

# Rexroth MAL Asynchronous Hollow Shaft Motor

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Project Planning Manual



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Asynchronous Hollow Shaft Motor
  
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- Purpose of Documentation** This documentation ....
  - explains product features and applications, technical data as well as conditions and limits for operation.
  - provides guidelines for product selection, application, handling and operation.

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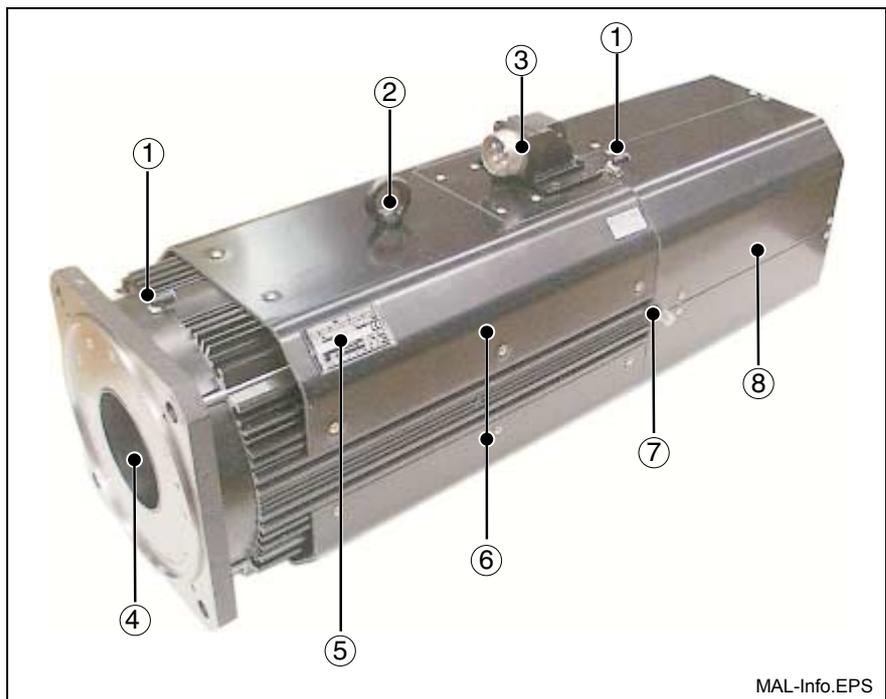
# 1 Introduction to the Product

## 1.1 Description

Asynchronous motors of the Rexroth MAL series have been designed as direct drives for printing presses. They are characterized by the following (and other) features:

- Air-cooled housing motor
- Hollow shaft with limited traversing distance
- Cylindrical roller bearing with regreasing option
- Encoder unit, mounted outside to the impression cylinder

The motors are coupled to the printing press via a customer-specific shaft coupling which must be mounted by the user before he starts up the motor. The driven shaft of the impression cylinder is passed through the hollow shaft of the motor and onto the moving shaft coupling. The large inside diameter of the hollow shaft of the motor allows swivel movements of the driven shaft of the impression cylinder. Here, it is particularly important to ensure that the displacement of the rotor generated by the swivel movement is less than the maximum permissible traversing distance of the rotor. The user is responsible for meeting and ensuring this requirement.



MAL-Info.EPS

- |                       |                   |
|-----------------------|-------------------|
| (1): Grease connector | (2): Ring screw   |
| (3): Power connector  | (4): Hollow shaft |
| (5): Name plate       | (6): Air baffles  |
| (7): Securing pin     | (8): Fan top      |

Fig. 1-1: MAL130E

**Drive layout** The drive layout for a printing press axis with MAL motor comprises the following components:

- MAL130E motor
- Control unit with power supply
- Firmware
- Encoder (customer part)
- Terminal accessories

## 1.2 About this Documentation

### Document Structure

This documentation includes safety regulations, technical data and operating instructions. The following setup provides an overview of the contents of this documentation.

| Sect. | Title                            |                                       |   |
|-------|----------------------------------|---------------------------------------|---|
| 1     | Introduction                     | Introduction to the product and notes |   |
| 2     | Important instructions on use    | <b>Important safety notes</b>         |   |
| 3     | Safety                           |                                       |   |
| 4     | Technical data for MAL130 motors | Product description                   | for planners and projectors             |
| 5     | Dimension sheet                  |                                       |   |
| 6     | Type codes                       |                                       |   |
| 7     | Accessories                      | Practice                              | for operating and maintenance personnel |
| 8     | Connection techniques            |                                       |   |
| 9     | Notes regarding application      |                                       |   |
| 10    | Handling & transport             |                                       |   |
| 11    | Installation                     |                                       |   |
| 12    | Operation                        |                                       |   |
| 13    | Service and support              |                                       |   |
| 14    | Index                            | Additional information                |   |

Fig. 1-12: Chapter structure

### Supplementary Documentation

To project the drive systems of the Rexroth MAL motor series, you might need additional documentation as required for the devices used. Rexroth provides the entire product documentation in PDF format on DVD or on the internet under [www.boschrexroth.com/BrcDoku/](http://www.boschrexroth.com/BrcDoku/) (single registration required). To project a system, you will not need all the documentation included on the DVD.

---

**Note:** All documentation are also available as printed versions which you can order from your Rexroth sales office.

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| Material no.:   | Title / description   |
|---|---|
| R911281882  | -Product documentation Electric Drives and Controls Version <b>xx</b> <sup>1)</sup><br>DOK-GENRL-CONTR*DRIVE-GNxx-EN-D650 (German)  |
| R911281883  | -Product documentation Electric Drives and Controls Version <b>xx</b> <sup>1)</sup><br>DOK-GENRL-CONTR*DRIVE-GNxx-EN-D650 (English) |
| 1) The index (e.g. .. <b>02</b> -...) identifies the version. |   |

Fig. 1-3: Supplementary documentation

## Standards

This documentation refers to German, European and international technical standards. Documents and sheets on standards underlie copyright protection and may not be passed on to third parties by Rexroth. If necessary, please contact your local authorized sales office or, in Germany, contact:

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## Additional Components

Documentation for external systems, which are connected to Bosch Rexroth components, are not included in the scope of delivery and must be ordered directly from the particular manufacturers.

For information on the manufacturers see chapter 9 "Application Notes".

## Feedback

Your experiences are an essential part of the process of improving both product and documentation.

Please do not hesitate to inform us of any mistakes you detect in this documentation or of any modifications you might desire. We would appreciate your feedback.

Please send your remarks to:

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## 2 Important Instructions on Use

### 2.1 Appropriate Use

#### Introduction

Bosch Rexroth products are designed and manufactured using the latest state-of-the-art-technology. Before they are delivered, they are checked to ensure that they are in a reliable state.

The products may only be used as intended. If they are used inappropriately, situations may arise resulting in injuries to property and persons.

---

**Note:** For damage caused by products not being used as intended, Bosch Rexroth gives no warranty, assumes no liability, and will not pay for any damages. Any risks resulting from the products not being used as intended are the sole responsibility of the user.

---

Before the Bosch Rexroth products are used, the following requirements must be met so as to ensure appropriate use of the products:

- Anyone handling one of the products in any manner must read and understand the appropriate safety regulations and the appropriate use.
- Regarding hardware components, the products concerned must be left in their original state, i.e. it is not permitted to modify them structurally. Software products may not be decompiled; their source codes may not be altered.
- Damaged or defective products may not be installed or put into operation.
- It must be ensured that the products are installed and serviced according to the regulations mentioned in the documentation.

## Fields of Use and Application

Asynchronous motors of the Rexroth MAL series are intended for use as rotatory drive motors in machines..

Unit types with different driving powers and different interfaces are available for an application-specific use of the motors.

Controlling and monitoring of the motors may require connection of additional sensors and actuators.

---

**Note:** The motors may only be used with the accessories specified in the documentation. Components which are not expressly named may neither be mounted nor connected. The same applies to cables.

The motors may be operated only in the expressly specified component configurations and combinations and with the software and firmware specified in the appropriate functional description.

---

Any connected drive controller must be programmed before startup in order to ensure that the motor executes the functions specific to the particular application.

The motors may only be operated under the assembly, mounting and installation conditions, in the normal position, and under the environmental conditions (temperature, degree of protection, humidity, EMC, and the like) specified in this documentation.

## 2.2 Inappropriate Use

Any use of the motors outside of the fields of application mentioned above or under operating conditions and technical data other than those specified in this documentation is considered to be "inappropriate use".

MAL motors may not be used if . . .

- they are subjected to operating conditions which do not comply with the ambient conditions described above (e.g. operation under water, under extreme temperature fluctuations or extreme maximum temperatures is not permitted),
- the intended fields of application have not been expressly released for the motors by Rexroth. Please be absolutely sure to also observe the statements made in the general safety notes.

## 3 Safety Instructions for Electric Drives and Controls

### 3.1 Introduction

Read these instructions before the initial startup of the equipment in order to eliminate the risk of bodily harm or material damage. Follow these safety instructions at all times.

Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.



**WARNING**

**Improper use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!**

### 3.2 Explanations

The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions.

| Warning symbol with signal word | Degree of hazard seriousness according to ANSI |
|---------------------------------|--|
| <br><b>DANGER</b>               | Death or severe bodily harm will occur.        |
| <br><b>WARNING</b>              | Death or severe bodily harm may occur.         |
| <br><b>CAUTION</b>              | Bodily harm or material damage may occur.      |

Fig. 3-1: Hazard classification (according to ANSI Z535)

### 3.3 Hazards by Improper Use



**DANGER**

**High voltage and high discharge current!  
Danger to life or severe bodily harm by electric shock!**

---



**DANGER**

**Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!**

---



**WARNING**

**High electrical voltage due to wrong connections! Danger to life or bodily harm by electric shock!**

---



**WARNING**

**Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!**

---



**CAUTION**

**Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!**

---



**CAUTION**

**Risk of injury due to improper handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock or incorrect handling of pressurized systems!**

---



**CAUTION**

**Risk of injury due to incorrect handling of batteries!**

---

## 3.4 General Information

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment or within its proximity.
  - The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment as well as an understanding of all warnings and precautionary measures noted in these instructions.
  - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and equipment on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual. If this is not the case, they are excluded.

The following areas of use and application, for example, include safety features and applications: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications in which electrical devices with vital functions can be electromagnetically disturbed, mining, food processing, control of protection equipment (also in a machine).
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturer must

  - make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
  - make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.

- Operation is only permitted if the national EMC regulations for the application are met.  
The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems".  
The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

## 3.5 Protection Against Contact with Electrical Parts

---

**Note:** This section refers to equipment and drive components with voltages above 50 Volts.

---

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.

---



**DANGER**

### **High electrical voltage! Danger to life, severe bodily harm by electric shock!**

- = Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
- = Follow general construction and safety regulations when working on high voltage installations.
- = Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
- = Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
- = Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
- = The following should be observed with electrical drive and filter components:
  - = Wait thirty (30) minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
  - = Never touch the electrical connection points of a component while power is turned on.
  - = Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
  - = A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
  - = Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.

---

To be observed with electrical drive and filter components:

**DANGER**

**High electrical voltage on the housing!  
High leakage current! Danger to life, danger of  
injury by electric shock!**

- = Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- = Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- = Use a copper conductor with at least 10 mm<sup>2</sup> cross section over its entire course for this safety conductor connection!
- = Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

### 3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth products are protective low voltages designed in accordance with international standards on electrical safety.

**WARNING**

**High electrical voltage due to wrong  
connections! Danger to life, bodily harm by  
electric shock!**

- = Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.
- = Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

### 3.7 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of the connected motors. Some common examples are:

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components

- software or firmware errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily injury and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.



**DANGER**

### **Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!**

- = Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.
- = Pay attention to unintended machine motion or other malfunction in any mode of operation.
- = Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:
  - use safety fences
  - use safety guards
  - use protective coverings
  - install light curtains or light barriers
- = Fences and coverings must be strong enough to resist maximum possible momentum, especially if there is a possibility of loose parts flying off.
- = Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
- = Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.
- = Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.
- = Secure vertical axes against falling or dropping after switching off the motor power by, for example:
  - mechanically securing the vertical axes
  - adding an external braking/ arrester/ clamping mechanism
  - ensuring sufficient equilibration of the vertical axes

The standard equipment motor brake or an external brake controlled directly by the drive controller are not sufficient to guarantee personal safety!

- = Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
    - maintenance and repair work
    - cleaning of equipment
    - long periods of discontinued equipment use
  - = Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such equipment cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.
- 

### 3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

---



**WARNING**

#### **Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!**

- = Persons with heart pacemakers, hearing aids and metal implants are not permitted to enter the following areas:
    - Areas in which electrical equipment and parts are mounted, being operated or started up.
    - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
  - = If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
  - = Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.
-

### 3.9 Protection Against Contact with Hot Parts

---



CAUTION

**Housing surfaces could be extremely hot!  
Danger of injury! Danger of burns!**

- = Do not touch housing surfaces near sources of heat! Danger of burns!
  - ⇒ After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
  - = Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors. Danger of burns!
- 

### 3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.

---



CAUTION

**Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!**

- = Observe general installation and safety instructions with regard to handling and mounting.
  - ⇒ Use appropriate mounting and transport equipment.
  - ⇒ Take precautions to avoid pinching and crushing.
  - = Use only appropriate tools. If specified by the product documentation, special tools must be used.
  - ⇒ Use lifting devices and tools correctly and safely.
  - = For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
  - ⇒ Never stand under suspended loads.
  - = Clean up liquids from the floor immediately to prevent slipping.
-

## 3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.



**CAUTION**

### Risk of injury by incorrect handling!

- = Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and cauterization).
- = Never charge non-chargeable batteries (danger of leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- = Do not damage electrical components installed in the equipment.

**Note:** Be aware of environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other waste. Observe the legal requirements in the country of installation.

## 3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.



**CAUTION**

### Danger of injury by incorrect handling of pressurized systems !

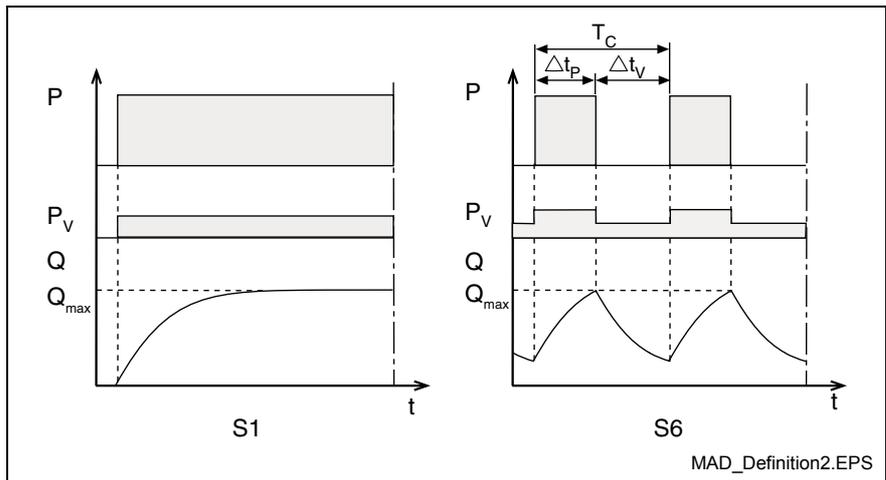
- = Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- = Observe the operation instructions of the respective manufacturer.
- = Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- = Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- = Remove any fluid that has leaked out onto the floor immediately.

**Note:** Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.

## 4 Technical Data for MAL130 Motors

### 4.1 Operating Modes

Bosch Rexroth motors are documented according to the test criteria and measuring methods of EN 60034-1. Stated technical data refer to the operating mode S1 (continuous operation) and S6 (periodic operation), each with surface cooling through direct-connected fan units or liquid cooling.



- P: Capacity
- P<sub>v</sub>: Electric losses
- Q: Temperature
- Q<sub>max</sub>: Highest temperature (stator)
- t: Time
- T<sub>c</sub>: Duty cycle time
- Δt<sub>p</sub>: Operating time with constant capacity
- Δt<sub>v</sub>: Idle time

Fig. 4-1: Operating modes according to EN 60034-1 :1998

#### ON time

The operating mode S6 is supplemented by specification of the ON time (ED) in %. The ON time is calculated as follows:

$$ED = \frac{\Delta t_p}{T_c} \cdot 100\%$$

- ED: Cyclic duration factor in %
- T<sub>c</sub>: Duty cycle time
- Δt<sub>p</sub>: Operating time with constant capacity

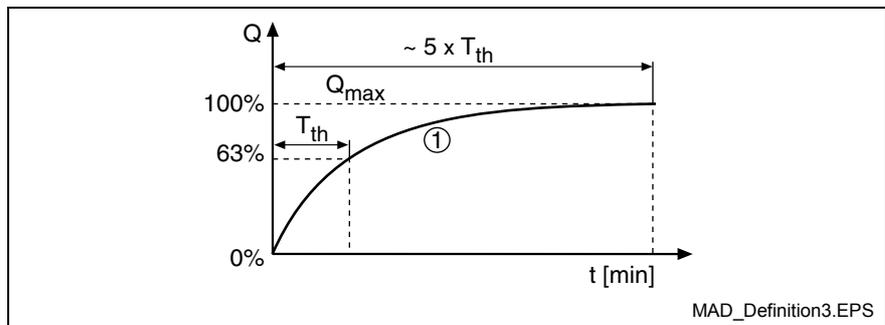
Fig. 4-2: Cyclic duration factor

### 4.2 Operating Behavior

#### Parameters

- Rated torque M<sub>N</sub>** Available torque that can be output at the rated speed in operating mode S1 (continuous operation). Unit: newtonmeters (Nm).
- Rated power P<sub>N</sub>** Mechanical power output of the motor while running at rated speed and rated torque. Value specified in kilowatts (kW).

|   |  |
|---|--|
| <b>Rated current <math>I_N</math></b>                                     | Phase current of the motor while running at rated speed and rated torque. Value specified as root-mean-squared value in amps (A).  |
| <b>Rated speed <math>n_N</math></b>                                       | Typical working speed as defined by the manufacturer. Depending on the particular application, other working speeds are possible (see speed-torque characteristic curve).  |
| <b>Maximum torque <math>M_{max}</math></b>                                | This is the maximum torque available with the maximum current $I_{max}$ . Value specified in newtonmeters (Nm).<br>⇒ The achievable maximum torque depends on the drive controller used. Only the specified maximum torque $M_{max}$ in the selection lists is binding.  |
| <b>Maximum current <math>I_{max}</math></b>                               | Maximum briefly permissible phase current of the motor without any harmful effect on the winding. Value specified as effective value in amps (A).<br>⇒ When the motor is operated with external control units, it must be ensured that, in order to avoid any thermal overload, the current must be reduced to 2.2 times the rated current after 400 msec and that $I_{max}$ may be re-applied only if the winding temperature is within the permissible range, as allowed by the degree of relief of the motor. |
| <b>Maximum speed <math>n_{max}</math></b>                                 | Maximum allowed speed of the motor in (min <sup>-1</sup> ). Normally restricted by mechanical factors like centrifugal force or bearing stress.  |
| <b>Torque constant in the nominal working point <math>K_{M\_N}</math></b> | Ratio of torque increase to motor torque forming current. Unit: (Nm/A). Valid up to the rated current $I_N$ .  |
| <b>Discharge capacity <math>C_{ab}</math></b>                             | Capacity of short-circuited power connections U, V, W against the motor housing.   |
| <b>Rotor moment of inertia <math>J_{rot}</math></b>                       | The moment of inertia of the rotor without bearing and encoder. Unit: (kgm <sup>2</sup> ).   |
| <b>Mass <math>m</math></b>  | Mass of the motor in standard version, without holding brake, specified in kilograms (kg).   |
| <b>Thermal time constant <math>T_{th}</math></b>                          | Duration of the temperature rise to 63% of the final temperature of the motor under load with rated torque in S1-operation and surface ventilation by direct-connected fan units.  |

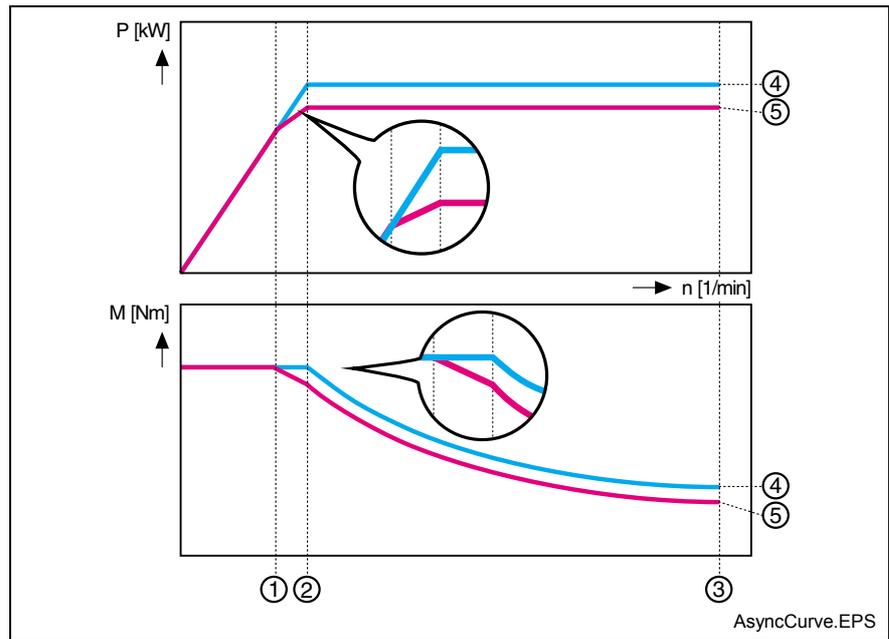


(1): Curve of the motor temperature over time  
 $T_{th}$ : Thermal time constant

Fig. 4-3: Thermal time constant

|  |   |
|--|---|
| <b>Duty cycle time <math>T_c</math></b>    | Duration of the cycle in the S6 operation mode required for reaching the thermally stabilized state, where the maximum temperature value is equal to the final temperature in the S1 operation mode (see Fig. 4-3). |
| <b>Number of pole pairs <math>p</math></b> | Number of pole pairs of the motor.  |

### Characteristic Curve



- P [kW]: Mechanical output in kilowatts
- M [Nm]: Torque available on the output shaft, in Newton meters
- n [rpm]: Motor speed, in revolutions per minute.
- (1): Key speed ( $n_1$  in data sheet)
- (2): Rated speed ( $n_N$ )
- (3): Maximum torque ( $n_{max}$ )
- (4): Characteristic curve without de-rating
- (5): Characteristic curve with de-rating

Fig. 4-4: Example of MAL characteristic curves

**Note:** The achievable torque depends on the drive controller used. The reference value for the characteristic curves of the motor is a non-stabilized DC bus voltage of 540V<sub>DC</sub>.

### Explanation:

**(1) Key speed** Start of a drop in speed and power before the rated speed  $n_N$  is reached. This behavior is called **de-rating** and occurs only with some versions of motor windings. **With no de-rating, key speed equals rated speed.**

Until the key speed is reached, continuous current at standstill  $I_1$  applies (effective value). **With no de-rating, the continuous current at standstill equals the rated current  $I_N$ .**

Until the key speed is reached, continuous torque at standstill  $M_1$  is available for S1 operation. **With no de-rating, the continuous torque at standstill equals the rated torque  $M_N$ .**

With de-rating effective, the torque is reduced once the key speed is reached. Fig. 4-4 shows two characteristic curves starting at the key speed.

**(2) Rated speed** With no de-rating effect, induction motors provide a constant torque until the rated speed (rated torque); starting at the rated speed, constant performance **rated power  $P_N$**  is available.

**(3) Maximum speed** The speed limit up to which a motor can be safely operated. Normally limited by the mechanical construction (bearing) or by the use of a holding brake.

### 4.3 Data Sheet MAL130

| Description  | Symbol    | Unit              | MAL130   |
|--|-----------|-------------------|--|
| <b>Motor data <sup>1)</sup></b>  |           |                   |  |
| Frame length   |           |                   | E  |
| Winding  |           |                   | 0075   |
| Rated torque   | $M_N$     | Nm                | 115  |
| Rated power  | $P_N$     | kW                | 9  |
| Rated current  | $I_N$     | A                 | 21.7   |
| Rated speed  | $n_N$     | rpm               | 750  |
| Maximum torque   | $M_{max}$ | Nm                | 280  |
| Maximum current  | $I_{max}$ | A                 | 47.2   |
| Maximum speed  | $n_{max}$ | rpm               | 3500   |
| Torque constant at 20°C  | $K_{M,N}$ | Nm/A              | 6.08   |
| Thermal time constant  | $T_{th}$  | min               | 30   |
| Duty cycle time (S6-44%)   | $T_C$     | min               | 10   |
| Discharge capacity   | $C_{ab}$  | nF                | 20   |
| Number of pole pairs   | $p$       |                   | 3  |
| Power connector <sup>2)</sup>  | A         | mm <sup>2</sup>   | 2.5  |
| Rotor moment of inertia  | $J_{rot}$ | kgm <sup>2</sup>  | 0.207  |
| Motor mass <sup>3)</sup>   | m         | kg                | 145  |
| Medium acoustic pressure <sup>4)</sup>   | $L_P$     | dB(A)             | 70 (+3)  |
| Permissible ambient temperature  | $T_{um}$  | °C                | 0...+40  |
| Insulation class according to DIN EN 60034-1   |           |                   | F  |
| Class of motor protection  |           |                   | IP54   |
| Class of fan protection  |           |                   | IP44 / IP24  |
| <b>Fan</b>   |           |                   | <b>Axial fan</b>                                     |
| Air current  |           |                   | B → A, blowing                                       |
| Connection voltage   | $U_N$     | V                 | 3 x 400 V ±15%, 50/60 Hz ..... 3 x 460 V ±10%, 60 Hz |
| Power consumption  | $S_N$     | VA                | 115 .... 150   |
| Fan current <sup>5)</sup>  | $I_N$     | A                 | 0.17   |
| Medium air volume  | V         | m <sup>3</sup> /h | 1500   |
| <sup>1)</sup> Values determined according to IEC 60034-1. Current and voltage specified as root-mean-square values. Reference value 540 V <sub>DC</sub> DC bus voltage.<br><sup>2)</sup> Rated for cable assemblies with current carrying capacity according to VDE0298-4 (1992) and installation type B2 according to EN 60204-1 (1993) at 40°C ambient temperature.<br><sup>3)</sup> Value with fan.<br><sup>4)</sup> At 1m distance, with PWM = 4 kHz<br><sup>5)</sup> With $I_N + 20%$ and higher, fans should be monitored. |           |                   |  |

Fig. 4-5: Data sheet for MAL130 motors

### Characteristic Curve of MAL130 Motors

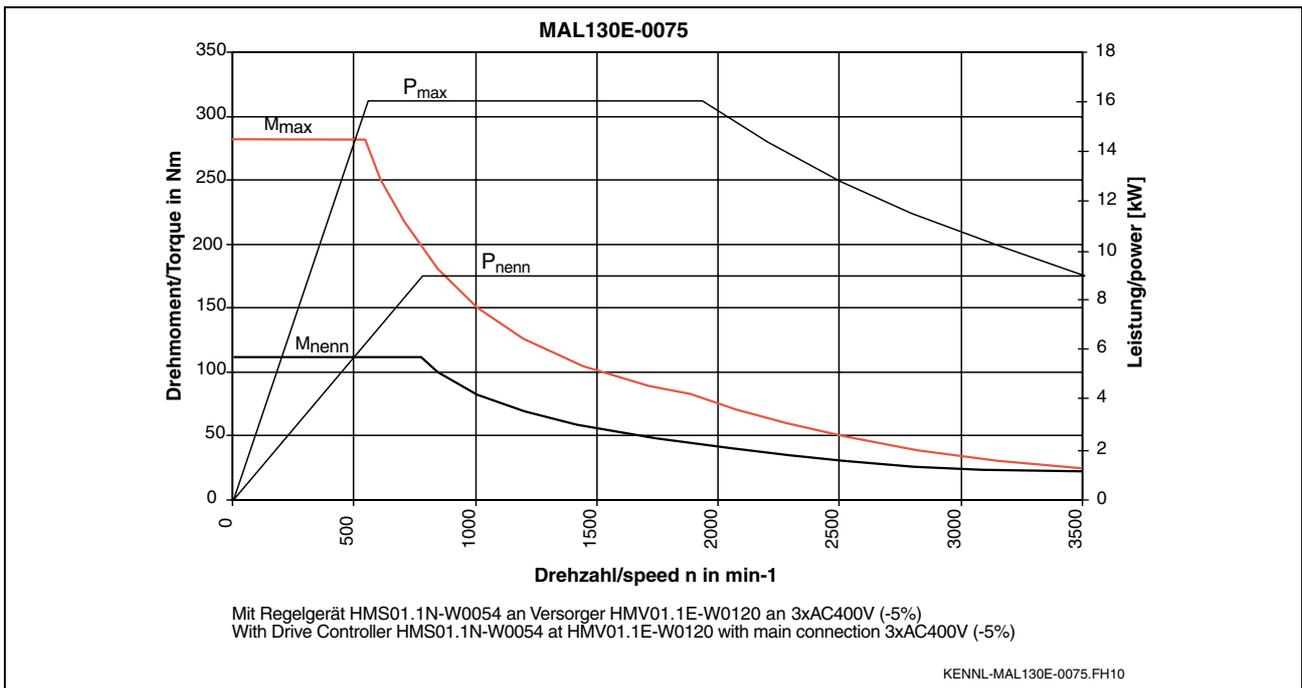


Fig. 4-6: Characteristic curve of MAL130E-0075 motors







## 6 Type Code MAL130

### 6.1 Introduction

Rexroth MAL is the product name of the asynchronous hollow-shaft motors from REXROTH.

The type code describes the available motor variants; it is the basis for selecting and ordering products from BOSCH REXROTH. This applies to both new products as well as spare parts and repairs.

The following descriptions provide an overview of the separate columns of the type code ("abbrev. column") and their meaning.

---

**Note:** When selecting a product, please always consider the detailed specifications in chapter 4 "Technical Data" and chapter 9 "Notes Regarding Application".

---

#### 1. Product

**Abbrev. column 1 2 3** **MAL** is the name of the product group of air-cooled asynchronous motors with hollow shaft, which are designed as rotary cylindrical drives for printing presses.

#### 2. Frame size

**Abbrev. column 4 5 6** The motor frame size is specified according to the axle height. The axle height is the distance from the center of the shaft to the foot bearing surface. In the case of MAL motors, the size specification is determined from the corresponding measurement and rounding to the closest standard axle height.

Available sizes: **MAL130**.

#### 3. Frame Length

**Abbrev. column 7** Within a series, the graduation of increasing motor frame length is indicated by ID letters in alphabetic order. The higher the motor frame length, the higher the continuous torque.

Available frame length: **E**.

#### 4. Winding Code

**Abbrev. column 9 10 11 12** Winding codes serve to differentiate winding variants from one another and indicate the rated speed.

Example: The rated speed for the winding "0075" is  $n_N = 750 \text{ min}^{-1}$ . The DC bus voltage of  $540 \text{ V}_{\text{DC}}$  is a fixed reference value.

A drive combination is selected on the basis of the corresponding selection data and operating characteristics.

#### 5. Type of Cooling

**Abbrev. column 14 15** In general, MAL motors are equipped with an axial-flow fan for operation with **surface cooling**.

Operation without cooling is not permissible.

## 6. Motor Encoder

Abbrev. column 17 18 MAL motors are delivered without motor encoder, as the encoder is integrated into the machine. The motor encoder is selected and applied by the machine manufacturer.

## 7. Electrical Connection

Abbrev. column 20 The electrical connection is established via a flanged socket with outgoing feeder toward the A-side of the motor.

As a counterpart, the flanged socket requires a plug which is not included in the scope of delivery. Preferably, ready-made cables of BOSCH REXROTH with completely mounted plug should be used for connecting the motor. For more information, please refer to chapter 8, "Connection Techniques".

## 8. Output Shaft

Abbrev. column 21 Not applicable (due to the hollow shaft)

## 9. Holding Brake

Abbrev. column 22 Not available.

## 10. Frame shape

Abbrev. column 24 25 The standard design is frame shape B05 for flanged mounting.

## 11. Bearings

Abbrev. column 27 The motor bearing consists of cylindrical roller bearings (ID letter "C") with permanent lubrication. The bearings can be re-lubricated via two connectors on the housing top.

## 12. Vibration Severity Level

Abbrev. column 28 MAL motors are dynamically balanced according to the requirements of DIN ISO 2373; the default level is "R".

## 13. Other Designs

Abbrev. column 30 31 32 33 No option available.





## 7 Accessories

At present, accessories are not available for Rexroth MAL motors.



## 8 Connection Techniques

### 8.1 Notes



**CAUTION**

**Motors will be destroyed when they are connected directly to the 50/60 Hz supply network (three-wire or single-phase network)!**

⇒ The motors described here may only be operated with the appropriate drive devices with variable output voltage and frequency (converter operation), as specified by Rexroth.

The user can either use ready-made Bosch Rexroth cables or assemble the required cables himself.

Bosch Rexroth offers an extensive program of ready-made cables and plug-in connectors that are optimally adapted to the products and to a wide range of demands.

Decisive advantages of Rexroth ready-made cables are:

- Pre-wired without additional finishing
- Designed for continuous alternate bending use
- Resistant against mineral oils, grease and biologic oils, silicon- and halogen-free, low adhesion
- Use of licensed cables acc. to UL and CSA
- Burning characteristics fulfill VDE0472-804 requirements
- Maintain EMC guidelines
- Protection class up to IP67

**Note:** Please note that self assembled cables or cable systems of other manufactures might not fulfill these criteria.

**Bosch Rexroth shall not be held responsible for resulting malfunction states or damages.**



You can find additional information ...

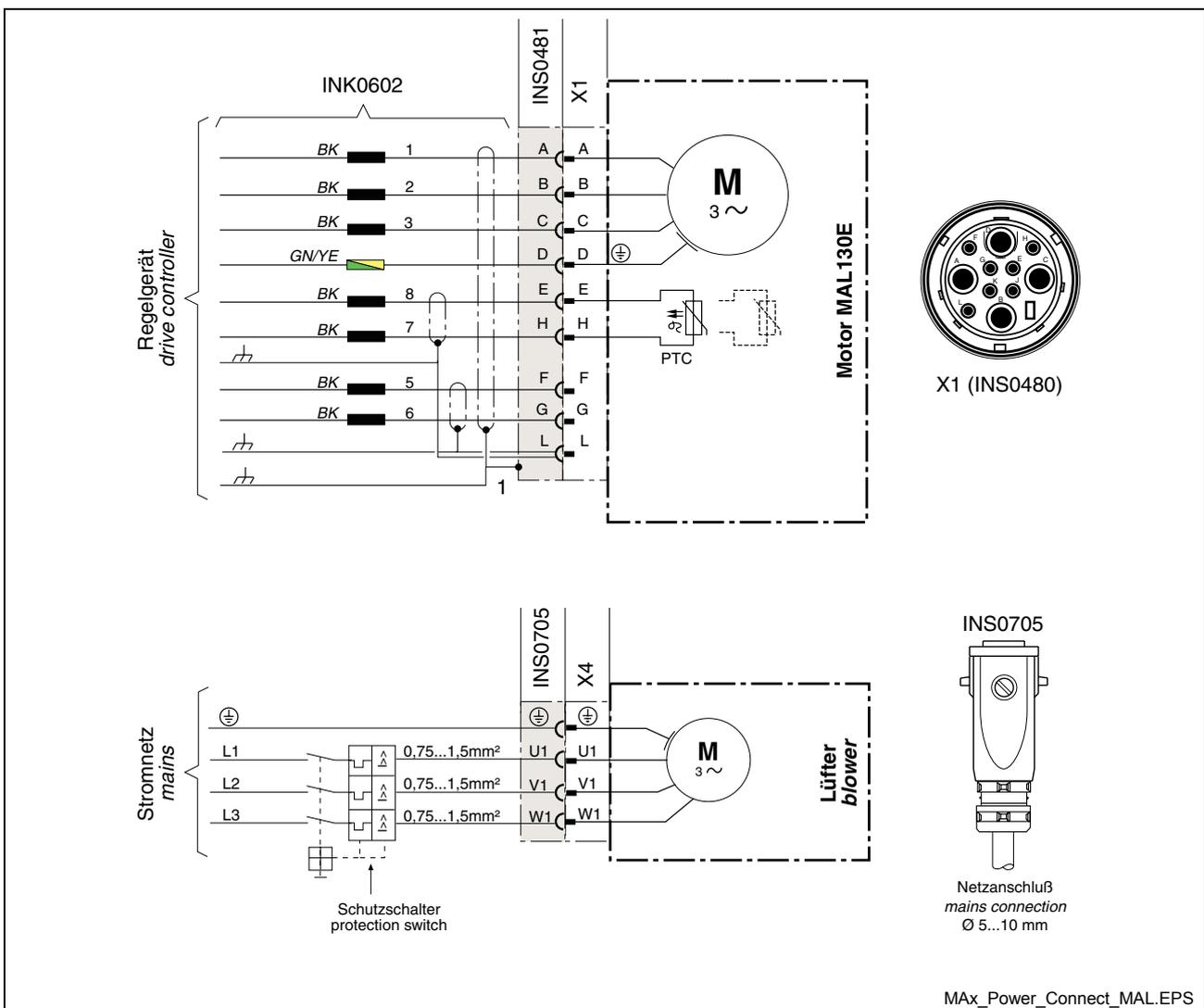
- on the electrical connection of MAL motors in the sections of this chapter following below;
- on selecting power and encoder cables for **power and encoder cables** for Rexroth MAL motors in the documentation "Rexroth Connection Cables", MNR. R911282688;
- on assembling **cables and plugs**, as well as technical data, in the documentation "Rexroth Connection Techniques, Assembling and Tools...", MNR. R911280895.

## 8.2 Power Connector

Operation of a MAL motor requires the following connections.

- (1) **Power** The power connector is implemented by an INS0480 flange socket on the motor.
- (2) **Blower** Depending on the motor type, a motor blower is connected either with 2 or with 3 phases to the power supply via blower cables and a motor protection switch (example: 3 phases in Fig. 8-1). The blower unit is working independently of the drive device.
- (3) **Temperature sensor** Two temperature sensors (KTY84-130) are permanently installed in the motor winding, only one of which may be connected. The wires for connecting the sensor are coming out of the flange socket. If one of the sensors fails, the spare sensor can still be used.

### Overview

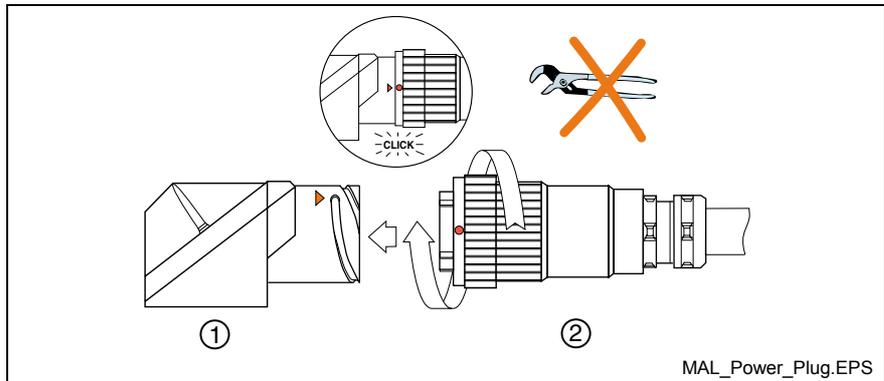


- (1): Total shield connection by cable strain relief of the cable clamp in the coupling

Fig. 8-1: Overview of connections

## Flange Socket

MAL motors for drive combinations with Rexroth control units and DC bus voltages of up to 750 V are equipped with an **INS0480 flange socket** for **INS0481 coupling with bayonet lock**.



- (1): INS0480 flange socket on the motor  
 (2): INS481 coupling on the power cable

Fig. 8-2: Flange socket for power connection to Rexroth MAL motors

**Please pay attention to the following when selecting cable connections:**

- The motor is always equipped with a flange socket with bayonet lock and the connection cable with a coupling with bayonet lock.
- The flange socket on the motor side and the coupling on the cable side are connected to each other and screwed on. They are therefore structured as a mirror image, i.e. with different poles.
- The mechanical codings of the flange socket and the coupling must be compatible.
- The design of the power cable also depends on the drive device used.

## 8.3 Blower Connection

The motor blower is connected to the power supply system via a cable and a motor protecting switch (Fig. 8-1) and is working independently of the control unit.

**Note:**

- To establish the connection, the blower plug must be opened and closed.
- The electric connection may be established by skilled personnel only. Please observe the safety notes.
- The tightness of the plug housing must not be reduced.
- The machine manufacturer selects the motor protecting switch and the electrical protection. Please observe the regulations in the country of installation.
- The plug for connecting the motor blower is included in the scope of delivery. The cables and the motor protecting switch for the blower are not included in the scope of delivery from Bosch Rexroth.

## 8.4 Temperature Sensor

Two temperature sensors (KTY84-130) are permanently installed in the motor winding of MAL motors, only one of which may be connected (Fig. 8-1). The wires for connecting the sensors are coming out of the flange socket. If one of the sensors fails, the spare sensor can still be used. The polarity within a pair of wires is not relevant for the functioning of the temperature sensor.

The pair of wires of the spare sensor lies electrically insulated in the flange socket housing. In order to be able to connect the spare sensor, the housing must be opened.

For additional information on temperature sensors, please refer to section 9.10 "Motor Temperature Monitoring Circuit".

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### Note:

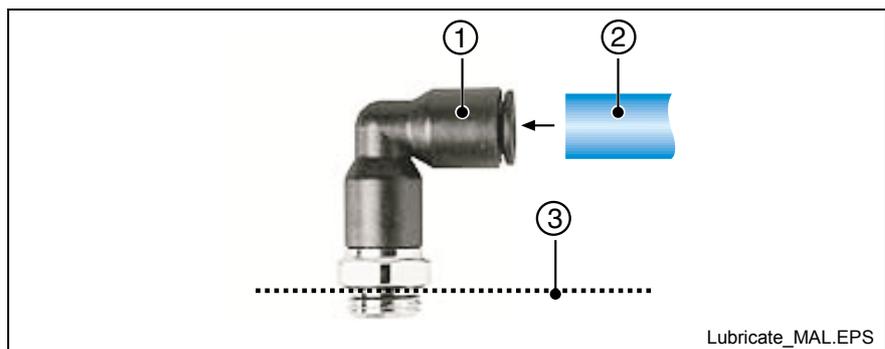
- The signal lines of the sensors are conducted to the controller via the motor power cable (Fig. 8-1).
  - Ensure correct polarity when using the sensor for temperature measurement externally (see Fig. 9-10).
  - Only one sensor is connected and evaluated. The function of the spare sensor cannot be guaranteed.
- 

## 8.5 Grease Connector

On their top, MAL motors are provided with two screwed connectors for re-lubricating the motor bearings.

⇒ Only use flexible plug-in plastic tubes and fittings with an appropriate cross-section.

⇒ Avoid any over-lubrication of the motor bearings.



- 1: Example: Fitting with plug-in connector (customer part)  
 2: Example: Plastic tube, 6 mm in diameter (customer part)  
 3: Motor housing

Fig. 8-3: Grease connector example

Please also observe the notes on re-lubrication of the motor bearings in Chapter 12.4 "Maintenance".

## 9 Notes Regarding Application

### 9.1 Operating Conditions

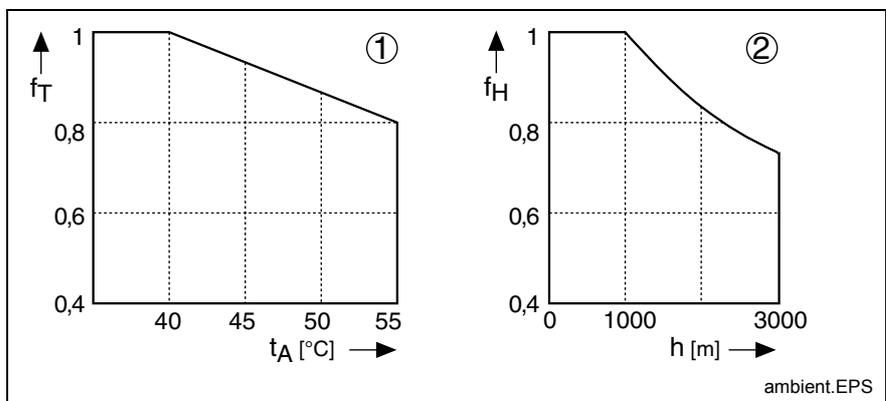
#### Setup Elevation and Ambient Temperature

The performance data specified for the motors apply in the following conditions:

Ambient temperatures ranging from 0 °C to +40 °C

Setup elevations ranging from 0 to 1000 m above sea level.

If you want to use the motors in areas with values beyond these ranges, the performance data is reduced according to the following figure.



- (1): Utilization depending on the ambient temperature  
 (2): Utilization depending on the setup elevation  
 $f_T$ : Temperature utilization factor  
 $t_A$ : Ambient temperature in degrees Celsius  
 $f_H$ : Height utilization factor  
 $h$ : Setup elevation in meters

Fig. 9-1: Utilization factors

If **either** the ambient temperature **or** the setup elevation exceeds the nominal data:

1. Multiply the motor data provided in the selection data with the calculated utilization factor.
2. Ensure that the reduced motor data is not exceeded by your application.

If **both** the ambient temperature **and** the setup elevation exceed the nominal data:

1. Multiply the determined utilization factors  $f_T$  and  $f_H$  by each other.
2. Multiply the value obtained by the motor data specified in the selection data.
3. Ensure that the reduced motor data is not exceeded by your application.

## 9.2 Air Humidity

Climatic environmental conditions are defined in different classes according to DIN EN 60721-3-3 (1995), Table 1. They are based on observations made over long periods of time throughout the world and take into account all supply parameters that might have an effect, such as the air temperature and humidity.

Based on this table, Rexroth recommends class 3K4 for continuous use of the motors.

This class is excerpted in the following table.

| Environmental factor        | Unit             | Class 3K4        |
|-----------------------------|------------------|------------------|
| Low air temperature         | °C               | +5 <sup>1)</sup> |
| High air temperature        | °C               | +40              |
| Low rel. air humidity       | %                | 5                |
| High rel. air humidity      | %                | 95               |
| Low absolute air humidity   | g/m <sup>3</sup> | 1                |
| High absolute air humidity  | g/m <sup>3</sup> | 29               |
| Speed of temperature change | °C/min           | 0.5              |

<sup>1)</sup> Rexroth permits 0°C as the lowest air temperature.

Fig. 9-2: Classification of climatic environmental conditions according to DIN EN 60721-3-3, Table 1

## 9.3 Vibration and Shock

### Vibration

Sine-shaped vibrations occur in stationary use; depending on their intensity, they have different effects on the robustness of the motors.

The robustness of the overall system is determined by the weakest component.

According to DIN EN 60721-3-3 and DIN EN 60068-2-6, the following values are approved for Rexroth motors:

| Direction | Amplitude<br>0 – 55 Hz | Acceleration<br>55 – 2000Hz |
|-----------|------------------------|-----------------------------|
| axial     | 0.3 mm                 | 1 m/s <sup>2</sup>          |
| radial    | 0.75 mm                | 30 m/s <sup>2</sup>         |

Fig. 9-3: Maximum values for sine-shaped vibrations

### Shock

The shock load of the motors is indicated by specifying the maximum permitted acceleration in non-stationary use, such as during transport.

Damage to functions is prevented by maintaining the limit values specified.

According to DIN EN 60721-3-3 (1995), the values for MAL motors are as follows:

| Motor frame size | Maximum permissible shock stress<br>(duration 11 msec) |                      |
|------------------|--|----------------------|
|                  | axial  | radial               |
| MAL130E          | 10 m/s <sup>2</sup>                                    | 150 m/s <sup>2</sup> |

Fig. 9-4: Shock stress

**Note:** Please also observe the specifications in Chapter 10.4 regarding transport and storage.



The construction and effectiveness of shock-absorbing or shock-decoupling attachments depends on the application and must be tested using measurements. This does not lie within the area of responsibility of the motor manufacturer. Modifications of the motor construction result in nullification of the warranty.

## 9.4 Compatibility with Foreign Material

All Rexroth control and drive devices are developed and tested according to the state-of-the-art.

However, as it is impossible to observe the permanent new development of all materials which may come into contact with our controllers and drive devices (e.g. lubricants for machine tools), we cannot generally exclude any reaction with the materials used in our systems.

For this reason, you will have to carry out a test on compatibility among new lubricants, detergents, etc. and our housing and device materials.

## 9.5 Degree of Protection

The degree of protection is defined by the abbreviation IP (International Protection) and two reference numbers specifying the degree of protection. The first reference number describes the degree of protection against contact and penetration of foreign bodies; the second reference number describes the degree of protection against the ingress of water.

| Motor area               | Degree of Protection | Note                              |
|--------------------------|----------------------|-----------------------------------|
| Motor                    | IP54                 |                                   |
| Power and fan connectors | IP65                 |                                   |
| Motor fan                | IP54                 | Fan motor IP54<br>Fan screen IP24 |

Fig. 9-5: Motor protection class ranges

It must be ensured that, in each and every installation position, the motors are not exposed to ambient conditions outside of the particularly applicable degree of protection according to DIN EN 60034-5.



Products and ranges with a low degree of protection are not suited for cleaning procedures with high pressures, vapors or water jets.

## 9.6 Frame Shape and Installation Position

Rexroth MAL motors for horizontal installation are available in frame shape B05. Please refer to the table below for the conditions of installation permissible according to EN 60034-7.

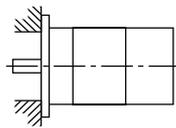
| Motor frame shape | Permissible conditions of installation |  |  |
|-------------------|--|--|--|
|                   | Description                            | Sketch   | Setup  |
| B05               | IM B5                                  |  | Flange mounting on the drive end of the flange |

Fig. 9-6: Installation positions

## 9.7 Transport Protection / Mounting Tool

When delivered ex factory, MAL motors are provided with a transport protection in the form of a securing pin. This securing pin provides

- protection of the rotor during transport,
- a mounting tool for attaching the motor.

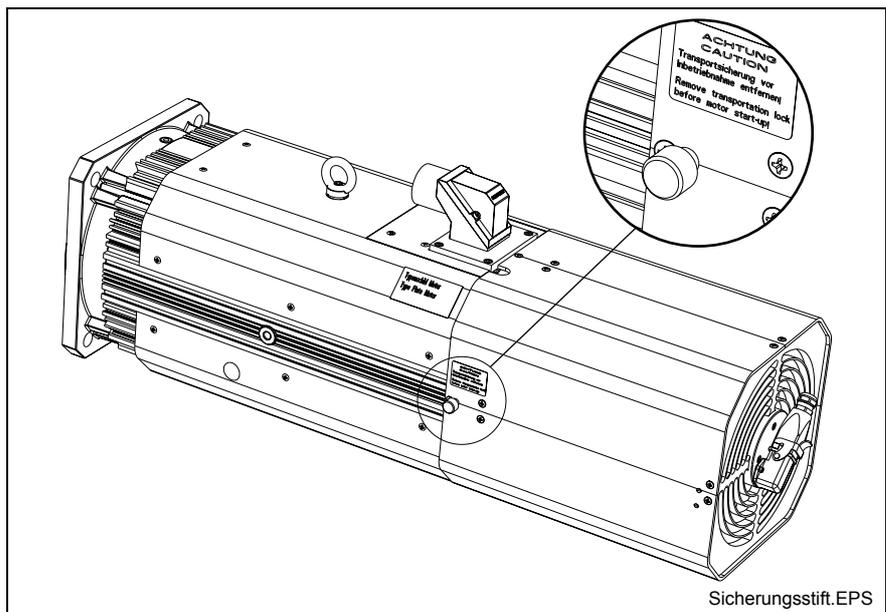


Fig. 9-7: Securing pin on the MAL motor

### Transport protection

As transport protection, the securing pin ensures that the rotor remains in its intended axial position (central position) until assembly and cannot be damaged during transport. It also prevents any rotary movements of the rotor.

**Note:** Please remove the securing pin only after you have mounted the motor, in order to prevent the motor from being damaged from the very start. After having removed the securing pin, please close the hole with a closing screw or an appropriate safety cap. Please also note the information on mounting the rotor in Chapter 11.2 "Motor Attachment".

**Mounting tool** As a mounting tool, the securing pin ensures that the rotor, while being mounted, remains fixed in its intended position (central position) and that the maximum rotor traversing distance is available after the shaft has been mounted.

Removal of the securing pin after mounting results in

- a permissible rotor traversing distance of no more than 2.8 mm in the A- and B-directions of the motor,
- a free-running rotor.

---

**Note:** The securing pin does not necessarily represent the exact central position of the rotor in the motor or in relation to the motor bearings. For that reason, please ensure that, after completed mounting, the necessary traversing distance of the shaft attached by the customer does not exceed the specified traversing distance of the rotor (max. ± 2.8 mm). Please also note the information on mounting the rotor in Chapter 11.2 "Motor Attachment".

---

## 9.8 Housing Painting

The housing painting of the motors consists of a black (RAL9005) 2K epoxy resin coating based on

- epoxy polyamide resin in water.

| Chemical resistance against   | Limited resistance against            | No resistance against                     |
|---|---------------------------------------|---|
| diluted acids and alkaline solutions<br><br>water, sea-water, sewage<br><br>commercial machine oils | organic solvents<br><br>hydraulic oil | concentrated acids and alkaline solutions |

Fig. 9-8: Painting resistance



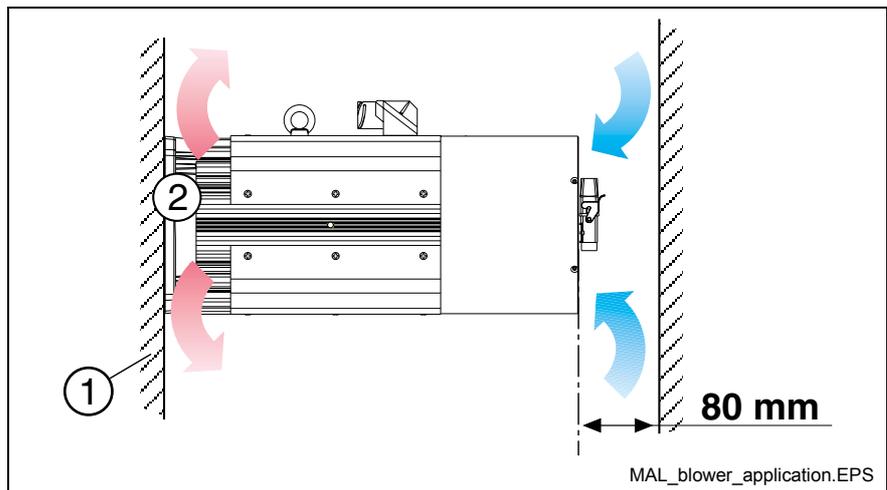
It is permitted to provide the housing with additional painting (coat thickness no more than 40 µm). Check the adhesion and resistance of the new paint coat before applying it.

## 9.9 Motor Cooling

MAL motors must always be operated with fans. Cooling occurs using air currents that are guided through air baffles over the surface of the motor.

An axial-flow fan is used for cooling purposes. The fan is only available with the "blowing" option. Please note the information included in the type code.

In order to ensure that the required air amount (see Chapter 4, "Technical Data") can be routed by the fan, a minimum distance between the fan screen and the machine must be kept so that the air can be sucked in. The distance (2) is determined by the motor construction.



(1): Machine  
 (2): Delivery space  
 Fig. 9-9: MAL cooling

- ⇒ Observe the air flow in the machine construction. The minimum distance is 80 mm for all MAL motors.
- ⇒ The design for all fan variants is "blowing".

Soiling can reduce the performance of the fans and lead to thermal overload of the motors.

When the machine is operated in a soiled environment, increase the system availability by regularly cleaning the fan and motor radiator fins. For more detailed information on fan maintenance, please refer to Chapter 12.4 "Maintenance".



The machine construction must allow easy access to the motor and the fans for maintenance work purposes.

## 9.10 Motor Temperature Monitoring Circuit

In MAL motors, two temperature sensors (KTY84) are permanently installed in the motor winding, one of which is connected only. The wires for connecting the sensors are coming out of the flange socket.

If one of the sensors fails, the spare sensor can still be used. The polarity within a pair of wires is not relevant for the functioning of the temperature sensor.

The pair of wires of the spare sensor lies electrically insulated in the flange socket housing. In order to be able to connect the spare sensor, the housing must be opened.

The characteristic curve of the sensors is approximately linear as shown below.

Temperature sensor

| Type                         | KTY84-130 |
|------------------------------|-----------|
| Resistance at 25 °C          | 577 ohms  |
| Resistance at 100 °C         | 1000 ohms |
| Continuous current at 100 °C | 2 mA      |

Fig. 9-10: Temperature sensor

**Note:** Ensure correct polarity when using the sensor for an external temperature measurement.

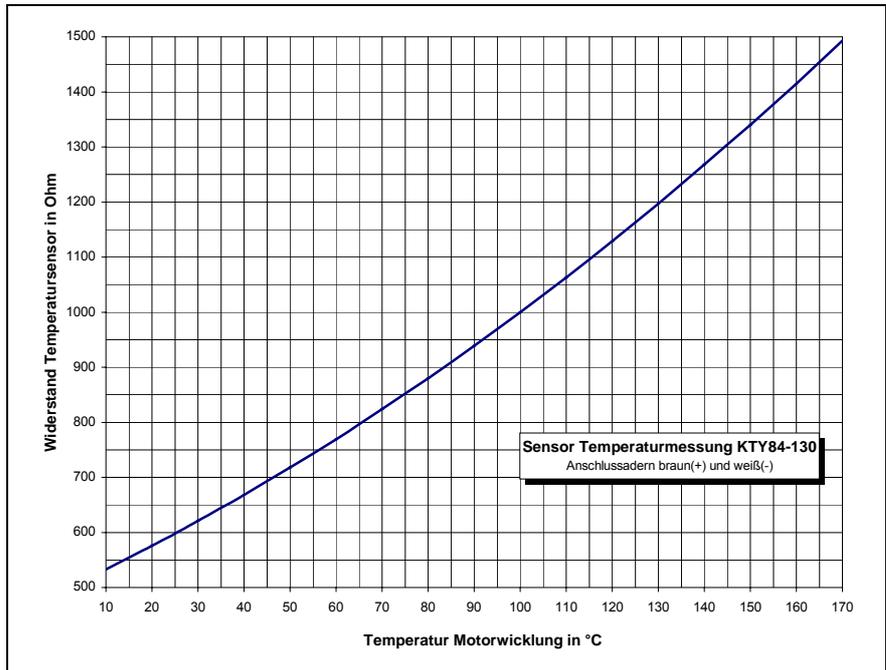


Fig. 9-11: Characteristic curve of temperature sensor KTY84-130 (PTC)

A polynomial of degree 3 proves sufficient for describing the resistance characteristic of the sensor used for temperature measurement (KTY84-130). Below, this is specified for determining a temperature from a given resistance, and vice versa.

Temperature in relation to resistance

$$T_w = A \cdot R_{KTY}^3 + B \cdot R_{KTY}^2 + C \cdot R_{KTY} + D$$

- T<sub>w</sub>: Winding temperature of the motor in °C
- R<sub>KTY</sub>: Resistance of the temperature sensor in ohms
- A: 3.039 · 10<sup>-8</sup>
- B: -1.44 · 10<sup>-4</sup>
- C: 0.358
- D: -143.78

Fig. 9-12: Polynomial used for determining the temperature with a known sensor resistance (KTY84)

Resistance in relation to temperature

$$R_{KTY} = A \cdot T_w^3 + B \cdot T_w^2 + C \cdot T_w + D$$

- T<sub>w</sub>: Winding temperature of the motor in °C
- R<sub>KTY</sub>: Resistance of the temperature sensor in ohms
- A: 1.065 · 10<sup>-6</sup>
- B: 0.011
- C: 3.93
- D: 492.78

Fig. 9-13: Polynomial used for determining the sensor resistance (KTY84) with a known temperature

## 9.11 Motor Encoder

A motor encoder is required for measuring the position and the velocity of the shaft. The requirements for the motor encoder and its mechanical connection are particularly high.

**Note:** The motor encoder is not included in the scope of delivery of MAL motors. The selection of suitable motor encoders is the machine manufacturer's task and depends on the requirements of your application or machine.

For further questions about selection and technical clarification of the compatibility of the motor encoder with Rexroth drive devices, please contact our sales and service facilities (Chapter 13).

## 9.12 Bearing Lifetime

The bearing lifetime is an important criterion for the availability of MAL motors. When the lifetime is considered, the "mechanical lifetime" of bearing components and materials is differentiated from the "grease lifetime" of the bearing lubricant.

Since the maximum speed is low and the bearing load is also low, the working life of the bearing lubricant is assumed to be at least 20,000 operating hours.

For more information, particularly on regreasing the motor bearings, please refer to Chapter 12.4 "Maintenance".

## 9.13 Vibration Severity Level

Rexroth MAL motors are dynamically balanced according to DIN ISO 2373.

The default vibration severity level is R for all MAL motors.

| Vibration severity level | Effective vibration speed $V_{eff}$ in [mm/s] |           |
|--------------------------|---|-----------|
|                          | MAL130E                                       |           |
|                          | Speed n [rpm]                                 |           |
|                          | 600-1800                                      | 1800-3600 |
| R                        | 0.71  | 1.12      |

Fig. 9-14: Effective vibration speed

The vibration behavior of attached or driven machine elements can cause repercussions on the motor; in unfavorable cases, they can cause premature deterioration or loss.

Due to the system-specific influences on the vibration behavior of the system as a whole, the machine manufacturer must determine the specific circumstances.

In certain cases, the machine elements may need to be balanced in such a manner that no resonance or repercussions occur.

⇒ Already take the vibration behavior of the motor and the machine elements into account when designing the system.

## 9.14 Acceptances and Authorizations

### CE Mark

**Certificates of conformity** Certificates of conformity certifying the structure of and the compliance with the valid EN standards and EC guidelines are available for all MAL motors. If necessary, these certificates of conformity can be requested from the responsible sales office.

The CE mark is applied to the motor type label of MAL motors.



Fig. 9-15: CE mark

### UR, cUR Listing

MAL motors have been presented to and approved by the UL authorities "Underwriters Laboratories Inc.®".

The appropriate identification of the motors is specified on the motor name plate.



Fig. 9-16: cUR mark



# 10 Handling and Transport

## 10.1 Delivery Status

MAL motors are delivered in wooden crates or in cartons. Packing units on pallets are secured by bandages.



**CAUTION**

**Injuries may be caused by uncontrolled movements of the bandages when they are cut!**

⇒ Maintain an appropriate distance and be careful when cutting the bandages.

On delivery, the motors are provided with protective sleeves and covers as well as with a securing for protection of the rotor during transport. During transport and storage, these parts must remain on the motor.

## Factory Test

All MAL motors undergo the following (and other) tests at the factory:

- |                        |   |
|------------------------|---|
| <b>Electrical test</b> | <ul style="list-style-type: none"> <li>• High-voltage test according to EN 60034-1 (= VDE 0530-1).</li> <li>• Insulation resistance according to EN 60204-1/1.92, Section 20.3.</li> <li>• Protective earth conductor connection according to EN 60204-1/1.92, Section 20.3.</li> </ul> |
| <b>Mechanical test</b> | <ul style="list-style-type: none"> <li>• Concentricity and position tolerances of shaft end and fastening flange according to DIN 42955.</li> <li>• Vibration measurement according to DIN 2373.</li> </ul>   |

## Test by the Customer

Since all MAL motors undergo a standardized inspection procedure, high-voltage tests by the customer are not required. Motors and components may be damaged if they are repeatedly subjected to high-voltage tests.



**CAUTION**

**Destruction of motor components by improperly executed high-voltage test! Invalidation of warranty!**

⇒ Avoid repeated inspections.

⇒ Observe the regulations of EN 60034-1 (= VDE 0530-1).

## 10.2 Identification

The total scope of a delivery can be seen in the delivery note or waybill. However, the contents of a delivery can be distributed over several packages.

Each individual package can be identified using the shipment label attached to the outside.

Each device has an individual name plate containing the device designation and technical information.

⇒ After receiving the goods, compare the type ordered with the type delivered. Submit claims concerning deviation immediately.

## 10.3 Designation

The type designation of the complete product results from the options selected. These designations, along with additional product data, are impressed on the name plate.

Using the designation and the serial number, every BOSCH REXROTH product can be uniquely identified.

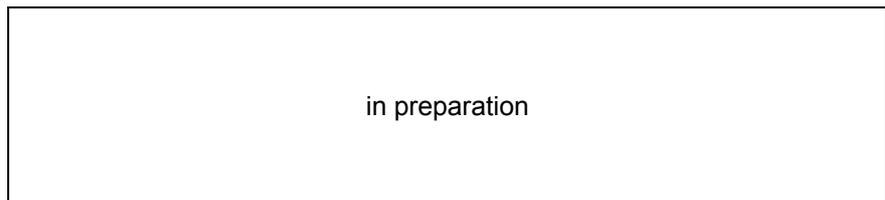


Fig. 10-1: MAL motor name plate

The motors are supplied with 2 name plates each.

Attach the second name plate to an easily visible portion of the machine. Thus, you will be able to read the motor data at any time without having to get into inaccessible places where the built-in motor may be situated.



Before sending questions to BOSCH REXROTH, always specify the full type identification data and serial number of the products involved.

## 10.4 Transport and Storage



### CAUTION

#### Damage or injuries and invalidation of the warranty due to improper handling! Heavy!

- ⇒ Protect the products from dampness and corrosion.
- ⇒ Avoid mechanical stressing, throwing, tipping or dropping of the products.
- ⇒ Use only suitable lifting equipment on the transport eyes of the motor.
- ⇒ Never lift the motor out of the fan housing.
- ⇒ Use suitable protective equipment and protective clothing during transport.

#### Note:

- The permissible **transport temperature** ranges from -20 C to +80 C.
- The permissible **storage temperature** ranges from 0 C to +45 C.

Also observe the notes regarding storage and transport on the packages

#### Mechanical ambient conditions

According to EN60721-3-2 (1997) class 2M2, the MAL motors must not exceed the following load limits during transport and storage.

| Random noise spectrum      |                                  |                                    |
|----------------------------|----------------------------------|------------------------------------|
| Spectral acceleration data | 1 m <sup>2</sup> /s <sup>3</sup> | 0.3 m <sup>2</sup> /s <sup>3</sup> |
| Frequency range            | 10–2000 Hz                       | 200–2000 Hz                        |

Fig. 10-2: Mechanical ambient conditions during transport or storage

On delivery, MAL motors are provided with protective sleeves and covers as well as with a securing for protection of the rotor during transport. During transport and storage, these parts must remain on the motor.

- ⇒ Remove the protective sleeves just before assembly.
- ⇒ Do not remove the securing pin before you have completed assembly.
- ⇒ Also use these parts if you return the goods.



# 11 Installation

## 11.1 Safety



### WARNING

#### Injuries due to live parts! Lifting of heavy loads!

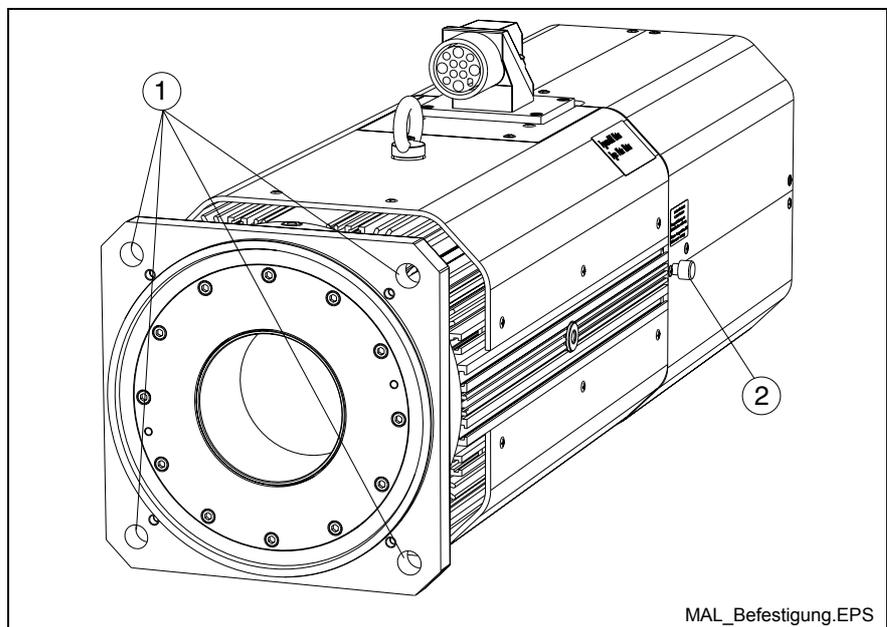
- ⇒ Install the motors only when they are de-energized and not connected electrically.
- ⇒ Use suitable lifting equipment, protective equipment and protective clothing during transport.
- ⇒ Do not lift or move the motor by the fan unit.
- ⇒ Observe the safety notes specified in the previous chapters.

Carry out all working steps with particular care. In this way, you minimize the risk of accidents and damage.



MAL motors have additional threaded holes on their long sides for inserting eyelets (for details, see the dimension sheet). Additional eyelets can simplify handling and transport.

## 11.2 Motor Attachment



- (1): Fixing holes
- (2): Securing pin

Fig. 11-1: Motor attachment

## Fixing Holes

At the factory, MAL motors are produced for flange assembly (frame shape 05). For detailed information on the fixing holes, please refer to the corresponding dimension sheet. For mounting, the following general assignment applies:

| MAL...   | B05 (flange assembly) |          |                      |
|--|-----------------------|----------|----------------------|
|  | Hole                  | Screw 1) |                      |
|  | Ø [mm]                | Type     | M <sub>GA</sub> [Nm] |
| 130  | 18                    | M16      | 215                  |
| 1) Type and torques recommended for screws of tightening class 8.8<br>M <sub>GA</sub> = Tightening torque in Newton meters (with $\mu_G = 0.14$ as mean friction coefficient in the thread). |                       |          |                      |

Fig. 11-2: Fixing holes

---

**Note:** The screwed connections must be able to take up both the force due to the weight of the motor and the forces acting during operation.

---

## Transport Protection

When delivered ex works, all MAL motors are provided with a transport protection in the form of a securing pin. This securing pin must not be removed before completed assembly of the motor. For more information, please also refer to Chapter 9.7 "Transport Protection / Mounting Tool".

## Preparation

⇒ Log all measures taken in the commissioning log.

Prepare motor assembly as follows:

1. Check the components for visible damage. Do not mount any defective components.
2. Ensure that dimensions and tolerances on the system side are suitable for motor attachment (for details, see the dimension sheet).
3. Ensure that mounting can be done in a dry, clean and dust-free environment.
4. Keep tools and auxiliary material, as well as measuring and testing equipment, ready at hand.
5. Check whether all components, assembly surfaces and threads are clean.
6. Ensure that the holder for the motor flange on the machine side has no burrs.

## Assembly

**CAUTION**

**The motor might be damaged if the maximum permissible rotor traversing distance fails to be kept!**

⇒ Before mounting the motor, please ensure that the swivel movement of the driven shaft does not cause any displacement of the rotor that exceeds the maximum permissible rotor traversing distance ( $\pm 2.8$  mm). For more information, please also refer to Chapter 9.7 "Mounting Tool".

---

⇒ Mount the motor.

**Note:**

- ⇒ Avoid clamping or jamming the centering bundle on the motor side.
- ⇒ Avoid damage to the insertion fitting on the system side.
- ⇒ Check the fit and accuracy of the connection before you proceed.
- ⇒ Remove the securing pin (Fig. 11-1) after you have mounted the motor completely.

After having mounted the motor mechanically as prescribed, establish the electrical connections.

## Electrical Connection

It is recommended that you use ready-made Rexroth connection cables. These cables provide a number of advantages, such as UL/CSA authorization, extreme load capability and resistance as well as a design suitable for EMC.

⇒ Establish the electrical connection of the MAL motors according to the instructions in Chapter 8 "Interconnect Technology".

---

**Note:**

- In the case of self-manufactured cables, pay attention that the design and installation are suitable for EMC.
  - The terminal diagrams of the product documentation serve to generate the system circuit diagrams. The machine manufacturer's system circuit diagrams are authoritative for the connection of the drive components to the machine.
-



## 12 Operation of MAL Motors

### 12.1 Commissioning

**CAUTION**

**Material damage may be caused by improper activation of motors and moving elements!  
Unclear operating states and product data!**

- ⇒ Do not carry out commissioning if connections, operating states or product data is unclear or faulty!
- ⇒ Do not carry out commissioning if the safety and monitoring equipment of the system is damaged or not in operation.
- ⇒ If damaged, the products must not be operated!
- ⇒ Contact Bosch Rexroth for missing information or support during commissioning!

The following commissioning instructions refer to the MAL motors as part of a drive system with drive and control unit.

#### Preparation

1. Keep the documentation of all used products ready at hand.
2. Log all measures taken in the commissioning log.
3. Check the products for damage.
4. Check all mechanical and electrical connections.
5. Check the motor shaft for smooth running.
6. Activate the safety and monitoring equipment of the system.

#### Execution

**When all prerequisites have been fulfilled, proceed as follows:**

1. Activate the blower on the MAL motor and check its proper state and its rotational direction.
2. Commission the drive system according to the instructions in the respective product documentation. You can find the respective information in the functional description of the drive controller.
3. Log all measures taken in the commissioning report.



Commissioning of drive controllers and the control unit may require additional steps. The systems are not checked for proper functioning and performance while the motor is being commissioned, but while the machine is commissioned as a whole. Observe the machine manufacturer's information and regulations.

## 12.2 Deactivation

**If there are malfunctions, if maintenance measures must be taken or if the motors must be deactivated, proceed as follows:**

1. Observe the instructions in the machine documentation.
2. Use the machine-side control commands to bring the drive to a controlled standstill.
3. Switch off the power and control voltage of the drive device.
4. Switch off the motor protection switch for the motor blower.
5. Switch off the main switch of the machine.
6. Secure the machine against accidental movements and against unauthorized operation.
7. Wait until the discharge time of the electrical systems has elapsed and then disconnect all electrical connections.
8. Before dismantling, secure the motor and blower unit against falling or movements before disconnecting the mechanical connections.
9. Log all measures taken in the commissioning report.

## 12.3 Dismounting



**DANGER**

**Fatal injuries may be caused by improper activation of motors and moving elements!**

- ⇒ Do not work on unsecured or operating machines.
- ⇒ Secure the machine against accidental movements and against unauthorized operation.
- ⇒ Before dismantling, secure the motor and power supply lines against falling or movements before disconnecting the mechanical connections.

1. Observe the instructions in the machine documentation.
2. Please observe the safety notes and carry out all steps described in the chapter "Deactivation" above.
3. Before dismantling, secure the motor and power supply lines against falling or movements before disconnecting the mechanical connections.
4. Dismount the motor from the machine. Store the motor properly!
5. Document all measures taken in the commissioning report and machine maintenance plan.

## 12.4 Maintenance

Asynchronous hollow-shaft motors of the MAL series operate without wear within the given operating conditions and service life. However, operation under unfavorable conditions can lead to limited availability.

- ⇒ Increase the availability with regular preventive maintenance measures. Note the information in the maintenance schedule of the machine manufacturer and the described service measures.
- ⇒ Log all maintenance measures in the machine maintenance plan.

## Measures



**DANGER**

### **Danger of injury due to moving elements! Danger of injury due to hot surfaces!**

- ⇒ Do not carry out any maintenance measures when the machine is running.
- ⇒ During maintenance work, secure the system against restart and unauthorized use.
- ⇒ Do not work on hot surfaces.

Bosch Rexroth recommends the following maintenance measures, based on the machine manufacturer's maintenance plan:

| Measure   | Interval   |
|---|--|
| Check the motor blower and the air circulation for proper functioning.                      | According to the guidelines in the machine maintenance plan, but at least every 1000 operating hours.  |
| Check the mechanical and electrical connections.  | According to the guidelines in the machine maintenance plan, but at least every 1000 operating hours.  |
| Check the machine for smooth running, vibrations and bearing noise.                         | According to the guidelines in the machine maintenance plan, but at least every 1000 operating hours.  |
| Remove dust, chips and other dirt from the motor housing, cooling fins and the connections. | Depending on the degree of soiling, but after one operating year at the latest.                        |
| Regrease the motor bearing.   | According to the guidelines in the machine maintenance plan, but at least every 20000 operating hours. |
| Clean the drainage holes for the motor bearing.   | If dirty and occluded.   |

Fig. 12-1: Maintenance measures

## Regreasing the Motor Bearings

Since the maximum speed is low and the bearing load is also low, the working life of the bearing grease is assumed to be at least 20,000 operating hours.

The bearing can be regreased via two supply lines on the top of the housing. Relubrication can also be automated via the connection to a central lubrication system.

Also refer to Chapter 8.5 "Grease Connector".

### **Instructions on relubrication:**

- Only use SHELL RETINAX LX2 as bearing grease. Other bearing greases are not permitted.
- The first factory filling is approx. 30 g bearing grease per bearing.
- Avoid any overgreasing of the bearings. Observe the manufacturer's instructions on installation and setting of the lubrication system.
- Minor amounts of residual grease may flow out through two drainage holes (6 mm in diameter) on the bottom of the

motor. These holes must not be closed when the motor is installed and running.

## Motor blower

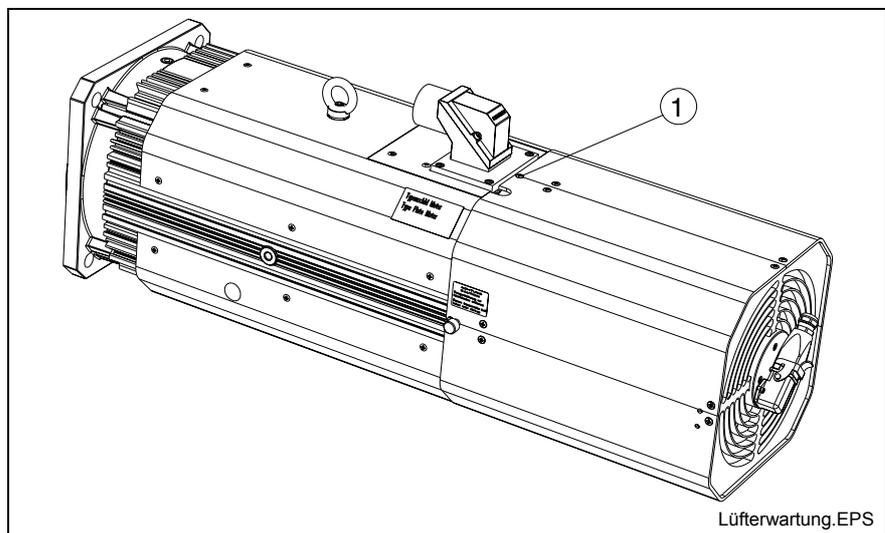
It may become necessary to dismount the blower unit for maintenance measure or troubleshooting.

- ⇒ This work must be carried out only by skilled personnel.
- ⇒ Do not carry out any maintenance measures when the machine is running. Please observe the safety notes.
- ⇒ During disassembly, keep the strips, screws and nuts with which the blower units are fastened.

Parts of the blower unit housings consist of several elements that are screwed together. Remove only the screws indicated.

### General procedure for maintaining the blower:

1. Switch off the system and disconnect the electrical blower connection.
2. Before loosening the fixing screws, make sure the blower unit does not drop; carefully remove the blower unit from the motor.
3. After completed cleaning or troubleshooting, reattach the blower unit. Secure the fixing screws with "LOCTITE 243 screw fastener" and reestablish the connections.
4. Check the functioning of the motor blower and the air circulation.
5. Log all maintenance measures in the machine maintenance plan.



(1): Fixing screws for blower unit (4x; 1 screw on each side of the motor)

Fig. 12-2: MAL motor blower

## 12.5 Troubleshooting



**DANGER**

### **Danger of injury due to moving elements! Danger of injury due to hot surfaces!**

- ⇒ Do not carry out any maintenance measures when the machine is running.
- ⇒ Before starting troubleshooting, switch off the drive device and the machine and wait until the discharging time of the electric systems has elapsed.
- ⇒ During maintenance work, secure the system against restart and unauthorized use.
- ⇒ Do not work on hot surfaces.

Possible causes for the malfunctioning of the motors can be limited to the following areas:

- Proper motor blower functioning and temperature course
- Internal temperature sensor
- Motor encoder or encoder connection
- Mechanical damage of the motor
- Mechanical connection to the machine

Encoder connection and temperature sensor are controlled by the drive device or control unit; the appropriate diagnostic messages are displayed. Observe the notes in the corresponding documentation.

Below, some of the troubles are shown with potential reasons. This list does not claim to be complete.

### Excess Temperature of Motor Housing

|                        |  |
|------------------------|--|
| <b>Status</b>          | The housing temperature of the motor rises to unusually high values.   |
| <b>Possible causes</b> | <ol style="list-style-type: none"> <li>1. Failure or malfunction of the blower system.</li> <li>2. The original operating cycle has been changed.</li> <li>3. Original motor parameters have been changed.</li> <li>4. Motor bearings are worn or defective.</li> </ol>  |
| <b>Countermeasures</b> | <ol style="list-style-type: none"> <li>1. Check the blower for proper functioning. Clean if necessary. In the case of loss, contact Bosch Rexroth Service.</li> <li>2. Check the layout of the drive for changed requirements. If overloading occurs, stop operation. Danger of damage!</li> <li>3. Restore the original parameters. Check the layout of the drive in the case of changed requirements.</li> <li>4. Contact the machine manufacturer.</li> </ol> |

## High Motor Temperature Values, but Normal Housing Temperature

|                        |   |
|------------------------|---|
| <b>Status</b>          | The diagnostics system of the drive controller shows unusually high values for the winding temperature via the display or control software. However, the motor housing has a normal temperature.  |
| <b>Possible causes</b> | <ol style="list-style-type: none"><li>1. Wiring error or cable break in sensor cable.</li><li>2. Diagnostics system defective.</li><li>3. Winding temperature sensor malfunction (PTC).</li></ol>   |
| <b>Countermeasures</b> | <ol style="list-style-type: none"><li>1. Check the wiring and connection of the temperature sensor according to the terminal diagram.</li><li>2. Check the diagnostics system on the drive device or the control unit.</li><li>3. Check the resistance value of the temperature sensor using a multimeter.<ul style="list-style-type: none"><li>• Set the measuring instrument to resistance measurement.</li><li>• Shut down the system and wait until the discharging time has elapsed. Separate the temperature sensor connection from the drive device and connect the wire pair to the measuring instrument (this includes the sensor cable in the test). Check the values according to Fig. 9-10.</li></ul></li></ol> |

## Motor Generates Vibrations

|                        |  |
|------------------------|--|
| <b>Status</b>          | Audible or tactile vibrations occur on the motor.  |
| <b>Possible causes</b> | <ol style="list-style-type: none"><li>1. Driven machine elements are insufficiently coupled or they are damaged.</li><li>2. Motor bearings are worn or defective. Available bearing lifetime or grease lifetime elapsed.</li><li>3. Motor mount loose.</li><li>4. Drive system control loop is instable from a control point of view.</li></ol>  |
| <b>Countermeasures</b> | <ol style="list-style-type: none"><li>1. Contact the machine manufacturer.</li><li>2. Contact the machine manufacturer.</li><li>3. Check the mechanical connection. Do not continue to use damaged parts. Contact the machine manufacturer.</li><li>4. Check parameters of drive system (motor and encoder data). Observe the troubleshooting notes in the documentation for the drive device.</li></ol> |

## Specified Position is not Reached

|                        |   |
|------------------------|---|
| <b>Status</b>          | The positioning command of the control unit is not precisely executed – or not at all. No malfunction display on the drive device or the control unit.  |
| <b>Possible causes</b> | <ol style="list-style-type: none"><li>1. Wiring of encoder cable is incorrect or defective. Pin assignment (encoder signals) in cable or plug may be switched.</li><li>2. Insufficient shielding of encoder cable against interference.</li><li>3. Incorrect encoder parameters set in drive device.</li><li>4. Motor-machine connection loose.</li><li>5. Encoder defective.</li></ol>   |
| <b>Countermeasures</b> | <ol style="list-style-type: none"><li>1. Check wiring according to terminal diagram and check state of cables for damage.</li><li>2. Check shielding; if necessary increase effective contact surfaces of shielding.</li><li>3. Correct the parameters. Observe the commissioning report for original values.</li><li>4. Check the mechanical connection. Do not continue to use damaged parts. Contact the machine manufacturer.</li><li>5. Encoder replacement necessary. Contact the machine manufacturer.</li></ol> |

## 12.6 Waste Disposal

|                                |  |
|--------------------------------|--|
| <b>Manufacturing process</b>   | <p>The products are manufactured such that the associated manufacturing process saves energy and raw material to an optimum extent while simultaneously permitting recycling and utilization of incidental waste.</p> <p>Bosch Rexroth is trying to replace polluted raw materials and supplies by environmentally alternatives regularly.</p>   |
| <b>Application</b>             | <p>Bosch Rexroth products do not contain any kind of dangerous substances which might be released as long as these products are used as intended. Normally, negative effects on the environment must not be expected.</p>  |
| <b>Forbidden substances</b>    | <p>We guarantee that our products do not include any of the substances forbidden according to the chemicals-ban-decree. Furthermore, our products are free from quicksilver, asbestos, PCB and chlorinated hydrocarbon.</p>  |
| <b>Substantial composition</b> | <p>Basically our motors contain</p> <ul style="list-style-type: none"><li>• Steel</li><li>• Aluminum</li><li>• Copper</li><li>• Brass</li><li>• Magnetic materials</li><li>• Electronic components and assemblies</li></ul>  |
| <b>Recycling</b>               | <p>Owing to their high metal content, the major part of the products can be recycled. To reach an optimum metal recovery, the various individual assemblies must be dismantled.</p> <p>The metals contained in the electric and electronic components can also be recovered by special separation processes. The plastics arising herein can be thermally recycled.</p>  |
| <b>Return</b>                  | <p>The products manufactured by us can be returned to us for waste disposal purposes at no charge. This requires, however, that no disturbing adhesions, such as oil, grease or other contamination are contained.</p> <p>Furthermore, the return shipment must not contain any inappropriate foreign materials or foreign components.</p> <p>Deliver the products "free domicile" to the following address:</p> <p style="padding-left: 40px;">Bosch Rexroth AG<br/>Electric Drives and Controls<br/>Bürgermeister-Dr.-Nebel-Strasse 2<br/>D-97816 Lohr am Main</p> |
| <b>Packing</b>                 | <p>High-quality products need optimal packaging. The packaging material consists of paper, wood and polystyrene. They can be recycled everywhere without any problems.</p> <p>The return transport should be refrained from for ecological reasons.</p>  |

## 13 Service & Support

### 13.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- telefonisch - by phone:  
über Service Call Entry Center  
- via Service Call Entry Center **+49 (0) 9352 40 50 60**  
Mo-Fr 07:00-18:00  
Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: [service.svc@boschrexroth.de](mailto:service.svc@boschrexroth.de)

### 13.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

**+49 (0) 171 333 88 26**  
oder - or **+49 (0) 172 660 04 06**

### 13.3 Internet

Unter [www.boschrexroth.com](http://www.boschrexroth.com) finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen \*) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

- Verkaufsniederlassungen
- Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

\*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At [www.boschrexroth.com](http://www.boschrexroth.com) you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses \*) of our sales- and service facilities figuring on the following pages.

- sales agencies
- offices providing service

Please contact our sales / service office in your area first.

\*) Data in the present documentation may have become obsolete since printing.

### 13.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

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

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

## 13.5 Kundenbetreuungsstellen - Sales & Service Facilities

### Deutschland – Germany

vom Ausland: (0) nach Landeskennziffer weglassen!  
from abroad: don't dial (0) after country code!

|   |  |  |  |
|---|--|--|--|
| Vertriebsgebiet Mitte<br>Germany Centre<br><br>Rexroth Indramat GmbH<br>Bgm.-Dr.-Nebel-Str. 2 / Postf. 1357<br>97816 Lohr am Main / 97803 Lohr<br><br><b>Kompetenz-Zentrum Europa</b><br><br>Tel.: +49 (0)9352 40-0<br>Fax: +49 (0)9352 40-4885       | <b>SERVICE AUTOMATION</b><br><br><b>CALL ENTRY CENTER</b><br><b>Helpdesk</b><br><b>MO – FR</b><br><b>von 07:00 - 18:00 Uhr</b><br><b>from 7 am – 6 pm</b><br><br><b>Tel. +49 (0) 9352 40 50 60</b><br><b>Fax +49 (0) 9352 40 49 41</b><br><a href="mailto:service.svc@boschrexroth.de">service.svc@boschrexroth.de</a> | <b>SERVICE AUTOMATION</b><br><br><b>HOTLINE 24 / 7 / 365</b><br><br><b>außerhalb der Helpdesk-Zeit</b><br><b>out of helpdesk hours</b><br><br><b>Tel.: +49 (0)172 660 04 06</b><br><small>oder / or</small><br><b>Tel.: +49 (0)171 333 88 26</b> | <b>SERVICE AUTOMATION</b><br><br><b>ERSATZTEILE / SPARES</b><br>verlängerte Ansprechzeit<br>- extended office time -<br>♦ nur an Werktagen<br>- only on working days -<br>♦ von 07:00 - 18:00 Uhr<br>- from 7 am - 6 pm -<br><b>Tel. +49 (0) 9352 40 42 22</b> |
| Vertriebsgebiet Süd<br>Germany South<br><br>Bosch Rexroth AG<br>Landshuter Allee 8-10<br>80637 München<br><br>Tel.: +49 (0)89 127 14-0<br>Fax: +49 (0)89 127 14-490   | Vertriebsgebiet West<br>Germany West<br><br>Bosch Rexroth AG<br>Regionalzentrum West<br>Borsigstrasse 15<br>40880 Ratingen<br><br>Tel.: +49 (0)2102 409-0<br>Fax: +49 (0)2102 409-406<br>+49 (0)2102 409-430   | Gebiet Südwest<br>Germany South-West<br><br>Bosch Rexroth AG<br>Service-Regionalzentrum Süd-West<br>Siemensstr. 1<br>70736 Fellbach<br><br>Tel.: +49 (0)711 51046-0<br>Fax: +49 (0)711 51046-248   |  |
| Vertriebsgebiet Nord<br>Germany North<br><br>Bosch Rexroth AG<br>Walsroder Str. 93<br>30853 Langenhagen<br><br>Tel.: +49 (0) 511 72 66 57-0<br>Service: +49 (0) 511 72 66 57-256<br>Fax: +49 (0) 511 72 66 57-93<br>Service: +49 (0) 511 72 66 57-783 | Vertriebsgebiet Mitte<br>Germany Centre<br><br>Bosch Rexroth AG<br>Regionalzentrum Mitte<br>Waldecker Straße 13<br>64546 Mörfelden-Walldorf<br><br>Tel.: +49 (0) 61 05 702-3<br>Fax: +49 (0) 61 05 702-444   | Vertriebsgebiet Ost<br>Germany East<br><br>Bosch Rexroth AG<br>Beckerstraße 31<br>09120 Chemnitz<br><br>Tel.: +49 (0)371 35 55-0<br>Fax: +49 (0)371 35 55-333  | Vertriebsgebiet Ost<br>Germany East<br><br>Bosch Rexroth AG<br>Regionalzentrum Ost<br>Walter-Köhn-Str. 4d<br>04356 Leipzig<br><br>Tel.: +49 (0)341 25 61-0<br>Fax: +49 (0)341 25 61-111  |

## Europa (West) - Europe (West)

**vom Ausland:** (0) nach Landeskennziffer weglassen, **Italien:** 0 nach Landeskennziffer mitwählen  
**from abroad:** don't dial (0) after country code, **Italy:** dial 0 after country code

|  |  |   |   |
|--|--|---|---|
| <b>Austria - Österreich</b><br>Bosch Rexroth GmbH<br>Electric Drives & Controls<br>Stachegasse 13<br>1120 Wien<br>Tel.: +43 (0) 1 985 25 40<br>Fax: +43 (0) 1 985 25 40-93   | <b>Austria – Österreich</b><br>Bosch Rexroth GmbH<br>Electric Drives & Controls<br>Industriepark 18<br>4061 Pasching<br>Tel.: +43 (0)7221 605-0<br>Fax: +43 (0)7221 605-21   | <b>Belgium - Belgien</b><br>Bosch Rexroth NV/SA<br>Henri Genessestraat 1<br>1070 Bruxelles<br>Tel: +32 (0) 2 451 26 08<br>Fax: +32 (0) 2 451 27 90<br><a href="mailto:info@boschrexroth.be">info@boschrexroth.be</a><br><a href="mailto:service@boschrexroth.be">service@boschrexroth.be</a>  | <b>Denmark - Dänemark</b><br>BEC A/S<br>Zinkvej 6<br>8900 Randers<br>Tel.: +45 87 11 90 60<br>Fax: +45 87 11 90 61  |
| <b>Great Britain – Großbritannien</b><br>Bosch Rexroth Ltd.<br>Electric Drives & Controls<br>Broadway Lane, South Cerney<br>Cirencester, Glos GL7 5UH<br>Tel.: +44 (0)1285 863000<br>Fax: +44 (0)1285 863030<br><a href="mailto:sales@boschrexroth.co.uk">sales@boschrexroth.co.uk</a><br><a href="mailto:service@boschrexroth.co.uk">service@boschrexroth.co.uk</a> | <b>Finland - Finnland</b><br>Bosch Rexroth Oy<br>Electric Drives & Controls<br>Ansatie 6<br>017 40 Vantaa<br>Tel.: +358 (0)9 84 91-11<br>Fax: +358 (0)9 84 91-13 60  | <b>France - Frankreich</b><br>Bosch Rexroth SAS<br>Electric Drives & Controls<br>Avenue de la Trentaine<br>(BP. 74)<br>77503 Chelles Cedex<br>Tel.: +33 (0)164 72-63 22<br>Fax: +33 (0)164 72-63 20<br><b>Hotline: +33 (0)608 33 43 28</b>  | <b>France - Frankreich</b><br>Bosch Rexroth SAS<br>Electric Drives & Controls<br>ZI de Thibaud, 20 bd. Thibaud<br>(BP. 1751)<br>31084 Toulouse<br>Tel.: +33 (0)5 61 43 61 87<br>Fax: +33 (0)5 61 43 94 12   |
| <b>France – Frankreich</b><br>Bosch Rexroth SAS<br>Electric Drives & Controls<br>91, Bd. Irène Joliot-Curie<br>69634 Vénissieux – Cedex<br>Tel.: +33 (0)4 78 78 53 65<br>Fax: +33 (0)4 78 78 53 62   | <b>Italy - Italien</b><br>Bosch Rexroth S.p.A.<br>Strada Statale Padana<br>Superiore 11, no. 41<br>20063 Cernusco S/N.MI<br><b>Hotline: +39 02 92 365 563</b><br>Tel.: +39 02 92 365 1<br>Service: +39 02 92 365 300<br>Fax: +39 02 92 365 500<br>Service: +39 02 92 365 516   | <b>Italy - Italien</b><br>Bosch Rexroth S.p.A.<br>Via Paolo Veronesi, 250<br>10148 Torino<br>Tel.: +39 011 224 88 11<br>Fax: +39 011 224 88 30  | <b>Italy - Italien</b><br>Bosch Rexroth S.p.A.<br>Via Mascia, 1<br>80053 Castellamare di Stabia NA<br>Tel.: +39 081 8 71 57 00<br>Fax: +39 081 8 71 68 85   |
| <b>Italy - Italien</b><br>Bosch Rexroth S.p.A.<br>Via del Progresso, 16 (Zona Ind.)<br>35020 Padova<br>Tel.: +39 049 8 70 13 70<br>Fax: +39 049 8 70 13 77   | <b>Italy - Italien</b><br>Bosch Rexroth S.p.A.<br>Via Isonzo, 61<br>40033 Casalecchio di Reno (Bo)<br>Tel.: +39 051 29 86 430<br>Fax: +39 051 29 86 490  | <b>Netherlands - Niederlande/Holland</b><br>Bosch Rexroth Services B.V.<br>Technical Services<br>Kruisbroeksestraat 1<br>(P.O. Box 32)<br>5281 RV Boxtel<br>Tel.: +31 (0) 411 65 19 51<br>Fax: +31 (0) 411 67 78 14<br><b>Hotline: +31 (0) 411 65 19 51</b><br><a href="mailto:services@boschrexroth.nl">services@boschrexroth.nl</a> | <b>Netherlands – Niederlande/Holland</b><br>Bosch Rexroth B.V.<br>Kruisbroeksestraat 1<br>(P.O. Box 32)<br>5281 RV Boxtel<br>Tel.: +31 (0) 411 65 16 40<br>Fax: +31 (0) 411 65 14 83<br><a href="http://www.boschrexroth.nl">www.boschrexroth.nl</a>                    |
| <b>Norway - Norwegen</b><br>Bosch Rexroth AS<br>Electric Drives & Controls<br>Berghagan 1 or: Box 3007<br>1405 Ski-Langhus 1402 Ski<br>Tel.: +47 64 86 41 00<br>Fax: +47 64 86 90 62<br><b>Hotline: +47 64 86 94 82</b><br><a href="mailto:jul.ruud@rexroth.no">jul.ruud@rexroth.no</a>  | <b>Spain – Spanien</b><br>Goimendi Automation S.L.<br>Parque Empresarial Zuatzu<br>C/ Francisco Grandmontagne no.2<br>20018 San Sebastian<br>Tel.: +34 9 43 31 84 21<br>- service: +34 9 43 31 84 56<br>Fax: +34 9 43 31 84 27<br>- service: +34 9 43 31 84 60<br><a href="mailto:sat.indramat@goimendi.es">sat.indramat@goimendi.es</a> | <b>Spain - Spanien</b><br>Bosch Rexroth S.A.<br>Electric Drives & Controls<br>Centro Industrial Santiga<br>Obradors 14-16<br>08130 Santa Perpetua de Mogoda<br>Barcelona<br>Tel.: +34 9 37 47 94 00<br>Fax: +34 9 37 47 94 01   | <b>Spain - Spanien</b><br>Bosch Rexroth S.A.<br>Electric Drives & Controls<br>c/ Almazara, 9<br>28760 Tres Cantos (Madrid)<br>Tel.: +34 91 806 24 79<br>Fax: +34 91 806 24 72<br><a href="mailto:fernando.barieqo@boschrexroth.es">fernando.barieqo@boschrexroth.es</a> |
| <b>Sweden - Schweden</b><br>Bosch Rexroth AB<br>Electric Drives & Controls<br>- Varuvägen 7<br>(Service: Konsumentvägen 4, Älfsjö)<br>125 81 Stockholm<br>Tel.: +46 (0) 8 727 92 00<br>Fax: +46 (0) 8 647 32 77  | <b>Sweden - Schweden</b><br>Bosch Rexroth AB<br>Electric Drives & Controls<br>Ekvändan 7<br>254 67 Helsingborg<br>Tel.: +46 (0) 4 238 88 -50<br>Fax: +46 (0) 4 238 88 -74  | <b>Switzerland East - Schweiz Ost</b><br>Bosch Rexroth Schweiz AG<br>Electric Drives & Controls<br>Hemrietstrasse 2<br>8863 Buttikon<br>Tel. +41 (0) 55 46 46 111<br>Fax +41 (0) 55 46 46 222   | <b>Switzerland West - Schweiz West</b><br>Bosch Rexroth Suisse SA<br>Av. Général Guisan 26<br>1800 Vevey 1<br>Tel.: +41 (0)21 632 84 20<br>Fax: +41 (0)21 632 84 21   |

## Europa (Ost) - Europe (East)

**vom Ausland:** (0) nach Landeskenziffer weglassen  
**from abroad:** don't dial (0) after country code

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|---|--|---|--|
| <p>Czech Republic - Tschechien</p> <p>Bosch -Rexroth, spol.s.r.o.<br/> Hviezdoslavova 5<br/> 627 00 Brno<br/> Tel.: +420 (0)5 48 126 358<br/> Fax: +420 (0)5 48 126 112</p>   | <p>Czech Republic - Tschechien</p> <p>DEL a.s.<br/> Strojirenská 38<br/> 591 01 Zdar nad Sázavou<br/> Tel.: +420 566 64 3144<br/> Fax: +420 566 62 1657</p>  | <p>Hungary - Ungarn</p> <p>Bosch Rexroth Kft.<br/> Angol utca 34<br/> 1149 Budapest<br/> Tel.: +36 (1) 422 3200<br/> Fax: +36 (1) 422 3201</p>  | <p>Poland – Polen</p> <p>Bosch Rexroth Sp.zo.o.<br/> ul. Staszica 1<br/> 05-800 Pruszków<br/> Tel.: +48 (0) 22 738 18 00<br/> – service: +48 (0) 22 738 18 46<br/> Fax: +48 (0) 22 758 87 35<br/> – service: +48 (0) 22 738 18 42</p>                          |
| <p>Poland – Polen</p> <p>Bosch Rexroth Sp.zo.o.<br/> Biuro Poznan<br/> ul. Dabrowskiego 81/85<br/> 60-529 Poznan<br/> Tel.: +48 061 847 64 62 /-63<br/> Fax: +48 061 847 64 02</p>  | <p>Romania - Rumänien</p> <p>East Electric S.R.L.<br/> Bdul Basarabia no.250, sector 3<br/> 73429 Bucuresti<br/> Tel./Fax: +40 (0)21 255 35 07<br/> +40 (0)21 255 77 13<br/> Fax: +40 (0)21 725 61 21<br/> <a href="mailto:eastel@rdsnet.ro">eastel@rdsnet.ro</a></p>      | <p>Romania - Rumänien</p> <p>Bosch Rexroth Sp.zo.o.<br/> Str. Drobety nr. 4-10, app. 14<br/> 70258 Bucuresti, Sector 2<br/> Tel.: +40 (0)1 210 48 25<br/> +40 (0)1 210 29 50<br/> Fax: +40 (0)1 210 29 52</p>   | <p>Russia - Russland</p> <p>Bosch Rexroth OOO<br/> Wjatskaja ul. 27/15<br/> 127015 Moskau<br/> Tel.: +7-095-785 74 78<br/> +7-095 785 74 79<br/> Fax: +7 095 785 74 77<br/> <a href="mailto:laura.kanina@boschrexroth.ru">laura.kanina@boschrexroth.ru</a></p> |
| <p>Russia Belarus - Weissrussland</p> <p>ELMIS<br/> 10, Internationalnaya<br/> 246640 Gomel, Belarus<br/> Tel.: +375/ 232 53 42 70<br/> +375/ 232 53 21 69<br/> Fax: +375/ 232 53 37 69<br/> <a href="mailto:elmis ltd@yahoo.com">elmis ltd@yahoo.com</a></p> | <p>Turkey - Türkei</p> <p>Bosch Rexroth Otomasyon<br/> San &amp; Tic. A..S.<br/> Fevzi Cakmak Cad No. 3<br/> 34630 Sefaköy Istanbul<br/> Tel.: +90 212 413 34 00<br/> Fax: +90 212 413 34 17<br/> <a href="http://www.boschrexroth.com.tr">www.boschrexroth.com.tr</a></p> | <p>Turkey - Türkei</p> <p>Servo Kontrol Ltd. Sti.<br/> Perpa Ticaret Merkezi B Blok<br/> Kat: 11 No: 1609<br/> 80270 Okmeydani-Istanbul<br/> Tel: +90 212 320 30 80<br/> Fax: +90 212 320 30 81<br/> <a href="mailto:remzi.sali@servokontrol.com">remzi.sali@servokontrol.com</a><br/> <a href="http://www.servokontrol.com">www.servokontrol.com</a></p> | <p>Slovenia - Slowenien</p> <p>DOMEL<br/> Otoki 21<br/> 64 228 Zelezniki<br/> Tel.: +386 5 5117 152<br/> Fax: +386 5 5117 225<br/> <a href="mailto:brane.ozebek@domel.si">brane.ozebek@domel.si</a></p>  |

## Africa, Asia, Australia – incl. Pacific Rim

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|---|--|--|---|
| <p>Australia - Australien</p> <p>AIMS - Australian Industrial Machinery Services Pty. Ltd.<br/>28 Westside Drive<br/>Laverton North Vic 3026<br/>Melbourne</p> <p>Tel.: +61 3 93 14 3321<br/>Fax: +61 3 93 14 3329<br/><b>Hotlines: +61 3 93 14 3321<br/>+61 4 19 369 195</b><br/><a href="mailto:enquires@aimservices.com.au">enquires@aimservices.com.au</a></p>  | <p>Australia - Australien</p> <p>Bosch Rexroth Pty. Ltd.<br/>No. 7, Endeavour Way<br/>Braeside Victoria, 31 95<br/>Melbourne</p> <p>Tel.: +61 3 95 80 39 33<br/>Fax: +61 3 95 80 17 33<br/><a href="mailto:mel@rexroth.com.au">mel@rexroth.com.au</a></p>  | <p>China</p> <p>Shanghai Bosch Rexroth Hydraulics &amp; Automation Ltd.<br/>Waigaoqiao, Free Trade Zone<br/>No.122, Fu Te Dong Yi Road<br/>Shanghai 200131 - P.R.China</p> <p>Tel.: +86 21 58 66 30 30<br/>Fax: +86 21 58 66 55 23<br/><a href="mailto:richard.yang_sh@boschrexroth.com.cn">richard.yang_sh@boschrexroth.com.cn</a><br/><a href="mailto:qf.zhu_sh@boschrexroth.com.cn">qf.zhu_sh@boschrexroth.com.cn</a></p> | <p>China</p> <p>Shanghai Bosch Rexroth Hydraulics &amp; Automation Ltd.<br/>4/f, Marine Tower<br/>No.1, Pudong Avenue<br/>Shanghai 200120 - P.R.China</p> <p>Tel.: +86 21 68 86 15 88<br/>Fax: +86 21 68 86 05 99</p>   |
| <p>China</p> <p>Bosch Rexroth China Ltd.<br/>15/F China World Trade Center<br/>1, Jianguomenwai Avenue<br/>Beijing 100004, P.R.China</p> <p>Tel.: +86 10 65 05 03 80<br/>Fax: +86 10 65 05 03 79</p>  | <p>China</p> <p>Bosch Rexroth China Ltd.<br/>Guangzhou Repres. Office<br/>Room 1014-1016, Metro Plaza,<br/>Tian He District, 183 Tian He Bei Rd<br/>Guangzhou 510075, P.R.China</p> <p>Tel.: +86 20 8755-0030<br/>+86 20 8755-0011<br/>Fax: +86 20 8755-2387</p>   | <p>China</p> <p>Bosch Rexroth (China) Ltd.<br/>A-5F., 123 Lian Shan Street<br/>Sha He Kou District<br/>Dalian 116 023, P.R.China</p> <p>Tel.: +86 411 46 78 930<br/>Fax: +86 411 46 78 932</p>   | <p>China</p> <p>Melchers GmbH<br/>BRC-SE, Tightening &amp; Press-fit<br/>13 Floor Est Ocean Centre<br/>No.588 Yanan Rd. East<br/>65 Yanan Rd. West<br/>Shanghai 200001</p> <p>Tel.: +86 21 6352 8848<br/>Fax: +86 21 6351 3138</p>  |
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| <p>Indonesia - Indonesien</p> <p>PT. Bosch Rexroth<br/>Building # 202, Cilandak<br/>Commercial Estate<br/>Jl. Cilandak KKO, Jakarta 12560</p> <p>Tel.: +62 21 7891169 (5 lines)<br/>Fax: +62 21 7891170 - 71<br/><a href="mailto:rudu.karimun@boschrexroth.co.id">rudu.karimun@boschrexroth.co.id</a></p>   | <p>Japan</p> <p>Bosch Rexroth Automation Corp.<br/>Service Center Japan<br/>Yutakagaoka 1810, Meito-ku,<br/>NAGOYA 465-0035, Japan</p> <p>Tel.: +81 52 777 88 41<br/>+81 52 777 88 53<br/>+81 52 777 88 79<br/>Fax: +81 52 777 89 01</p>   | <p>Japan</p> <p>Bosch Rexroth Automation Corp.<br/>Electric Drives &amp; Controls<br/>2F, I.R. Building<br/>Nakamachidai 4-26-44, Tsuzuki-ku<br/>YOKOHAMA 224-0041, Japan</p> <p>Tel.: +81 45 942 72 10<br/>Fax: +81 45 942 03 41</p>  | <p>Korea</p> <p>Bosch Rexroth-Korea Ltd.<br/>Electric Drives and Controls<br/>Bongwoo Bldg. 7FL, 31-7, 1Ga<br/>Jangchoong-dong, Jung-gu<br/>Seoul, 100-391</p> <p>Tel.: +82 234 061 813<br/>Fax: +82 222 641 295</p>  |
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