BAUMÜLLER

Safety information

be in motion be in motion

TAM 00697

Three-phase a.c. motor

for safety-related applications

Version: 07/2021
English

LEGAL INFORMATION ON THE DOCUMENTATION

Copyright

Obligation

This documentation is part of the device/the machine. These safety instructions must be kept accessible for the operator and in a legible condition at all times.

In case of sale/relocation of the device/the machine, the owner must pass on this documentation together with the device/the machine. After selling the device/the machine, this original and all copies must be handed over to the buyer. After disposal or other end of use, this original and all copies must be destroyed.

With the handover of this documentation, earlier versions of corresponding documentation are superseded.

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However, no guarantee can be given regarding the freedom from errors of this documentation, unless described otherwise in the General Terms and Conditions of Sale and Delivery.

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1 Safety-related information

1.1 Basic instruction handbooks with safety instructions

This electric motor with motor article number 06xxxxxx has been built to current safety standards and was tested for its operating safety and reliability before leaving the plant.

The following documents must be followed for proper commissioning and safe use of the motor:

- these safety instructions (TAM 00697 Three-phase a.c. motor for safety-related applications).
- the instruction handbook - safety and commissioning instructions for three-phase a.c. motors TAM 00552.
- the product-specific instruction handbook TAM 00xxx.
- the assembly and instruction handbook, the implementation handbook with safety instructions as well as all other documents of the respective encoder manufacturer on functional safety belonging to the product.

Note the following basic hazards when handling this product:

Hazards due to

- lifting and transportation processes
- electrical current
- moving parts
- hot surfaces
- EMC interference
- mechanical overload
- thermal overload

To avoid hazards for persons and property and to minimize any existing residual risks, please note and follow all safety instructions, in particular all warnings marked by the following product safety symbols:

	**Danger due to electric shock** Failure to comply can cause fatal or serious injuries.
	**Warning of general hazards** Failure to comply can cause serious injuries or damage to property.
	**Prohibition of action likely to increase or cause danger** Failure to comply can cause serious injuries.
	**Use in safety-rated applications**

Also follow all other applicable safety instructions, (for example, those of the evaluation electronics manufacturer), which are necessary for safe operation in terms of functional safety.

1.2 Important notes

	Manufacturers' data on the motor and encoder must be strictly adhered to. They may not be exceeded, not even in unfavorable operating conditions.
	No unauthorized modifications and changes to the electric motor are permitted whatsoever for safety reasons! If necessary, contact the motor manufacturer. Do not dismantle or disable any safety devices or guards to operate the electric motor.
	Have all work carried out by qualified skilled personnel only! All work must only be carried out after the plant/system has been disconnected from the power supply and secured against switching on (including auxiliary circuits)! All work must only be carried out if the motor is at a standstill! In case of three-phase synchronous motors with permanent magnet excitation, voltages > 60 V can occur at the motor contacts if the rotor is rotating. Comply with the regulations for working on electrical installations!

1.3 Intended use

The electric motor for use in functional safety must have an 06xxxxxx article number and is only approved within its intended use. In this context, it must only be used for the use cases provided for in the technical documents and only in compliance with all safety instructions in these technical instructions.

All assembly, installation commissioning and maintenance work and work during operation must only be carried out by **qualified personnel**. Qualified personnel for the purpose of the safety instructions listed here means a person who has been trained and authorized in the subject, who is authorized to install, assemble, commission and to operate devices, systems, and electric circuits in compliance with the relevant safety standards (EN 50110-1).

Improper behavior can cause serious personal injuries and damage to property!

This **electric motor** is intended for **use** in **commercial plants/systems** and is subject to the **standards and directives** of the applicable product-specific EU Declarations of Conformity and or Declarations of Incorporation, as well as the safety standards **EN ISO 13849 and EN 61800-5-2** on functional safety.

Electric motors of this series meet the requirements for fault exclusion of the mechanically safe encoder interface.

Also note and comply with all binding national, local, and system-specific industrial safety and health regulations!

1.4 Scope of delivery

1.4.1 Motor marking

	**In addition to the type plate, each Baumüller motor for safety-related applications has a safety sticker**

1.4.2 Checking the delivery

They are delivered and assembled based on the order.

- If transport damage is found on delivery, it must be reported to the transport company and the parent plants of Baumüller immediately.
- Check the completeness of the delivery and its documents. Compare the performance data and models of the delivered motor against your purchase order data immediately. If identifiable defects or an incomplete delivery are determined, the responsible Baumüller field office or the main Baumüller plant in Nuremberg must be notified directly.

In both cases it is prohibited to commission the motor until the defects have been corrected properly.

2 Technical data

2.1 Safety instructions

	The technical data of the motor and encoder manufacturers must always be complied with in the application. For example, the real angular acceleration that occurs in the motor used must be checked against the maximum possible angular acceleration given by the encoder manufacturer. Exceedance of the maximum angular accelerations given is not permitted, since the mechanically safe encoder link is endangered as a result!

Furthermore, the following additional safety information on BAUMÜLLER motors with "fault exclusion for the mechanical encoder link" to installed/attached safe encoders :

It must always be taken into consideration that the BAUMÜLLER motor with "fault exclusion for the mechanical encoder link" subsystem merely represents a part of an overall system to a safety chain. To evaluate and ensure the functional safety of the safety functions, the person with overall responsibility for the system must include the other subsystems involved.
BAUMÜLLER motors with installed/attached safe encoders for use in "functional safety" must have a certified encoder link for the associated "mechanical fault exclusion". The other applicable regulations of the encoder and evaluation electronics manufacturers must always be taken into consideration. This must be ensured by the person responsible for the overall system (e.g. machine/or system manufacturer). The complete motor itself or its attachments such as transmission, brakes, pinions, coupling, etc. are not safety components as defined by the Machinery Directive. The 06xxxxxx BAUMÜLLER motor article number is merely an identifying feature, that these BAUMÜLLER motors contain safety components. The 06 article number alone does not mean that the Baumüller motor is suitable for safe application.

Optionally with integrated brakes:

Brakes, such as permanent magnet brakes (PE) or approved disk brakes (SB) for functional safety, can be optionally integrated; however, they are not safety brakes. Attention! The full braking force must always be ensured, i.e. even during commissioning. Therefore, in particular, in case of PE brakes, axial forces on the motor shaft end are always prohibited throughout the entire life cycle. BAUMÜLLER recommends that the brake air gap, the braking torque or, indirectly, the brake release voltage must be monitored, so that an "adequate stopping function" is ensured in all fault, attachment and operating states. Within their allowable ible specification, the integrated brakes are each not to be operated as service brakes, but as stopping brakes (speed 0 revolutions). The optional manual venting for SB brakes must generally not be blocked and may also not be operated while the machine is running. Any transport locking devices must be removed before commissioning/operation. We recommend that SB brakes are not operated with overexcitation, since this can cause increased potential braking interference fields to act on the encoder. The respective evaluation electronics must reliably detect and switch off these potential malfunctions.

General effect of brake abrasion on the functional safety of the safe encoder on the motor:

If stopping brakes, e.g. with emergency stop function, are used, the resulting brake wear (including conductive) can penetrate the encoder system, since it is not possible to fully seal the gap between the brake and the encoder system in the motor!
Therefore, safe encoder systems must reliably detect the penetration of brake wear as such. The downstream evaluation electronics must register the reliable fault detection of the encoder and ensure safe switching off. To this end, the respective regulations of the encoder and evaluation electronics manufacturer (such as instruction handbook, implementation handbooks, safety instructions) must always be applied.

BAUMÜLLER recommendation for brake operation with safe encoders in functional safety:

The brakes integrated in BAUMÜLLER motors in combination with safe encoders are not to be operated as service brakes, but as stopping brakes (speed 0 revolutions), since the frequency and load of braking influences the brake wear behavior. We therefore recommend that emergency stop

operation with integrated brakes be avoided wherever possible, to reach the optimum encoder life! Impermissible starting of the motors against applied brakes at speeds greater than 0, as well as bedding-in the brakes can also cause substantial brake abrasion. Brake dust penetrating the safe encoder system must be detected reliably; however, this can provoke associated early encoder failures. In particular, we recommend use of the reliable Baumüller converter technology for this, in whose documentation the required reliable error detection and safe shutdown are described.

Motor operation with safe resolvers in combination with brakes:

Especially in strong electromagnetic fields in combination with safe resolvers, the resolver signals can be disrupted due to application. This must be overcome by reliable early detection and safe switching off by the respective safe evaluation electronics! Accordingly, we recommend use of certified BM evaluation electronics. In general, the suitability of the measurement system must be checked with regard to the required measurement accuracy of the application.

Heidenhain safe optical encoders:

According to the encoder manufacturer's specification, moisture (incl. condensation) must not penetrate Heidenhain safe optical encoders since this can lead to unsafe encoder failures! To this end, attention must be paid to the motor specifications incl. operating/environmental conditions. In particular, impermissible cooling, e.g. by cooling medium that is too cold, can provoke condensation.

2.2 Allowable technical properties for the certified encoders used

2.2.1 Encoders made by Heidenhain

Refer to the information provided by the encoder manufacturer, in particular the reliability data on the respective SIL/PL level classification as well as the MTTFd values.

2.2.2 Encoders made by Sick

Refer to the information provided by the encoder manufacturer, in particular the reliability data on the respective SIL/PL level classification as well as the MTTFd values.

2.2.3 Resolvers made by LTN

2.2.3.1 RE-21 with mechanically safe Baumüller encoder interface

Resolver properties	**technical data requiring absolute compliance**
SIL level	up to SIL 3 depending on the implementation of the overall system in terms of functional safety
$MTTF_d$ value	8320 years
max. all. speed	<= 6,000 min^{-1}
max. all. angular acceleration	certified: <= 100,000 rad/s^2
Operating temperature	-55°C to +155°C
Motor properties	**technical data requiring absolute compliance**
all. vibration resistance	radial 3g / axial 1g 10Hz to 100Hz (EN 60068-2-6)

the resolver data sheets, and motor specifications also apply

2.2.3.2 RE-15 with mechanically safe Baumüller encoder interface

Resolver properties	**technical data requiring absolute compliance**
SIL level	up to SIL 3 depending on the implementation of the overall system in terms of functional safety
$MTTF_d$ value	30720 years
max. all. angular acceleration	certified: <= 200,000 rad/s^2
Operating temperature	-55°C to +155°C
Motor properties	**technical data requiring absolute compliance**
all. vibration resistance	radial 3g / axial 1g 10Hz to 100Hz (EN 60068-2-6)

the resolver data sheets, and motor specifications also apply

3 Commissioning, normal operation

3.1 Safety instructions

	Do not carry out any work on the electric unless the motor is stopped, de-energized and cooled. All connections such as screws etc. loosened during the work on the motor must be refastened before starting up. When working, always comply with the technical notes and instructions in the respective chapters of these commissioning and maintenance instructions.
	The electric motor may not be operated without safety devices, the motor type-related operating and safety instructions must be followed. The motor must be shut down to install and disassemble components and systems provided to monitor safe operation of the motor.

3.2 Initial commissioning

Before the initial startup, a notch position run and possibly checking the function of the brakes is required so that possible deviations can be detected early, and potential associated “unsafe failures” can be prevented.

3.3 Conditions in operation

The data provided by the motor, converter, and encoder manufacturers, as well as the relevant laws and directives for their use or planned purpose must be noted and followed.

The mechanical and electrical characteristics (e.g. ambient temperature, speed, mechanical load, max. supply voltage, electromagnetic and electrostatic fields, etc.) of the motor and the rotary encoders used, may never exceed the limit values given by the manufacturer.

4 Fault correction, servicing, maintenance, and cleaning

4.1 Safety instructions

	Maintenance work inside the motor and on the encoder system, as well as repairs or general overhauls may only be carried out in the parent plants of Baumüller. If the above-named work is described otherwise in our commissioning and maintenance instructions, this work must expressly not be carried out. Repair workshops and service companies are not authorized to carry out this work if they have not been trained accordingly in the parent plants! **Repair of safe motors by the customer is prohibited.** **Breaking open sealed areas leads to immediate exclusion of all liability for Baumüller.**

4.2 Fault correction, servicing, and maintenance

The customer may only carry out the maintenance work approved by Baumüller, e.g. relubricating bearings, insofar as relubrication equipment is provided. All safety instructions and safety-related information in this document as well as the specifications and notes of the respective commissioning and maintenance instructions must be followed.

After replacing or repairing a motor, brakes or encoder, a notch position run is required, and possibly checking of the function of the brakes (see also chap. 3.2).

4.3 Cleaning

The motor surface is cleaned as described in the commissioning and maintenance instructions. Cleaning the surface of the motor with high pressure or steam is not permitted.

Warranty and liability

All data provided in this documentation are non-binding customer information that is subject to continuous further development and is updated continuously by our permanent revision service. Warranty and liability claims against Baumüller Nürnberg GmbH are excluded, in particular if one or several of the causes listed by us in the following caused the damage:

- You have disregarded notes and instructions in this documentation.
- You have used the system for a purpose for which it is not intended to be used.
- You have
  - improperly assembled, connected, commissioned/started up, operated or not serviced/maintained the system
  - allowed unqualified or inadequately qualified personnel to assemble/install, connect. start up, operate and / or service/maintain the system,
  - overloaded the system,
  - operated the system with
    - defective safety devices,
    - guards not attached or not attached properly,
    - non-functional safety devices and guards.
  - not operated the system within the specified ambient conditions.
- You have modified the system without the written approval of Baumüller Nürnberg GmbH.
- You have not followed the instructions regarding maintenance in the component descriptions.
- You have poorly monitored the parts subject to wear.
- You have combined the system improperly with the products of other manufacturers.
- You have combined the drive system with faulty and/or faultily documented products of other manufacturers.

The latest version of the “General Terms and Conditions of Sale and Delivery” (“Allgemeinen Verkaufs- und Lieferbedingungen”) of Baumüller Nürnberg GmbH always apply.
These have been available to you since the signing of the contract at the latest.

Change:
TAM00697 old version of 2012 has been completely revised