sling belts or lifting eye bolts. Secure the lifting eye bolts before use.
  Never walk under hanging loads.
- Never lift the motor on the shaft.
- Use suitable protective equipment and protective clothing during transport, and wear safety shoes.

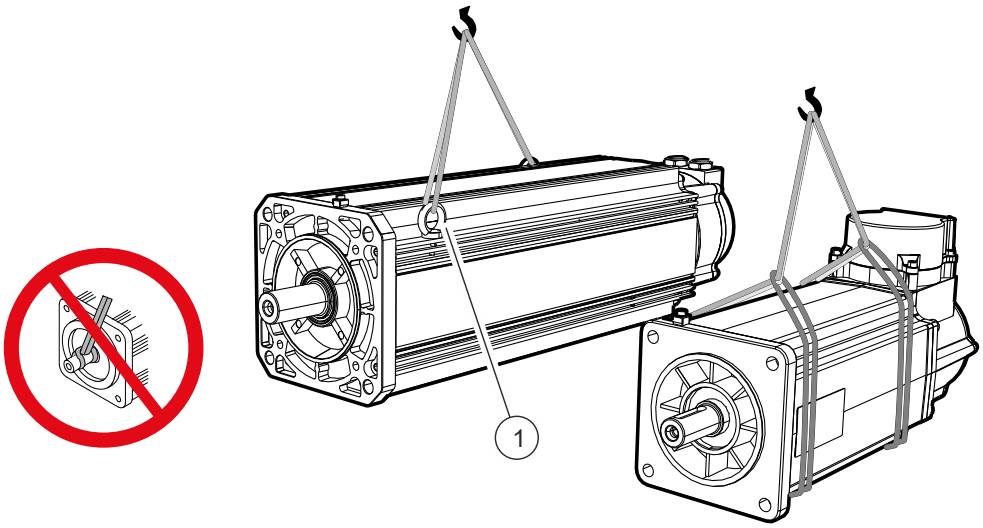


Fig. 59: Lifting and transporting motors

- Before transporting the motor, determine the weight of the motor. For more details about motor weight, please refer to the type plate or the project planning manual (Technical data).
- Adjust the carrying capacity of the lifting device to the motor weight.
- If provided by the manufacturer, all lifting eye bolts must be used and tightened before use.
- Avoid increased transport vibrations.
- Remove any existing transport locks prior to commissioning and keep them.

10.4 Storage

Store the motors in their original packaging in a dry, dust-free, vibration-free and light-protected place without direct solar radiation. Please observe classes 1K21, 1B1, 1C1, 1S10, 1M11 specified for storage acc. to DIN EN IEC 60721-3-1.

Please observe the following classification limitations:

Table 19: Classification limitation (DIN EN IEC 60721-3-1)

Bearing	
Ambient conditions	-25 ... +55 °C
Relative air humidity	5 ... 75 %
Absolute air humidity	1 ... 29 g/m³
Direct solar radiation	Not permitted
Shock load	➦Chapter 10.5 “Shock load during transport und storage ” on page 87

Do not remove factory-fitted transport protection devices such as dust protection, shaft protection, blind screw fittings when storing the motors. Keep the transport protection devices for later use.

NOTICE

Damage due to moisture and humidity!

- Protect the products from dampness and corrosion.
- Store them only in rainproof and dry rooms.

Additional measures have to taken upon commissioning to ensure smooth functioning – irrespective of the storage time which may be longer than the warranty period of our products. Warranty extension is not a consequence.

Table 20: Measures before commissioning motors that have been stored over a prolonged period of time

Storage time / months			Measures for commissioning
> 1	> 12	> 60	
●	●	●	Visual inspection of all parts to be damage-free
●	●	●	Resurface the holding brake
	●	●	Check the electric contacts to verify that they are free from corrosion
	●	●	Let the motor run in without load for one hour at 800 ... 1000 rpm.
	●	●	Measure insulation resistance. Dry the winding at a value of < 1kOhm per volt rated voltage.
		●	Replace bearings
		●	Replace encoder

10.5 Shock load during transport und storage

Function-impairing effects are avoided as long as the specified limits are complied with.

Table 21: Permissible shock load for MKE motors

Frame size	Maximum allowed shock load (11 ms)	
	Axial	Radial
MKE037	10 m/s^2	1000 m/s^2
MKE047	10 m/s^2	1000 m/s^2
MKE098	10 m/s^2	300 m/s^2
MKE118	10 m/s^2	200 m/s^2

11 Service repair, maintenance and spare parts

Wearing parts are reliably and professionally repaired and replaced by the Rexroth Service in shopfloor-oriented quality.

MKE motors may only be repaired at certified Bosch Rexroth service branches. External service providers are not allowed to perform repairs on MKE motors, otherwise the product certification will expire.

The service lives of motor components, such as seals and bearings, may vary depending on the operating conditions, such as operation mode, speed, vibration and shock load, and frequent reverse mode. We recommend to change the bearing after 30,000 operating hours. Shorter replacement intervals may be necessary; cf. checks during operation . We recommend regular visual inspections on shaft sealing rings. Depending on operating conditions, signs of wear may appear after 5,000 operating hours. If necessary, replace the shaft sealing rings.

The Bosch Rexroth service helpdesk at our headquarters in Lohr, Germany and our worldwide service provide You can contact us **24/7**.

Telephone:	**+49 (0) 9352 40 50 60**
Fax:	**+49 (0) 9352 18 49 41**
Email	service.svc@boschrexroth.de
Internet:	➦ https://www.boschrexroth.com

Preparing information

For quick and efficient help, please have the following information ready:

- Detailed description of the fault and the circumstances
- Information on the rating plate of the products in question, particularly type codes and serial numbers
- Your contact data (phone number, fax number, email address)

12 Environmental protection and disposal

Disposal of the motor components can be done according to the applicable legal process in normal recycling process.

Recycling

Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual assemblies. Metals contained in electric and electronic assemblies can also be recycled by means of special separation processes.

Significant motor components

Basically, our motors consist of the following components:

- Steel, stainless steel, aluminum, copper, brass
- Plastic parts, insulation and composite material
- Electronic components
- Permanent magnets

Plastic parts of the products may contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the applicable legal provisions.

Magnets

⚠ WARNING	Danger due to permanent magnets!
	– Health hazard for persons with heart pacemakers, metallic implants and hearing aids in direct environment of permanent magnets. – Crushing hazard of fingers and hand due to heavy attractive forces of the magnets. – Risk of destruction of sensitive parts like watches, credit cards, ...

Remark

The permanent magnets of the rotor or secondary part must be demagnetized before disposal to avoid injuries or damage.

The demagnetization is reached via special thermal treatment. The handling duration is influenced by the rotor frame size. The rotor or the secondary part has to remain in the oven for a minimum of 30 minutes, starting at the time, the magnetic surface has reached 300 °C. If the magnets are surrounded by a bandage or a cover plate, it is recommended to remove it before heating in the oven to expose the magnets.

If demagnetization is successful, the magnets can be separated from the rotor or secondary part after cooling without applying force.

Packaging

Our packaging materials do not contain any problematic materials and can therefor be easily disposed. Packaging materials are: wood, cardboard and polystyrene.

Batteries and accumulators

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin. End users in the EU are legally bound to return used batteries and accumulators. Outside the scope of the EU Directive 2006/66/EC, the applicable regulations must be followed. Batteries and accumulators can contain hazardous substances which can harm the environment or

people's health when improperly stored or disposed of. The batteries or accumulators must be returned to the country-specific collection systems for proper disposal.

Disposal by the manufacturer

Our products can be returned to us for disposal. However, this requires that the products are free from oil, grease or other dirt. The motor components must be returned in a suitable packaging (origin package if possible). In the case of a transport by air freight, please observe the dangerous goods regulations (IATA) for the secondary part.
Send the products to the following address, carriage free:

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr a.Main, Germany

13 Appendix

13.1 CE conformity

Declarations of conformity confirming the design and compliance with the valid EN standards and directives are available for MKE motors. If required, the declarations of conformity can be requested from the responsible sales office.

The CE mark is attached to the type label of the motors.

13.2 UL / CSA

The UL/CSA conformity of MKE motors can be found on the type plate of the motors.

MKE motors according to ATEX standard are “UL Recognized”. Information can be found under UL file number E335445 on the website ➦ www.ul.com.

13.3 China RoHS 2

The China RoHS 2 conformity can be found on the type plate of the motors. Information about listing:➦ www.boschrexroth.com.cn/zh/cn/home_2/china_rohs2

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rexroth
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