Telemecanique

Technical documentation

BDH AC servomotor USA

Document # **30072-452-59**

a brand of Schneider Electric

Important information

The servomotors described in this document are products for general use built in accordance with good practice. Motor and drive controllers that are not specifically designed for safety functions must not be used when motor operation could result in danger to personnel. Dangerous movements cannot be ruled out while additional safety devices are not in place. For this reason, personnel must under no circumstances enter the dangerous area unless the appropriate additional safety devices have eliminated any danger to personnel. This is applicable for operation of the machine during production and for servicing and maintenance work on the motors and the machine. The design of the machine must provide for safety of personnel. The appropriate measures must also be taken to prevent equipment damage.

See also the section “Before You Begin”.

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

Subject to technical modifications.

All information in this document refers to technical characteristics and does not give guaranteed properties.

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

Contents

1 Introduction

1.1 Important Information

Before using the motor for the first time, read this User's Manual carefully.

Particular care must be taken to ensure that the instructions in Section 2 are followed.

Only personnel with the qualifications listed in Section 2.4 are authorized to work on the motor.

A copy of the User's Manual must always be available to personnel responsible for work on the motor.

The User's Manual helps you to use the motor correctly and safely, and to make use of its capabilities in line with regulations.

By complying with the User's Manual, you will help to avoid risks, reduce the cost of repairs and downtime and increase the service life and reliability of the system.

You must also comply with the rules and instructions concerning accident prevention and environmental protection that are in force in the country of use and the location in which the motor is installed.

1.2 Symbols, signs and methods of representation

This document uses the following symbols and signs:

Representation	Meaning
■	First level bullet point for lists
–	Second level bullet point for lists
▸	**Action symbol:** The text that follows this symbol indicates an action to be performed. Perform the actions in the order indicated.
✓	**Result symbol:** The text that follows this symbol indicates the result of an action.
Italics	Technical terms (parameters, for example) that appear in descriptive text are written in italics.
Serif font	Any program codes contained in this manual are printed in a serif font.
	Information symbol: After this symbol you will find useful information or tips on using the system.
	**Safety Alert symbol:** An exclamation point symbol in a safety message is the manual indicates potential personal injury hazard. Obey all safety messages introduced by this symbol to avoid possible injury or death

2 Before You Begin

This section contains the general instructions, to help minimize risk in the application and use of this equipment.

Practical information is given throughout the document where operation involves risk. This information contains a description of the possible hazards, and preventive measures to be implemented.

2.1 General

The motor use may cause serious physical injury and equipment damage, or even result in death, if:

- Work on the motor is not performed by specialists or specially trained personnel
- You modify or convert the motor inappropriately
- Following installation, startup or repair, you fail to test the protective measures that are used
- You fail to comply with the instructions and regulations

The motor must only be used in good condition, in accordance with the instructions and in full knowledge of the hazards involved and the rules to be followed.

The functional operation of the motor is also determined by the care taken during transport, storage, assembly, installation and maintenance.

If situations arise that could compromise safety or result in changes to performance during operation, the motor must be stopped immediately and personnel from the appropriate department informed.

In addition, ensure compliance with the following:

- The information on the labels, affixed to the motor, connected components and in the enclosure, indicating prohibited actions, compulsory actions or safety messages
- The applicable laws and regulations
- The user's manual for the other components
- The applicable local and national safety and accident prevention regulations

2.2 Hazard Categories and Special Symbols

The following symbols and special messages may appear in this manual or on the equipment to warn of potential hazards.

Depending on the seriousness of the hazard, the messages are divided into three 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.

2.3 Use in accordance with instructions

The motor is designed as a drive component for installation in a machine or for combination with other components to form a machine/plant. The motor may only be used under the installation and operating conditions described in this documentation. You must use the accessories and ancillary parts (components, cables, etc.) mentioned in the documentation. You must not use any foreign objects or components that are not explicitly approved by Schneider Electric.

Use as directed also means that you

- observe the operating manuals and other documentations (see appendix)
- observe the inspection and service instructions.

Do not use other than as directed

The operating conditions at the place where the device is used must be checked on the basis of the given technical data (performance information and ambient conditions) and observed.

The motor must only be started when you are certain that the machine or the installation in which the motor is mounted conforms, in its entirety, with the requirements of the machinery directive 98/37/EEC, NFPA79, NFPA70E or other applicable local codes.

It is also necessary to comply with the following standards, directives and instructions:

- DIN EN 60204 Machine: Electrical equipment of industrial machines
- DIN EN 292 parts 1 and 2 Machine:
  Basic concepts, general design principles
- DIN EN 50178 Electronic equipment used in power installations
- EMC directive 89/336/EEC
- In the United States, the NEC, NFPA79, NFPA70E and local codes.

2.4 Selection and qualifications of personnel

This manual is intended exclusively for qualified technical personnel who have an in-depth knowledge in the control systems field.

This manual is essentially intended for manufacturers and users in the machine manufacture and electrical engineering fields, as well as for maintenance and commissioning engineers.

Work on electrical equipment

Work on electrical equipment must only be performed by qualified electrical engineers or specially trained personnel, under the supervision and monitoring of an electrical engineer, in accordance with electrical engineering rules.

A qualified electrical engineer is a person who, by training, learning, experience and knowledge of the applicable regulations, is capable of:

- Evaluating the work assigned to him
- Identifying the potential hazard
- Taking the necessary measures to reduce hazards

2.5 Remaining risks

The motor is built in accordance with good practice. Some risks do however remain. These are risks linked to the fact that the motor operates with electrical voltages and currents and is capable of generating significant force under certain conditions.

2.5.1 Mounting and handling

⚠ WARNING

EQUIPMENT HANDLING HAZARD

- Use suitable installation and transport facilities and use them professionally. If necessary, use special tools.
- Use suitable Personal Protective Equipment (PPE) (e.g. safety glasses, shoes, protective gloves).
- Do not stay under suspended loads.
- Remove any leaking liquids from the floor immediately to avoid skidding.

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

2.5.2 Electrical risks

During the operation of electrical equipment, some parts are inevitably subject to hazardous voltages.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Observe the local codes and rules for working on high-voltage units.
- After installation, check the fixed connection of the ground conductor on all electric appliances according to the connection plan.
- Operation, even for short-term measuring and test purposes, is only permitted with a ground conductor firmly connected to all electric components. Otherwise a potential shock hazard may occur on the casing.
- Before accessing electric parts with voltages exceeding 30 Volts, disconnect the unit from mains or power supply and lock it out. Make sure that the motor is in stand still. After switching off, wait for at least 6 minutes before touching any components.
- Do not touch electrical connections of the components while the unit is powered up.
- Before applying power to the unit, cover all voltage carrying parts to prevent accidental contact.
- Provide for protection against indirect touching (DIN EN 50178 / 1998 section 5.3.2, NFPA70E or equivalent controlling standard).
- Be sure the power connector is covered (no possible contact to active parts) when motor is external driven.

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

⚠ DANGER

LEAKAGE CURRENT HAZARD

- The leakage current may be greater than 3.5 mA.
- Ground equipment according to all local and national codes.

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

2.5.3 Protection from touching hot surfaces

The casing of the motor may get hot following prolonged operation at high power levels. The motor must be mounted with adequate air circulation, and with protection against contact by operators or other persons while in operation.

⚠ WARNING

THERMAL HAZARD

- Mount in a location that will prevent contact by personnel. During operation the motor may get hot.

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

If your application involves operation at high power for extended periods, consider using a larger motor.

2.5.4 Hazardous movements

There can be different causes for potentially hazardous movements:

- mistakes in wiring or cable connection
- software errors
- inoperable components
- errors in measuring value and signal encoders
- operating mistakes

The monitoring functions in the driving components to a large extent rule out malfunction. For your protection, you must not rely on these functions alone. You should anticipate unexpected movement of the motor, which can vary depending on the kind of malfunction and the operating state. Point-of-operation protection must be ensured by additional measures external to the motor and machine. These are planned by the equipment manufacturer with regard to the specific circumstances of the equipment and after a Failure Modes and Effects Analysis (FMEA) and an overall risk analysis.

⚠ DANGER

HAZARDOUS MOVEMENTS

- Prevent access to all hazardous areas. Use safety fences, protective grilles, protective screens, light curtains or other point-of-operation protection.
- Ensure the safety devices are the correct size.
- Install the emergency stop switch in a location which is quick and easy to access. The operation of the emergency stop device must be checked before startup and during the periodic maintenance inspections.
- Install emergency stop circuits and/or use the "Power Removal" function so that they are in compliance with local and national codes.
- Before accessing the hazardous area, ensure that the motors are completely stopped and power is disconnected.
- During installation work, remove power at the main switch and lockout power switches according to local and national codes.
- The use of high frequency equipment, such as remote controls or radio transmitters/receivers, must be avoided in the vicinity of the equipment electronics and its power supply cables. If such equipment has to be used, check before the initial startup that, in their various positions, they do not cause unintended equipment operation in the system and the installation. If necessary, carry out a special EMC inspection.

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

3 Overview

3.1 General

Synchronized AC servomotors are machines with permanently synchronized magnetic fields, specially designed for position control with a high dynamic performance.

The low moment of inertia compared with other AC servomotors provides excellent acceleration values combined with a high overload capacity. It also reduces energy consumption and the heat loss that occurs in the motor.

The torque is determined by the stator winding supplied with a sinusoidal 3-phase current in relation to the magnetic field produced by the rotor magnets.

The generation of the 3-phase current system is closely connected with the position of the rotor in the servomotor.

3.2 Characteristics of the servomotors

BDH motors can be distinguished by the following characteristics:

- High operational reliability
- Low maintenance requirements
- Overload protection (by monitoring the motor temperature)
- High capacity data
- High dynamic performance
- High overload capacity
- Large torque margin
- Sinusoidal emf
- High voltage = low currents technique
- Low moment of inertia
- Motor connection and feedback system via angled connectors
- Quick, simple start-up (by electronic motor identification)

3.3 Options

Position sensor

- Resolver
- Singleturn SinCos encoder (standard)
- Multiturn SinCos encoder (option)

Holding brake

- Without brake (standard)
- With holding brake (option) to stop the axis in vertical position or when the axis is turned off

Shaft

- Smooth shaft (standard)
- Shaft with key (option)

Connection system

- Right-angled connectors

Mounting

- IEC
- NEMA

4 Transportation, storage, unpacking

4.1 Transportation

- Avoid jolts
- Avoid impacts, in particular on the shaft end
- If the packaging is damaged, check whether there is any visible damage to the motor. Inform the transport company and, if necessary, the manufacturer

4.2 Storage

- Store the equipment in a clean, dry location

Storage conditions:

- Air temperature between -25°C and +70°C
- Temperature variations maximum 20 K per hour
- Relative humidity between 5% and 95% without condensation

4.3 Unpacking

- Check whether the delivery is complete
- Check that the equipment has not suffered any damage during transport

Rating plate

The rating plate contains all the important information:

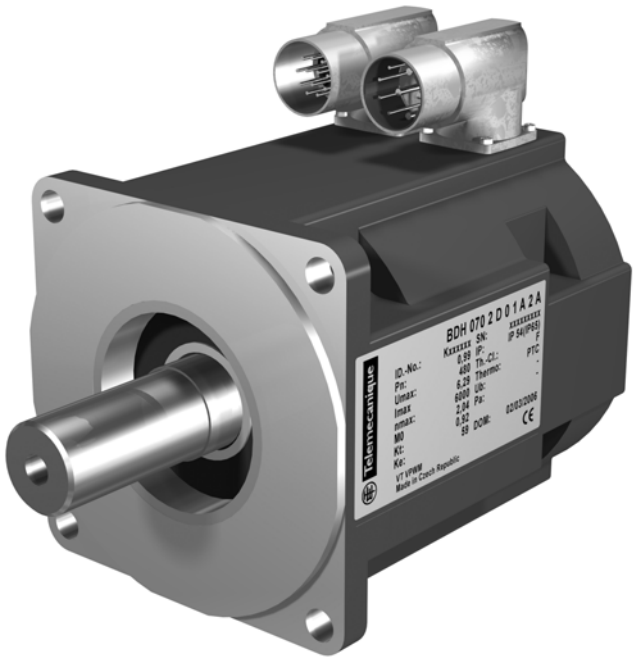


Illustration 4.1 Rating plate on the BDH motor

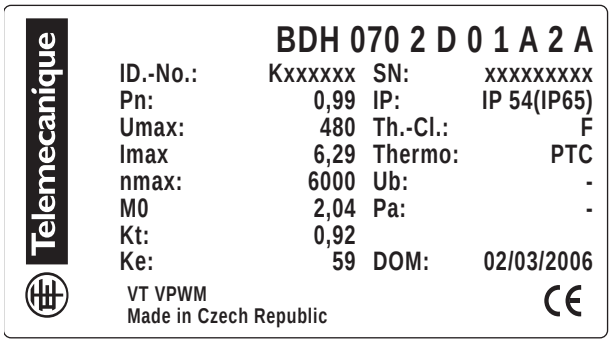


Illustration 4.2 Rating plate

	Meaning
BDH 070 2 D01 A2A	Type of motor, see key to types of motor
Machine number	
P_n	Nominal power
U_{max}	Converter voltage rms value
I_{max}	Current rms value
n_{max}	Maximum speed
M_0	Nominal standstill torque
K_t	Torque constant
K_e	Voltage constant
SN	Serial number
IP	Degree of protection
Th-Cl	Insulation class
Thermo	Thermal protection
U_{Br}	Brake – nominal voltage
P_{Br}	Brake – nominal power
DOM	Date of manufacture
VT	Variable torque
VPWM	Variable PWM
Exxxxxx ...	UL – file number
cUr	cUR mark
CE	CE mark

Table 4.1 Explanation of the rating plate

5 Maintenance

5.1 Replacing the device

To commission or exchange the motor, do not open the device. The warranty is voided when opening the motor.

In addition to the notes below, please observe the information from the machine manufacturer when exchanging the motor.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before servicing the motor or motor cables:
  - Disconnect all power, including external control power that may be present, before servicing the motor.
  - Place a "DO NOT TURN ON" label on all motor and power disconnects.
  - Lock all power disconnects in the open position.
- The motors must be stopped because life-threatening voltages can occur on the motor cables of servo motors in generator operation.
- Do not disconnect connector plugs while they are carrying voltage.
- Connect or disconnect main power cable to motor only when no voltage is present on unit and verify that the motor is at stop.

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

CAUTION

STATIC SENSITIVE COMPONENTS

- The control board can be damaged by static electricity. Observe the electrostatic precautions below when handling controller circuit boards or testing components.

Failure to follow these instructions can result in equipment damage.

Observe the following precautions when handling static sensitive components:

- Keep static producing material (plastic, upholstery, carpeting) out of the immediate work area.
- Store the control board in its protective packaging when it is not installed in the drive controller.
- When handling the control board, wear a conductive wrist strap connected to the control board through a minimum of one megaohm resistance.
- Avoid touching exposed conductors and component leads with skin or clothing.

Replacing the motor

NOTE

If motors were stored longer than 2 years, the holding brake has to be re-surfaced before you use it. See also " holding brake (option)" on page 6-28.

- ▸ Turn off the main switch.
- ▸ Protect the main switch against accidental operation.

CAUTION

IMPROPER MECHANICAL FORCE

- Do not apply impact load to motor shaft when removing or installing a coulpling to the motor shaft.
- Use suitable tools such as gear pullers, etc.

Failure to follow these instructions can result in damage to the encoder.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- When the encoder is used to define a reference point, exchanging the motor will lose the reference information. The reference point must be re-established, otherwise the movement will end at the wrong position.

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

- Exchange motor as described by the machine manufacturer.

Replacement of cables

- ▸ Turn off the main switch.
- ▸ Protect the main switch against accidental operation.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Connect or disconnect cables only when there is no voltage on the system.
- Connect cables only under clean and dry conditions.
- If locally assembled cables are used, ensure that all connections are correct and secure before using cables.

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

- Replace the cables in accordance with the machine manufacturer's instructions.

5.2 Cleaning

If installed correctly, the equipment requires virtually no maintenance.

CAUTION

LIQUID PENETRATION

- Do not clean motor with high pressure liquid cleaners.
- Follow the machine supplier’s directions for cleaning.
- Use cleaning methods suitable for the protection class of the motor (see table 6.4 on page 24 for protection ratings).

Failure to follow these instructions can result in damage to the motor.

5.3 EMC rules

Comply with the following EMC rules:

- It is essential to check that the motor casing is correctly grounded, i.e. to a point with the lowest impedance (for example, unpainted enclosure mounting plate).
- Ensure that the contact area is as large as possible (skin effect). If necessary, remove the coat of paint to ensure contact over a large area.
- The various connections must be grounded in a star configuration at a central grounding point. Looping of grounding conductors is not permitted as it can generate unnecessary disturbance.
- Use shielded cables only.
- The connection of shielding using the contact pins of the connectors is prohibited. Ensure that connector shells are correctly grounded and properly secured.
- The diagrams in the documentation MUST be adhered to.
- Motor connection cables must be as short as possible.
- Cable loops must not be used inside the enclosure.
- Keep the motor cables and control cables separate.

5.4 Start-up

Directions for the initial start-up:

Unpack and check

- Remove the packaging.
- Check that the equipment is in good condition. Only put undamaged equipment into operation.
- Check whether the delivery is complete.
- Compare the data using the rating plates.

See also section Transportation, storage, unpacking.

Mounting

- Comply with the requirements concerning siting.
- Comply with the requirements concerning the degree of protection and the EMC rules.
- Mount the equipment.

See also section Maintenance.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not operate the motor on corner grounded systems.
- Use only on system voltages not exceeding the motor rating.

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

CAUTION

IMPROPER CONNECTOR HANDLING

- Do not permanently move the connectors of the motor.
- Do not move the connectors of the motor more than five times.
- Do not handle or lift the motor by the connectors.

Failure to follow these instructions can result in connector damage.

Electric wiring

Before connecting the connectors:

- Check that the drive is turned off.
- Confirm voltage is absent using a properly rated voltage sensing device.
- Tighten the cap nut: tightening torque 2 N*m for the current connector and 2.5 N*m for the signal connector.
- Check the condition of the protective screen and eliminate any possibility of short circuits and interruptions.

See also section Technical characteristics and Maintenance.

Check these critical functions

- Check that the brake operates correctly (if there is a brake).
- When the motor is in service, at least once per year, check that the brake works correctly.

- Check the EMERGENCY STOP system, the EMERGENCY STOP limit switches and all point-of-operation protective equipment are operational per local codes and standards.

⚠ DANGER

IMPROPER MOUNTING ON KEYED SHAFT

- Do not operate the motor without fully equipped belt pulley
- Ensure that the shaft to collar connection is completely secured.

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

Continue to start up the installation

- Continue to start up the installation in accordance with the instructions (manufacturer of the packaging machine and the servodrive).

5.5 Configuration/programming/diagnostics

The motors are adjusted. The customer does not need to execute alignment.

To ensure good service life of the bearing, do not use the motor with angles of rotation less than 100 degrees or at constant very low speeds.

Please refer to the servodrive documentation for how to adapt the servodrives to the motors.

See also the servodrive documentation.

Diagnosis and monitoring of the operating states is carried out in the Telemecanique monitoring devices.
See the corresponding descriptions in the reference manual.

5.6 Order numbers

5.6.1 BDH servomotor

Telemecanique BDH servomotor product references

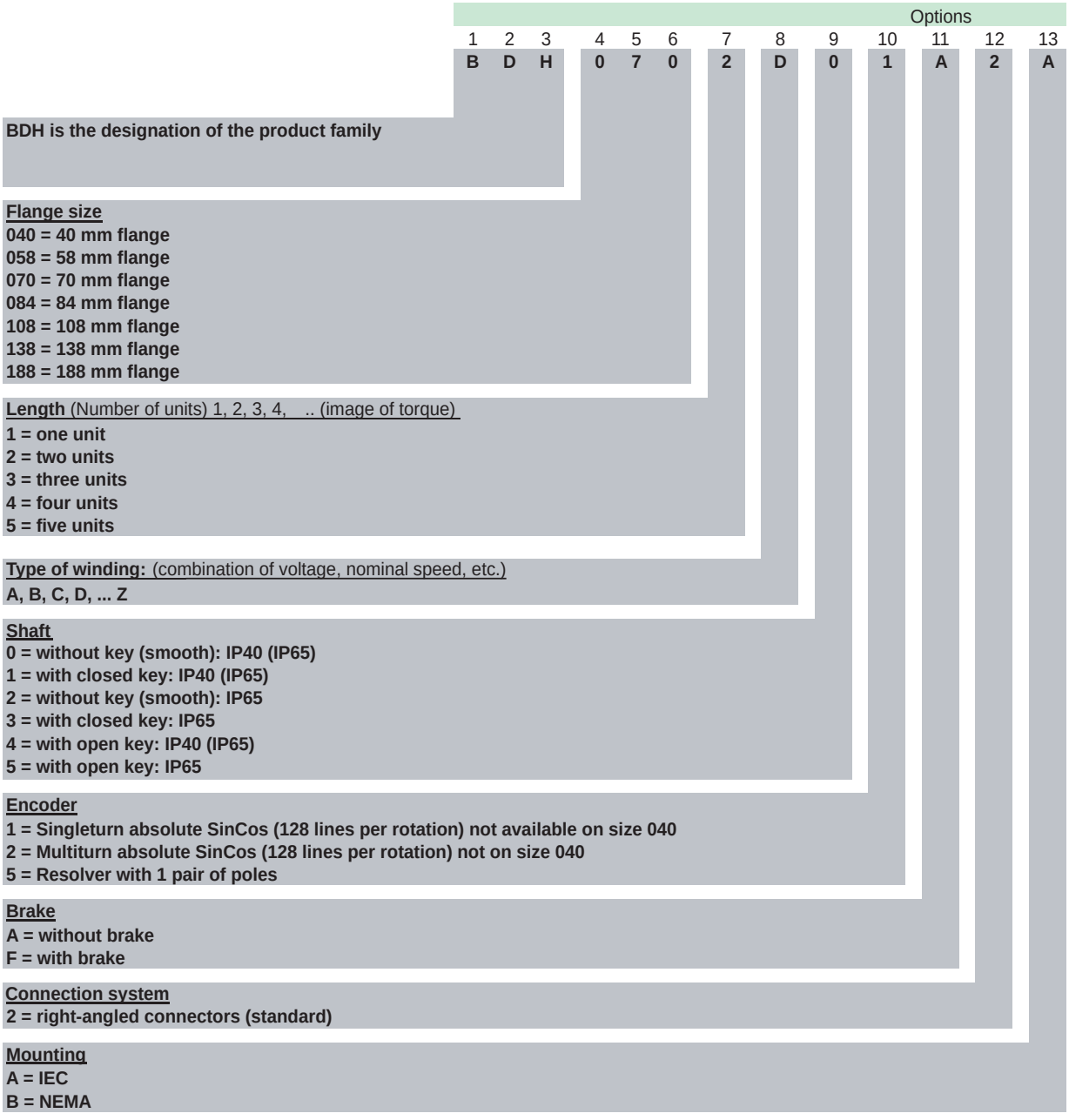


Illustration 5.1 BDH servomotor product code

6 Technical characteristics

6.1 General technical characteristics

Designation	Description
Motor type	Synchronous rotary servomotor with permanent excitation
Magnetic equipment	Neodymium-iron-boron (NdFeB)
Insulation system (according to DIN 57530)	Insulation class F (155°C)
Mounting position (according to DIN 42 950)	IM B5, IM V1, IM V3
Degree of protection (according to IEC 60529)	IP54 (IP67 with optional shaft seal)
Cooling	Self-cooling, nominal ambient temperature up to 40°C
Temperature monitoring	3-code posistor in the stator winding, switching temperature 155°C
Shaft end	Cylindrical shaft end according to DIN 748 without keyway (with keyway available as an option)
Concentric accuracy, coaxiality, axial run-out (according to DIN 42955)	Tolerance N (normal)
Vibration class (according to DIN ISO 2373)	Quality factor N
Measurement system	Resolver with 1 pair of poles SinCos® SKS 36 or SKM 36 (single or multiturn version with Hiperface® interface)
Connection system	Angled cylindrical connectors (IP67)

Table 6.1 General technical characteristics

6.1.1 Definitions and physical relationships

Abbrev.	Unit	Definition
I_0	[A_{rms}]	Motor standstill current Rms value of the motor current at standstill torque M_0
I_N	[A_{rms}]	Nominal motor current Rms value of the motor current at nominal torque M_N
$I_{max.}$	[A_{rms}]	Peak motor current Rms value of the motor current at peak torque M_{max}
J_M	[$kgcm^2$]	Moment of inertia of the rotor The moment of inertia of the rotor refers to a motor with resolver and without brake.
k_T	[Nm/A_{rms}]	Motor torque constant Quotient of the standstill torque M_0 divided by the standstill current I_0 (for a winding temperature of 120°C).
m	[kg]	Weight Weight of the motor without brake or fan
M_0	[Nm]	Motor standstill torque Permanent torque (ED 100%) at speed 5 rpm. At an ambient temperature of 40°C and a winding temperature limit of 80°C.
M_N	[Nm]	Motor nominal torque Permanent torque (ED 100%) at nominal speed n_N. Due to speed-related losses, it is less than M_0. At an ambient temperature of 40°C and a winding temperature limit of 80°C.
$M_{max.}$	[Nm]	Motor peak torque The max. torque that the servomotor can supply at its output for a short period.
n_N	[rpm]	Nominal motor speed Speed that can be used at nominal torque. The no-load speed and the mechanical rotation limit speed of the servomotor are higher.
P_N	[kW]	Nominal mechanical power Nominal mechanical power of the servomotor at nominal speed n_N and nominal torque M_N.
R_{U-V}	[Ω]	Motor winding resistance Resistance of a motor winding between 2 phases for a winding temperature of 20°C.
L_{U-V}	[mH]	Winding inductance between 2 phases
k_E	[V_{rms}/krpm]	Voltage constant
T_{TK}	[°C]	PTC probe switching point

Table 6.2 Definitions and physical relationships

6.1.2 Ambient conditions, approvals

Parameter	Characteristic value
Permissible ambient temperature from 0 to 1000 m above sea level	5 – 40°C for higher temperatures, reduce power by 1% per °C
Humidity of the air	95% relative humidity, without condensation
Insulation class	F
Approvals	UL/cUL/CE
When the motor is in use, ensure there is adequate heat dissipation. Reduce the power of the motor for thermally insulated mounting.	

Table 6.3 Ambient conditions, approvals

6.1.2.1 Reduced power for higher ambient temperature and/or lower atmospheric pressure

If the motors are operated outside the specified nominal characteristics, they can be damaged. The effects of the ambient temperature and the mounting height are described below.

Higher ambient temperature The maximum permissible ambient temperature for the BDH motor is 40°C. If the ambient temperature exceeds 40°C, the nominal power is reduced by 1% per °C.

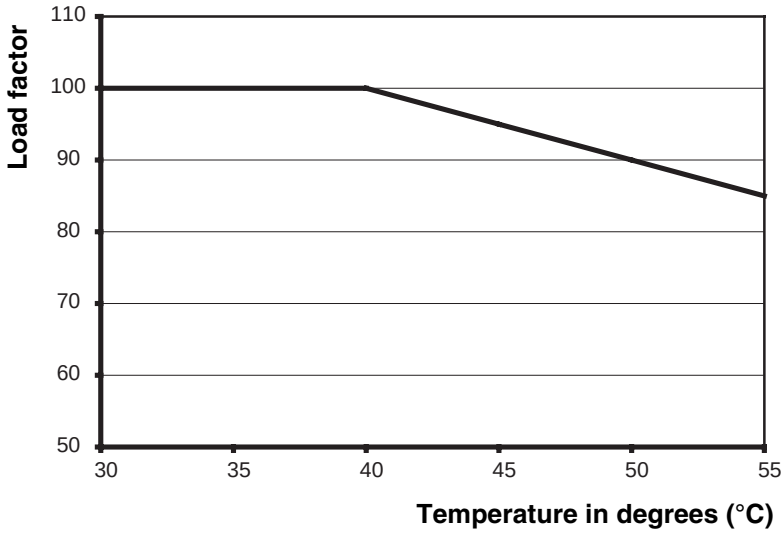


Illustration 6.1 Reduced power for high ambient temperatures

In the marginal range from 40°C to 55°C, the power characteristics must be multiplied by the load factor determined for the ambient temperature.

Low atmospheric pressure For installations located less than 1000 meters above sea level, no reduction in the power of the BDH motors is necessary. For installations located more than 1000 meters above sea level, the power characteristics are given in the diagram below.

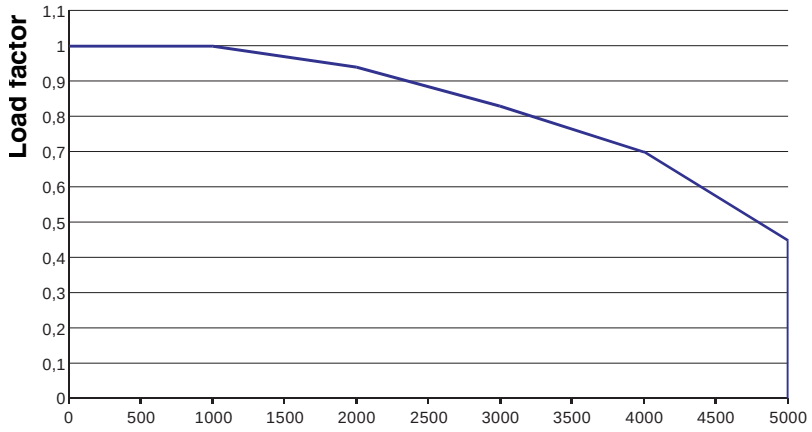


Illustration 6.2 Reduced power when installation height exceeded

In the range from 1000 to 3000 m, the power characteristics must be multiplied by the load factor determined for the height of the installation.

If the power is reduced as a result of these two parameters, the power values must be multiplied by both load factors.

6.1.3 DIN 42950 Part 1 Motor Mounting Protection

The degree of protection of the BDH motor depends on its mounting position.

For all types of motor, the mounting flange is made in such a way that B05 mounting (flange with through holes) is possible.

According to DIN 42950 part 1 (ed. 08.77) motors can be mounted on the machine as follows :

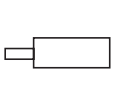
Structural shape	Permissible mounting positions according to DIN 42950		
B05	 IM B5	 IM V1	 IM V3

Illustration 6.3 Mounting positions for motor

CAUTION
INCORRECT MOUNTING POSITION • Remove any liquid from motor shaft after mounting motor in IM V3 position. • Prevent liquid from entering motor casing when motor is mounted in IM V3 position. **Failure to follow these instructions can result in motor damage.**

Motor part	Degree of protection	Mounting position
Shaft	IP 54 IP 67 (with optional shaft seal)	IM B5, IM V1, IM V3 IM B5, IM V1, IM V3
Surface/connectors	IP 65	

Table 6.4 Protection of BDH motors

6.1.4 Motor shaft and bearings

6.1.4.1 Design of the shaft end

Smooth shaft end (standard) In the case of drive by clamping, the torque must be transmitted by surface pressure only. Force is thus transmitted with no play.

Shaft end with round end key according to DIN 6885 Drives with key are form-fitted. As a result of continuous stress caused by variations in torque or a significant amount of reverse operation, the housing of the round end key can be moved out of line. This results in a reduction in the concentricity (play occurs!). Increasing deformation can break the round end key and lead to damage of the shaft. Shaft-hub connection is only suitable for minimum requirements. We therefore recommend the use of smooth shaft ends.

6.1.4.2 Bearings

The ball bearings on BDH motors have a a typical service life of 20,000 hours under nominal conditions. Your actual service life may vary.

- Every 2,500 hours of operation or at least once per year, check whether the motor emits ball bearing noises. If you hear any noise, do not continue operating the motor: the ball bearings must be replaced.

6.1.4.3 Permissible load on shaft

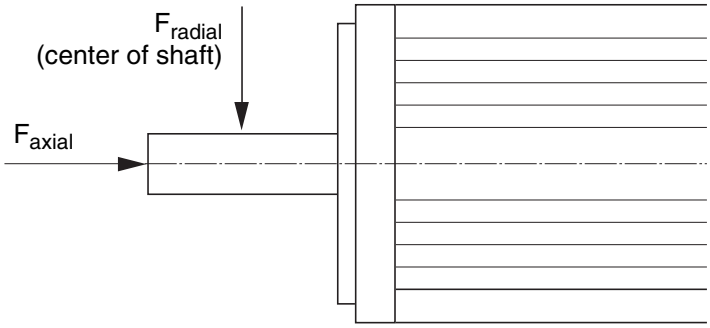


Figure 6.4 Definition of the load on the shaft

Motor	1000 rpm	2000 rpm	3000 rpm	4000 rpm	5000 rpm	6000 rpm	7000 rpm	8000 rpm
BDH 040	46	43	40	37	33	30	27	23
BDH 058	138	137	135	133	132	130	128	127
BDH 070	300	240	200	180	165	150	-	-
BDH 084	460	430	400	370	340	310	-	-
BDH 108	425	400	375	350	325	300	-	-
BDH 138	1200	900	775	700	650	600	-	-
BDH 188	1400	1100	800	-	-	-	-	-

Table 6.5 Permissible radial force F_{radial} [N]

Basis of calculation:

20,000 hours' operation as nominal service life of bearing L_{10h} for a smooth shaft.

Permissible axial force F_{axial} [N]

$$F_{axial} = \frac{1}{3} \times F_{radial}$$

6.1.5 Resolver

Parameter	Characteristic value	Unit
Maximum mechanical speed	20,000	rpm
Excitation voltage	7 (± 10%)	Vrms
Excitation frequency	1 (± 5%)	kHz
Max. excitation current	30	mA
Accuracy	< ±30	arcminutes
Number of poles	2	
Transformation ratio	0.5 (±10%)	
Thermal operating range	-55 … +155	°C

Table 6.6 Resolver

6.1.6 Encoders

6.1.6.1 Singleturn SinCos (SKS36)

Parameter	Characteristic value	Unit
Resolution	Depends on controller	
Number of revolutions	1	
"Singleturn" absolute measurement period	1	revolution
Numerical absolute value tolerance limits depending on controller	+/-5.3	angular minutes
Precision of evaluation of incremental position	+/-1.3	angular minutes
Pulse shape	sinusoidal	
Supply voltage	7 ... 12	V
Recommended supply voltage	8	V
Supply current	60 max. (without load)	mA

Table 6.7 Technical characteristics of the SinCos (SKS) encoder

6.1.6.2 Multiturn SinCos (SKM36)

Parameter	Characteristic value	Unit
Resolution	Depends on controller	
Number of revolutions	4096	
"Multiturn" absolute measurement period	1	revolution
Numerical absolute value tolerance limits depending on controller	+/-5.3	angular minutes
Precision of evaluation of incremental position	+/-1.3	angular minutes
Pulse shape	sinusoidal	
Supply voltage	7 ... 12	V
Recommended supply voltage	8	V
Supply current	60 max. (without load)	mA

Table 6.8 Technical characteristics of the SinCos (SKM) encoder

6.1.7 Holding brake (available as an option)

The servomotors can be supplied with an integrated holding brake. This brake keeps the axis stationary when the installation is stopped. Applying a 24 V ⎓ voltage releases the brake and inhibits the holding effect by replacing the magnetic field, generated by the permanent magnet, with an induced magnetic field.

The brake is released, with no residual torque and independently of the mounting position, by a steel spring. In addition to frictionless axial movement of the armature, the spring also ensures the braking torque is transmitted with no play.

Before performing any installation, check the operation of the holding brake, if there is one (apply 24 V ⎓, the brake should be released).

⚠ WARNING

UNINTENDED EQUIPMENT MOVEMENT

- Do not rely only on the holding brake to ensure personnel protection.
- For personnel protection, provide additional measures such as a protective grid or a mechanical brake in addition to the holding brake.

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

⚠ WARNING

IMPROPER USE OF HOLDING BRAKE

- Check that the system is fitted with the correct brake control device:
  - Lexium 05: external braking device VW3 M3103 (see catalog)
  - Lexium 15: device incorporated in the drive, this device does not guarantee the safety of personnel
- Only use the holding brake when the axis is at a standstill.
- The holding brake should not be used for stopping purposes, except for possible use in emergency stop situations.
- Activation of the holding brake in emergency stop situations requires a normally open contact in the brake circuit and a demagnetization device (for example, a varistor) for the brake. (See Lexium 15 installation manual)

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

In normal operation, motors must not be used with the brake engaged. An emergency stop of the motor (where the brake is activated when the motor is operating) is allowed in exceptional circumstances if the following conditions are met:

- The time from connection of the current through to reduction of the torque to 10% of the nominal torque is considered as the *release time*.
- The time from stopping of the current through to nominal torque being reached is considered as the *engage time*.

Note:

The times are applicable for DC connection, and at nominal operating temperature and voltage.

Note:

The BDH 040 servomotor does not have the optional brake.

The holding brake is sized differently depending on the motor series:

	BDH 058 xxxx Fxx	Unit
Holding torque	1.42	[Nm]
Engage time	18	[ms]
Release time	20	[ms]
Weight	0.27	[kg]
Moment of inertia	0.011	[kgcm²]
Nominal power	8.4	[W]
Nominal voltage	24 +/-10%	[V] DC

Table 6.9 Technical characteristics of the BDH 058 motor holding brake

	BDH 070 xxxx Fxx	Unit
Holding torque	2.5	[Nm]
Engage time	10	[ms]
Release time	25	[ms]
Weight	0.35	[kg]
Moment of inertia	0.011	[kgcm²]
Nominal power	10.1	[W]
Nominal voltage	24 +/-10%	[V] DC

Table 6.10 Technical characteristics of the BDH 070 motor holding brake

	BDH 084 xxxx Fxx	Unit
Holding torque	6	[Nm]
Engage time	15	[ms]
Release time	35	[ms]
Weight	0.63	[kg]
Moment of inertia	0.068	[kgcm²]
Nominal power	12.8	[W]
Nominal voltage	24 +/-10%	[V] DC

Table 6.11 Technical characteristics of the BDH 084 motor holding brake

	BDH 108 xxxx Fxx	Unit
Holding torque	14.5	[Nm]
Engage time	15	[ms]
Release time	80	[ms]
Weight	1.1	[kg]
Moment of inertia	0.173	[kgcm²]
Nominal power	19.5	[W]
Nominal voltage	24 +/-10%	[V] DC

Table 6.12 Technical characteristics of the BDH 108 motor holding brake

	BDH 138 xxxx Fxx	Unit
Holding torque	25	[Nm]
Engage time	20	[ms]
Release time	105	[ms]
Weight	2	[kg]
Moment of inertia	0.61	[kgcm²]
Nominal power	25.7	[W]
Nominal voltage	24 +/-10%	[V] DC

Table 6.13 Technical characteristics of the BDH 138 motor holding brake

	BDH 188 xxxx Fxx	Unit
Holding torque	53	[Nm]
Engage time	35	[ms]
Release time	110	[ms]
Weight	2.1	[kg]
Moment of inertia	1.64	[kgcm²]
Nominal power	35.6	[W]
Nominal voltage	24 +/-10%	[V] DC

Table 6.14 Technical characteristics of the BDH 188 motor holding brake

6.1.7.1 Running in the holding brake

If the motors are equipped with a holding brake and were already stored for more than 2 years before the assembly, the holding brake has to be ground in before use.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only grind in the holding brake when the system is fully assembled.
- Rotating the motor can induce high voltages on the terminals. Ensure that the terminals cannot be touched during the grinding operation.

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

- ▸ In addition turn the motor by hand for approx. 50 revolutions in the closed state of the holding brake.
- ✓ The holding brake is now ready for use.

6.1.8 Detailed technical characteristics

Reference data	Abbrev. [Unit]	BDH 040 1	BDH 040 2	BDH 040 3
		B	C	C
General technical characteristics				
Standstill torque	M_0 [Nm]	0.18	0.31	0.41
Peak torque	M_{max} [Nm]	0.61	1.08	1.46
Supply voltage U_N = 115 V				
Nominal speed	n_N [rpm]	4000	4000	3000
Nominal torque	M_N [Nm]	0.18	0.3	0.41
Nominal power	P_N [kW]	0.08	0.13	0.13
Supply voltage U_N = 230 V				
Nominal speed	n_N [rpm]	8000	8000	8000
Nominal torque	M_N [Nm]	0.17	0.28	0.36
Nominal power	P_N [kW]	0.14	0.23	0.3
Supply voltage U_N = 400 V				
Nominal speed	n_N [rpm]	-	-	-
Nominal torque	M_N [Nm]	-	-	-
Nominal power	P_N [kW]	-	-	-
Supply voltage U_N = 480 V				
Nominal speed	n_N [rpm]	-	-	-
Nominal torque	M_N [Nm]	-	-	-
Nominal power	P_N [kW]	-	-	-
Technical characteristics – Electrical data				
Number of poles	p	6	6	6
Connection of windings		Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	0.16	0.21	0.28
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	20.2	12.4	13.5
Winding inductance Ph-Ph	L_{U-V} [mH]	12.5	9.1	10.3
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	10.2	13.3	17.9
Standstill current	I_0 [A_{rms}]	1.16	1.51	1.58
Nominal current	I_N [A_{rms}]	1.12	1.48	1.46
Max. current	I_{max} [A_{rms}]	4.65	6.06	5.93
Technical characteristics – Mechanical data				
Moment of inertia of the rotor	J_M [kgcm²]	0.017	0.031	0.045
Weight	m [kg]	0.35	0.49	0.63
Technical characteristics – Thermal data				
Switching point of motor PTC	T_{TK} [°C]	155	155	155

Table 6.15 BDH 040 technical characteristics

Reference data	Abbrev. [Unit]	BDH 058 2		BDH 058 3			BDH 058 4		
		C	E	C	D	F	C	D	F
General technical characteristics									
Standstill torque	M_0 [Nm]	0.84	0.87	1.13	1.16	1.18	1.38	1.41	1.42
Peak torque	M_{max} [Nm]	2.73	2.76	3.77	3.84	3.88	4.73	4.76	4.82
Supply voltage U_N = 115 V									
Nominal speed	n_N [rpm]	1000	3500	1000	1500	4500	-	1500	3000
Nominal torque	M_N [Nm]	0.83	0.81	1.11	1.12	1.07	-	1.36	1.33
Nominal power	P_N [kW]	0.09	0.3	0.12	0.18	0.5	-	0.21	0.42
Supply voltage U_N = 230 V									
Nominal speed	n_N [rpm]	3500	8000	2500	5000	8000	2000	4000	8000
Nominal torque	M_N [Nm]	0.78	0.7	1.08	1.03	0.94	1.32	1.29	1.12
Nominal power	P_N [kW]	0.29	0.59	0.28	0.54	0.79	0.28	0.54	0.94
Supply voltage U_N = 400 V									
Nominal speed	n_N [rpm]	8000	-	5500	8000	-	4500	8000	-
Nominal torque	M_N [Nm]	0.68	-	0.99	0.92	-	1.25	1.11	-
Nominal power	P_N [kW]	0.57	-	0.57	0.77	-	0.59	0.93	-
Supply voltage U_N = 480 V									
Nominal speed	n_N [rpm]	8000	-	7000	8000	-	5500	8000	-
Nominal torque	M_N [Nm]	0.68	-	0.95	0.92	-	1.22	1.11	-
Nominal power	P_N [kW]	0.57	-	0.7	0.77	-	0.7	0.93	-
Technical characteristics – Electrical data									
Number of poles	p	6	6	6	6	6	6	6	6
Connection of windings		Y	Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	0.61	0.32	0.8	0.52	0.27	0.97	0.63	0.36
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	19.4	5.09	20.3	8.36	2.23	20.4	8.4	2.77
Winding inductance Ph-Ph	L_{U-V} [mH]	35.5	9.7	40.7	17.3	4.68	43.8	18.7	6.16
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	39	20.4	51.8	33.8	17.6	62.4	40.8	23.4
Standstill current	I_0 [A_{rms}]	1.39	2.73	1.41	2.19	4.31	1.42	2.21	3.89
Nominal current	I_N [A_{rms}]	1.38	2.72	1.41	2.23	4.37	1.42	2.24	3.94
Max. current	I_{max} [A_{rms}]	5.6	10.9	5.6	8.8	17.2	5.7	8.8	15.6
Technical characteristics – Mechanical data									
Moment of inertia of the rotor	J_M [kgcm²]	0.16		0.22			0.27		
Weight	m [kg]	1.1		1.38			1.66		
Technical characteristics – Thermal data									
Switching point of motor PTC	T_{TK} [°C]	155		155			155		

Table 6.16 BDH 058 technical characteristics

Reference data	Abbrev. [Unit]	BDH 070 1		BDH 070 2			BDH 070 3		
		C	E	C	D	H	C	E	H
General technical characteristics									
Standstill torque	M_0 [Nm]	1.15	1.2	2	2.04	2.1	2.71	2.79	2.88
Peak torque	M_{max} [Nm]	3.88	4	6.92	7.05	7.26	9.76	9.96	10.2
Supply voltage U_N = 115 V									
Nominal speed	n_N [rpm]	-	2500	-	1000	3000	-	-	2500
Nominal torque	M_N [Nm]	-	1.17	-	2	1.96	-	-	2.66
Nominal power	P_N [kW]	-	0.31	-	0.21	0.62	-	-	0.7
Supply voltage U_N = 230 V									
Nominal speed	n_N [rpm]	2500	6000	1500	2500	7000	1000	2000	5500
Nominal torque	M_N [Nm]	1.12	0.95	1.95	1.93	1.45	2.64	2.62	2.27
Nominal power	P_N [kW]	0.29	0.6	0.31	0.51	1.06	0.28	0.55	1.31
Supply voltage U_N = 400 V									
Nominal speed	n_N [rpm]	5000	-	3000	5500	-	2000	4500	-
Nominal torque	M_N [Nm]	1	-	1.86	1.65	-	2.54	2.34	-
Nominal power	P_N [kW]	0.52	-	0.58	0.95	-	0.53	1.1	-
Supply voltage U_N = 480 V									
Nominal speed	n_N [rpm]	6000	-	3500	6000	-	2500	5000	-
Nominal torque	M_N [Nm]	0.91	-	1.83	1.58	-	2.5	2.27	-
Nominal power	P_N [kW]	0.57	-	0.67	0.99	-	0.65	1.19	-
Technical characteristics – Electrical data									
Number of poles	p	8	8	8	8	8	8	8	8
Connection of windings		Y	Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	0.85	0.41	1.4	0.92	0.39	1.86	1.1	0.52
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	21.4	4.58	23.0	9.57	1.64	25.4	8.36	1.82
Winding inductance Ph-Ph	L_{U-V} [mH]	37.5	8.6	46.5	20.1	3.55	53.6	18.5	4.1
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	54.5	26.1	89.8	59	24.8	120	70.6	33.4
Standstill current	I_0 [A_{rms}]	1.37	2.99	1.44	2.23	5.5	1.47	2.58	5.62
Nominal current	I_N [A_{rms}]	1.35	2.93	1.43	2.22	5.38	1.46	2.54	5.54
Max. current	I_{max} [A_{rms}]	5.50	12.00	5.70	8.90	22.00	5.90	10.30	22.50
Technical characteristics – Mechanical data									
Moment of inertia of the rotor	J_M [kgcm²]	0.33		0.59			0.85		
Weight	m [kg]	1.55		2.23			2.9		
Technical characteristics – Thermal data									
Switching point of motor PTC	T_{TK} [°C]	155		155			155		

Table 6.17 BDH 070 technical characteristics

Reference data	Abbrev. [Unit]	BDH 084 1			BDH 084 2				BDH 084 3			BDH 084 4		
		C	E	H	C	E	G	J	E	G	K	E	G	J
General technical characteristics														
Standstill torque	M_0 [Nm]	1.95	2.02	2.06	3.35	3.42	3.53	3.56	4.7	4.8	4.9	5.76	5.88	6.00
Peak torque	M_{max} [Nm]	6.12	6.28	6.36	11.1	11.3	11.5	11.6	15.9	16.1	16.3	19.9	20.2	20.4
Supply voltage U_N = 115 V														
Nominal speed	n_N [rpm]	-	1200	3000	-	-	-	3000	-	-	2500	-	-	-
Nominal torque	M_N [Nm]	-	1.94	1.86	-	-	-	3.03	-	-	4.08	-	-	-
Nominal power	P_N [kW]	-	0.24	0.58	-	-	-	0.95	-	-	1.07	-	-	-
Supply voltage U_N = 230 V														
Nominal speed	n_N [rpm]	1200	3000	6000	-	1800	3500	6000	1500	2500	6000	1200	2000	4000
Nominal torque	M_N [Nm]	1.88	1.82	1.62	-	3.12	2.9	2.38	4.24	4.00	2.62	5.22	4.9	3.84
Nominal power	P_N [kW]	0.24	0.57	1.02	-	0.59	1.06	1.5	0.67	1.05	1.65	0.66	1.03	1.61
Supply voltage U_N = 400 V														
Nominal speed	n_N [rpm]	3000	6000	-	1500	3500	6000	-	2500	5000	-	2000	4000	6000
Nominal torque	M_N [Nm]	1.77	1.58	-	3.1	2.81	2.35	-	3.92	3.01	-	4.8	3.76	2.75
Nominal power	P_N [kW]	0.56	0.99	-	0.49	1.03	1.48	-	1.03	1.58	-	1.01	1.57	1.73
Supply voltage U_N = 480 V														
Nominal speed	n_N [rpm]	3500	6000	-	2000	4000	6000	-	3000	6000	-	2500	5000	6000
Nominal torque	M_N [Nm]	1.74	1.58	-	3.02	2.72	2.35	-	3.76	2.57	-	4.56	3.19	2.75
Nominal power	P_N [kW]	0.64	0.99	-	0.63	1.14	1.48	-	1.18	1.61	-	1.19	1.67	1.73
Technical characteristics – electrical data														
Number of poles	p	10	10	10	10	10	10	10	10	10	10	10	10	10
Connection of windings		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	1.34	0.71	0.37	2.4	1.26	0.74	0.43	1.72	0.99	0.52	2.04	1.19	0.69
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	21.7	5.7	1.51	27.5	7.22	2.38	0.8	8.04	2.61	0.7	8.08	2.65	0.88
Winding inductance Ph-Ph	L_{U-V} [mH]	66.1	18.4	5.00	97.4	26.8	9.2	3.1	32.6	10.8	2.9	33.9	11.5	3.8
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	86.3	45.6	23.7	154	80.9	47.5	27.5	111	63.9	33.2	132	76.6	44.2
Standstill current	I_0 [A_{rms}]	1.46	2.85	5.6	1.4	2.74	4.8	8.4	2.76	4.87	9.6	2.9	5.00	8.8
Nominal current	I_N [A_{rms}]	1.46	2.85	5.57	1.40	2.71	4.77	8.28	2.73	4.85	9.42	2.82	4.94	8.70
Max. current	I_{max} [A_{rms}]	5.8	11.4	22.4	5.61	11.0	19.2	33.7	11.0	19.5	38.3	11.4	20.0	35.2
Technical characteristics – mechanical data														
Moment of inertia of the rotor	J_M [kgcm²]	0.81			1.5				2.1			2.7		
Weight	m [kg]	2.44			3.39				4.35			5.3		
Technical characteristics – thermal data														
Switching point of motor PTC	T_{TK} [°C]	155			155				155			155		

Table 6.18 BDH 084 technical characteristics

Reference data	Abbrev. [Unit]	BDH 108 1			BDH 108 2			
		E	G	K	E	G	K	M
General technical characteristics								
Standstill torque	M_0 [Nm]	4.70	4.75	4.9	8.34	8.43	8.60	8.60
Peak torque	M_{max} [Nm]	11.6	11.7	12.0	21.3	21.5	21.9	21.9
Supply voltage U_N = 115 V								
Nominal speed	n_N [rpm]	-	-	2500	-	-	-	-
Nominal torque	M_N [Nm]	-	-	4.15	-	-	-	-
Nominal power	P_N [kW]	-	-	1.09	-	-	-	-
Supply voltage U_N = 230 V								
Nominal speed	n_N [rpm]	1200	2500	5500	-	1500	3000	4500
Nominal torque	M_N [Nm]	4.41	4.02	2.35	-	7.69	6.8	5.2
Nominal power	P_N [kW]	0.55	1.05	1.35	-	1.21	2.14	2.45
Supply voltage U_N = 400 V								
Nominal speed	n_N [rpm]	2500	5000	-	1500	2500	5500	-
Nominal torque	M_N [Nm]	3.98	2.62	-	7.61	7.06	3.90	-
Nominal power	P_N [kW]	1.04	1.37	-	1.20	1.85	2.25	-
Supply voltage U_N = 480 V								
Nominal speed	n_N [rpm]	3000	6000	-	2000	3000	6000	-
Nominal torque	M_N [Nm]	3.8	1.94	-	7.28	6.66	3.25	-
Nominal power	P_N [kW]	1.19	1.22	-	1.52	2.09	2.04	-
Technical characteristics – Electrical data								
Number of poles	p	10	10	10	10	10	10	10
Connection of windings		Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	1.72	0.99	0.52	2.79	1.79	0.93	0.66
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	8.47	2.75	0.75	8.59	3.47	0.93	0.48
Winding inductance Ph-Ph	L_{U-V} [mH]	36.6	12.1	3.4	44.7	18.5	5	2.5
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	110	63.6	33.5	179	115	60.1	42.4
Standstill current	I_0 [A_{rms}]	2.75	4.84	9.4	2.99	4.72	9.3	13.1
Nominal current	I_N [A_{rms}]	2.73	4.80	9.42	2.99	4.71	9.25	13.03
Max. current	I_{max} [A_{rms}]	8.24	14.50	28.30	9.00	14.20	27.80	39.40
Technical characteristics – Mechanical data								
Moment of inertia of the rotor	J_M [kgcm²]	3.4			6.2			
Weight	m [kg]	4.2			5.8			
Technical characteristics – Thermal data								
Switching point of motor PTC	T_{TK} [°C]	155			155			

Table 6.19 BDH 108 1 and 108 2 technical characteristics

Reference data	Abbrev. [Unit]	BDH 108 3				BDH 108 4			
		G	K	M	P	G	K	L	N
General technical characteristics									
Standstill torque	M_0 [Nm]	11.4	11.6	11.4	11.4	14.3	14.4	14.1	14.1
Peak torque	M_{max} [Nm]	29.7	30.1	29.8	29.8	37.8	38.4	37.5	37.6
Supply voltage U_N = 115 V									
Nominal speed	n_N [rpm]	-	-	-	-	-	-	-	-
Nominal torque	M_N [Nm]	-	-	-	-	-	-	-	-
Nominal power	P_N [kW]	-	-	-	-	-	-	-	-
Supply voltage U_N = 230 V									
Nominal speed	n_N [rpm]	1000	2000	3000	5000	-	1800	2500	3500
Nominal torque	M_N [Nm]	10.7	10.1	8.72	5.88	-	12.7	11.5	9.85
Nominal power	P_N [kW]	1.12	2.12	2.74	3.08	-	2.39	3.00	3.61
Supply voltage U_N = 400 V									
Nominal speed	n_N [rpm]	2000	4000	-	-	1500	3500	4500	-
Nominal torque	M_N [Nm]	9.85	7.65	-	-	12.9	10	8.13	-
Nominal power	P_N [kW]	2.06	3.20	-	-	2.03	3.68	3.83	-
Supply voltage U_N = 480 V									
Nominal speed	n_N [rpm]	2400	4500	-	-	2000	4000	-	-
Nominal torque	M_N [Nm]	9.50	6.85	-	-	12.3	9.25	-	-
Nominal power	P_N [kW]	2.39	3.23	-	-	2.57	3.87	-	-
Technical characteristics – Electrical data									
Number of poles	p	10	10	10	10	10	10	10	10
Connection of windings		Y	Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	2.39	1.24	0.85	0.60	2.88	1.50	1.13	0.80
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	3.75	1.00	0.51	0.27	3.80	1.02	0.63	0.33
Winding inductance Ph-Ph	L_{U-V} [mH]	21.3	5.70	2.70	1.30	22.9	6.20	3.50	1.80
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	154	79.8	54.7	38.4	185	96.6	72.9	51.3
Standstill current	I_0 [A_{rms}]	4.77	9.4	13.4	19.1	5.00	9.7	12.5	17.8
Nominal current	I_N [A_{rms}]	4.77	9.35	13.41	19.00	4.97	9.60	12.48	17.63
Max. current	I_{max} [A_{rms}]	14.3	28.1	40.3	57.4	14.9	29.2	37.5	53.4
Technical characteristics – Mechanical data									
Moment of inertia of the rotor	J_M [kgcm²]	9.1				12			
Weight	m [kg]	7.4				9			
Technical characteristics – Thermal data									
Switching point of motor PTC	T_{TK} [°C]	155				155			

Table 6.20 BDH 108 3 and 108 4 technical characteristics

Reference data	Abbrev. [Unit]	BDH 138 2				BDH 138 3			
		G	K	M	P	G	K	M	N
General technical characteristics									
Standstill torque	M_0 [Nm]	11.9	12.2	12.2	12.3	16.5	16.8	17.0	17.0
Peak torque	M_{max} [Nm]	29.8	30.1	30.2	30.4	41.8	42.6	43.0	43.0
Supply voltage U_N = 115 V									
Nominal speed	n_N [rpm]	-	-	-	-	-	-	-	-
Nominal torque	M_N [Nm]	-	-	-	-	-	-	-	-
Nominal power	P_N [kW]	-	-	-	-	-	-	-	-
Supply voltage U_N = 230 V									
Nominal speed	n_N [rpm]	-	2000	3000	4500	-	1500	2000	3000
Nominal torque	M_N [Nm]	-	10.4	9.50	8.10	-	14.9	14.3	13.0
Nominal power	P_N [kW]	-	2.18	2.98	3.82	-	2.34	2.99	4.08
Supply voltage U_N = 400 V									
Nominal speed	n_N [rpm]	1800	3500	6000	-	1200	3000	4000	5000
Nominal torque	M_N [Nm]	10.4	9.00	5.70	-	14.9	12.9	11.3	9.60
Nominal power	P_N [kW]	1.96	3.3	3.58	-	1.87	4.05	4.73	5.03
Supply voltage U_N = 480 V									
Nominal speed	n_N [rpm]	2000	4500	6000	-	1500	3500	4500	6000
Nominal torque	M_N [Nm]	10.2	8.00	5.70	-	14.6	12.0	10.5	7.00
Nominal power	P_N [kW]	2.14	3.77	3.58	-	2.29	4.40	4.95	4.40
Technical characteristics – Electrical data									
Number of poles	p	10	10	10	10	10	10	10	10
Connection of windings		Y	Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	2.47	1.28	0.91	0.66	3.70	1.71	1.24	0.98
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	3.94	1.05	0.55	0.30	5.16	1.09	0.58	0.38
Winding inductance Ph-Ph	L_{U-V} [mH]	31.7	8.5	4.4	2.2	43.5	9.3	4.9	3.1
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	159	82.1	58.8	42.2	238	110	79.9	63.3
Standstill current	I_0 [A_{rms}]	4.9	9.6	13.4	18.8	4.5	9.9	13.8	17.4
Nominal current	I_N [A_{rms}]	4.82	9.53	13.41	18.64	4.46	9.82	13.71	17.35
Max. current	I_{max} [A_{rms}]	14.6	28.7	40.3	56.5	13.4	29.7	41.4	52.2
Technical characteristics – Mechanical data									
Moment of inertia of the rotor	J_M [kgcm²]	17				24			
Weight	m [kg]	8.9				11.1			
Technical characteristics – Thermal data									
Switching point of motor PTC	T_{TK} [°C]	155				155			

Table 6.21 BDH 138 2 and 138 3 technical characteristics

Reference data	Abbrev. [Unit]	BDH 138 4			BDH 138 5		
		K	L	P	K	M	N
General technical characteristics							
Standstill torque	M_0 [Nm]	20.8	21.0	20.4	24.8	25.0	24.3
Peak torque	M_{max} [Nm]	53.5	54.1	52.9	64.5	65.2	63.7
Supply voltage U_N = 115 V							
Nominal speed	n_N [rpm]	-	-	-	-	-	-
Nominal torque	M_N [Nm]	-	-	-	-	-	-
Nominal power	P_N [kW]	-	-	-	-	-	-
Supply voltage U_N = 230 V							
Nominal speed	n_N [rpm]	1200	1500	2500	1000	1500	2000
Nominal torque	M_N [Nm]	18.8	18.4	16.0	22.8	21.9	19.8
Nominal power	P_N [kW]	2.36	2.89	4.19	2.39	3.44	4.15
Supply voltage U_N = 400 V							
Nominal speed	n_N [rpm]	2000	3000	4500	2000	2500	3500
Nominal torque	M_N [Nm]	17.2	15.6	11.9	20.2	19.2	16.0
Nominal power	P_N [kW]	3.60	4.90	5.61	4.23	5.03	5.86
Supply voltage U_N = 480 V							
Nominal speed	n_N [rpm]	2500	3500	5500	2200	3000	4000
Nominal torque	M_N [Nm]	16.3	14.4	9.00	19.7	18.1	14.7
Nominal power	P_N [kW]	4.27	5.28	5.18	4.54	5.69	6.16
Technical characteristics – Electrical data							
Number of poles	p	10	10	10	10	10	10
Connection of windings		Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	2.28	1.66	1.10	2.54	1.85	1.38
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	1.34	0.71	0.36	1.27	0.68	0.42
Winding inductance Ph-Ph	L_{U-V} [mH]	11.8	6.2	2.8	11.4	6.1	3.4
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	147	107	71	164	119	88.8
Standstill current	I_0 [A_{rms}]	9.2	12.8	18.6	9.8	13.6	17.8
Nominal current	I_N [A_{rms}]	9.12	12.65	18.55	9.76	13.51	17.61
Max. current	I_{max} [A_{rms}]	27.5	38.4	55.9	29.4	40.9	53.3
Technical characteristics – Mechanical data							
Moment of inertia of the rotor	J_M [kgcm²]	32			40		
Weight	m [kg]	13.3			15.4		
Technical characteristics – Thermal data							
Switching point of motor PTC	T_{TK} [°C]	155			155		

Table 6.22 BDH 138 4 and 138 5 technical characteristics

Reference data	Abbrev. [Unit]	BDH 188 2			BDH 188 3		BDH 188 4	
		K	M	P	M	P	L	P
General technical characteristics								
Standstill torque	M_0 [Nm]	29.7	30.0	29.4	42.0	41.6	53.0	52.5
Peak torque	M_{max} [Nm]	79.2	79.7	78.5	113	111	143	142
Supply voltage U_N = 115 V								
Nominal speed	n_N [rpm]	-	-	-	-	-	-	-
Nominal torque	M_N [Nm]	-	-	-	-	-	-	-
Nominal power	P_N [kW]	-	-	-	-	-	-	-
Supply voltage U_N = 230 V								
Nominal speed	n_N [rpm]	-	-	1800	-	1300	-	-
Nominal torque	M_N [Nm]	-	-	23.8	-	34.7	-	-
Nominal power	P_N [kW]	-	-	4.49	-	4.72	-	-
Supply voltage U_N = 400 V								
Nominal speed	n_N [rpm]	1500	2000	3000	1500	2400	1200	1800
Nominal torque	M_N [Nm]	25.1	23.6	20.1	33.8	28.5	43.5	39.6
Nominal power	P_N [kW]	3.94	4.94	6.31	5.31	7.16	5.47	7.46
Supply voltage U_N = 480 V								
Nominal speed	n_N [rpm]	1800	2500	3500	1800	2800	1400	2000
Nominal torque	M_N [Nm]	24.0	22.1	18.2	32.1	26.3	41.5	35.9
Nominal power	P_N [kW]	4.52	5.79	6.67	6.05	7.71	6.08	7.52
Technical characteristics – Electrical data								
Number of poles	p	10	10	10	10	10	10	10
Connection of windings		Y	Y	Y	Y	Y	Y	Y
Torque constant (120°C)	k_T [Nm/A_{rms}]	3.23	2.33	1.58	3.10	2.13	4.14	2.84
Winding resistance Ph-Ph (20°C)	R_{U-V} [Ω]	1.22	0.64	0.33	0.68	0.35	0.85	0.43
Winding inductance Ph-Ph	L_{U-V} [mH]	20.7	10.8	5.0	12.4	5.9	16.4	7.7
Voltage constant Ph-Ph (120°C)	k_E [V_{rms}/krpm]	208	150	102	200	137	266	183
Standstill current	I_0 [A_{rms}]	9.3	13.0	18.7	13.6	19.5	12.9	18.5
Nominal current	I_N [A_{rms}]	9.20	12.88	18.61	13.55	19.53	12.80	18.49
Max. current	I_{max} [A_{rms}]	27.8	38.9	56.1	40.8	58.6	38.7	55.5
Technical characteristics – Mechanical data								
Moment of inertia of the rotor	J_M [kgcm²]	65			92		120	
Weight	m [kg]	19.7			26.7		33.6	
Technical characteristics – Thermal data								
Switching point of motor PTC	T_{TK} [°C]	155			155		155	

Table 6.23 BDH 188 technical characteristics

6.2 Electric wiring

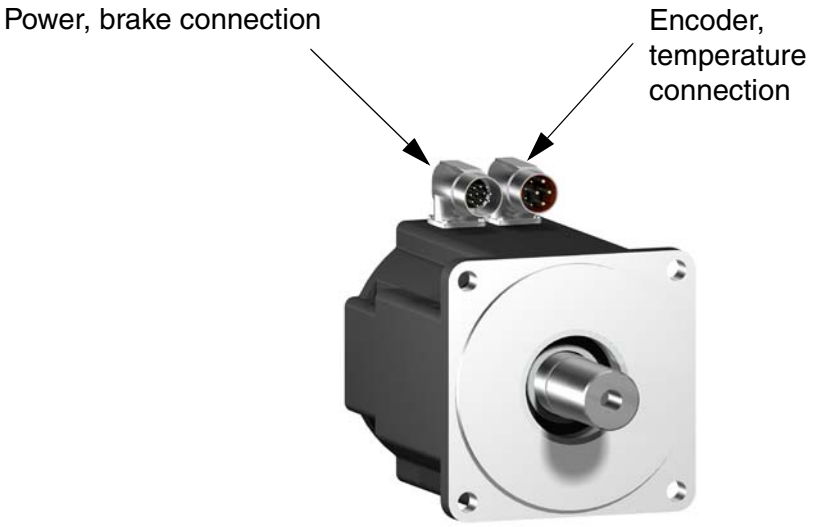
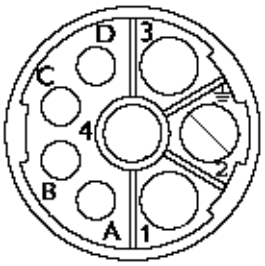


Illustration 6.5 BDH motor electrical connections

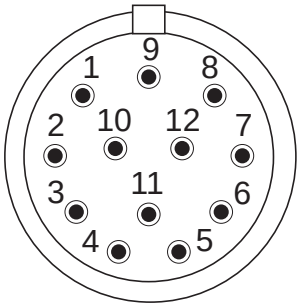
6.2.1 Motor/power/brake cable connection



Pin	Designation (Strand no.)	Meaning	Range
1	U	Power	3 AC 0 – 480 V
2	PE	Shielding	
3	W	Power	3 AC 0 – 480 V
4	V	Power	3 AC 0 – 480 V
A	brake +	brake	24 VDC
B	brake -	brake	0 VDC
C	-	not assigned	
D	-	not assigned	

Table 6.24 Power, brake connector (BDH 040 ... BDH 188)

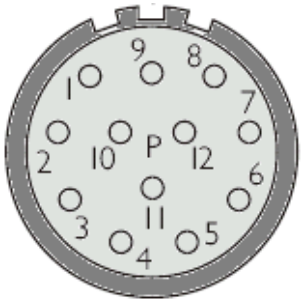
6.2.2 Temperature/resolver connection



Pin	Designation (Strand no.)	Meaning	Range
1	Temperature sensor	Temperature	
2	Temperature sensor	Temperature	
3	-	not assigned	
4	SIN -		
5	COS -		
6	REF +	Reference signal	
7	REF -	Reference signal	
8	SIN +		
9	COS +		
10	-	not assigned	
11	-	not assigned	
12	-	not assigned	

Table 6.25 Temperature, resolver connection

6.2.3 Temperature/encoder connection



Pin	Designation (Strand no.)	Meaning	Range
1	PTC sensor	Temperature	
2	PTC sensor	Temperature	
3	-	not assigned	
4	REF SIN	Reference signal	
5	REF COS	Reference signal	
6	Data +	RS 485	
7	Data -	RS 485	
8	SIN +		
9	COS +		
10	U	Power	7 – 12 VDC
11	GND	Ground	0 VDC
12	-	not assigned	

Table 6.26 Encoder, temperature connection

6.3 Dimensions

6.3.1 BDH motor

6.3.1.1 BDH 040

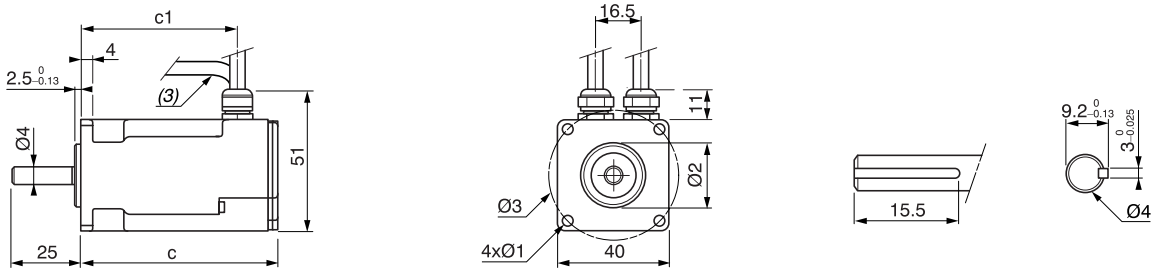


Illustration 6.6 BDH 040 outline dimension drawing

Model	IEC mounting					
	With resolver		Ø1	Ø2	Ø3	Ø4
	c	c1				
BDH 0401	69.6	56.1	4.3	30 h7	46	8 h7
BDH 0402	88.6	75.1	4.3	30 h7	46	8 h7
BDH 0403	107.6	94.1	4.3	30 h7	46	8 h7

Model	NEMA mounting						
	With resolver		Ø1	Ø2		Ø3	Ø4
	c	c1					
BDH 0401	69.6	56.1	3.56	20.015	+0.025 -0.025	46.69	6.35 0 -0.012
BDH 0402	88.6	75.1	3.56	20.015	+0.025 -0.025	46.69	6.35 0 -0.012
BDH 0403	107.6	94.1	3.56	20.015	+0.025 -0.025	46.69	6.35 0 -0.012

Table 6.27 Length of BDH 040

6.3.1.2 BDH 058

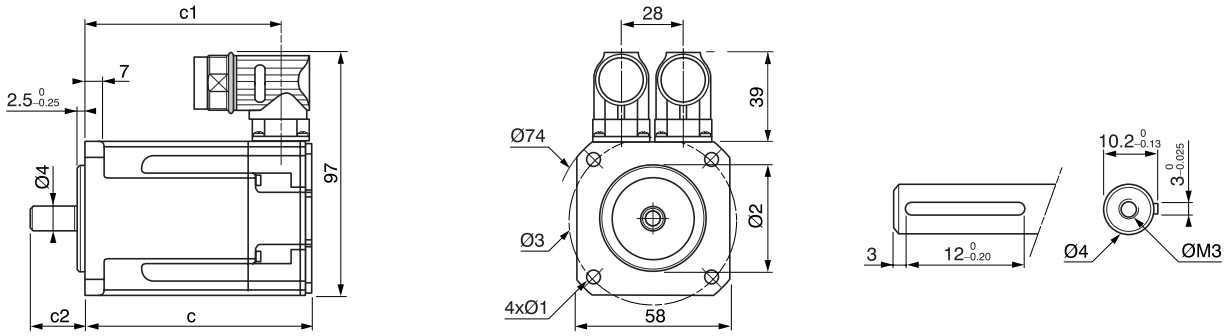


Illustration 6.7 BDH 058 outline dimension drawing

Model	IEC mounting									
	With resolver		With encoder		c1	c2	Ø1	Ø2	Ø3	Ø4
	c w'out brake	c with brake	c w'out brake	c with brake						
BDH 0582	105.2	148.5	114.4	148.5	93.6	20	4.8	40 j6	63	9 k6
BDH 0583	124.2	167.5	133.4	167.5	112.6	20	4.8	40 j6	63	9 k6
BDH 0584	143.2	186.5	152.4	186.6	131.6	20	4.8	40 j6	63	9 k6

Model	NEMA mounting												
	With resolver		With encoder		c1	c2		Ø1	Ø2		Ø3	Ø4	
	c w'out brake	c with brake	c w'out brake	c with brake									
BDH 0582	105.2	148.5	114.4	148.5	93.6	31.75	+0.79 -0.79	5.1	38.1	+0 -0.005	66.68	9.525	+0 -0.013
BDH 0583	124.2	167.5	133.4	167.5	112.6	31.75	+0.79 -0.79	5.1	38.1	+0 -0.005	66.68	9.525	+0 -0.013
BDH 0584	143.2	186.5	152.4	186.6	131.6	31.75	+0.79 -0.79	5.1	38.1	+0 -0.005	66.68	9.525	+0 -0.013

Table 6.28 Length of BDH 058

6.3.1.3 BDH 070 (IEC mounting only)

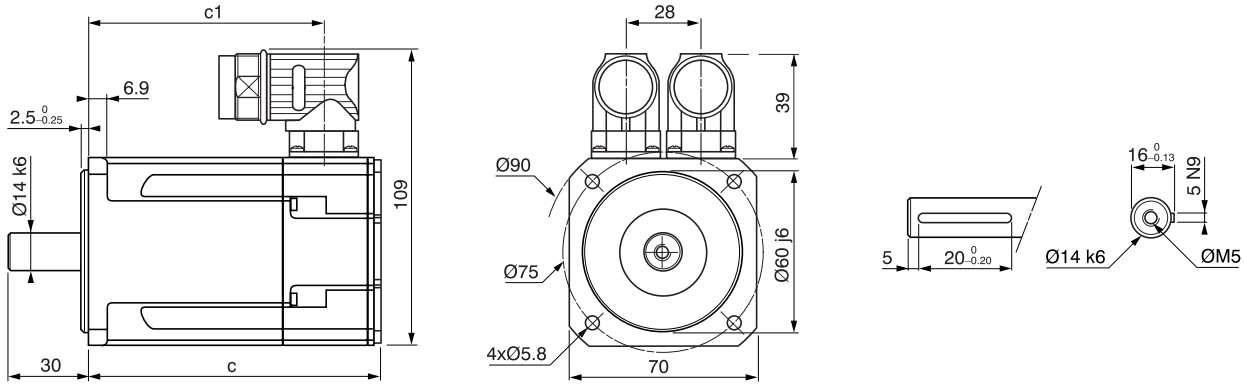


Illustration 6.8 BDH 070 outline dimension drawing

Model	With resolver or SinCos encoder		
	c w'out brake	c with brake	c1
BDH 0701	109.8	140.3	87.9
BDH 0702	140.8	171.3	118.9
BDH 0703	171.8	202.3	149.9

Table 6.29 Length of BDH 070

6.3.1.4 BDH 084

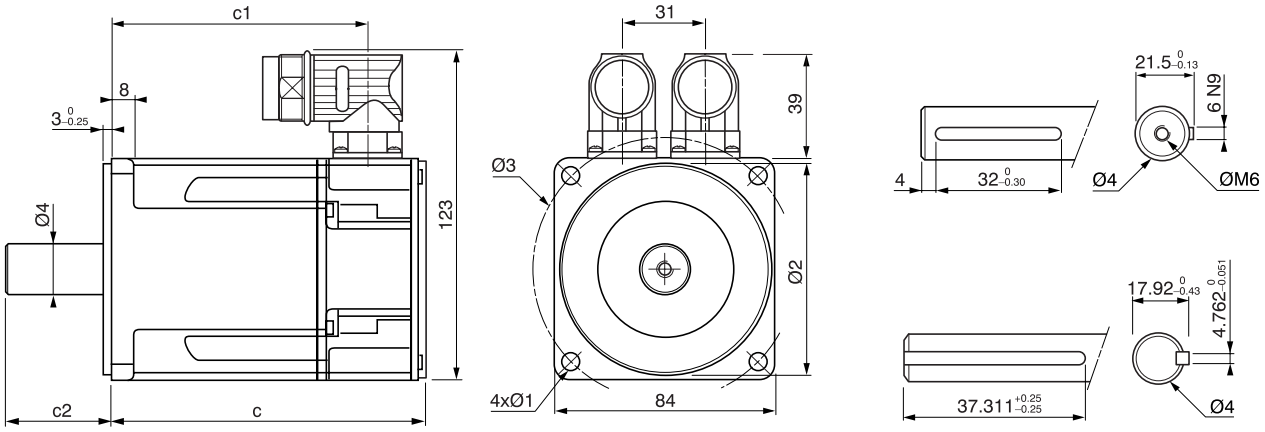


Illustration 6.9 BDH 084 outline dimension drawing

Model	IEC mounting							
	With resolver or SinCos encoder		c1	c2	Ø1	Ø2	Ø3	Ø4
	c w'out brake	c with brake						
BDH 0841	118.8	152.3	96.4	40	7	80 j6	100	19 k6
BDH 0842	147.8	181.3	125.5	40	7	80 j6	100	19 k6
BDH 0843	176.8	210.3	154.4	40	7	80 j6	100	19 k6
BDH 0844	205.8	239.3	183.4	40	7	80 j6	100	19 k6

Model	NEMA mounting										
	With resolver or SinCos encoder		c1	c2		Ø1	Ø2		Ø3	Ø4	
	c w'out brake	c with brake									
BDH 0841	118.8	152.3	96.4	52.4	+0.79 -0.79	5.54	73.025	0 -0.051	98.43	15.875	0 -0.013
BDH 0842	147.8	181.3	125.5	52.4	+0.79 -0.79	5.54	73.025	0 -0.051	98.43	15.875	0 -0.013
BDH 0843	176.8	210.3	154.4	52.4	+0.79 -0.79	5.54	73.025	0 -0.051	98.43	15.875	0 -0.013
BDH 0844	205.8	239.3	183.4	52.4	+0.79 -0.79	5.54	73.025	0 -0.051	98.43	15.875	0 -0.013

Table 6.30 Length of BDH 084

6.3.1.5 BDH 108

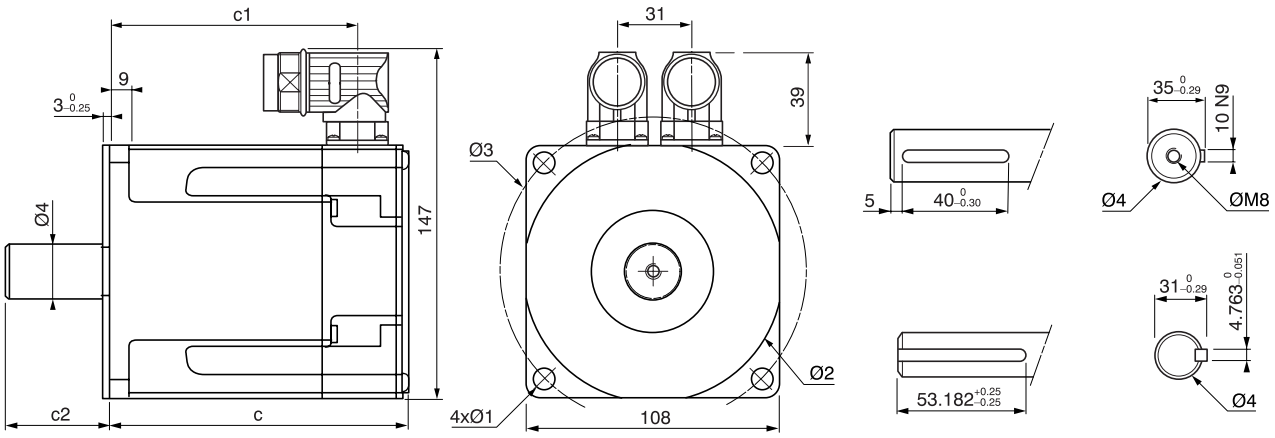


Illustration 6.10 BDH 108 outline dimension drawing

Model	IEC mounting									
	With resolver		With encoder		c1	c2	Ø1	Ø2	Ø3	Ø4
	c w'out brake	c with brake	c w'out brake	c with brake						
BDH 1081	127.5	172.5	146	189	105.3	50	9	110 j6	130	24 k6
BDH 1082	158.5	203.5	177	220	136.3	50	9	110 j6	130	24 k6
BDH 1083	189.5	234.5	208	251	167.3	50	9	110 j6	130	24 k6
BDH 1084	220.5	265.5	239	282	196.3	50	9	110 j6	130	24 k6

Model	NEMA mounting											
	With resolver		With encoder		c1	c2		Ø1	Ø2		Ø3	Ø4	
	c w'out brake	c with brake	c w'out brake	c with brake									
BDH 1081	127.5	172.5	146	189	105.3	57.15	+0.79 -0.79	8.83	55.563	+0 -0.051	125.73	19.05	+0 -0.013
BDH 1082	158.5	203.5	177	220	136.3	57.15	+0.79 -0.79	8.83	55.563	+0 -0.051	125.73	19.05	+0 -0.013
BDH 1083	189.5	234.5	208	251	167.3	57.15	+0.79 -0.79	8.83	55.563	+0 -0.051	125.73	19.05	+0 -0.013
BDH 1084	220.5	265.5	239	282	196.3	57.15	+0.79 -0.79	8.83	55.563	+0 -0.051	125.73	19.05	+0 -0.013

Table 6.31 Length of BDH 108

6.3.1.6 BDH 138

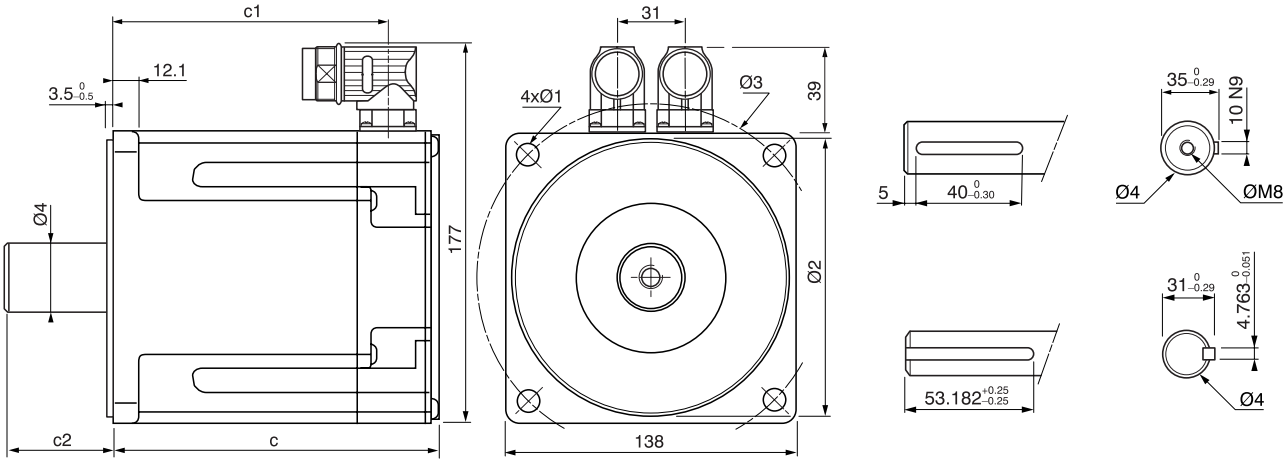


Illustration 6.11 BDH 138 outline dimension drawing

Model	IEC mounting									
	With resolver		With encoder		c1	c2	Ø1	Ø2	Ø3	Ø4
	c w'out brake	c with brake	c w'out brake	c with brake						
BDH 1381	153.7	200.7	172.2	218.7	130.5	58	11 $^{+0.36}_{0}$	130 j6	165	32 k6
BDH 1382	178.7	225.7	197.2	224.7	155.5	58	11 $^{+0.36}_{0}$	130 j6	165	32 k6
BDH 1383	203.7	250.7	222.2	268.7	180.5	58	11 $^{+0.36}_{0}$	130 j6	165	32 k6
BDH 1384	228.7	275.7	247.2	294.7	205.5	58	11 $^{+0.36}_{0}$	130 j6	165	32 k6

Model	NEMA mounting									
	With resolver		With encoder		c1	c2	Ø1	Ø2	Ø3	Ø4
	c w'out brake	c with brake	c w'out brake	c with brake						
BDH 1381	153.7	200.7	172.2	218.7	130.5	60	9 $^{+0.36}_{0}$	110 h7	145	28 h6
BDH 1382	178.7	225.7	197.2	224.7	155.5	60	9 $^{+0.36}_{0}$	110 h7	145	28 h6
BDH 1383	203.7	250.7	222.2	268.7	180.5	60	9 $^{+0.36}_{0}$	110 h7	145	28 h6
BDH 1384	228.7	275.7	247.2	294.7	205.5	60	9 $^{+0.36}_{0}$	110 h7	145	28 h6

Table 6.32 Length of BDH 138

6.3.1.7 BDH 188

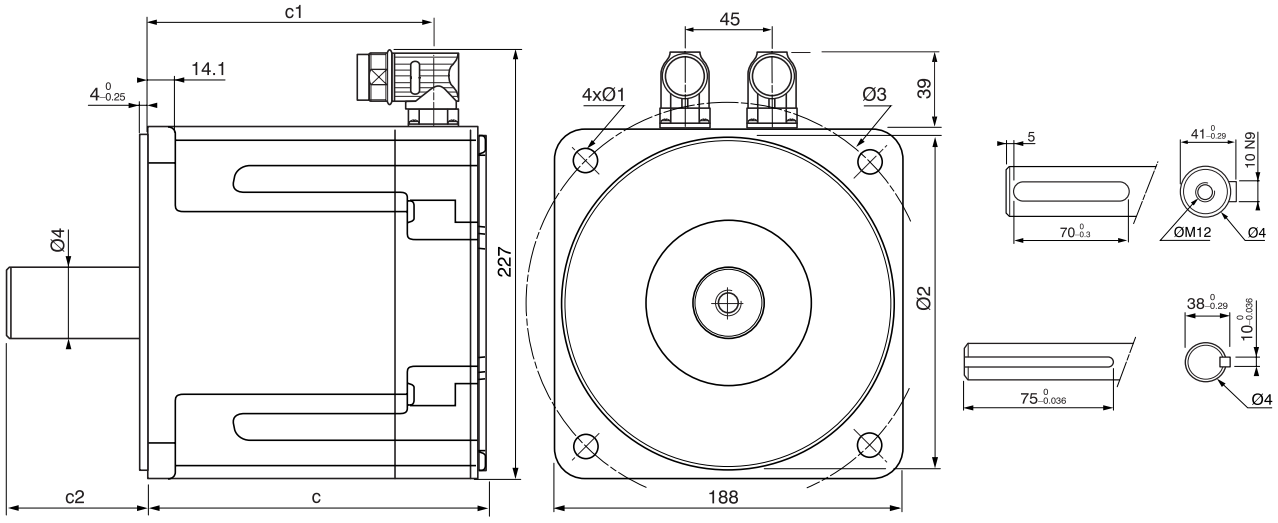


Illustration 6.12 BDH 188 outline dimension drawing

Model	IEC mounting										
	With resolver		With SinCos encoder		c1	c2	Ø1		Ø2	Ø3	Ø4
	c w'out brake	c with brake	c w'out brake	c with brake							
BDH 1881	192.5	234.5	201.7	253.3	164.5	80	13.5	$^{+0.43}_{0}$	180 j6	215	38 k6
BDH 1882	226.5	268.5	235.7	287.3	198.5	80	13.5	$^{+0.43}_{0}$	180 j6	215	38 k6
BDH 1883	260.5	302.5	269.7	321.3	232.5	80	13.5	$^{+0.43}_{0}$	180 j6	215	38 k6

Model	NEMA mounting										
	With resolver		With SinCos encoder		c1	c2	Ø1		Ø2		Ø3	Ø4
	c w'out brake	c with brake	c w'out brake	c with brake								
BDH 1881	192.5	234.5	201.7	253.3	164.5	79	13.5	$^{+0.43}_{0}$	114.3	$^{0}_{-0.025}$	200	35 h6
BDH 1882	226.5	268.5	235.7	287.3	198.5	79	13.5	$^{+0.43}_{0}$	114.3	$^{0}_{-0.025}$	200	35 h6
BDH 1883	260.5	302.5	269.7	321.3	232.5	79	13.5	$^{+0.43}_{0}$	114.3	$^{0}_{-0.025}$	200	35 h6

Table 6.33 Length of BDH 188

7 Appendices

7.1 Declaration of conformity

Please consult your field sales contact for declaration of conformity.

7.2 Modifications

03/2008

- New version

NOTE

The latest version of the documentation and the modifications log for this product are available at http://www.us.telemecanique.com

7.3 Index