BMH

Servomotor
Motor manual

V1.00, 06.2009

0198441113749, V1.00, 06.2009

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Schneider Electric

Important information

This manual is part of the product.

Carefully read this manual and observe all instructions.

Keep this manual for future reference.

Hand this manual and all other pertinent product documentation over to all users of the product.

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

Some products are not available in all countries.
For information on the availability of products, please consult the catalog.

Subject to technical modifications without notice.

All details provided are technical data which do not constitute warranted qualities.

Most of the product designations are registered trademarks of their respective owners, even if this is not explicitly indicated.

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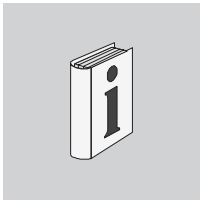
About this manual



This manual is valid for BMH standard products. Chapter 1 "Introduction" lists the type code for this product. The type code allows you to identify whether your product is a standard product or a customized product.

Source manuals

The latest versions of the manuals can be downloaded from the Internet at:

http://www.schneider-electric.com

Corrections and suggestions

We always try to further optimize our manuals. We welcome your suggestions and corrections.

Please get in touch with us by e-mail:
techcomm@schneider-electric.com.

Work steps

If work steps must be performed consecutively, this sequence of steps is represented as follows:

- ■ Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Specific response to this work step
- ▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

Making work easier

Information on making work easier is highlighted by this symbol:

Sections highlighted this way provide supplementary information on making work easier.

SI units

SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.

Example:
Minimum conductor cross section: 1.5 mm^2 (AWG 14)

Glossary

Explanations of special technical terms.

Index

List of keywords with references to the corresponding page numbers.

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1 Introduction

1

1.1 Motor family

The motors are AC synchronous servo motors with a very high power density. A drive system consists of the AC synchronous servo motor and the appropriate drive. Maximum performance requires the motor and drive to be adapted to each other.

Advanced drive technology is characterized by increasingly demanding requirements. The requirements comprise in particular:

- Positioning accuracy and speed accuracy
- Constant torque and broad control range
- Dynamics and high peak torque

Different motor series are available to meet the requirements of different applications. It is not possible to combine all motor versions with all drives.

Features

The AC synchronous servo motors excel with:

- High power density: the use of the latest magnetic materials and an optimized design result in motors with a shorter length at a comparable torque.
- High peak torque: the peak torque can be up to four times the continuous stall torque

1.2 Options and accessories

The motors are available with various options such as:

- Various encoder systems
- Holding brake
- Various shaft versions
- Various degrees of protection
- Various winding versions

The options can be found in the type code section on page 11.

For accessories see chapter 7 "Accessories and spare parts", page 67.

Gearboxes adapted to the BMH motor can be found in the Lexium 32 product catalog.

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1.3 Nameplate

The nameplate contains the following data:

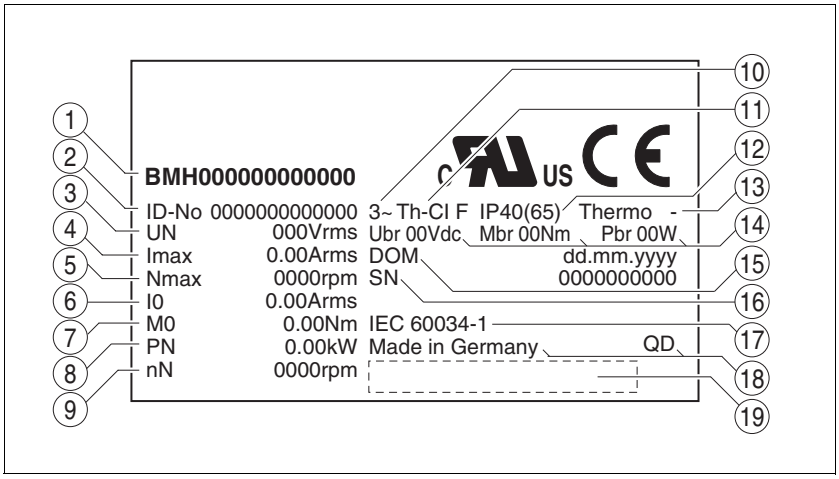

Figure 1.1 Nameplate

(1) Motor type, see type code
(2) Order no.
(3) Maximum nominal value of supply voltage
(4) Maximum current
(5) Maximum speed of rotation
(6) Continuous stall current
(7) Continuous stall torque
(8) Nominal power
(9) Nominal speed of rotation
(10) Number of motor phases
(11) Thermal class
(12) Degree of protection
(13) Temperature sensor
(14) Holding brake data
(15) Date of manufacture
(16) Serial number
(17) Applied standard
(18) Country of manufacture, site
(19) Barcode

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1.4 Type code

BMH	070	1	P	0	0	A	1	A	

Product family: Synchronous motor - medium inertia

Size (housing)
070 = 70 mm flange
100 = 100 mm flange
140 = 140 mm flange
205 = 205 mm flange

Length
1 = 1 stack
2 = 2 stacks
3 = 3 stacks

Winding
P = Optimized in terms of torque and speed of rotation
T = Optimized in terms of high speed of rotation [1)]

Shaft and degree of protection
0 = Smooth shaft; degree of protection: shaft IP54 [2)], housing IP65
1 = Parallel key; degree of protection: shaft IP 54 [2)], housing IP 65
2 = Smooth shaft; degree of protection: shaft and housing IP65 [3)]
3 = Parallel key; degree of protection: shaft and housing IP 65 [3)]

Encoder system
1 = Absolute singleturn 128 Sin/Cos periods per revolution (SKS36)
2 = Absolute multiturn 128 Sin/Cos periods per revolution (SKM36)
6 = Absolute singleturn 16 Sin/Cos periods per revolution (SEK37)
7 = Absolute multiturn 16 Sin/Cos periods per revolution (SEL37)

Holding brake
A = Without brake
F = With brake

Connection version
1 = Straight connector
2 = Angular connector 90°, can be rotated

Mechanical interface - mounting
A = International IEC Standard

1) for 240V only
2) In the case of mounting position IM V3 (drive shaft vertical, shaft end up), the motor only has degree of protection IP50.
3) The maximum permissible speed is limited to 6000 min^{-1} by the shaft sealing ring. Separate accessories allow you to obtain degree of protection IP67. See chapter 7 "Accessories and spare parts".

Customized product In the case of a customized product, position 8 is an "S".

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1.5 Declaration of conformity

SCHNEIDER ELECTRIC MOTION DEUTSCHLAND GmbH & Co. KG
Breslauer Str. 7 D-77933 Lahr

EC DECLARATION OF CONFORMITY
YEAR 2009

☐ according to EC Directive Machinery 98/37/EC
☐ according to EC Directive EMC 2004/108/EC
☒ according to EC Directive Low Voltage 2006/95/EC

We declare that the products listed below meet the requirements of the mentioned EC Directives with respect to design, construction and version distributed by us. This declaration becomes invalid with any modification on the products not authorized by us.

Designation:	3 phase servo motor
Type:	BMH070, BMH100, BMH140, BMH205
Applied harmonized standards, especially:	EN 60034-1:2005 Thermal class 155 EN 60034-5:2001 Degree of protection according product documentation EN 61800-5-1:2007
Applied national standards and technical specifications, especially:	UL 1004 Product documentation
Company stamp:	Schneider Electric Motion Deutschland GmbH & Co. KG Postfach 11 80 • D-77901 Lahr Breslauer Str. 7 • D-77933 Lahr
Date/Signature:	14 January 2009
Name/Department:	Wolfgang Brandstätter/Development

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2 Before you begin - safety information

2

2.1 Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

2.2 Intended use

This product is a motor and intended for industrial use according to this manual.

The product may only be used with permanently installed wiring.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

The product must NEVER be operated in explosive atmospheres (hazardous locations, Ex areas).

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

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2.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.

Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

CAUTION

CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. **can result** in equipment damage).

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2.4 Basic information

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.
- Do not touch unshielded components or terminals with voltage present. Only use electrically insulated tools.
- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors.
- Before performing work on the drive system:
  - Disconnect all power, including external control power that may be present.
  - Place a "DO NOT TURN ON" label on all power switches.
  - Lock all power switches in the open position.
  - Wait for the DC bus capacitors to discharge (see the product manual for the power stage). Then measure the DC bus voltage and verify it is less than < 42 V_{dc} (see the product manual for the power stage).
- Install and close all covers before applying voltage.

Failure to follow these instructions will result in death or serious injury.

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⚠ WARNING

MOVEMENT WITHOUT BRAKING EFFECT

If power outage or errors cause the power stage to be switched off, the motor is no longer decelerated in a controlled way and may cause damage. Overload or errors can cause hazards due to the failure of the holding brake. Incorrect use of the holding brake results in premature wear and failure.

- Secure the hazardous area so it cannot be accessed.
- Verify the function of the holding brake at regular intervals.
- Do not use the holding brake as a service brake.
- If necessary, use a cushioned mechanical stop or a suitable service brake.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are EMERGENCY STOP, overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe the accident prevention regulations and local safety guidelines. [1)]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death or serious injury.

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation for Construction and Operation of Adjustable-Speed Drive Systems.

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2.5 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61800-7 series: "Adjustable speed electrical power drive systems - Part 7-1: Generic interface and use of profiles for power drive systems - Interface definition"
- IEC 61158 series: "Industrial communication networks - Fieldbus specifications"
- IEC 61784 series: "Industrial communication networks - Profiles"
- IEC 61508 series: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

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3 Technical Data

3

This chapter contains information on the ambient conditions and on the mechanical and electrical properties of the product family and the accessories.

3.1 Certifications

Product certifications:

Certified by	Assigned number	Validity
UL	File E 198273	-

3.2 General features

Motor type	AC synchronous servo motor	
Number of pairs of poles	5	
Degree of protection motor housing	IP65	As per IEC 60034-5
Degree of protection shaft bushing with shaft sealing ring	IP65 [1)]	As per IEC 60034-5
Degree of protection shaft bushing without shaft sealing ring	IP54 [2)]	As per IEC 60034-5
Degree of protection with IP67 kit	IP67	As per IEC 60034-5
Thermal class	155	As per IEC 60034-1
Vibration grade	A	As per IEC 60034-14
Test voltage	> 2400 V_{ac}	As per IEC 60034-1
Shaft wobble / perpendicularity	normal class	As per IEC 60072-1, DIN 42955
Housing color	Black RAL 9005	
Overvoltage category	III	As per IEC 61800-5-1
Protection class	I III	Motor housing Encoder, holding brake

1) With shaft sealing ring: the maximum speed of rotation is limited to 6000 min^{-1}; shaft sealing ring with initial lubrication, if the seals run dry, this increases friction and reduces the service life
2) In the case of mounting position IM V3 (drive shaft vertical, shaft end upward), the motor only has degree of protection IP 50.

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Ambient conditions transportation and storage

The environment during transport and storage must be dry and free from dust.

The storage time is primarily determined by the service life of the lubricants in the bearings; do not store the product for more than 36 months. It is recommended to periodically operate the motor. Long storage periods may reduce the holding torque of the holding brake. See "Checking/ running in the holding brake" in chapter 8 "Service, maintenance and disposal".

Temperature	[°C]	-40 ... 70
Maximum temperature change	[K/h]	±25
Class as per IEC 60721-3-2		2K3

The following relative humidity is permissible during transportation and storage:

Relative humidity (non-condensing)	[%]	≤75
Class as per IEC 60721-3-2		2K3

Ambient conditions for operation

Ambient temperature [1](no icing, non-condensing)	[°C]	-20 ... 40
Ambient temperature with current reduction of 1% per °C [1]	[°C]	40 ... 60
Maximum temperature change	[K/h]	30

1) Limit values with flanged motor (steel plate, height and width = 2.5 * motor flange, 10 mm thickness.)

The following relative humidity is permissible during operation:

Relative humidity (non-condensing)	[%]	5 ... 85
Class as per IEC 60721-3-3		3K3, 3Z12 and 3Z2

The installation altitude is defined as height above sea level.

Installation altitude	[m]	≤1000
Installation altitude with current reduction of 1% per 100 m at heights of more than 1000 m	[m]	1000 ... 3000

Vibration and shock BMH070 ... 140

Vibration, sinusoidal	As per IEC 60068-2-6 0.15 mm (from 10 Hz ... 60 Hz) 20 m/s^2 (from 60 Hz ... 500 Hz)
Shock, semi-sinusoidal	As per IEC 60068-2-27 150 m/s^2 (11 ms)

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Vibration and shock BMH205

Vibration, sinusoidal	As per IEC 60068-2-6 0.35 mm (from 10 Hz ... 60 Hz) 50 m/s^2 (from 60 Hz ... 150 Hz)
Continuous shock	As per IEC 60068-2-29 200 m/s^2 (6 ms)

Service life

The service life of the motors when operated correctly is limited primarily by the service life of the rolling bearing.

The following operating conditions significantly reduce the service life:

- Installation altitude >1000 m above m.s.l.
- Rotary movement exclusively within a fixed angle of <100°
- Operation under vibration load >20 m/s^2
- Acceleration >200.000 rad/s^2
- Allowing sealing rings to run dry
- Contact of the seals with aggressive media

Shaft sealing ring / degree of protection

The motors can be equipped with an optional shaft sealing ring. With a shaft sealing ring, they have degree of protection IP65. The shaft sealing ring limits the maximum speed of rotation to 6000 min^{-1}.

Note the following:

- The shaft sealing ring is factory-lubricated.
- If the seals run dry, this increases friction and greatly reduces the service life of the sealing rings.

Accessory IP67 kit

Special compressed air must be used for the IP67 kit:

Nominal pressure	[bar] [PSI]	0.1 ... 0.3 (1.45 ... 4.35)
Maximum air pressure	[bar] [PSI]	0.4 (5.8)
Permissible humidity	[%]	20 ... 30
Other properties of the compressed air		Free from dust, free from oil

Tightening torque and property class of screws used

Tightening torque of housing screws M3	[Nm] (lb·in)	1 (8.85)
Tightening torque of housing screws M4	[Nm] (lb·in)	1.5 (13.28)
Tightening torque of housing screws M5 (BMH205 plastic cover)	[Nm] (lb·in)	5 (44.3)
Tightening torque protective ground conductor M4 (BMH070 ... 140) Tightening torque protective ground conductor M6 (BMH205)	[Nm] (lb·in)	2.9 (25.7) 9.9 (87.3)
Property class of the screws	H	8.8

Table 3.1 Tightening torques and property classes

Approved drives

You may use drives that are approved for the BMH motor family (for example, Lexium32). When selecting, consider the type and amount of the mains voltage. Please inquire for additional drives that can be used to operate BMH motors.

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3.3 Motor-specific data

3.3.1 BMH070

Motor type			BMH0701	BMH0701	BMH0702	BMH0702	BMH0703	BMH0703
Winding			**P**	**T**	**P**	**T**	**P**	**T**
Technical data - general								
Continuous stall torque [1]	M_0 [2]	[Nm]	1.40	1.40	2.48	2.48	3.40	3.40
Peak torque	M_{max}	[Nm]	4.20	4.20	7.44	7.44	10.20	10.20
With supply voltage U_n = 115 V_{dc}								
Nominal speed	n_N	[min^{-1}]	1250	2500	1250	2500	1250	2000
Nominal torque	M_N	[Nm]	1.38	1.35	2.37	2.27	3.18	3.05
Nominal current	I_N	[A_{rms}]	1.75	2.75	2.82	4.92	3.56	4.98
Nominal power	P_N	[kW]	0.18	0.35	0.31	0.59	0.42	0.64
With supply voltage U_n = 230 V_{dc}								
Nominal speed	n_N	[min^{-1}]	3000	5000	3000	5000	2500	4000
Nominal torque	M_N	[Nm]	1.34	1.31	2.23	2.06	2.96	2.70
Nominal current	I_N	[A_{rms}]	1.75	2.76	2.76	4.63	3.47	4.55
Nominal power	P_N	[kW]	0.42	0.68	0.70	1.08	0.75	1.13
With supply voltage U_n = 400 V_{dc}								
Nominal speed	n_N	[min^{-1}]	5500	-	5500	-	5000	-
Nominal torque	M_N	[Nm]	1.30	-	2.01	-	2.53	-
Nominal current	I_N	[A_{rms}]	1.72	-	2.49	-	3.02	-
Nominal power	P_N	[kW]	0.75	-	1.16	-	1.32	-
With supply voltage U_n = 480 V_{dc}								
Nominal speed	n_N	[min^{-1}]	7000	-	7000	-	6500	-
Nominal torque	M_N	[Nm]	1.27	-	1.89	-	2.26	-
Nominal current	I_N	[A_{rms}]	1.70	-	2.36	-	2.74	-
Nominal power	P_N	[kW]	0.93	-	1.38	-	1.54	-

1) Conditions for performance data: Mounted to steel plate 175*175*10 mm
2) M_0=Continuous stall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%

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Motor type			BMH0701	BMH0701	BMH0702	BMH0702	BMH0703	BMH0703
Winding			**P**	**T**	**P**	**T**	**P**	**T**
Technical data - electrical								
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680	680	680	680
Maximum voltage to ground		[V_{ac}]	280	280	280	280	280	280
Maximum current	I_{max}	[A_{rms}]	5.97	9.56	9.68	17.71	12.57	17.84
Continuous stall current	I_0	[A_{rms}]	1.78	2.85	2.94	5.38	3.91	5.55
Voltage constant [1)]	k_Eu-v	[V_{rms}]	50.72	31.70	54.08	29.58	55.00	39.29
Torque constant	k_t	[Nm/A]	0.79	0.49	0.84	0.46	0.87	0.61
Winding resistance	R_{20}u-v	[Ω]	8.28	3.23	3.84	1.15	2.65	1.32
Winding inductance	L_qu-v	[mH]	23.40	9.14	12.19	3.64	8.64	4.29
Winding inductance	L_du-v	[mH]	24.15	9.43	12.54	3.75	8.91	4.42
Technical data - mechanical								
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	8000	8000	8000	8000	8000	8000
Rotor inertia without brake	J_M	[$kgcm^2$]	0.59	0.59	1.13	1.13	1.67	1.67
Rotor inertia with brake	J_M	[$kgcm^2$]	0.70	0.70	1.24	1.24	1.78	1.78
Mass without brake	m	[kg]	1.60	1.60	1.80	1.80	2.00	2.00
Mass with brake	m	[kg]	2.60	2.60	2.80	2.80	3.00	3.00

1) rms value at 1000 min^{-1} and 20°C

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3.3.2 BMH100

Motor type			BMH1001	BMH1001	BMH1002	BMH1002	BMH1003	BMH1003
Winding			**P**	**T**	**P**	**T**	**P**	**T**
Technical data - general								
Continuous stall torque [1]	M_0 [2]	[Nm]	3.41	3.39	5.87	5.97	8.39	8.23
Peak torque	M_{max}	[Nm]	10.80	10.80	18.60	18.60	25.20	25.20
With supply voltage U_n = 115 V_{dc}								
Nominal speed	n_N	[min^{-1}]	1000	1750	1000	1750	1250	1500
Nominal torque	M_N	[Nm]	3.39	3.33	5.71	5.61	8.00	7.74
Nominal current	I_N	[A_{rms}]	3.11	4.96	4.75	7.79	8.12	9.10
Nominal power	P_N	[kW]	0.35	0.61	0.60	1.03	1.05	1.22
With supply voltage U_n = 230 V_{dc}								
Nominal speed	n_N	[min^{-1}]	2000	4000	2000	3500	2500	3000
Nominal torque	M_N	[Nm]	3.32	3.06	5.45	4.99	7.33	6.86
Nominal current	I_N	[A_{rms}]	3.00	4.59	4.80	7.61	6.93	7.53
Nominal power	P_N	[kW]	0.70	1.28	1.14	1.83	1.92	2.15
With supply voltage U_n = 400 V_{dc}								
Nominal speed	n_N	[min^{-1}]	4000	-	4000	-	5000	-
Nominal torque	M_N	[Nm]	3.07	-	4.69	-	5.17	-
Nominal current	I_N	[A_{rms}]	2.64	-	4.27	-	5.04	-
Nominal power	P_N	[kW]	1.29	-	1.97	-	2.71	-
With supply voltage U_n = 480 V_{dc}								
Nominal speed	n_N	[min^{-1}]	5000	-	5000	-	5000	-
Nominal torque	M_N	[Nm]	2.88	-	4.19	-	5.17	-
Nominal current	I_N	[A_{rms}]	2.68	-	3.86	-	5.04	-
Nominal power	P_N	[kW]	1.51	-	2.19	-	2.71	-

1) Conditions for performance data: Mounted to steel plate 175*175*10 mm
2) M_0=Continuous stall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%

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Motor type			BMH1001	BMH1001	BMH1002	BMH1002	BMH1003	BMH1003
Winding			**P**	**T**	**P**	**T**	**P**	**T**
Technical data - electrical								
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680	680	680	680
Maximum voltage to ground		[V_{ac}]	280	280	280	280	280	280
Maximum current	I_{max}	[A_{rms}]	11.93	19.38	18.23	30.24	29.10	33.85
Continuous stall current	I_0	[A_{rms}]	3.13	5.06	4.89	8.29	8.51	9.67
Voltage constant [1)]	k_Eu-v	[V_{rms}]	70.30	43.34	77.00	46.20	63.50	54.84
Torque constant	k_t	[Nm/A]	1.09	0.67	1.20	0.72	0.99	0.85
Winding resistance	R_{20}u-v	[Ω]	3.12	1.19	1.51	0.54	0.63	0.47
Winding inductance	L_qu-v	[mH]	13.87	5.27	7.50	2.70	4.00	2.98
Winding inductance	L_du-v	[mH]	13.87	5.27	7.50	2.70	4.00	2.98
Technical data - mechanical								
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	6000	6000	6000	6000	6000	6000
Rotor inertia without brake	J_M	[$kgcm^2$]	3.19	3.19	6.28	6.28	9.37	9.37
Rotor inertia with brake	J_M	[$kgcm^2$]	3.68	3.68	6.77	6.77	10.30	10.30
Mass without brake	m	[kg]	3.34	3.34	4.92	4.92	6.50	6.50
Mass with brake	m	[kg]	4.80	4.80	6.38	6.38	8.15	8.15

1) rms value at 1000 min^{-1} and 20°C

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3.3.3 BMH140

Motor type			BMH1401	BMH1402	BMH1403
Winding			**P**	**P**	**P**
Technical data - general					
Continuous stall torque [1]	M_0 [2]	[Nm]	10.30	18.50	24.00
Peak torque	M_{max}	[Nm]	39.90	55.50	75.00
With supply voltage U_n = 115 V_{dc}					
Nominal speed	n_N	[min^{-1}]	1000	1000	750
Nominal torque	M_N	[Nm]	9.36	16.34	22.17
Nominal current	I_N	[A_{rms}]	7.82	14.87	18.00
Nominal power	P_N	[kW]	0.98	1.71	1.78
With supply voltage U_n = 230 V_{dc}					
Nominal speed	n_N	[min^{-1}]	2000	2000	1750
Nominal torque	M_N	[Nm]	8.50	14.00	19.30
Nominal current	I_N	[A_{rms}]	7.30	13.13	14.90
Nominal power	P_N	[kW]	1.78	2.93	3.55
With supply voltage U_n = 400 V_{dc}					
Nominal speed	n_N	[min^{-1}]	3500	3500	3500
Nominal torque	M_N	[Nm]	7.22	10.17	13.06
Nominal current	I_N	[A_{rms}]	6.35	9.76	10.42
Nominal power	P_N	[kW]	2.64	3.73	4.75
With supply voltage U_n = 480 V_{dc}					
Nominal speed	n_N	[min^{-1}]	3500	3500	3500
Nominal torque	M_N	[Nm]	7.22	10.17	13.06
Nominal current	I_N	[A_{rms}]	6.35	9.76	10.42
Nominal power	P_N	[kW]	2.64	3.73	4.75

1) Conditions for performance data: Mounted to steel plate 350*350*10 mm
2) M_0=Continuous stall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%

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Motor type			BMH1401	BMH1402	BMH1403
Winding			**P**	**P**	**P**
Technical data - electrical					
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680
Maximum voltage to ground		[V_{ac}]	280	280	280
Maximum current	I_{max}	[A_{rms}]	29.80	57.42	62.32
Continuous stall current	I_0	[A_{rms}]	8.58	16.83	18.00
Voltage constant [1)]	k_Eu-v	[V_{rms}]	77.41	70.70	85.89
Torque constant	k_t	[Nm/A]	1.20	1.10	1.33
Winding resistance	R_{20}u-v	[Ω]	0.69	0.23	0.22
Winding inductance	L_qu-v	[mH]	6.72	2.99	3.00
Winding inductance	L_du-v	[mH]	6.72	2.99	2.80
Technical data - mechanical					
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	4000	4000	4000
Rotor inertia without brake	J_M	[$kgcm^2$]	16.46	32.00	47.54
Rotor inertia with brake	J_M	[$kgcm^2$]	17.96	33.50	50.27
Mass without brake	m	[kg]	8.00	12.00	16.00
Mass with brake	m	[kg]	10.30	14.30	18.53

1) rms value at 1000 min^{-1} and 20°C

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3.3.4 BMH205

Motor type			BMH2051	BMH2052	BMH2053
Winding			**P**	**P**	**P**
Technical data - general					
Continuous stall torque [1]	M_0 [2]	[Nm]	34.4	62.5	88
Peak torque	M_{max}	[Nm]	110	220	330
With supply voltage U_n = 115 V_{dc}					
Nominal speed	n_N	[min^{-1}]	750	500	375
Nominal torque	M_N	[Nm]	31.40	57.90	80.30
Nominal current	I_N	[A_{rms}]	19.6	22.4	23.6
Nominal power	P_N	[kW]	2.47	3.03	3.23
With supply voltage U_n = 230 V_{dc}					
Nominal speed	n_N	[min^{-1}]	1500	1000	750
Nominal torque	M_N	[Nm]	28.20	51.70	75.60
Nominal current	I_N	[A_{rms}]	17.6	20.0	23.0
Nominal power	P_N	[kW]	4.43	5.41	5.94
With supply voltage U_n = 400 V_{dc}					
Nominal speed	n_N	[min^{-1}]	3000	2000	1500
Nominal torque	M_N	[Nm]	21	34	58.7
Nominal current	I_N	[A_{rms}]	13.1	13.2	18.5
Nominal power	P_N	[kW]	6.60	7.12	9.22
With supply voltage U_n = 480 V_{dc}					
Nominal speed	n_N	[min^{-1}]	3600	2400	1800
Nominal torque	M_N	[Nm]	17.90	24.90	50.70
Nominal current	I_N	[A_{rms}]	11.2	9.7	16.4
Nominal power	P_N	[kW]	6.75	6.26	9.56

1) Conditions for performance data: Mounted to steel plate 585*450*10 mm
2) M_0=Continuous stall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%

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Motor type			BMH2051	BMH2052	BMH2053
Winding			**P**	**P**	**P**
Technical data - electrical					
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680
Maximum voltage to ground		[V_{ac}]	280	280	280
Maximum current	I_{max}	[A_{rms}]	78.1	96.8	107.4
Continuous stall current	I_0	[A_{rms}]	21.5	24.2	25.2
Voltage constant [1)]	k_Eu-v	[V_{rms}]	104	161	218
Torque constant	k_t	[Nm/A]	1.6	2.58	3.5
Winding resistance	R_{20}u-v	[Ω]	0.3	0.3	0.32
Winding inductance	L_qu-v	[mH]	5.9	5.6	6.9
Winding inductance	L_du-v	[mH]	5.6	5.2	6.4
Technical data - mechanical					
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	3800	3800	3800
Rotor inertia without brake	J_M	[$kgcm^2$]	71.4	129	190
Rotor inertia with brake	J_M	[$kgcm^2$]	88.4	146	207
Mass without brake	m	[kg]	33	44	67
Mass with brake	m	[kg]	37.9	48.9	71.9

1) rms value at 1000 min^{-1} and 20°C

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3.4 Dimensions

Dimensions BMH070

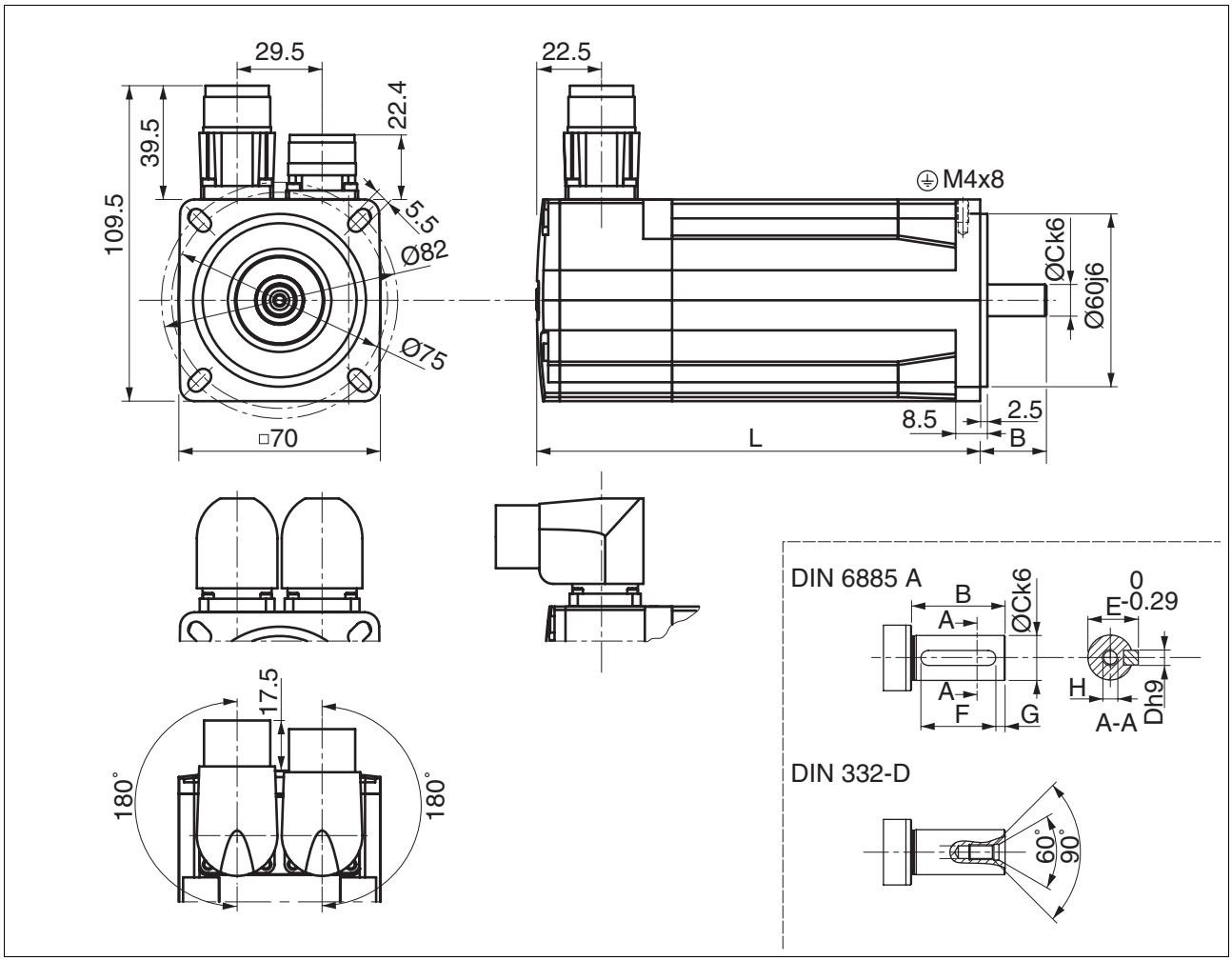

Figure 3.1 Dimensions BMH070

			BMH0701	BMH0702	BMH0703
L	Length without brake	[mm]	122	154	186
L	Length with brake	[mm]	161	193	225
B	Shaft exit	[mm]	23	23	30
C	Shaft diameter	[mm]	11	11	14
D	Width of parallel key	[mm]	4	4	5
E	Shaft width with parallel key	[mm]	12.5	12.5	16
F	Length of parallel key	[mm]	18	18	20
G	Distance parallel key to shaft end	[mm]	2.5	2.5	5
H	Female thread of shaft		M4	M4	M5
	Parallel key		DIN 6885-A4x4x18	DIN 6885-A4x4x18	DIN 6885-A4x4x20

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Dimensions BMH100

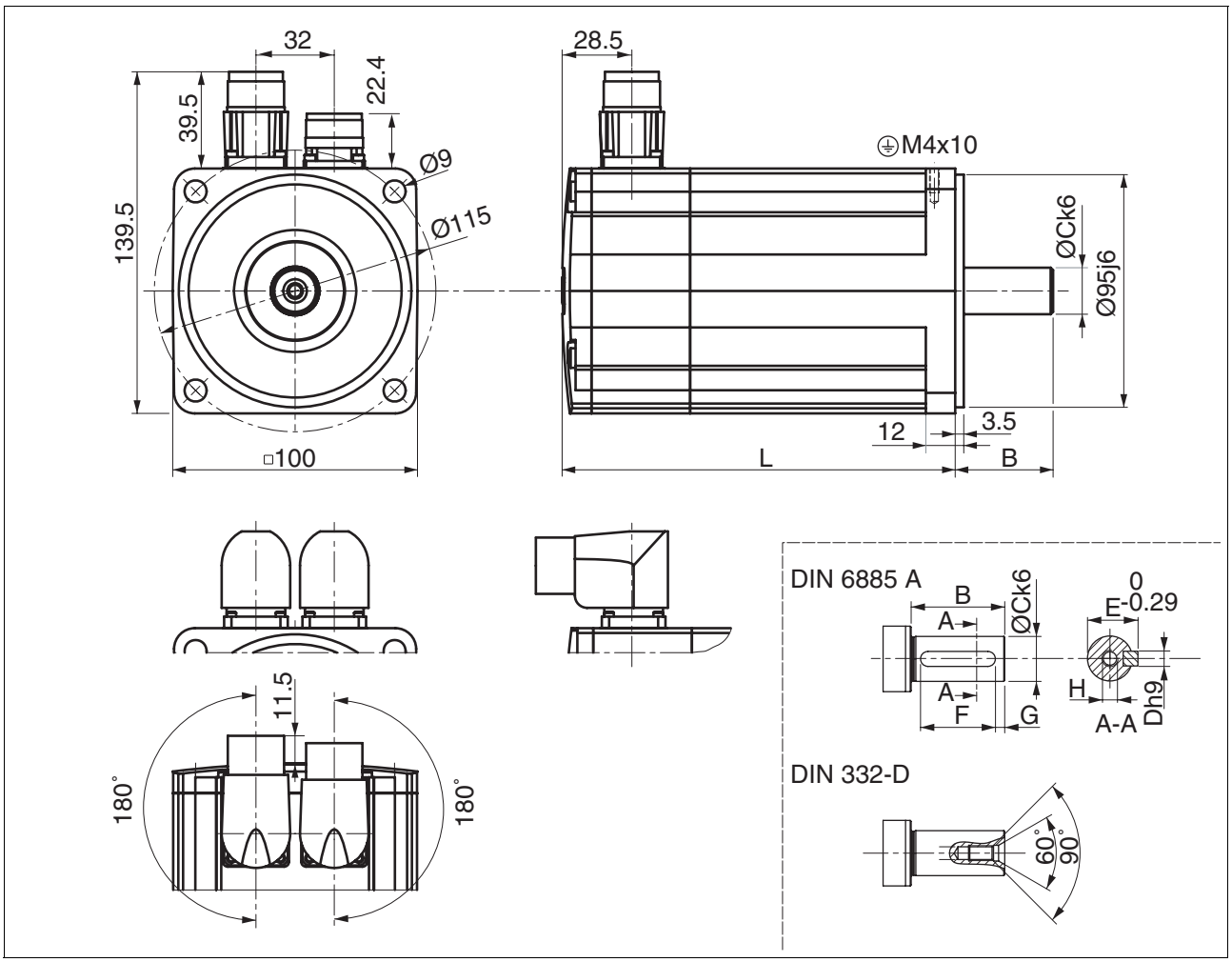

Figure 3.2 Dimensions BMH100

			BMH1001	BMH1002	BMH1003
A	Length without brake	[mm]	128.6	160.6	192.6
A	Length with brake	[mm]	170.3	202.3	234.3
B	Shaft exit	[mm]	40	40	40
C	Shaft diameter	[mm]	19	19	19
D	Width of parallel key	[mm]	6	6	6
E	Shaft width with parallel key	[mm]	21.5	21.5	21.5
F	Length of parallel key	[mm]	30	30	30
G	Distance parallel key to shaft end	[mm]	5	5	5
H	Female thread of shaft		M6	M6	M6
	Parallel key		DIN 6885-A6x6x30	DIN 6885-A6x6x30	DIN 6885-A6x6x30

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Dimensions BMH140

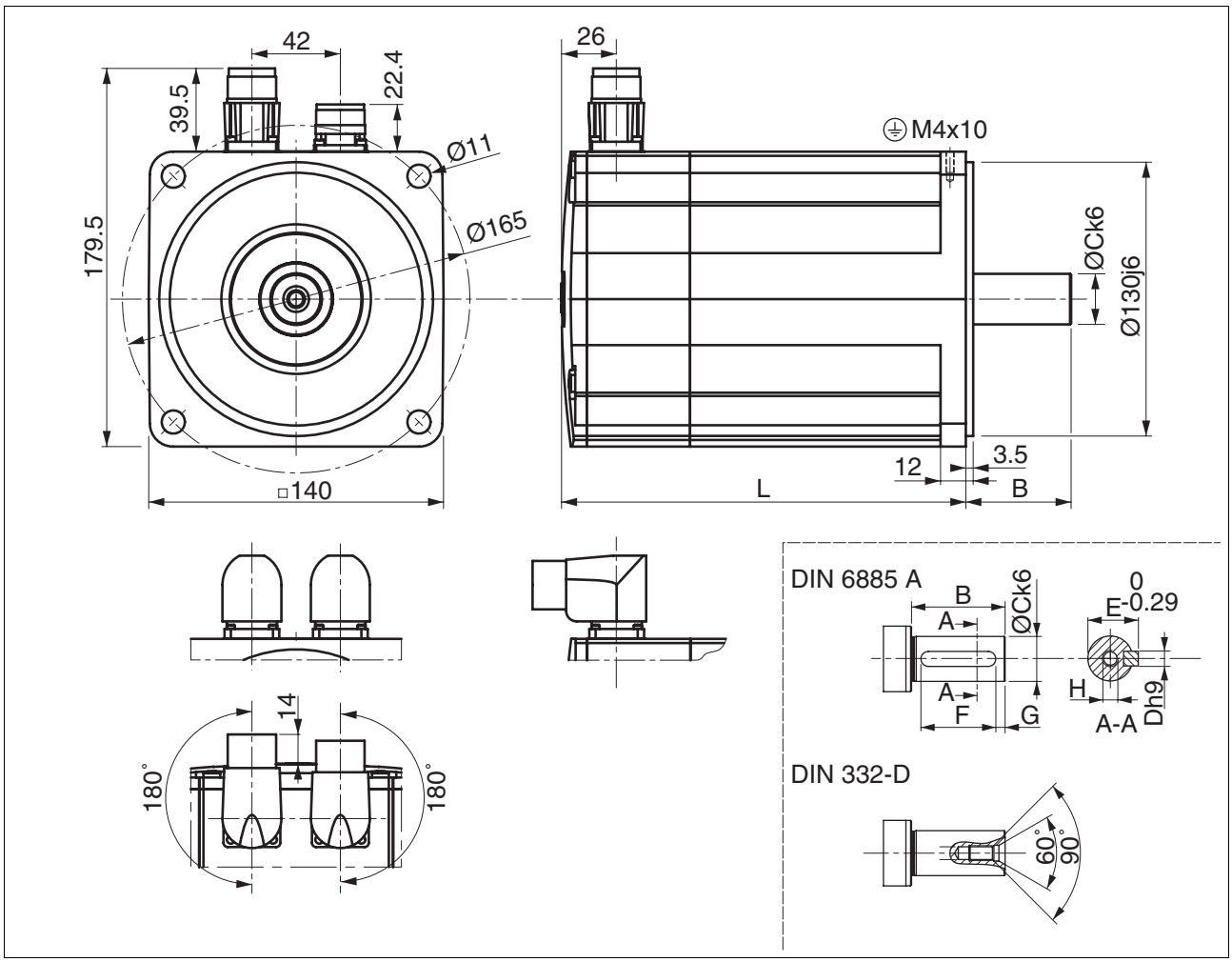

Figure 3.3 Dimensions BMH140

			BMH1401	BMH1402	BMH1403
A	Length without brake	[mm]	152	192	232
A	Length with brake	[mm]	187	227	267
B	Shaft exit	[mm]	50	50	50
C	Shaft diameter	[mm]	24	24	24
D	Width of parallel key	[mm]	8	8	8
E	Shaft width with parallel key	[mm]	27	27	27
F	Length of parallel key	[mm]	40	40	40
G	Distance parallel key to shaft end	[mm]	5	5	5
H	Female thread of shaft		M8	M8	M8
	Parallel key		DIN 6885-A8x7x40	DIN 6885-A8x7x40	DIN 6885-A8x7x40

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Dimensions BMH205

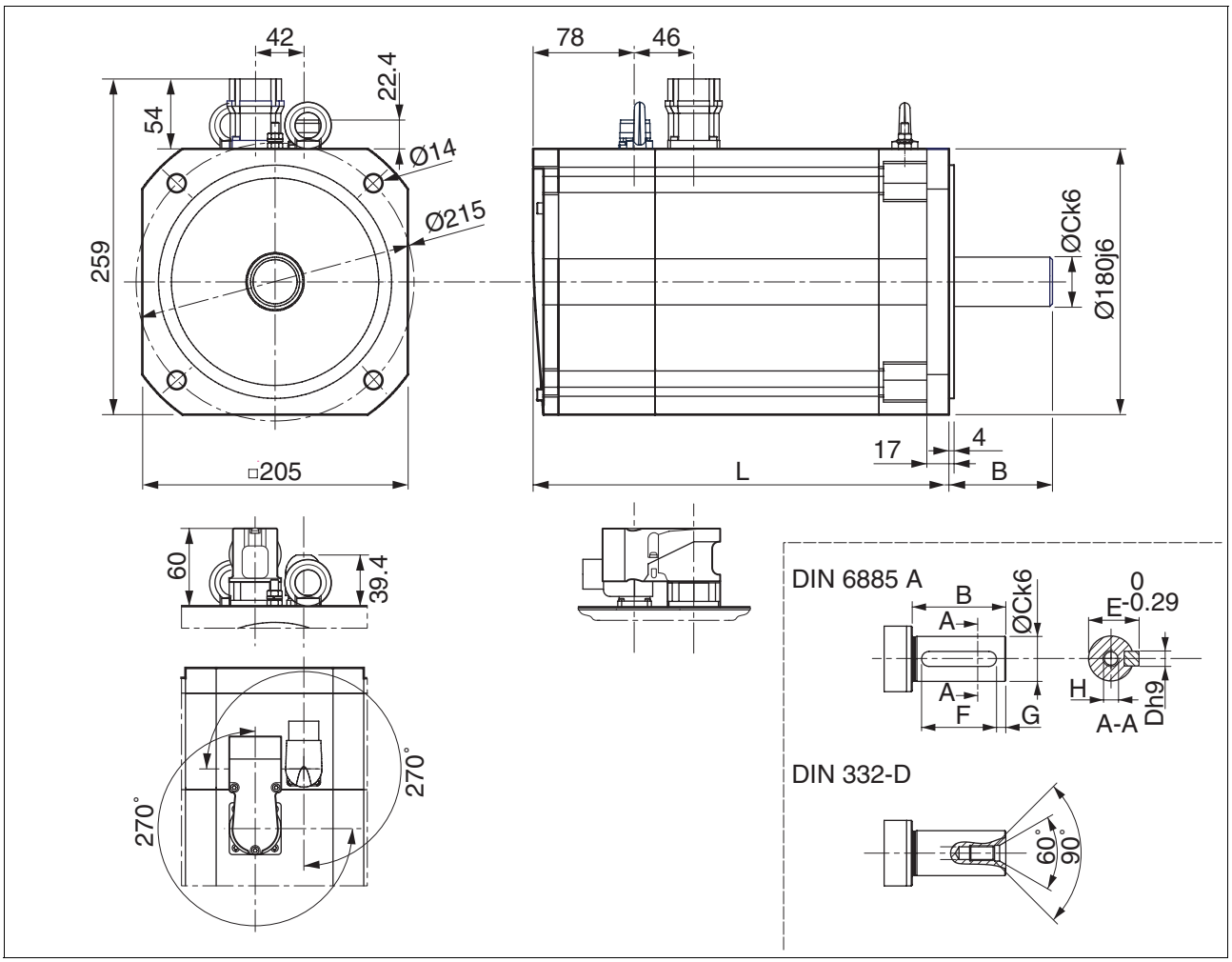

Figure 3.4 Dimensions BMH205

			BMH2051	BMH2052	BMH2053
A	Length without brake	[mm]	321	405	489
A	Length with brake	[mm]	370.5	454.5	538.5
B	Shaft exit	[mm]	80	80	80
C	Shaft diameter	[mm]	38	38	38
D	Width of parallel key	[mm]	10	10	10
E	Shaft width with parallel key	[mm]	41	41	41
F	Length of parallel key	[mm]	70	70	70
G	Distance parallel key to shaft end	[mm]	5	5	5
H	Female thread of shaft		M12	M12	M12
	Parallel key		DIN 6885-A10x8x70	DIN 6885-A10x8x70	DIN 6885-A10x8x70

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3.5 Shaft-specific data

⚠ WARNING

UNINTENDED BEHAVIOR CAUSED BY MECHANICAL DAMAGE TO THE MOTOR

If the maximum permissible forces at the shaft are exceeded, this will result in premature wear of the bearing, shaft breakage or damage to the encoder.

- Do not exceed the maximum permissible axial and radial forces.
- Protect the shaft from impact.
- Do not exceed the maximum permissible axial force when pressing on components.

Failure to follow these instructions can result in death, serious injury or equipment damage.

3.5.1 Press-on force

Maximum press-on force

The maximum press-on force is limited by the maximum permissible axial force that may act on the rolling bearing. Using assembly paste (such as Klüberpaste 46 MR 401) on the shaft and the component to be mounted reduces friction and mechanical impact on the surfaces.

If the shaft has a thread, it is recommend to use it to press on the component to be mounted. This way there is no axial force acting on the rolling bearing.

It is also possible to shrink-fit, clamp or glue the component to be mounted.

The following table shows the maximum permissible axial force F_A at standstill.

BMH...	070	100	140	205
[N] (lb)	80 (18)	160 (36)	300 (65)	740 (165)

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3.5.2 Shaft load

Note the following:

- The permissible press-on force applied to the shaft end must not be exceeded
- Radial and axial limit loads must not be applied simultaneously

The following conditions apply:

- Nominal bearing service life in operating hours at a probability of failure of 10%
- Mean speed of rotation n = 4000 min^{-1}
- Ambient temperature = 40 °C
- Peak torque = motor operating modes S3 - S8, 10% duty cycle
- Nominal torque = motor operating mode S1, 100% duty cycle

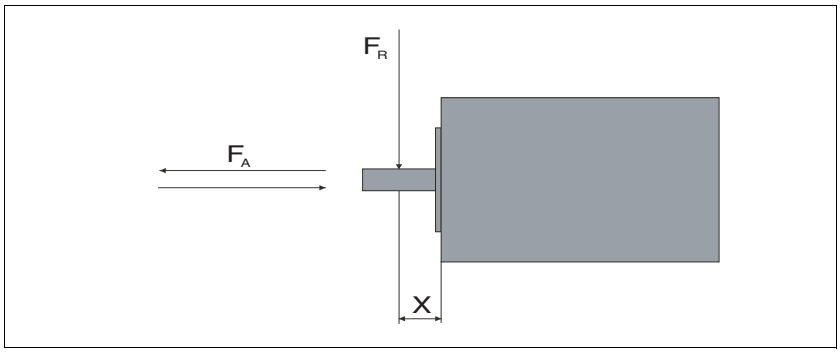

Figure 3.5 Shaft load

The point of application of the forces depends on the motor size:

Motor version		Values for "X"
BMH 070 1 and BMH 070 2	[mm]	11.5
BMH 070 3	[mm]	15
BMH 100	[mm]	20
BMH 140	[mm]	25
BMH 205	[mm]	40

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Note the following:

- The permissible press-on force applied to the shaft end must not be exceeded
- Radial and axial limit loads must not be applied simultaneously

The following table shows the maximum radial shaft load F_R.

BMH...	070 1	070 2	070 3	100 1	100 2	100 3	140 1	140 2	140 3	205 1	205 2	205 3
1000 min^{-1} [N]	660	710	730	900	990	1050	1930	2240	2420	3730	4200	4500
2000 min^{-1} [N]	520	560	580	720	790	830	1530	1780	1920	2960	3330	3570
3000 min^{-1} [N]	460	490	510	630	690	730	1340	1550	1670	2580	2910	3120
4000 min^{-1} [N]	410	450	460	570	620	660	-	-	-	-	-	-
5000 min^{-1} [N]	380	410	430	530	580	610	-	-	-	-	-	-
6000 min^{-1} [N]	360	390	400	-	-	-	-	-	-	-	-	-

The following table shows the maximum axial shaft load F_A.

BMH...	070 1	070 2	070 3	100 1	100 2	100 3	140 1	140 2	140 3	205 1	205 2	205 3
1000 min^{-1} [N]	132	142	146	180	198	210	386	448	484	746	840	900
2000 min^{-1} [N]	104	112	116	144	158	166	306	356	384	592	666	714
3000 min^{-1} [N]	92	98	102	126	138	146	268	310	334	516	582	624
4000 min^{-1} [N]	82	90	92	114	124	132	-	-	-	-	-	-
5000 min^{-1} [N]	76	82	86	106	116	122	-	-	-	-	-	-
6000 min^{-1} [N]	72	78	80	-	-	-	-	-	-	-	-	-

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3.6 Options

3.6.1 Holding brake

Holding brake

The holding brake in the motor has the task of holding the current motor position when the power stage is disabled, even if external forces act (for example, in the case of a vertical axis). The holding brake is not a safety function.

For a description of the controller, see chapter 4.5.3 "Holding brake connection".

Motor type		**BMH070**	**BMH100 1, 2**	**BMH100 3**	**BMH140 1**	**BMH140 2**	**BMH140 3**	**BMH205**
Holding torque [1)]	[Nm]	3.0	5.5	5.5	18	18	23	80
Brake release time	[ms]	80	70	70	100	100	100	200
Brake application time	[ms]	10	30	30	50	50	40	50
Nominal voltage	[V_{dc}]	24 +5/-15%						24 +6/-10%
Nominal power (electrical pull-in power)	[W]	7	12	12	18	18	19	40
Moment of inertia	[$kgcm^2$]	0.11	0.49	0.49	1.5	1.5	2.73	16
Maximum speed of rotation during braking of moving loads		3000						
Maximum number of brake applications during braking of moving loads and 3000 min^{-1}		500						
Maximum number of brake applications during braking of moving loads per hour (at even distribution)		20						
Maximum kinetic energy that can be transformed into heat per brake application during braking of moving loads	[J]	130	150	150	550	550	550	21000
Mass	[kg]	0.28	0.46	0.46	1.08	1.06	1.29	3.6

1) The holding brake is factory run in. After longer storage periods, parts of the holding brake may corrode. See "Checking/running in the holding brake" in chapter 8 "Service, maintenance and disposal".

Table 3.2 Technical data holding brake

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3.6.2 Encoder

The AC synchronous servo motors are fitted with a SinCos singleturn absolute encoder. Via the Hiperface interface between motor encoder and drive, the motor parameters and current controller parameters are automatically initialized. This greatly simplifies commissioning.

SKS36 Singleturn

This motor encoder measures an absolute value within one revolution during switching on and continues to count incrementally from this point.

Resolution in increments	Depending on evaluation
Resolution per revolution	128 sin/cos periods
Measurement range absolute	1 revolution
Accuracy of the digital absolute value [1)]	±0.0889°
Accuracy of the incremental position	±0.0222°
Signal shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc}
Maximum supply current	60 mA (without load)

1) Depending on the evaluation through the drive, the accuracy may be increased by including the incremental position in the calculation of the absolute value. In this case, the accuracy corresponds to the incremental position.

SKM36 Multiturn

This motor encoder measures an absolute value within 4096 revolutions during switching on and continues to count incrementally from this point.

Resolution in increments	Depending on evaluation
Resolution per revolution	128 sin/cos periods
Measurement range absolute	4096 revolutions
Accuracy of the digital absolute value [1)]	±0.0889°
Accuracy of the incremental position	±0.0222°
Signal shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc}
Maximum supply current	60 mA (without load)

1) Depending on the evaluation through the drive, the accuracy may be increased by including the incremental position in the calculation of the absolute value. In this case, the accuracy corresponds to the incremental position.

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SEK37 Singleturn This motor encoder measures an absolute value within one revolution during switching on and continues to count incrementally from this point.

Resolution in increments	Depending on evaluation
Resolution per revolution	16 sin/cos periods
Measurement range absolute	1 revolution
Accuracy of position	± 0.08°
Signal shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc}
Maximum supply current	50 mA (without load)

SEL37 Multiturn This motor encoder measures an absolute value within 4096 revolutions during switching on and continues to count incrementally from this point.

Resolution in increments	Depending on evaluation
Resolution per revolution	16 sin/cos periods
Measurement range absolute	4096 revolutions
Accuracy of position	± 0.08°
Signal shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc}
Maximum supply current	50 mA (without load)

3.7 Conditions for UL 1004

PELV power supply Use only power supply units that are approved for overvoltage category III.

Wiring Use at least 60/75 °C copper conductors.

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4 Installation

4

⚠ WARNING

GREAT MASS OR FALLING PARTS

The motor can have an unexpectedly great mass.

- Consider the mass of the motor when mounting it. It may be necessary to use a crane.
- Mount the motor in such a way (tightening torque, securing screws) that it cannot come loose even in the case of fast acceleration or continuous vibration.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

STRONG ELECTROMAGNETIC FIELDS

Motors can generate strong local electrical and magnetic fields. This can cause interference in sensitive devices.

- Keep persons with implants such as pacemakers away from the motor.
- Do not place any sensitive devices close to the motor.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNEXPECTED BEHAVIOR CAUSED BY DAMAGE OR FOREIGN OBJECTS

Damage to the product as well as foreign objects, deposits or humidity can cause unexpected behavior.

- Do not use damaged products.
- Keep foreign objects from getting into the product.
- Verify correct seat of seals and cable entries.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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⚠ WARNING

HOT SURFACES

The heat sink at the product may heat up to over 100°C (212°F) during operation.

- Avoid contact with the hot heat sink.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.

Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION

DAMAGE TO THE MOTOR OR BREAKAGE CAUSED BY STRESS

The motor is not designed for carrying loads. If the motor is subjected to stress, it can be damaged or break.

- Do not step onto the motor, do not use it as a climbing aid.
- Avoid improper use by means of safeguards at the machine or safety instructions

Failure to follow these instructions can result in injury or equipment damage.

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4.1 Overview of procedure

Chapter	Page
4.2 "Electromagnetic compatibility, EMC"	43
4.3 "Before mounting"	45
4.4 "Mounting the motor"	48
4.5.2 "Power and encoder connection"	54
4.5.3 "Holding brake connection"	61

▶ Finally, verify proper installation.

4.2 Electromagnetic compatibility, EMC

⚠ WARNING

SIGNAL AND DEVICE INTERFERENCE

Signal interference can cause unexpected responses of device.

- Install the wiring in accordance with the EMC requirements.
- Verify compliance with the EMC requirements.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Pre-assembled motor and encoder system connections in many different lengths are available for the drive solutions. Contact your local sales office.

EMC requirement: Route motor cable separately

When planning the wiring, take into account the fact that the motor cable must be routed separately. The motor cable must be separate from the mains cable or the signal wires.

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Motor and encoder cables

Motor and encoder cables are especially critical in terms of EMC. Use only pre-assembled cables or cables that comply with the specifications and implement the EMC measures described below.

EMC measures	Effect
Keep cables as short as possible. Do not install unnecessary cable loops, use short cables from the central grounding point in the control cabinet to the external ground connection.	Reduces capacitive and inductive interference.
Ground the product via the motor flange or with a ground strap to the ground connection at the cover of the connector housing.	Reduces emissions, increases immunity.
Connect large surface areas of cable shields, use cable clamps and ground straps	Reduces emissions.
Do not install switching elements in motor cables or encoder cables.	Reduces interference.
Route the motor cable at a distance of at least 20 cm from the signal cable or use shielding plates between the motor cable and signal cable.	Reduces mutual interference
Route the motor cable and encoder cable without cutting them. [1)]	Reduces emission.

1) If a cable is cut for the installation, it has to be connected with shield connections and a metal housing at the point of the cut.

Pre-assembled connection cables (accessories)

It is recommended to use the pre-assembled connection cables (accessories) to connect the motor and the encoder system. They are optimally adapted to these drive solutions.

Place the female connector of the motor cable onto the male connector and tighten the union nut. Proceed in the same manner with the connection cable of the encoder system. Connect the motor cable and the encoder cable to the drive according to the wiring diagram of the drive.

Equipotential bonding conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields.

The equipotential bonding conductor must be rated for the maximum current flowing. Practical experience has shown that the following conductor cross sections can be used:

- 16 mm^2 (AWG 4) for equipotential bonding conductors up to a length of 200 m
- 20 mm^2 (AWG 4) for equipotential bonding conductors with a length of more than 200 m

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4.3 Before mounting

Checking for damage

Damaged drive systems must neither be installed nor operated.

▶ Prior to mounting, check the drive system for visible damage.

Checking the holding brake (option)

See chapter 8.3 "Maintenance", "Checking/running in the holding brake".

Cleaning the shaft

The shaft extensions are factory-treated with an anti-corrosive. If output components are glued to the shaft, the anti-corrosive must be removed and the shaft cleaned. If required, use a grease removal agent as specified by the glue manufacturer. If the glue manufacturer does not provide information on grease removal, it is recommended to use acetone.

▶ Remove the anti-corrosive. Avoid direct contact of the skin and the sealing material with the anti-corrosive or the cleaning agent.

Mounting surface for flange

The mounting surface must be stable, clean and low-vibration.

▶ Verify that the system side meets all requirements in terms of dimensions and tolerances.

Cable specifications

Use pre-assembled cables to reduce the risk of wiring errors. See chapter 7 "Accessories and spare parts".

The genuine accessories have the following properties:

Cables with connectors		**VW3M5101R•••**	**VW3M5102R•••**	**VW3M5103R•••**
Cable jacket, insulation		PUR orange (RAL 2003), polypropylene (PP)		
Capacitance	[pF/m]	Approx. 70 (wire/wire) Approx. 110 (wire/shield)		
Number of contacts (shielded)		[(4 x 1.5 mm^2) + (2 x 1 mm^2)]	[(4 x 2.5 mm^2) + (2 x 1 mm^2)]	[(4 x 4 mm^2) + (2 x 1 mm^2)]
Connection version		Motor end 8-pin circular connector M23, other cable end open	Motor end 8-pin circular connector M23, other cable end open	Motor end 8-pin circular connector M40, other cable end open
Cable diameter	[mm]	12 ± 0.2	14 ± 0.3	16.3 ± 0.3
Minimum bending radius	[mm]	90	110	125
Nominal voltage	[V]	600		
Maximum orderable length	[m]	75 [1)]		
Permissible temperature range during operation	[°C]	-40 ... 90 (fixed installation) -20 ... 80 (moving)		
Certifications		UL, CSA, VDE, CE, DESINA		

1) Please contact your Schneider Electric sales office for longer cables.

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Cables without connectors		**VW3M5301R••••**	**VW3M5302R••••**	**VW3M5303R••••**
Cable jacket, insulation		PUR orange (RAL 2003), polypropylene (PP)		
Capacitance	[pF/m]	Approx. 70 (wire/wire) Approx. 110 (wire/shield)		
Number of contacts (shielded)		[(4 x 1.5 mm^2) + (2 x 1 mm^2)]	[(4 x 2.5 mm^2) + (2 x 1 mm^2)]	[(4 x 4 mm^2) + (2 x 1 mm^2)]
Connection version		Both cable ends open	Both cable ends open	Both cable ends open
Cable diameter	[mm]	12 ± 0.2	14 ± 0.3	16.3 ± 0.3
Minimum bending radius	[mm]	90	110	125
Nominal voltage	[V]	600		
Maximum orderable length	[m]	100		
Permissible temperature range during operation	[°C]	-40 ... 90 (fixed installation) -20 ... 80 (moving)		
Certifications		UL, CSA, VDE, CE, DESINA		

Cables with connectors		**VW3M8102R•••**
Cable jacket, insulation		PUR green (RAL6018), polypropylene (PP)
Capacitance	[pF/m]	Approx. 135 (wire/wire)
Number of contacts (shielded)		[3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)]
Connection version		Motor end 12-pin circular connector M23, device end 10-pin connector RJ45
Cable diameter	[mm]	6.8 ± 0.2
Minimum bending radius	[mm]	68
Nominal voltage	[V]	300
Maximum orderable length	[m]	75 [1)]
Permissible temperature range during operation	[°C]	-40 ... 90 (fixed installation) -20 ... 80 (moving)
Certifications		UL, CSA, VDE, CE, DESINA

1) Please contact your Schneider Electric sales office for longer cables.

Cables without connectors		**VW3M8222R••••**
Cable jacket, insulation		PUR green (RAL6018), polypropylene (PP)
Capacitance	[pF/m]	Approx. 135 (wire/wire)
Number of contacts (shielded)		[3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)]
Connection version		Motor end 12-pin circular connector M23, device end 10-pin connector RJ45
Cable diameter	[mm]	6.8 ± 0.2
Minimum bending radius	[mm]	68
Nominal voltage	[V]	300
Maximum orderable length	[m]	100
Permissible temperature range during operation	[°C]	-40 ... 90 (fixed installation) -20 ... 80 (moving)
Certifications		UL, CSA, VDE, CE, DESINA

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⚠ CAUTION

DAMAGE AND FIRE CAUSED BY INCORRECT INSTALLATION

Forces or movements at the connector may damage the cable and the contacts.

- Avoid forces or movements at the connector.
- The bend radius specified only applies to the connector in the case of permanent cable installation. The remainder of the cable may be moved with the bend radius specified.
- Attach the cable close to the connector with a strain relief.

Failure to follow these instructions can result in injury or equipment damage.

Space for connectors

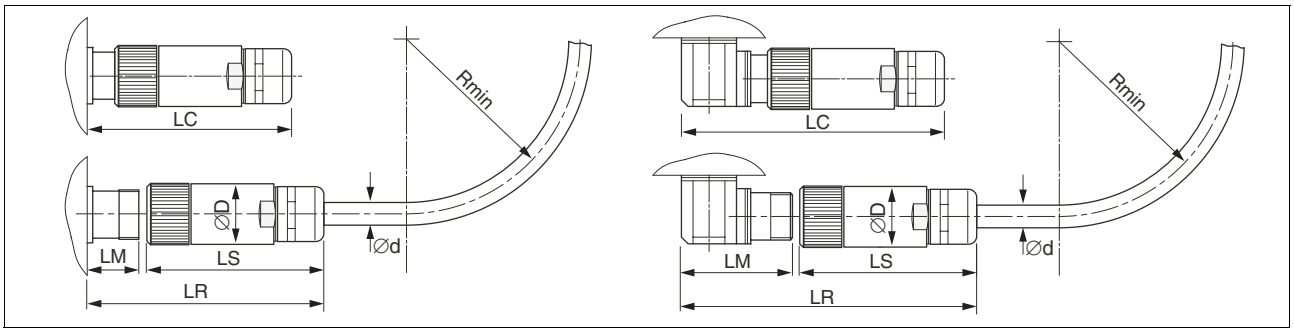

Figure 4.1 Connector installation space

Dimensions		Motor connectors straight BMH070 ... 140	Motor connectors straight BMH205	Encoder connector straight
D	[mm]	28	46	26
LS	[mm]	76	100	51
LR	[mm]	117	155	76
LC	[mm]	100	145	60
LM	[mm]	40	54	23

Dimensions		Motor connectors angular BMH070 ... 140	Motor connectors angular BMH205	Encoder connector angular
D	[mm]	28	46	26
LS	[mm]	76	100	51
LR	[mm]	132	191	105
LC	[mm]	114	170	89
LM	[mm]	55	91	52

Dimensions		Motor cables BMH070 ... 140	Motor cables BMH205	Encoder cables
d	[mm]	18	25	18
R_{min}	[mm]	90	125	68

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4.4 Mounting the motor

⚠ WARNING

UNEXPECTED MOVEMENT CAUSED BY ELECTROSTATIC DISCHARGE

In rare cases, electrostatic discharge to the shaft may cause incorrect operation of the encoder system and result in unexpected motor movements and damage to the bearing.

- Use conductive components (such as antistatic belts) or other suitable measures to avoid static charge by motion.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNEXPECTED MOVEMENT

If the approved ambient conditions are exceeded, external substances from the environment may penetrate and cause unexpected movement or equipment damage.

- Verify that the ambient conditions are met.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft bushing (for example in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries to the direct spray of a pressure cleaner.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNINTENDED BEHAVIOR CAUSED BY MECHANICAL DAMAGE TO THE MOTOR

If the maximum permissible forces at the shaft are exceeded, this will result in premature wear of the bearing, shaft breakage or damage to the encoder.

- Do not exceed the maximum permissible axial and radial forces.
- Protect the shaft from impact.
- Do not exceed the maximum permissible axial force when pressing on components.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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⚠ CAUTION

HOT SURFACES

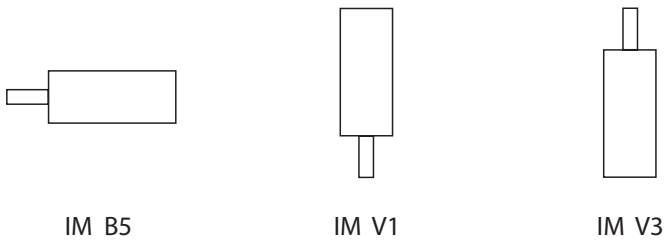
Depending on the operation, the surface may heat up to more than 100°C (212°F).

- Do not allow contact with the hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.
- Check the temperature during test runs.

Failure to follow these instructions can result in injury or equipment damage.

Mounting position

The following mounting positions are defined and approved as per IEC 60034-7:



Mounting

When the motor is mounted to the mounting flange, it must be accurately aligned axially and radially and evenly contact the surface. All mounting screws must be tightened with the specified torque. There must no tension. See chapter 3 "Technical Data" for data, dimensions and degrees of protection (IP).

Mounting output components

If output components are not properly mounted, the encoder may be damaged. Output components such as pulleys, couplings must be mounted with suitable equipment and tools. The maximum axial and radial forces acting on the shaft must not exceed the maximum shaft load values specified.

Observe the mounting instructions provided by the manufacturer of the output component. Motor and output component must be accurately aligned both axially and radially. Failure to follow the instructions will cause runout, damage to the rolling bearings and premature wear.

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4.4.1 Installation and connection of IP67 kit (accessory)

The IP67 kit is used to connect compressed air to the motor. The compressed air generates a permament overpressure inside the motor. This overpressure in the inside of the motor is used to obtain degree of protection IP67.

Note the special requirements in terms of the compressed air in chapter 3 "Technical Data".

Installation procedure

When the IP67 kit is installed, the existing cover is replaced by the cover of the IP67 kit. The O ring is also replaced (shipped with the IP67 kit).

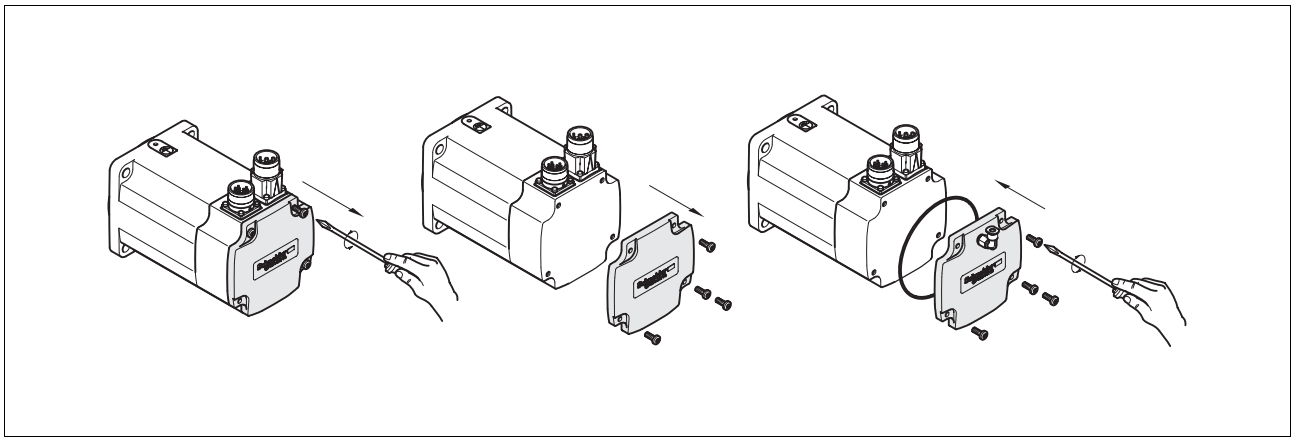

Figure 4.2 Installation IP67 Kit

- ▶ Loosen the 4 housing screws of the cover.
- ▶ Remove the cover and the O ring
- ▶ Verify proper seat of the O ring in the cover of the IP67 kit.

  To facilitate mounting of the new O ring, you may slightly grease the O ring to hold it in place.
- ▶ Fasten the cover of the IP67 kit with the 4 housing screws; use the required tightening torque as shown on page Table 3.1 "Tightening torques and property classes".
- ▶ Verify the tightening torque of the compressed air connection:

Tightening torque compressed air connection	[Nm] (lb·in)	0.6 (5.31)

Compressed air connection

The compressed air connection of the IP67 kit is designed for compressed air hoses made of standard plastic with an outside diameter of 4 mm.

Compressed air monitoring

It is recommended to use a compressed air monitor.

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4.5 Electrical installation

4.5.1 Connectors and connector assignments

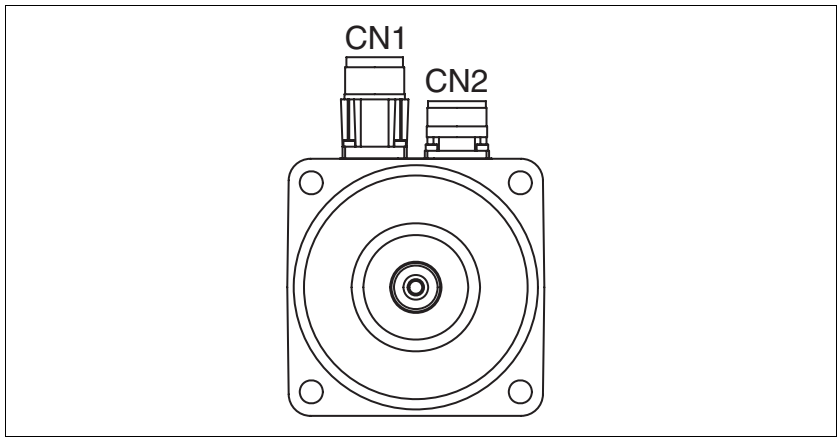

Figure 4.3 Connection overview

Depending on the motor size, different connector sizes are used for the motor connection CN1. BMH070, BMH100 and BMH140 have an M23 connection. BMH205 has an M40 connection. The encoder connection CN2 is identical irrespective of the motor size.

CN1 motor connection M23 Motor connector for connection of motor phases and holding brake

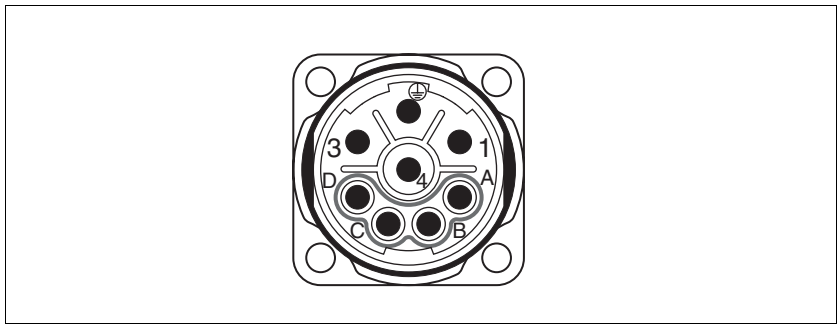

Figure 4.4 Pin assignment motor connection M23

See chapter 7.2 "Connector" for suitable mating connectors.

Pin	Assignment	Meaning
1	U	Motor phase U
⏚	PE	Protective ground conductor
3	W	Motor phase W
4	V	Motor phase V
A	Brake +	Supply voltage holding brake 24 V_{dc}
B	Brake -	Reference potential holding brake
C	Reserved	Reserved
D	Reserved	Reserved
	SHLD	Shield (to connector housing)

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CN1 motor connection M40 Motor connector for connection of motor phases and holding brake

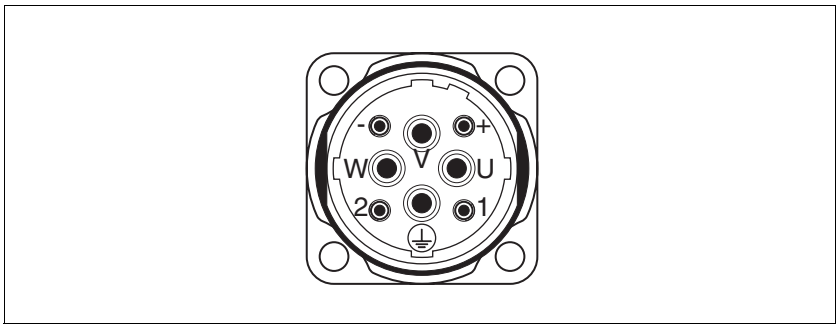

Figure 4.5 Pin assignment motor connection M40

See chapter 7.2 "Connector" for suitable mating connectors.

Pin	Assignment	Meaning
U	U	Motor phase U
⏚	PE	Protective ground conductor
W	W	Motor phase W
V	V	Motor phase V
+	Brake +	Supply voltage holding brake 24 V_{dc}
-	Brake -	Reference potential holding brake
1	Reserved	Reserved
2	Reserved	Reserved
	SHLD	Shield (connector housing)

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CN2 encoder connection M23

Encoder connector for connecting the SinCos encoder (singleturn and multiturn)

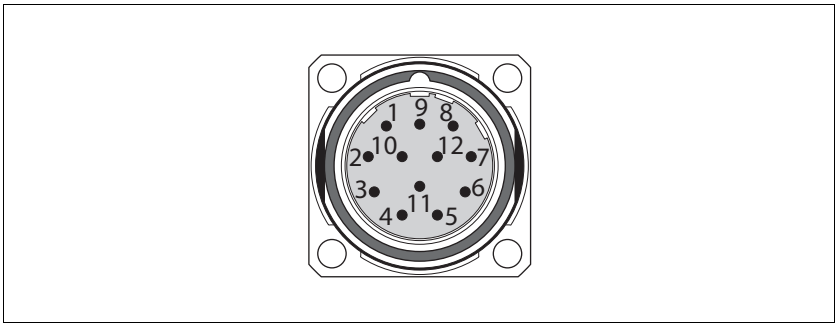

Figure 4.6 Pin assignment encoder connector

See chapter 7.2 "Connector" for suitable mating connectors.

Pin	Signal	Meaning	Pair [1]
1	Reserved	Reserved	6
2	Reserved	Reserved	5
3	Reserved	Reserved	5
4	REFSIN_OUT	Reference for sine signal, 2.5 V	1
5	REFCOS_OUT	Reference for cosine signal, 2.5V	2
6	DATA	Receive data, transmit data	3
7	$\overline{\text{DATA}}$	Receive data and transmit data, inverted	3
8	SIN_OUT	Sine signal	1
9	COS_OUT	Cosine signal	2
10	ENC+10V	7...12 V supply voltage	6
11	ENC_0V	Reference potential [2]	4
12	Reserved	Reserved	4
	SHLD	Shield (to connector housing)	

1) Signal pairs must be twisted
2) The ENC_0V connection of the supply voltage has no connection to the encoder housing.

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4.5.2 Power and encoder connection

⚠ DANGER

ELECTRIC SHOCK

High voltages at the motor connection may occur unexpectedly.

- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment. Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNEXPECTED MOVEMENT

Drives may perform unexpected movements because of incorrect connection or other errors.

- Operate the motor with approved power stages only. Even if power stages are similar, different adjustment of the encoder system may be a source of hazards.
- Verify proper wiring. Even if the connectors for power connection and encoder system of a third-party power stage vendor match, this does not indicate compatibility.
- Only start the system if there are no persons or obstructions in the hazardous area.
- Run initial tests without coupled loads.
- Do not touch the motor shaft or the mounted output components.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

FIRE HAZARD DUE TO POOR CONTACT

The motor connector may overheat and contacts may be destroyed by arcing if the connector is not properly connected and the union nut is not tightly screwed in place.

- Verify that the connector is properly plugged in and the union nut of the connector is tight.

Failure to follow these instructions can result in injury or equipment damage.

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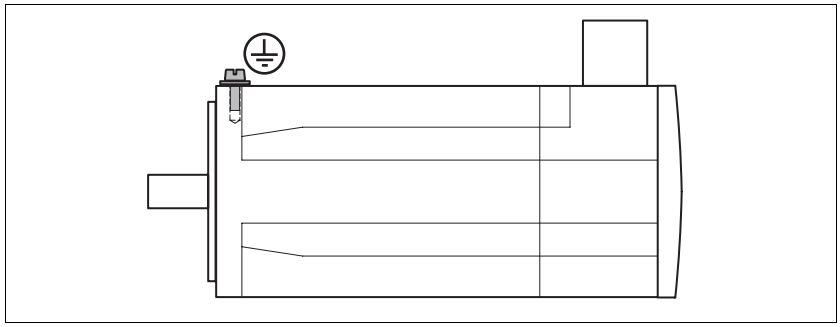
The motors are not suitable for direct connection to mains power. The motors must be operated with a suitable power stage.

Protective ground conductor connection



▶ Ground the motor via the grounding screw if grounding via the flange and the protective ground conductor of the motor cable is not sufficient.

Note the required tightening torque and the property class of the grounding screw, see Table 3.1 "Tightening torques and property classes" in chapter 3 "Technical Data".

Motor and encoder system connectors must not be disconnected or reconnected as long as voltage is present.

Assembling cables

Insulate unused wires individually.

▶ Note the EMC requirements for motor cables and encoder cables, page 44.

▶ Use equipotential bonding conductors for equipotential bonding.

Follow the procedure and note the dimensions in Figure 4.9.

Depending on the motor size, different connector sizes are used for the motor connection CN1. BMH070, BMH100 and BMH140 have an M23 connection. BMH205 has an M40 connection. The encoder connection CN2 is identical irrespective of the motor size.

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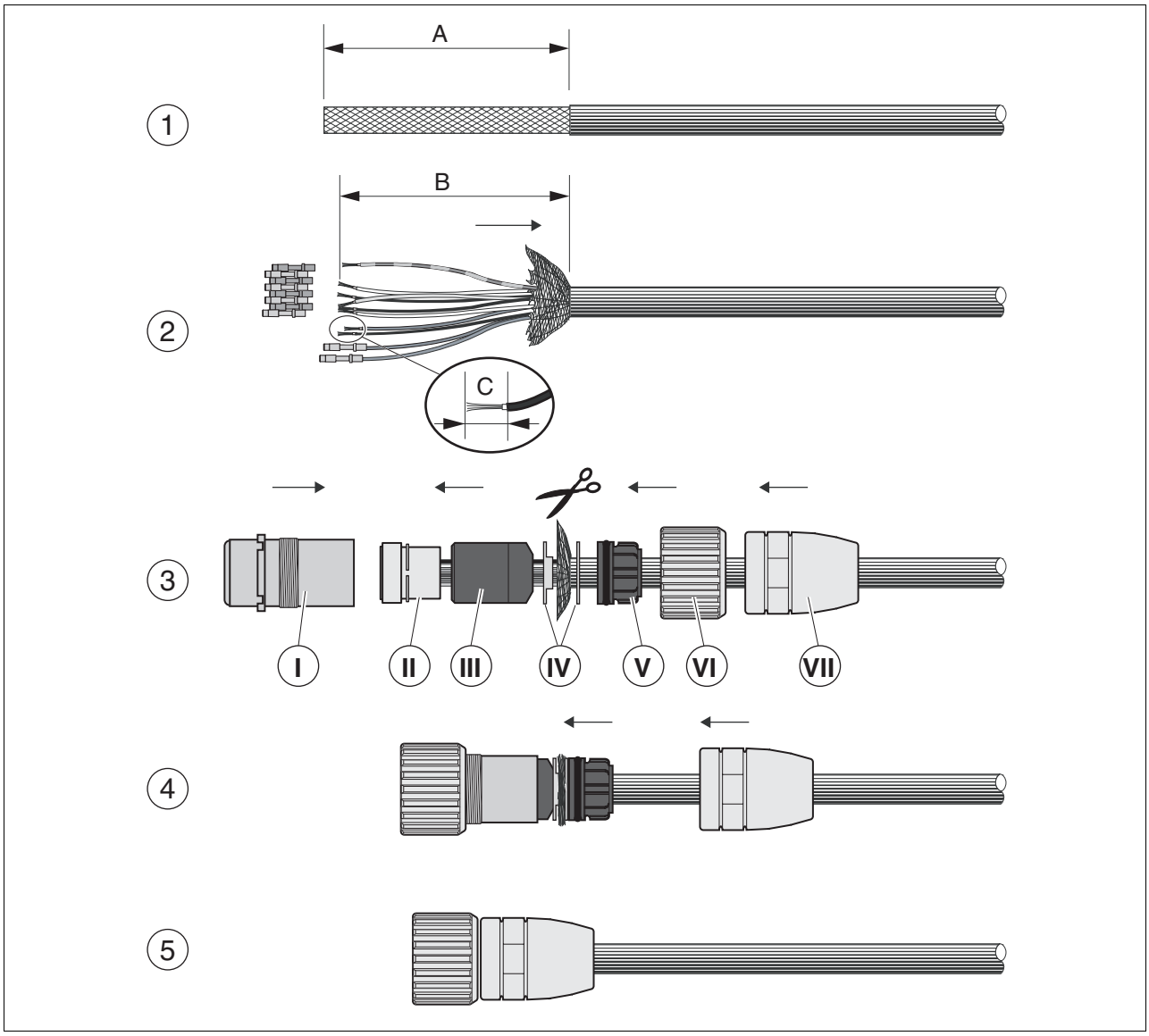

Figure 4.7 Assembling motor cables with M23 encoder connector

- ▶ (1) Strip the cable jacket; length as specified (see Table 4.1).
- ▶ Open the shield braiding and slide it back over the outer cable jacket.
- ▶ Shorten the inner cable jacket.
- ▶ (2) Shorten the wires to the specified length (see Table 4.1) and crimp them to the connector.

  Also connect unused wires, if possible. This improves EMC. Wires that are not connected must be insulated at both ends.
- ▶ (3) Push part (IV) and part (III) onto the cable. The cable entry contains rubber seals of various sizes for different cable diamters. Use rubber seals matching the diameter of the cable. Enclose the shield with part (IV). Snap the contacts into part (II). Open part (III) at the side and enclose part (II) as well as the rear part of the contacts with it. Slide part (II) into part (I).
- ▶ (4) Slide part (IV) behind the shield braiding. Slide part (VI) over part (I).
- ▶ Screw part (IV) onto part (I) all the way to the stop.

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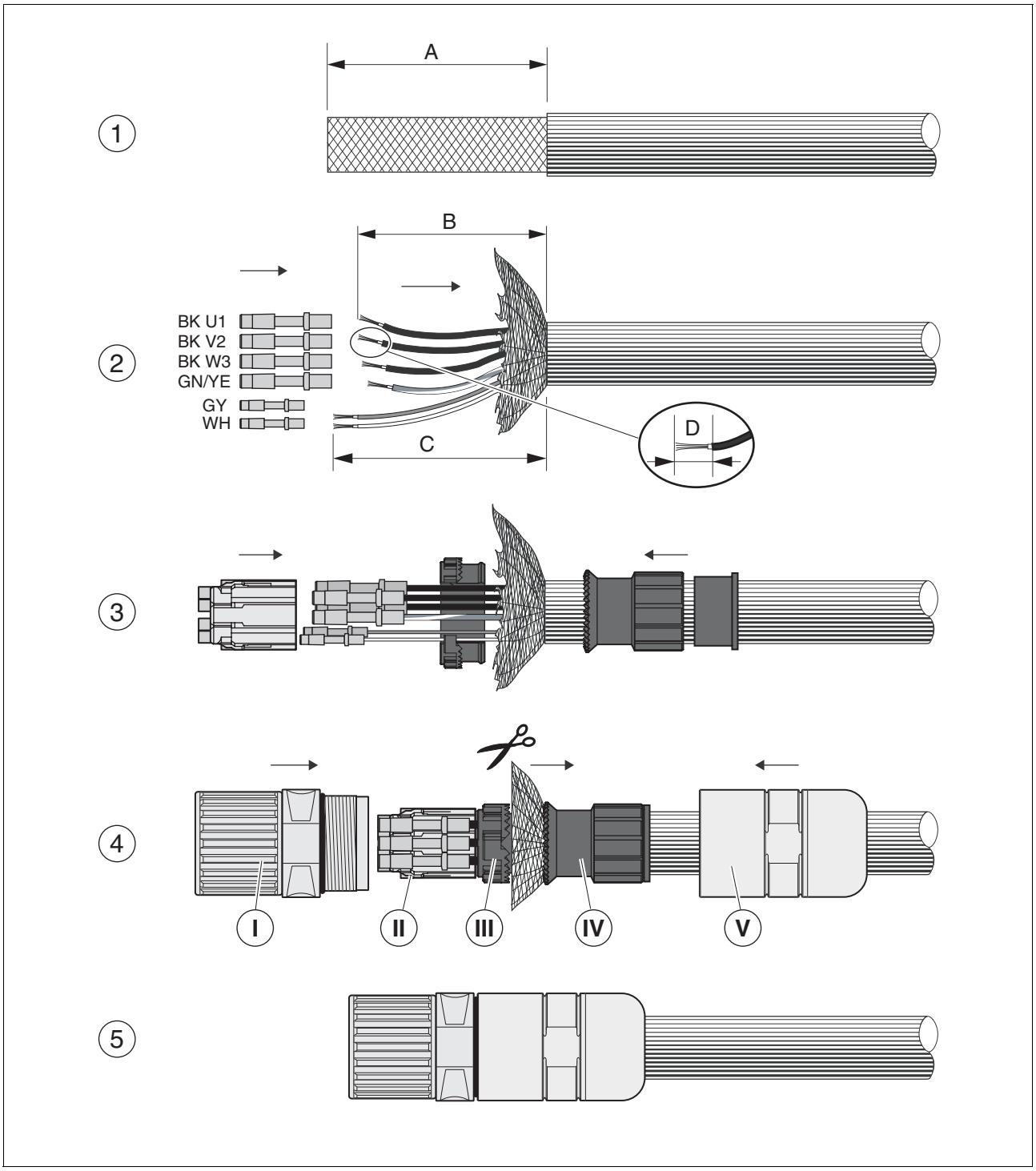

Figure 4.8 Assembling motor cables with M23 motor connector

- ▶ (1) Strip the cable jacket; length as specified (see Table 4.1).
- ▶ Open the shield braiding and slide it back over the outer cable jacket.
- ▶ Shorten the inner cable jacket.
- ▶ (2) Shorten the wires to the specified length (see Table 4.1) and crimp them to the connector.

  Also connect unused wires, if possible. This improves EMC. Wires that are not connected must be insulated at both ends.

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- ▶ (3) Push part (IV) and part (III) onto the cable. Snap the contacts into part (II). Open the side of part (III) and enclose the wires using this part.
- ▶ (4) Slide part (III) behind the shield braiding and insert part (II) into part (I). Arrange the shield braiding as shown. Push part (I) and part (III) together and shorten the shield braiding.
- ▶ Screw part (IV) onto part (I) all the way to the stop.
- ▶ If your motor is equipped with a holding brake, please follow the instructions in chapter 4.5.3 "Holding brake connection".

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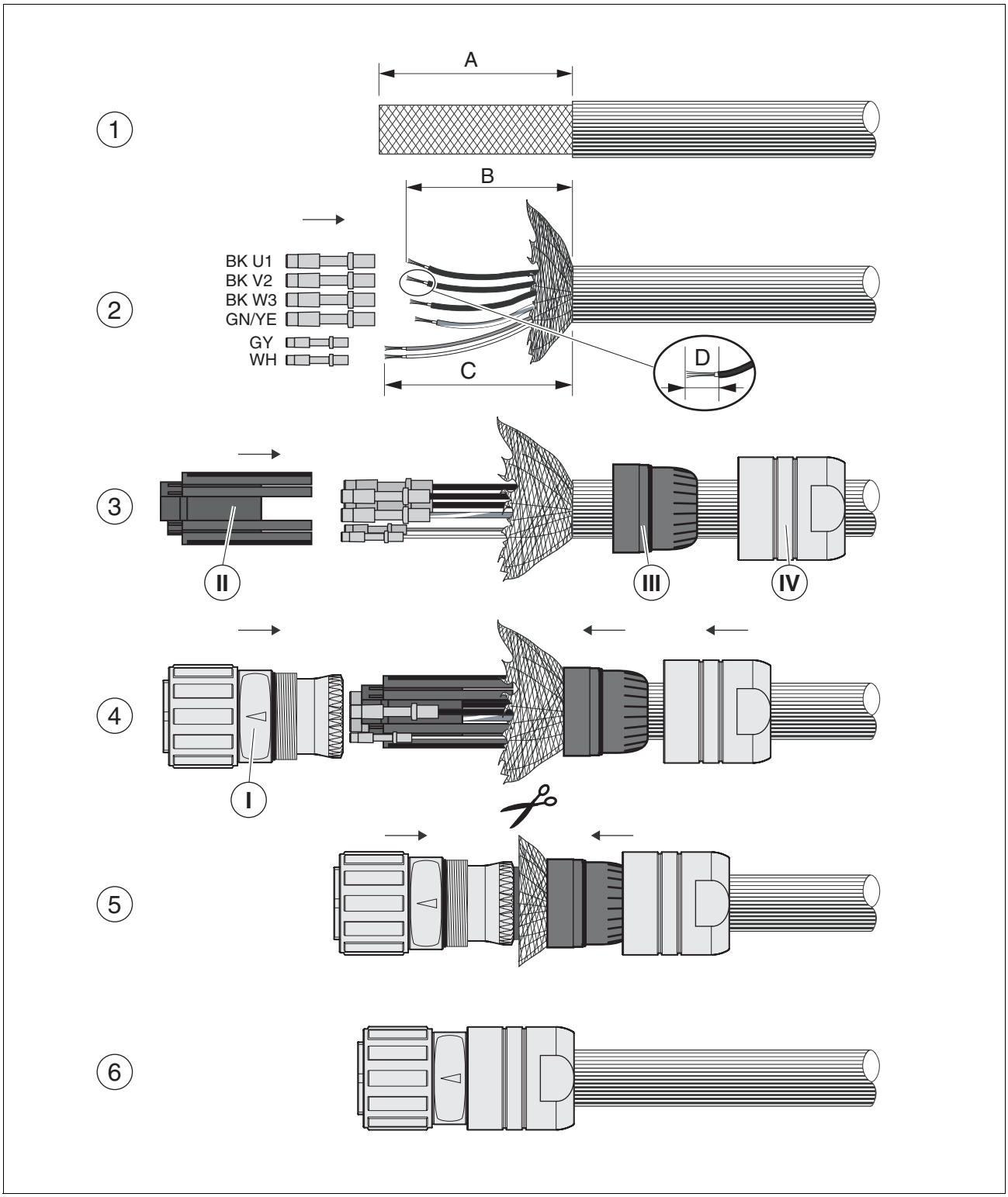

Figure 4.9 Assembling motor cables with M40 motor connector

- ▶ (1) Strip the cable jacket; length as specified (see Table 4.1).
- ▶ Open the shield braiding and slide it back over the outer cable jacket.
- ▶ Shorten the inner cable jacket.
- ▶ (2) Shorten the wires to the specified length (see Table 4.1) and crimp them to the connector.

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Also connect unused wires, if possible. This improves EMC. Wires that are not connected must be insulated at both ends.

- ▶ (3) Push part (IV) and part (III) onto the cable. Snap the contacts laterally into part (II).
- ▶ (4) Slide part (III) behind the shield braiding and insert part (II) into part (I).
- ▶ (5) Arrange the shield braiding as shown. Push part (I) and part (III) together and shorten the shield braiding.
- ▶ Screw part (IV) onto part (I) all the way to the stop.
- ▶ If your motor is equipped with a holding brake, please follow the instructions in chapter 4.5.3 "Holding brake connection".

	Signal wires encoder 0.25 mm²	**Signal wires encoder 0.5 mm²**	**Signal wires holding brake 1 mm²**	**Power wire 1.5 mm²**	**Power wire 2.5 mm²**	**Power wire 4 mm²**
Stripping length A BMH070 ... 140 BMH205	28 mm	28 mm	40 mm	40 mm	40 mm	40 mm
Stripping length B BMH070 ... 140 BMH205	28 mm	28 mm	-	36 mm	36 mm	36 mm
Stripping length C BMH070 ... 140 BMH205	-	-	40 mm	-	-	-
Stripping length D	4.5 mm	4.5 mm	4.5 mm	8 mm	8 mm	10 mm
Crimping tool	SF-Z0007	SF-Z0007	SF-Z0007	SF-Z0008	SF-Z0008	SF-Z0008
Positioner type	SF-Z2002	SF-Z2002	SF-Z0012	SF-Z0012	SF-Z0012	SF-Z0013
Parameters positioner	Fixed	Fixed	+2	-2	-2	-2
Parameters eccentric	5	6	1	4	6	6

Table 4.1 Dimensions for crimping and assembling

Connecting the cables

- ▶ Place the female connector of the motor cable onto the male connector and tighten the union nut. Proceed in the same manner with the connection cable of the encoder system.

  Keep the connection cables from being twisted when tightening the union nut.
- ▶ Connect the motor cable and the encoder cable to the drive according to the wiring diagram of the drive.
- ▶ Ground the shield to a large surface area.
- ▶ If your motor is equipped with a holding brake, please follow the instructions in chapter 4.5.3 "Holding brake connection".

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4.5.3 Holding brake connection

⚠ WARNING

LOSS OF BRAKING FORCE DUE TO WEAR OR HIGH TEMPERATURE

Applying the holding brake while the motor is running will cause excessive wear and loss of the braking force.

- Do not use the brake as a service brake.
- Note that "EMERGENCY STOPS" may also cause wear.
- Note the maximum number of brake applications and the kinetic energy during braking of moving loads.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNEXPECTED MOVEMENT

Releasing the holding brake may cause an unexpected movement in the system, for example if vertical axes are used.

- Take appropriate measures to avoid damage caused by the falling loads.
- Only run the test if there are no persons or obstacles in the hazardous area.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

MISOPERATION OF THE HOLDING BRAKE CAUSED BY INCORRECT VOLTAGE

If the voltage is incorrect, the holding brake cannot be released which causes wear.

- Verify that the polarity of the voltage is correct. If the voltage polarity is incorrect, the holding brake cannot be released.
- Check the level of the voltage. If the voltage is higher than the specified value, there is a danger of the holding brake being re-applied.

Failure to follow these instructions can result in injury or equipment damage.

A motor with a holding brake requires a suitable holding brake controller which releases the brake when the rotary movement starts and locks the motor shaft when the motor is stopped.

Cable specifications

- Minimum wire cross section: 2 * 1.0 mm^2 (AWG 16)
- Maximum cable length: See product manual of the drive.

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5 Commissioning

5

5.1 Preparing for commissioning

Before commissioning, check the following:

- Proper mechanical installation.
- Proper electrical installation: in particular, check the protective ground conductor connections and ground connections. Verify that all connections at the motor and the drive are correctly made and connected and that cable glands are properly tightened.
- Ambient and application conditions: verify that the specified ambient conditions are met and that the drive solution matches the operating conditions as specified on the nameplate.
- Drive elements: verify that any output components already installed are balanced and accurately aligned.
- Parallel key on the shaft end of the motor: if you have a motor with a parallel key groove and parallel key, the parallel key must not be inserted during commissioning without output component or it must be appropriately secured.
- Function of the holding brake: Verify that the holding brake really holds the maximum load. Verify that the holding brake is released when the brake voltage is applied. Verify that the holding brake is released before a movement is started.

5.2 Performing commissioning

⚠ WARNING

UNEXPECTED MOVEMENT

Drives may perform unexpected movements because of incorrect connection or other errors.

- Operate the motor with approved power stages only. Even if power stages are similar, different adjustment of the encoder system may be a source of hazards.
- Verify proper wiring. Even if the connectors for power connection and encoder system of a third-party power stage vendor match, this does not indicate compatibility.
- Only start the system if there are no persons or obstructions in the hazardous area.
- Run initial tests without coupled loads.
- Do not touch the motor shaft or the mounted output components.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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⚠ WARNING

ROTATING PARTS

Rotating parts may cause injuries and may catch clothing or hair. Loose parts or parts that are unbalanced may be flung.

- Verify correct mounting and installation of all rotating parts.
- Use a cover to help protect against rotating parts.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

FALLING PARTS

The motor may move, tip and crash down as a result of the reaction torque.

- Mount the motor securely so it will not break loose during strong acceleration.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

HOT SURFACES

Depending on the operation, the surface may heat up to more than 100°C (212°F).

- Do not allow contact with the hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.
- Check the temperature during test runs.

Failure to follow these instructions can result in injury or equipment damage.

Observe the information on commissioning in the product manual of the drive.

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6 Diagnostics and troubleshooting

6

6.1 Diagnostics and troubleshooting

6.1.1 Mechanical problems

Error	Cause	Troubleshooting
Excessive heat	Overload	Reduce load
	Holding brake not released	Check the holding brake controller
	Heavy pollution	Clean the motor
Whistling or knocking noise	Rolling bearings	Contact service
Grinding noise	Rotating output component grinds	Align output component
Radial oscillation	Poor alignment of output component	Align output component
	Output element out of balance	Balance output component
	Shaft bent	Contact service
	Resonance with mounting elements	Check the stiffness of the motor mounting
Axial oscillation	Poor alignment of output component	Align output component
	Shocks of the output component	Check output component
	Resonance with mounting elements	Check the stiffness of the motor mounting

6.1.2 Electrical problems

Error	Cause	Troubleshooting
Motor does not start or starts with problems	Overload	Reduce load
	Drive error	Check drive
	Connection cables, phases / winding short circuit	Check connection cable and connections
Excessive heat	Overload	Reduce power
Heat at the connection terminals	Connector loose or not tightened	Tighten connector

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7 Accessories and spare parts

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7.1 IP67 Kit

Description	Order no.
IP67 kit for BMH070, cover with compressed air connection, O ring, 4 screws	VW3M2301
IP67 kit for BMH100, cover with compressed air connection, O ring, 4 screws	VW3M2302
IP67 kit for BMH140, cover with compressed air connection, O ring, 4 screws	VW3M2303
IP67 kit for BMH205, cover with compressed air connection, O ring, 4 screws	VW3M2304

7.2 Connector

Description	Order no.
Encoder connector (cable end) for motor M23, 5 pcs	VW3M8214
Encoder connector (cable end) for drive RJ45 (10 pins), 5 pcs	VW3M2208
Motor connector (cable end) M23, 1.5 ... 2.5 mm^2, 5 pcs	VW3M8215
Motor connector (cable end) M40, 4 mm^2, 5 pcs	VW3M8217

Tool The tools required for cable assembly could be ordered directly from the manufacturer.

- Crimping tool for encoder connector M23: Coninvers SF-Z0007
- Crimping tool for power connector M23/M40: Coninvers SF-Z0008

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7.3 Motor cables

7.3.1 Motor cables 1.5 mm^2

These cables are suitable for the following motors:
Servo motor BMH3, flange 100 mm

Description	Order no.
Motor cable 1.5 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R15
Motor cable 3 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R30
Motor cable 5 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R50
Motor cable 10 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R100
Motor cable 15 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R150
Motor cable 20 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R200
Motor cable 25 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R250
Motor cable 50 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R500
Motor cable 75 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5101R750
Motor cable 25 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; both cable ends open	VW3M5301R250
Motor cable 50 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; both cable ends open	VW3M5301R500
Motor cable 100 m, [(4 x 1.5 mm^2) + (2 x 1 mm^2)] shielded; both cable ends open	VW3M5301R1000

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7.3.2 Motor cables 2.5 mm²

These cables are suitable for the following motors:
Servo motor BMH3, flange 140 mm

Description	Order no.
Motor cable 3 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R30
Motor cable 5 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R50
Motor cable 10 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R100
Motor cable 15 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R150
Motor cable 20 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R200
Motor cable 25 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R250
Motor cable 50 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R500
Motor cable 75 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M23, other cable end open	VW3M5102R750
Motor cable 25 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; both cable ends open	VW3M5302R250
Motor cable 50 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; both cable ends open	VW3M5302R500
Motor cable 100 m, [(4 x 2.5 mm²) + (2 x 1 mm²)] shielded; both cable ends open	VW3M5302R1000

7.3.3 Motor cables 4 mm²

These cables are suitable for the following motors:
Servo motor BMH3, flange 205 mm

Description	Order no.
Motor cable 3 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R30
Motor cable 5 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R50
Motor cable 10 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R100
Motor cable 15 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R150
Motor cable 20 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R200
Motor cable 25 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R250
Motor cable 50 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R500
Motor cable 75 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; motor end 8-pin circular connector M40, other cable end open	VW3M5103R750
Motor cable 25 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; both cable ends open	VW3M5303R250
Motor cable 50 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; both cable ends open	VW3M5303R500
Motor cable 100 m, [(4 x 4 mm²) + (2 x 1 mm²)] shielded; both cable ends open	VW3M5303R1000

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7.4 Encoder cables

Description	Order no.
Encoder cable 1.5 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R15
Encoder cable 3 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R30
Encoder cable 5 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R50
Encoder cable 10 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R100
Encoder cable 15 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R150
Encoder cable 20 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R200
Encoder cable 25 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R250
Encoder cable 50 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R500
Encoder cable 75 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; motor end 12-pin circular connector M23, device end 10-pin connector RJ45	VW3M8102R750
Encoder cable 25 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; both cable ends open	VW3M8222R25
Encoder cable 50 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; both cable ends open	VW3M8222R500
Encoder cable 100 m, [3 x (2 x 0.14 mm^2) + (2 x 0.34 mm^2)] shielded; both cable ends open	VW3M8222R1000

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8 Service, maintenance and disposal

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8.1 Service address

If you have any questions please contact your sales office. Your sales office staff will be happy to give you the name of a customer service office in your area.

8.2 Storage

The motors must be transported and stored in a dry, dust-free and vibration-free environment. The ambient conditions and application conditions specified in chapter 3.2 "General features" must be met; in case of doubt you must air-condition the storage location.

The storage time is primarily determined by the service life of the lubricants; do not store the product for more than 36 months. It is recommended to periodically operate the drive solution to maintain its operability.

8.3 Maintenance

Repairs may only be made by the manufacturer. No warranty or liability is accepted for repairs made by unauthorized persons.

Repairs cannot be made with the device installed.

Prior to any type of work on the drive system, consult the chapters on Installation and Commissioning for information on the precautions and processes to be observed.

We recommend the following maintenance work at regular intervals:

Connections and fastening

- ▶ Check all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- ▶ Check that all output elements are firmly seated.
- ▶ Tighten all mechanical and electrical threaded connections to the specified torque. Check the union nuts at the connection cables.

Lubricating the shaft sealing ring

In the case of motors with shaft sealing ring, lubricant must be applied to the space between the sealing lip of the shaft sealing ring and the shaft with a suitable non-metallic tool. If the shaft sealing rings are allowed to run dry, the service life of the shaft sealing rings will be significantly reduced.

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Cleaning

⚠ WARNING

UNEXPECTED MOVEMENT

If the approved ambient conditions are exceeded, external substances from the environment may penetrate and cause unexpected movement or equipment damage.

- Verify that the ambient conditions are met.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft bushing (for example in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries to the direct spray of a pressure cleaner.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Clean dust and dirt off the motor at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

Motors are not suitable for cleaning with a high-pressure cleaner. The high pressure may force water into the motor.

When using solvents or cleaning agents, verify that the motor and encoder cables, cable entry seals, O rings and motor paint are not damaged.

Checking/running in the holding brake

Occasional braking while the load moves helps to maintain the holding torque of the holding brake. If the brake does not work mechanically (braking while the load moves) for an extended period of time, parts of the holding brake may corrode or particles may accumulate and reduce the holding torque.

The holding brake is factory run in. If the brake does not work mechanically for an extended period of time, parts of the holding brake may corrode. If the holding brake does not have the holding torque indicated in the technical data, it must be run in again.

■ The motor is dismounted. The holding brake is applied.

▶ Check the holding torque of the holding brake using a torque wrench.

▶ Compare the value to the specified holding torque of the holding brake when it was delivered. See Table 3.2 "Technical data holding brake" in chapter 3.6.1 "Holding brake"

▶ If the holding torque of the holding brake considerably differs from the specified values, manually rotate the motor shaft by 25 rotations in both directions.

▶ Repeat the process. Contact your sales office if you cannot restore the original holding torque by repeating the process 3 times.

Replacing the rolling bearing

The customer must not replace the rolling bearing. The motor will be partially demagnetized by this procedure and lose power.

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8.4 Changing the motor

- ▶ Switch off all supply voltages. Verify that no voltages are present (safety instructions).
- ▶ Label all connections and uninstall the product.
- ▶ Note the identification number and the serial number shown on the product nameplate for later identification.
- ▶ Install the new product as per chapter 4 "Installation".
- ▶ Commission the product as per chapter 5 "Commissioning".

8.5 Shipping, storage, disposal

Note the ambient conditions in chapter 3.2 "General features".

Shipping The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage The product may only be stored in spaces where the specified permissible ambient conditions for room temperature and humidity are met. Protect the product from dust and dirt.

Disposal The product consists of various materials that can be recycled and must be disposed of separately. Dispose of the product in accordance with local regulations.

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9 Glossary

9

9.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 meters [m] to yards [yd]
5 m / 0.9144 = 5.468 yd

9.1.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

9.1.2 Mass

	lb	oz	slug	kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* $1.942559*10^{-3}$	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ $1.942559*10^{-3}$	-	* 14.5939	* 14593.9
kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

9.1.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* $9.807*10^{-3}$
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ $100*10^{3}$
N	/ 4.448222	/ 0.27801	/ $9.807*10^{-3}$	* $100*10^{3}$	-

9.1.4 Power

	HP	W
HP	-	* 746
W	/ 746	-

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9.1.5 Rotation

	min^{-1} (RPM)	**rad/s**	**deg./s**
min^{-1} (RPM)	-	* π / 30	* 6
rad/s	* 30 / π	-	* 57.295
deg./s	/ 6	/ 57.295	-

9.1.6 Torque

	lb·in	**lb·ft**	**oz·in**	**Nm**	**kp·m**	**kp·cm**	**dyne·cm**
lb·in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129*10^6$
lb·ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558*10^6$
oz·in	/ 16	/ 192	-	* $7.0616*10^{-3}$	* $720.07*10^{-6}$	* $72.007*10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616*10^{-3}$	-	* 0.101972	* 10.1972	* $10*10^6$
kp·m	/ 0.011521	/ 0.138255	/ $720.07*10^{-6}$	/ 0.101972	-	* 100	* $98.066*10^6$
kp·cm	/ 1.1521	/ 13.8255	/ $72.007*10^{-3}$	/ 10.1972	/ 100	-	* $0.9806*10^6$
dyne·cm	/ $1.129*10^6$	/ $13.558*10^6$	/ 70615.5	/ $10*10^6$	/ $98.066*10^6$	/ $0.9806*10^6$	-

9.1.7 Moment of inertia

	lb·in^2	**lb·ft^2**	**kg·m^2**	**kg·cm^2**	**kp·cm·s^2**	**oz·in^2**
lb·in^2	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb·ft^2	* 144	-	* 0.04214	* 421.4	* 0.429711	* 2304
kg·m^2	* 3417.16	/ 0.04214	-	* $10*10^3$	* 10.1972	* 54674
kg·cm^2	* 0.341716	/ 421.4	/ $10*10^3$	-	/ 980.665	* 5.46
kp·cm·s^2	* 335.109	/ 0.429711	/ 10.1972	* 980.665	-	* 5361.74
oz·in^2	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

9.1.8 Temperature

	°F	**°C**	**K**
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
°C	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

9.1.9 Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm^2	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm^2	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

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9.2 Terms and Abbreviations

See chapter 2.5 "Standards and terminology" for information on the pertinent standards on which many terms are based. Some terms and abbreviations may have specific meanings with regard to the standards.

Axial forces Tension or compression forces acting longitudinally on the shaft

Size In the type code, the size is defined in terms of the flange size.

Length In the type code, the length is defined in terms of the number of stacks.

DOM (The **D**ate **o**f **m**anufacturing on the nameplate of the device is shown in the format DD.MM.YYYY for example 31.12.2006 (December 31, 2006).

Direction of rotation Rotation of the motor shaft in a positive or negative direction of rotation. Positive direction of rotation is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

EMC Electromagnetic compatibility

Encoder Sensor for detection of the angular position of a rotating component. Installed in a motor, the encoder shows the angular position of the rotor.

Error Discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition.

Fatal error In the case of fatal error, the product is no longer able to control the motor so that the power stage must be immediately disabled.

Fault Operating state of the drive caused as a result of a discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.

Fault reset A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active (transition from operating state "Fault" to state "Operation Enable").

Error class Classification of errors into groups. The different error classes allow for specific responses to faults, for example by severity.

PTC Resistor with positive temperature coefficient. Resistance value increases as the temperature rises.

Radial forces Forces that act radially on the shaft

Degree of protection The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).

Warning If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning is not an error and does not cause a transition of the operating state.

Centering collar Centering device at the motor flange that allows for accurate motor mounting.

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