

MDD Digital AC Servo Motors

Project Planning Manual

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The purpose of this documentation

This project planning documentation

- lists the technical data and performance features of the motor
- offers guidelines on the mechanical integration of the motor into the machine
- offers guidelines on the electrical integration of the motor into the machine
- lists the available options
- lists order information of the motor and its electrical accessories
- offers guidelines on the transportation, handling and storage of the motor

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1. MDD Digital AC Servo Motors

This section offers an overview of the range of applications, power features, parts and the construction of the MDD AC servo motors.

Applications Together with intelligent digital drive controllers from INDRAMAT, digital AC servo motors of the MDD series create cost-effective and rapid-response automatization systems.

Drives with MDD AC servo motors are especially well-suited for use in tool, textile, printing and packaging machines, as well as robotics, handling equipment and transfer facilities. MDD motors assure high contouring accuracies at high feedrates, in particular when used for cutting in high speed ranges.

A series of nine motors with different continuous torques and speeds are available for the most varying of applications. Using this extensive product program means it is possible to realize, both technically and cost-effectively, the most optimum solution for just about any application.

Due to their slender construction and very high power density, the following digital AC servo motors are used with screwing applications, auxiliary axes and tool changing devices:

- MDD 021
- MDD 025
- MDD 041

For highly-dynamic applications such as roller feeds for pressing, punching and nibbling machines as well as tool changing devices, the following AC servo motors are especially used because of their very high power density:

- MDD 065
- MDD 071
- MDD 093
- MDD 115

For high-precision applications where an extreme degree of synchronism is required (e.g. in grinding machines), the following motors are especially suited:

- MDD 090
- MDD 112

Overview of the power levels

Figure 1.1 depicts the available motors with the power features "continuous torque at standstill M_{dN} " and "nominal speed n ".

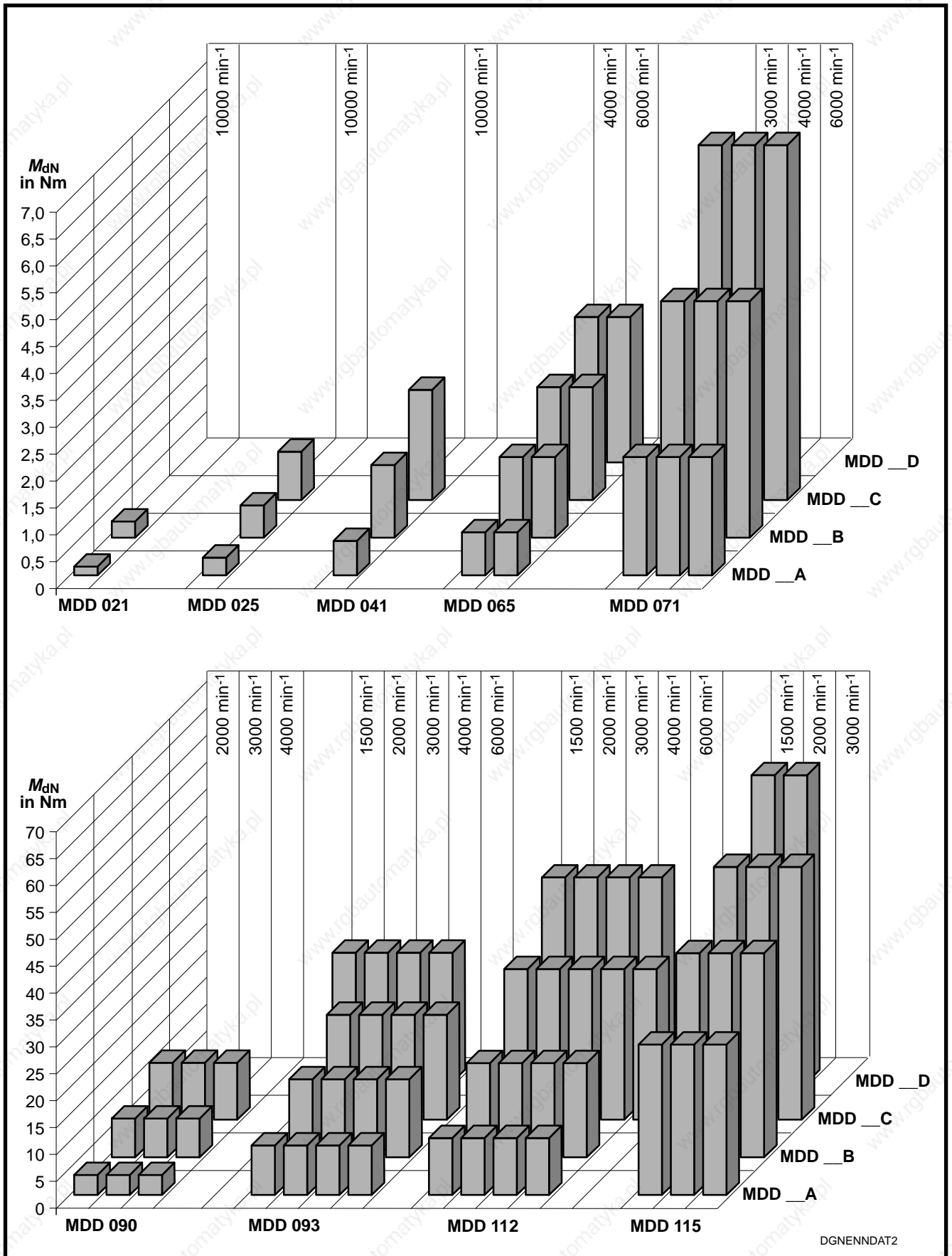


Fig. 1.1: Power levels

Construction and components of the motors

The digital MDD AC servo motors are permanent magnet-excited synchronous motors with electronic commutation. The permanent magnets of the rotor are made of rare-earth or iron oxide magnetic materials. The use of such materials makes it possible to construct a motor with low inertia.

Figure 1.2 depicts the principle of construction and the components of the MDD AC servo motor.

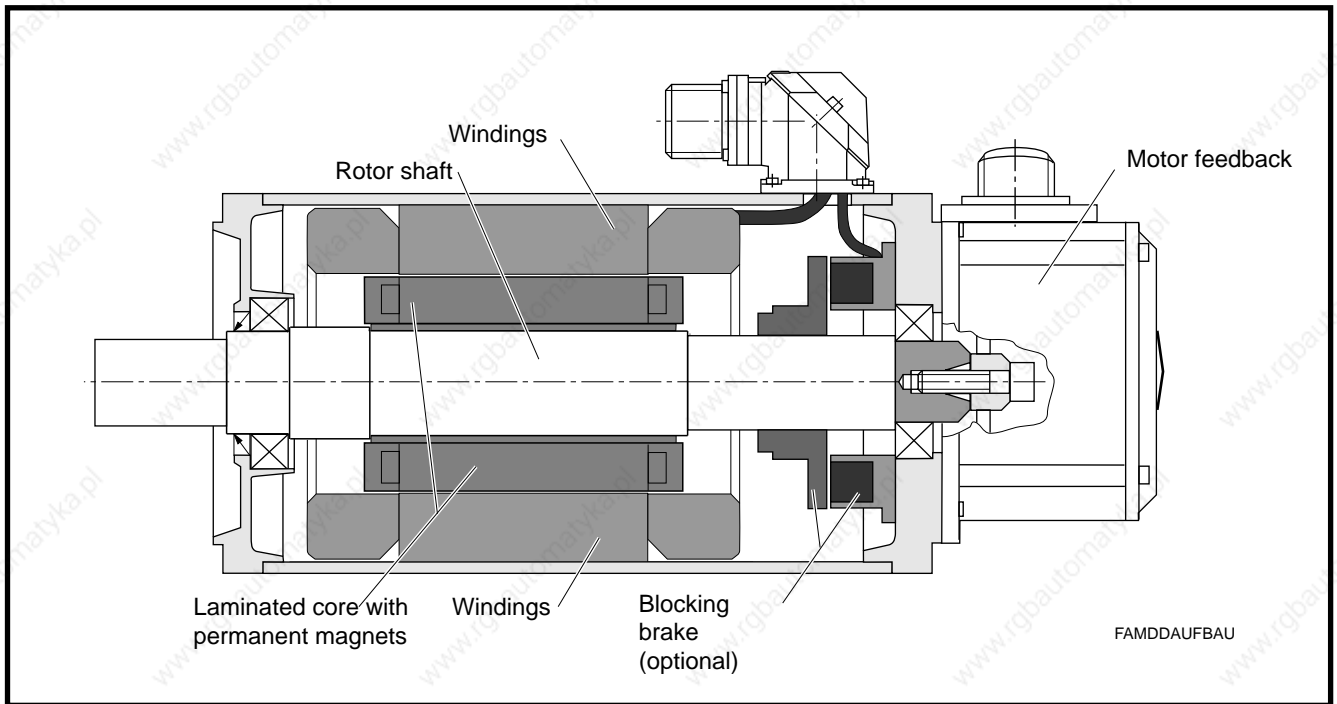


Fig. 1.2: The construction of an MDD AC servo motor

Operating reliability

The **high degree of operating reliability** is the result of the following constructional features of MDD motors:

- Maintenance-free operation as a result of:
 - a brushless design of the motor and
 - the use of life-time lubricated bearings.
- Can be used directly within the working area of the machine even under poor environmental conditions (e.g., affects of coolants or soluble oil emulsions):
 - because the motor housing is completely sealed and
 - the connections for the motor power cable and the feedback cable are constructed as per protection category IP 65.
- Motor temperature monitoring by means of a temperature sensor built into the motor windings prevents overload damage.

Performance data The motors are characterized by high performance data, which are described in detail as follows:

- High dynamics due to favorable torque-inertia ratio.
- High overload capabilities due to efficient heat conduction from the stator windings to the outside wall of the motor housing.
- Peak torque is utilized over a wide speed range.
- High power to weight ratio because of the compact construction.
- High cyclic load capacity permits continuous start-stop operations with high repetition rates. This is due to the electronic commutation of the motor.
- High synchronous operation features. This is achieved by the sinusoidal application of current together with high motor feedback resolution.

Installation on the motor The **installation** of the motors on the machine **is simple**.

- Direct attachment of pinions and belt pulleys to the shaft because the design makes it possible to apply high radial loads.
- There is a defined load assimilation of outside forces at the motor shaft. This means that the floating bearing of side "A" of the motor absorbs the radial forces, while the fixed bearing of side "B" absorbs the axial forces.
- The motor can be installed in any orientation.
- Flange design with throughholes permits mounting as per design IM B5, or as per design IM B14 with threads in the flange.
- A wide variety of ready-made cables is available eliminating additional installation work.

Cooling Some motor series are available with surface cooling to accommodate extreme loads. A summary of the blower options available for each series is outlined in section 2.2.

Blocking brake The MDD motors are available either with or without a blocking brake. The MDD 021 is the only exception as it is not available with blocking brake.

The blocking brake makes it possible to clamp or hold the output shaft at a standstill. This means that the axis is brought to a safe standstill when power is off.

Output shaft The output shaft is available in two different designs:

- as a plain shaft for non positive shaft-hub connections and
- shafts with keyways for form-fitting shaft-hub connections.

Motor feedback The motors are equipped with a motor feedback especially developed and designed for this line. This feedback enables position and speed evaluation and detection of rotor position. It is available with

- either relative or
- absolute position detection.

The motor feedback is either a "resolver feedback" or a "digital servo feedback" depending on the motor line.

Electrical Connections Both the power and the motor feedback cables are directly connected to the motor by means of connectors on the corresponding flanged sockets.

Labelling the Sides To make sure that the sides of the MDD motor are unequivocally labelled and that there can be no confusion, they have been fixed and depicted in Figure 1.3.

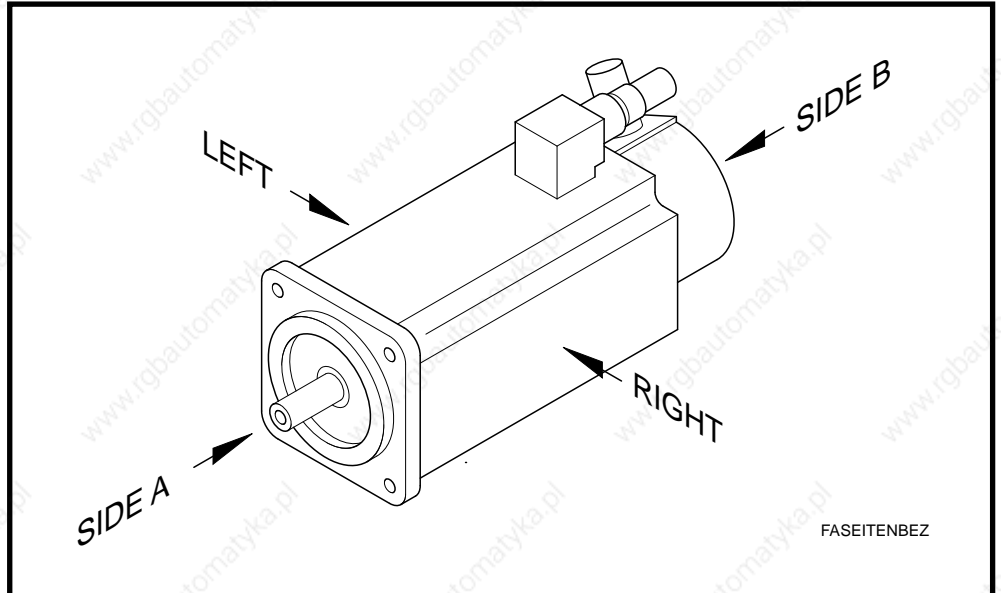


Fig. 1.3: Fixing and designating the sides of an MDD servo motor

2. Technical Explanations

This section outlines a description of the ambient conditions, the mechanical and electrical features of the motor as well as the motor feedback. Section 2.5 offers important details about the torque-speed characteristics curves which are, in turn, depicted for each type of motor in sections 3.2, 4.2 and through to 11.2.

2.1. Ambient Conditions

Installation elevation and ambient temperatures

The output data outlined in the section "Technical Data" are achieved under the following conditions:

Ambient temperature: 0° to + 45 °C

Installation elevation: 0 to 1000 meters above sea level

If the conditions deviate from the values, then the output data will decrease as depicted in the diagrams shown in Figure 2.1. If higher ambient temperatures and higher installation elevations occur simultaneously, then the load factors f_T and f_H must be multiplied.

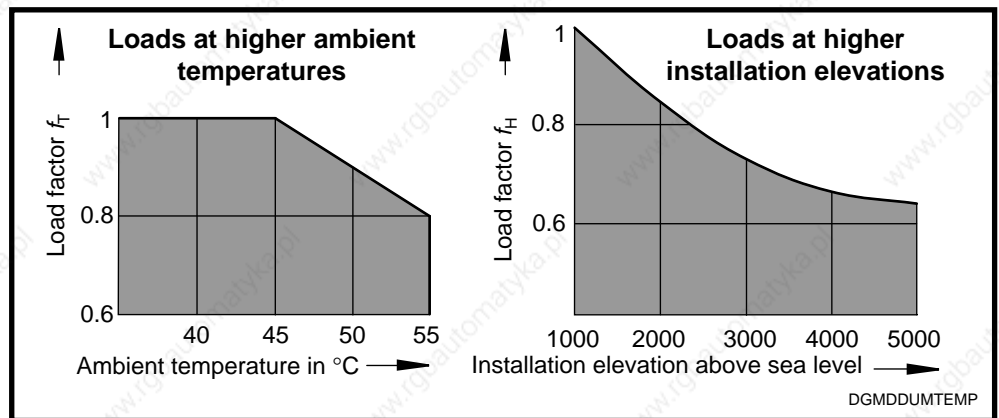


Fig. 2.1: Load capabilities at higher ambient temperatures and higher installation elevations

Protection Category

The MDD motors are protected by their housing and covers which in construction and design adhere to the guidelines found in DIN 40050 and protect

- against contact to high voltage with motor parts either moving or alive (contact guards),
- the penetration by extrinsic objects
- and the penetration of water.

The protection categories are laid down by the abbreviation IP (International Protection) and two numbers for the type of protection, for example, IP 40.

The first number represents the degree of protection afforded against contact and penetration by extrinsic objects (see Figure 2.2). The second number represents the degree of protection afforded against the damaging penetration by water (see Figure 2.3).

Figure 2.4 depicts the range of the protection categories as applicable to MDD motors.

| First number | Protection against contact and penetration by objects |
|--------------|--|
| 0 | Little or no protection. |
| 1 | Protection against penetration by extrinsic objects with a diameter exceeding 50 mm. No protection against deliberate access, e.g., by a hand. Will keep larger body surfaces out, however. |
| 2 | Protection against penetration by extrinsic objects with a diameter exceeding 12 mm. Will keep fingers or similar objects out. |
| 3 | Protection against penetration by extrinsic objects with a diameter exceeding 2.5 mm. Keeps out tools, wiring or similar objects thicker than 2.5 mm. |
| 4 | Protection against penetration by extrinsic objects with a diameter exceeding 1 mm. Keeps out tools, wiring or similar objects thicker than 1 mm. |
| 5 | Protection against damaging dust. Complete penetration by dust is not prevented, but the dust may not be permitted to penetrate to the extent that the operation of the electrical equipment is in any way hindered (protected against dust). Complete protection against penetration by extrinsic objects. |
| 6 | Protection against the penetration of dust (dust-free). Complete protection against penetration by extrinsic objects. |

Fig. 2.2: Protection grades for contact and penetration as per DIN 40 050, section 2 (edition dated 6/72)

| Second number | Protection against Water |
|---------------|---|
| 0 | Little or no protection. |
| 1 | Protection against vertically dripping water (dripping or trickling water). It may not have any destructive affects. |
| 2 | Protection against vertically dripping water. It may not have any adverse affects on electrical equipment tilted up to 15° in contrast to its normal position (water dripping or trickling at an angle). |
| 3 | Penetration against water falling at an angle of up to 60°. Does not permit any damaging affects (sprayed water). |
| 4 | Protection against water sprayed at the equipment (housing) from all directions. Does not permit any damaging affects (splashwater). |
| 5 | Protection against a jet of water sprayed from a nozzle onto the equipment (housing) from all directions. Does not permit any damaging affects (jet of water). |

Fig. 2.3: Protection grades for water as per DIN 40 050, section 2 (edition dated 6/72)

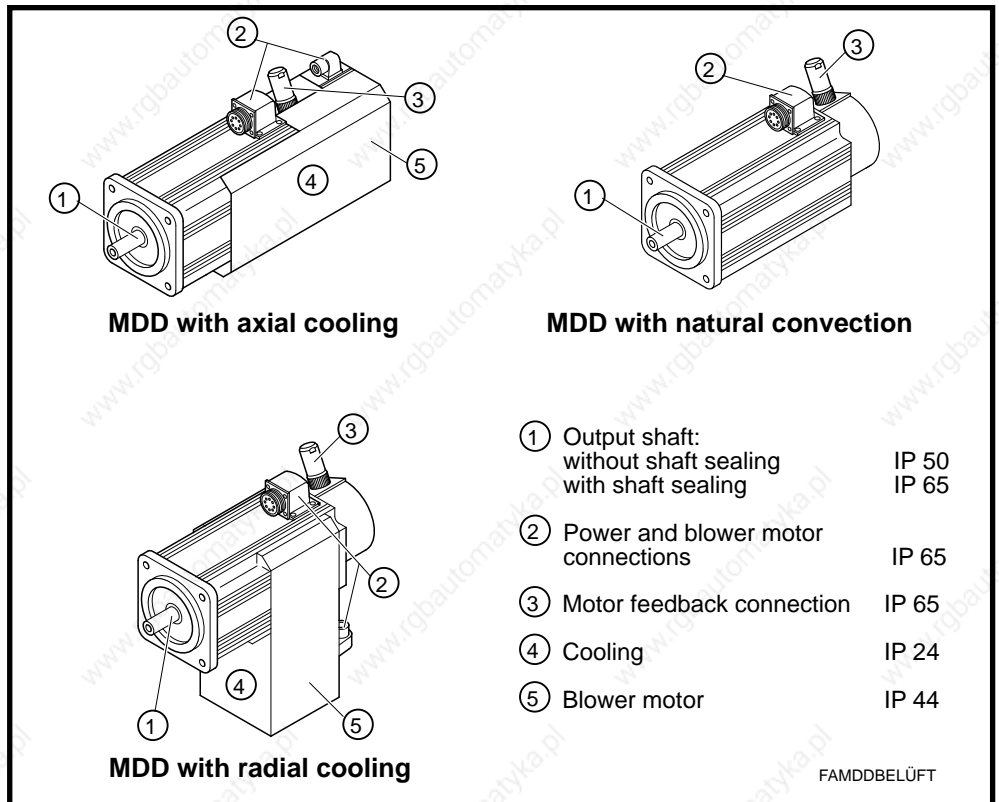


Fig. 2.4: Range of protection categories for MDD motors

Mechanical ambient conditions

MDD servo motors can be operated in a stationary manner under weather-proofed conditions as per IEC 721-3-3, the 1987 edition, or EN 60721-3-3, the 6/1994 edition:

- as per class 3M1 respective the longitudinal axis of the motor and
- as per class 3M6 respective the lateral axis of the motor.

The maximum values stated in Figure 2.5 thus apply to transportation and operation of MDD servo motors.

| Environmental variables | | Unit | Maximum values longitudinal axis | Maximum values lateral axis |
|-------------------------|---|------------------|--|---|
| sinusoidal oscillations | excursion amplitude | mm | 0.3 | 7.0 |
| | frequency range | Hz | 2 to 9 | 2 to 9 |
| | acceleration amplitude | m/s ² | 1 | 20 |
| | frequency range | Hz | 9 to 200 | 9 to 200 |
| shocks | total shock-response spectrum | - | type L per IEC 721-1 ed. 1990 table 1, section 6 | type II per IEC 721-1 ed. 1990 table 1, section 6 |
| | reference acceleration (in IEC 721-1 named peak acceleration) | m/s ² | 40 | 250 |
| | duration | ms | 22 | 6 |

Fig. 2.5: Maximum values of the environmental variables



MDD servo motors are only suited for such extreme demands as is the case with punching, pressing, press feeds and similar applications, if shock-damped mounted or mounted shock decoupled.

We cannot recommend a generally applicable solution for shock-damped mounting. It is dependent on the respective construction of the machine and the results of metrological tests.

Housing coat The housing of the MDD motors is painted with a black prime coating. An additional layer of paint can cover this prime coat. The thickness of the layer may, however, not exceed 40 µm.

The coat is resistant to:

- weathering, yellowing and chalky build-ups as well as
- diluted acids and lyes.

The coat can, however, peel if the housing is frequently cleaned with a steam cleaner.

2.2. Mechanical Features

Construction and mounting orientation

The mounting flange is designed, in all types of motors, in such a way that mounting as per Design B5, i.e., a mounting flange with throughholes, is possible.

Mounting mode as per Design B14, i.e., mounting flange with threads, is **additionally** possible with the following motors:

- MDD 021
- MDD 041
- MDD 090
- MDD 093
- MDD 112
- MDD 115

Figure 2.6 demonstrates the ways that the motors can be mounted to the machine as per DIN 42950, section 1 (edition dated 8/77).







| Construction | Permissible mounting orientations as per DIN IEC 34-7 | | |
|--------------|---|---|---|
| B05 |  IM B5 |  IM V1 |  IM V3 |
| B14 |  IM B14 |  IM V18 |  IM V19 |

Fig. 2.6: Additional mounting orientations



In the case where the motors are mounted in orientations IM V3 and IM V19, it is necessary to prevent liquids from collecting at the output shaft over extended periods of time. Even the use of a shaft sealing does not absolutely prevent liquids from penetrating, along the output shaft, into the housing of the motor.

Pilot diameter To generate compatibility with the motors of other manufacturers, it is possible to also select a mounting flange with a customized pilot/centering diameter in addition to the standard types. This is possible only with some of the motors. The choices and appropriate dimensions are listed in the table in Figure 2.8.

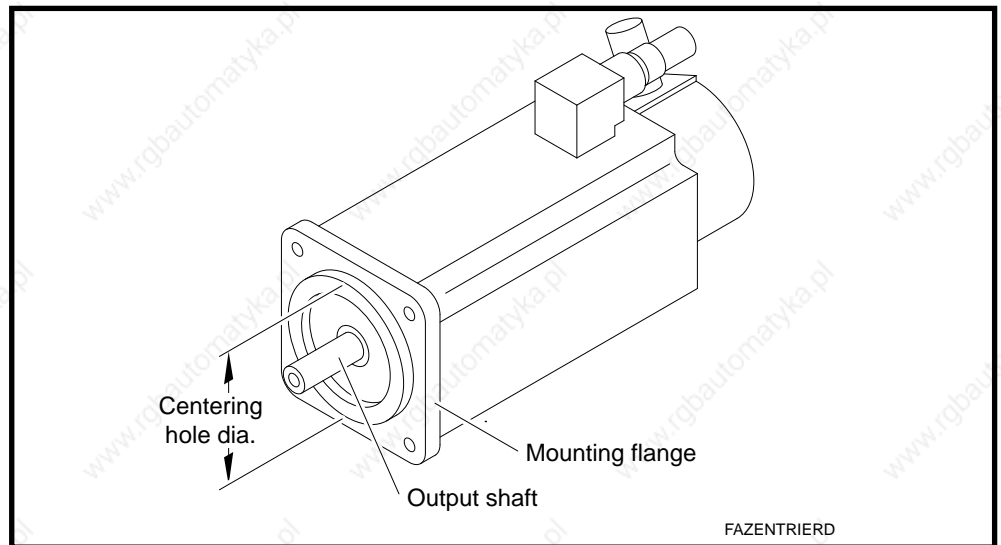


Fig. 2.7: Defining the term pilot /centering diameter

| motor series | Pilot diameter in mm | |
|--------------|----------------------|------------------|
| | Standard types | Customized types |
| MDD 021 | 32 | — |
| MDD 025 | 40 | — |
| MDD 041 | 50 | — |
| MDD 065 | 95 | — |
| MDD 071 | 95 | — |
| MDD 090 | 110 | 130 |
| MDD 093 | 110 | 130 |
| MDD 112 | 130 | 180 |
| MDD 115 | 130 | 180 |

Fig. 2.8: Pilot diameters for the individual motor series

Output shaft The design of the output shaft can be selected by the user. INDRAMAT recommends the use of plain output shafts.

Plain output shaft

A backlash-free and non-positive transmission of the torque can be achieved with a plain shaft. Clamping sets, pressure sleeves or similar clamping components can be used for coupling pinions, belt pulleys or similar elements.

Output shaft with keyway

This achieves a form-fitting torque transmission. This type of shaft-hub connection is suitable for lesser demands. A multi-axial stress state occurs at the shaft-hub connection as a result of torsion, bending, radial and axial loads. It is possible, during powerful reverse operations, for the bottom of the key to turn out and reduce the quality of concentricity. Ever-increasing defor-

mations can cause fractures. The use of plain shaft ends with non positive connections is therefore recommended.

Shaft sealing The shaft sealing is attached to the output shaft. It ensures that no liquids can penetrate into the motor housing along the shaft. An output shaft with shaft sealing is required for those applications where dirt or the affects of a jet of water can be present. The protetion category in this case is IP 65.

From motor series MDD 065 upwards, the output shafts are standardly equipped with a shaft sealing.

The output shaft of the MDD 021 is only available without a shaft sealing. The protection category in this case is IP 50. This means that this motor type is not suited for any applications where dirt or a jet of water are a factor.

The MDD 025 and MDD 041 offer the option of a design with or without a shaft sealing.

Permissible shaft load A load is being applied to the shaft as soon as radial or axial forces affect the motor shaft.

The **permissible radial force** (radial shaft load) is depicted in a diagram in section "Shaft Load Capacity" (Section 3.3., 4.3 and so on).

The permissible radial force depends on

- the average speed and
- the point of application of force.

The **permissible axial force** (axial shaft load) can be calculated with the aid of a formula, which can be found in this section.

Thermal Deformations



Thermal deformations in length affect side A of the motor. This means that the A side of the motor shaft end can shift up to 0.6 mm with respect to the motor housing. As a result, there is

- **a shifting of position by using drive pinions with helical teeth mounted to the motor output shaft but not axially fixed to the machine or**
- **occurring thermal stress by using drive pinions with helical teeth axially fixed to the machine and with bevel gear pinions. The latter can lead to damage on the bearing of side B of the motor.**

Cooling For extreme loads, as it is, for example, the case with continuous start-stop operations with a high level of repetitive frequency, it is possible to mount a surface-cooling unit to some of the motors.

Blower motors operating with 1 x AC 230 V and AC 115 V from the supply voltage are available.

The blower unit represents a separate component and can only be ordered with the use of its own order number. When ordered, the surface-cooling unit is delivered by INDRAMAT mounted to the motors and ready to connect.

Additional information about the blower units can be found in the documentation entitled "Blowers for mounting to MDD servo motors", doc. no.: 9.578.003.4.

Two possible types of surface cooling are available:

- axial and
- radial surface cooling.

Axial surface cooling

Axial cooling is suited for those applications that need a slender form.

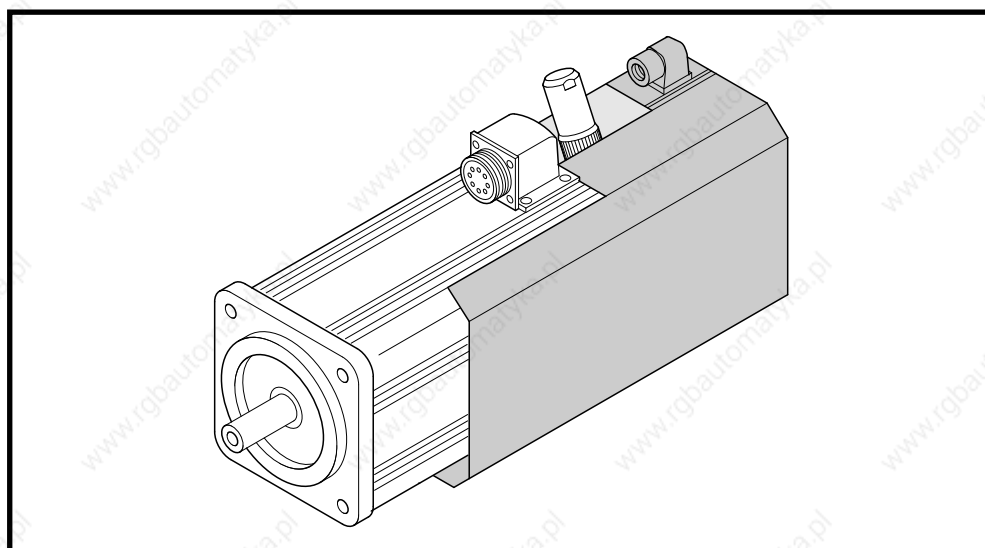


Fig. 2.9: An example of an MDD servo motor with axial surface cooling

Radial surface cooling

Radial cooling is suited for those applications that need a short construction.

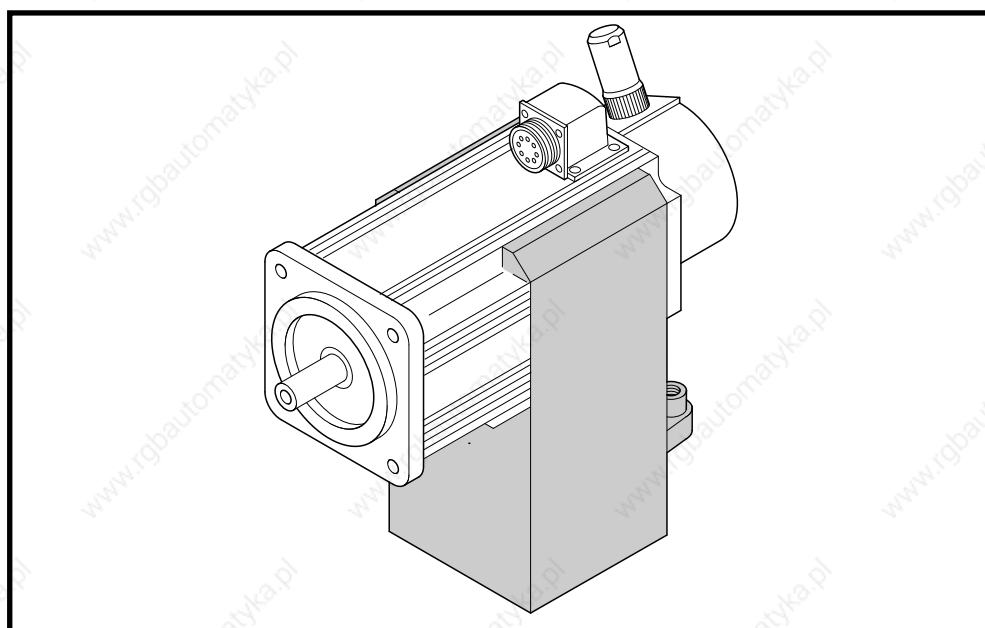


Fig. 2.10: An example of an MDD servo motor with radial surface cooling

The blower options for the individual motor series are listed in the table in Figure 2.11.

| Motor type | Blower for surface cooling | |
|------------|----------------------------|-----------------|
| | axial | radial |
| MDD 021 | — | — |
| MDD 025 | — | — |
| MDD 041 | — | — |
| MDD 065 | + ¹⁾ | — |
| MDD 071 | + ¹⁾ | + ¹⁾ |
| MDD 090 | + | + ¹⁾ |
| MDD 093 | + | + |
| MDD 112 | + | + |
| MDD 115 | + | + |

— not available +available ¹⁾not available for motor length "A"

Fig. 2.11: Blower options

Blocking brake For a backlash-free holding of the servo axes when the machine is powered off, it is possible to equip them with a blocking brake.

The blocking brake, especially developed for these motors, works along the closed-circuit principle. At zero current, a magnetic force acts on the brake armature disc. This means that the brake is locked and holding off the axis. With the application of 24V DC, the electrical field cancels the permanent magnetic field and the brake opens.

The intelligent digital drive controller activates the blocking brake. This maintains the on and off switching sequence in all operating states. Current measurements in the drive monitor the release of the brake. The moment of clamping for an E-stop or fault situation can be selected via parameters to suit the application:

- immediate clamping
- clamping after speeds falls below 10 rpm or
- clamping after 400 ms, even with speeds greater than 10 rpm.



The blocking brake alone cannot guarantee the safety of personnel as it can fail or wear down. Additional measures must be taken to ensure personnel safety. These must be undertaken by the manufacturer of the machine and can, for example, be the mounting of a second brake.



The blocking brake is not a service brake. It wears down after approximately 20,000 revolutions against the closed brake.

With some motor types, the blocking brake is available with varying holding torques. With motors MDD 025 and MDD 041, the nominal torque M_{dN} drops somewhat if the motor is equipped with a blocking brake. Notes on this can be found in the section "Technical Data" of the respective motor series.



If the motor is stored for a period exceeding two years, then it is necessary to re-seat it before using.

To re-seat:

1. Run the motor at a speed of approximately 100 rpm.
2. Close the blocking brake and keep it closed for approximately 60 seconds.

Note: Open the line connection of the blocking brake to the controller.

3. Shut down the drive after 60 seconds.
4. Reconnect blocking brake to drive.

Balance class The MDD motors are dynamically balanced as per the balance class specified in DIN VDE 0530, section 14 (2/93 edition).

The user can select either one of two possible balance classes for the MDD 112 and MDD 115 depending upon the conditions of application of the motor

- balance class N (normal) for normal applications
- balance class R (reduced)
 - for more demanding applications, e.g., in grinding machines
 - for servo motors in main spindle applications, e.g., power tools in tool turrets of tool machines.

MDD 021, MDD 025 and MDD 040 motors are **only** balanced in terms of balance class N.

MDD 065, MDD 071, MDD 090 and MDD 093 motors are **always** balanced in terms of balance class R (reduced).

The balance class only applies to the pure motor and does not apply to the motor with components mounted on side A of the shaft end. The motors are balanced with the entire key in the case of output shafts with keyway.

Power connection The user must select the output direction of the power connection at the time the order is placed. This direction must correspond to the conditions at the machine. The output direction cannot be changed after delivery.

The following variants are available (see Figure 2.12):

- connector to side A
- connector to side B
- connector to the right
- connector to the left

Restrictions:

MDD 021 and MDD 041 are only available with side A or B output directions.

A variant with connecting cable and coupling unit in lieu of the connector housing is also available with the MDD 025 series. See the dimensions of the MDD 025.

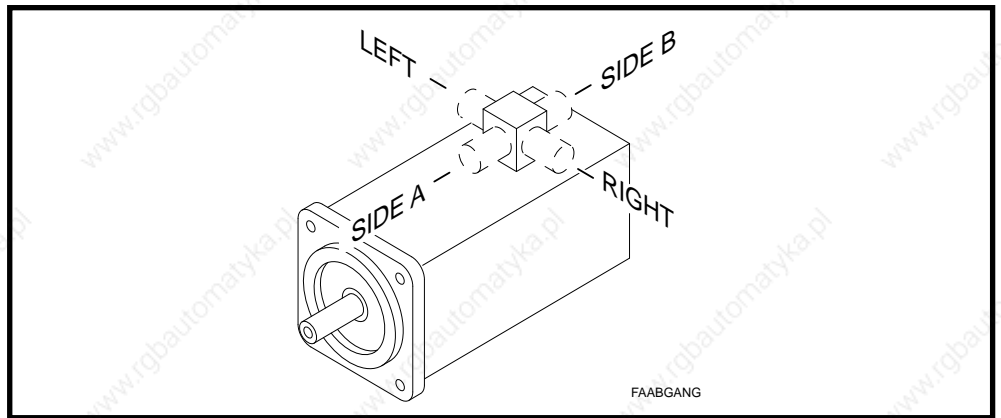


Fig. 2.12: Possible output directions of the power connections

Feedback connector

Different types of connectors can be selected for connecting the motor feedback cable depending upon the installation conditions. Available are:

- straight connector
- angle connector

Information about the allocation of the connector type to the motor type can be found in the dimensional data sheets and in section 13.2 "Connector for the Feedback Connections".

Straight Connector

Figure 2.13 depicts a motor with a straight feedback connector.

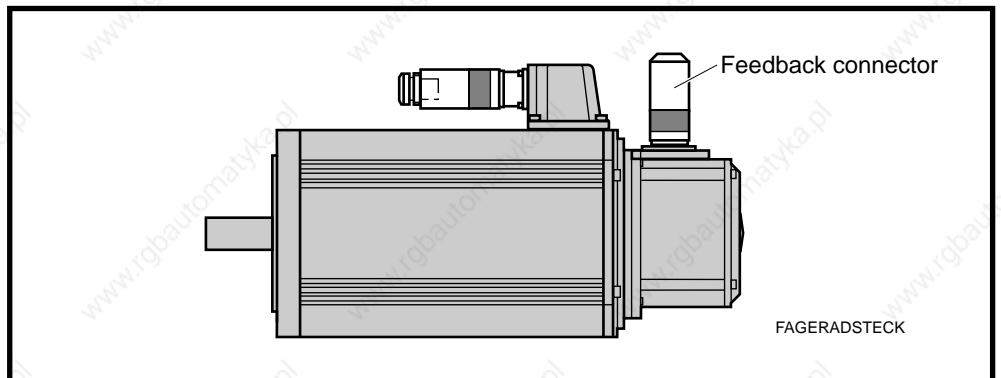


Fig. 2.13: MDD motor with straight feedback connector

Angle connector

INDRAMAT supplies and delivers the angle connectors so that the output direction of the cable, once inserted into the flanged socket, is side B of the motor.

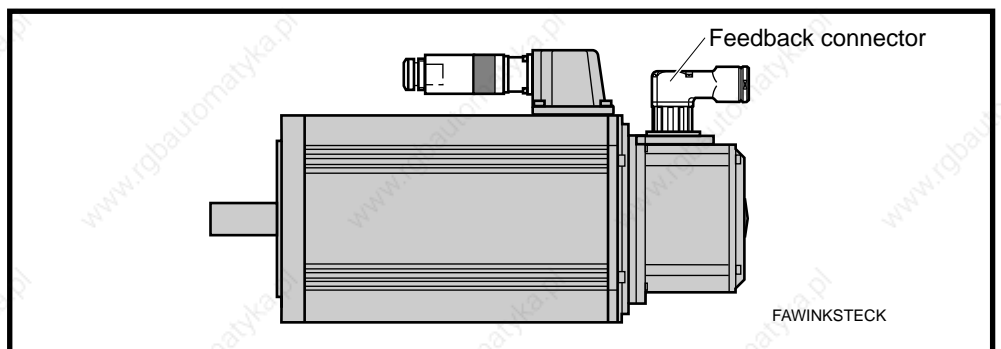


Fig. 2.14: MDD motor with angle connector (output direction at delivery is side B)

The user can change the output direction. Just release the four fixing screws (see Figure 2.15). The connector part can now be turned in increments of 90° into the position desired.



Make sure that neither the gasket nor the cable cores of the cable are damaged when re-tightening the screws.

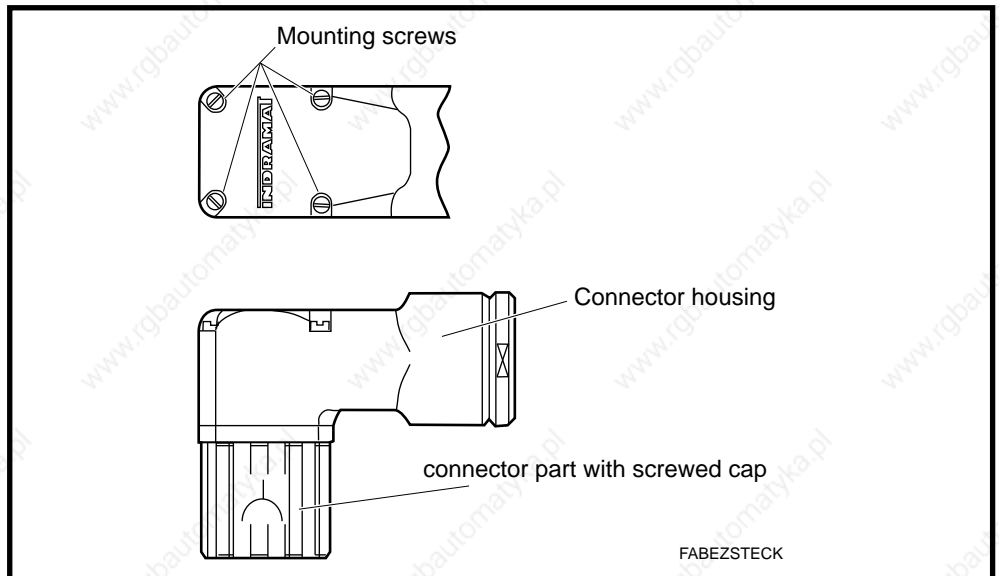


Fig. 2.15: Labelling the parts of the connector

2.3. Electrical Features

Terminal diagram

The terminal diagram shown in Figure 2.16 is purely schematic. It represents a checklist of all the necessary electrical connections to operate the MDD AC servo motor.

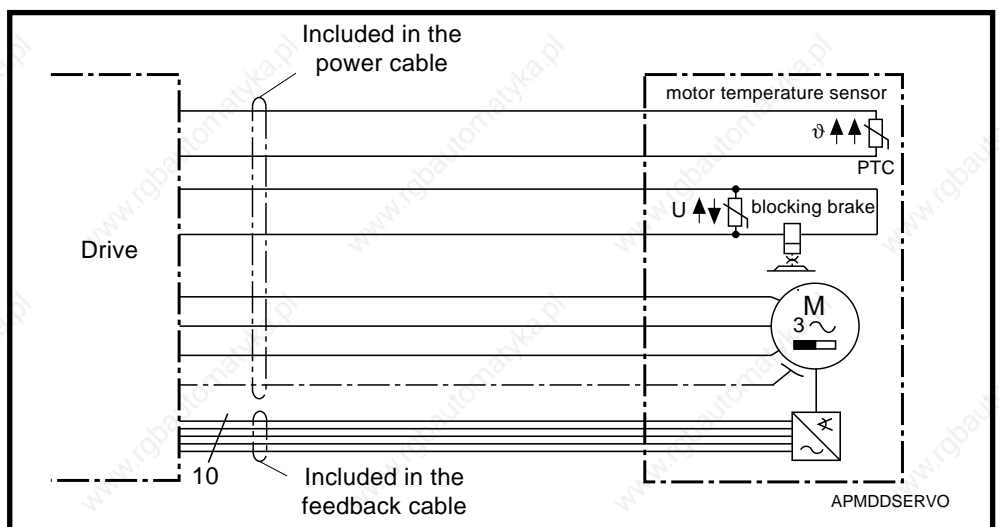


Fig. 2.16: Schematic terminal diagram

The following electrical connections are on the MDD motor:

- power connection
- feedback connection

If a blower for surface cooling is mounted on the motor, then a motor blower connection is also present. This is not shown in the terminal diagram.

The electrical connections of INDRAMAT drives have been standardized to minimize cable diversity. Sections 12 and 13 specify the electrical connections for a given application and motor type.

Power connection The following connections are integrated into the power connection:

- power cable
- connecting cable for temperature sensor (PTC)
- connecting cable for blocking brake

The temperature sensor is built into the windings of the motor. The motor is protected against overheating by evaluating the temperature sensor in the controller. In the case of a motor shutdown for thermal reasons, the controller will generate the appropriate error message.

The blocking brake is controlled by the drive controller.

Motor power connectors for the electrical power connections are available either

- for crimping or
- soldering.

Power cables with metric cable diameters can be either crimped or soldered to the motor power connector. Power cables with inch diameters can only be soldered.

Feedback connection There is a 12-pin flanged socket on the motor for the feedback connection.

The connection diagram, available feedback cables and feedback connectors are all outlined in section 13.

Motor blower connection The motor blower is connected via a protective motor switch. This means it operates independently of the controller.

Additional information about the motor blower can be found in the document "Blowers for mounting to MDD servo motors", doc. no. 9.578.003.4.

2.4. Motor feedback

Versions The motors are equipped with a motor feedback for the evaluation of position and speed and for the detection of rotor position. It is available with either

- relative or
- absolute position detection.

Depending on the motor series, the motor feedback is either a "resolver feedback" or a "digital servo feedback". Figure 2.17 shows the allocation of version to motor type.

| Measuring principle | | Inductive System | | Optical System | |
|-----------------------|-----|-------------------------|---|------------------------------|--|
| | | relative | absolute | relative | absolute |
| Position detection | | relative | absolute | relative | absolute |
| Version | | Resolver feedback (RSF) | Resolver feedback with integrated pulse wire absolute encoder (RSF + IDG) | Digital servo feedback (DSF) | Digital servo feedback with integrated multi-turn absolute encoder (DSF + MTG) |
| Line of motors MDD... | 021 | X | X | | |
| | 025 | X | X | | |
| | 041 | X | X | | |
| | 065 | | | X | X |
| | 071 | | | X | X |
| | 090 | | | X | X |
| | 093 | | | X | X |
| | 112 | | | X | X |
| | 115 | | | X | X |

Fig. 2.17: Possible versions of the motor feedback and allocation to line of motor

The versions "DSF" and "DSF + MTG" have the same dimensions. The dimensions of the versions "RSF" and "RSF + IDG" are also identical.

Motor feedback with relative position detection (DSF or RSF)

This version permits a **relative indirect position evaluation** of position on the motor. The relative position is stored in the intelligent digital drive. It can be handed over to the NC master control. This eliminates the need for separate incremental encoders on the motor. The absolute position of the axis is lost when power is shut down. Powering up requires renewed homing.

This version is also used with **relative direct position detection** on the machine.

Motor feedback with absolute position detection (DSF + MTG or RSF + IDG)

This version permits an **absolute indirect position detection** on the motor. The absolute position is stored in the intelligent digital drive and can be handed over to the NC master control. This eliminates the need for a separate absolute encoder on the motor. The absolute position of the axis is maintained when power is shut off.

This version is also used with **relative direct position detection** on the machine combined with absolute position detection on the motor

Feedback storage The motor feedback is equipped with data storage capacities in which the motor parameters are stored. After each powering up, the parameters are set in the drive. This guarantees that the drive can be operated without damaging the motor.

Technical Data

| Digital Servo Feedback with/without Integrated Multiturn Absolute Encoder | |
|--|--|
| Features | Data |
| Measuring principle | Optical System |
| Position resolution on the motor | $256 \times 2^{13} = 2\,097\,152$ increments/revolutions |
| System accuracy | ± 0.5 angular minutes |
| Detection range with absolute position detection | 4096 motor revolutions |

Fig. 2.18: "Digital servo feedback" - technical data

| Resolver Feedback with/without integrated Absolute Pulse Encoder | |
|---|--|
| Features | Data |
| Measuring principle | Inductive System |
| Position resolution on the motor | $2 \times 2^{13} = 16\,384$ increments/revolutions |
| System accuracy | ± 7 angular minutes |
| Detection range with absolute position detection | 4096 motor revolutions |

Fig. 2.19: "Resolver feedback" - technical data

2.5. Torque-Speed Characteristics

This section contains explanations about the torque-speed characteristics. These are depicted for each type of motor in sections 3.2, 4.2 through to 11.2.

The curves of some of the motors may deviate from the features described here. These deviations are, however, then relevantly documented.

What is depicted The operating curves depict:

- the torque limiting data,
- the speed limiting data and
- the operating curves.

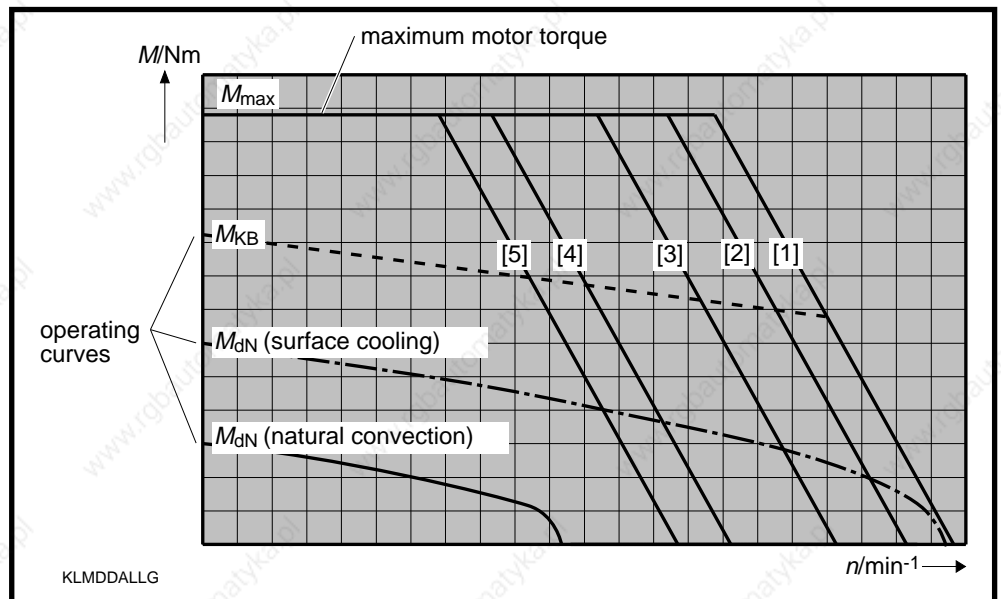


Fig. 2.20: The torque-speed characteristics curves illustrated

Usage The torque-speed characteristics curves can be used:

- to record information from the selection documentation
- to determine the possible maximum usable speed for a special application with known torque requirements, and
- to check whether the application remains within the thermal limits of the motor. The effective torque for a critical cycle must be below the S1 continuous operating characteristics curve of the arithmetically averaged speed.

Limiting value for torque

The horizontal line M_{max} depicts the theoretically possible maximum torque of the motor. The drive can limit this maximum torque resulting from the various motor-controller combinations. It is outlined in the selection documentation.

Limiting value for speed

Maximum motor speed is determined by the DC bus voltage produced by the supply source at the drive. Depending upon the DC bus voltage at the drive, maximum torque drops at a breaking point.

DC bus with a regulated power supply

In the case of those supply modules with a regulated power supply, the power data of the drive-motor combination are not dependent on the fluctuations of the mains voltage.

DC bus voltage with an unregulated power supply

In the case of those supply modules with an unregulated power supply, the power data of the drive-motor combination are dependent on the fluctuations of the mains voltage. Varying power data are achieved under the following conditions at the mains:

- 10 % overvoltage
- nominal voltage
- 10 % undervoltage

The declining lines are numbered. The following allocations apply:

- [1] -DC bus voltage with a regulated power supply (e.g., KDV 4, TVD, KVR and TVR) or an unregulated power supply (e.g., TVM 2, KDV 1, KDV 2, KDV 3 and DKS) if AC mains input voltage is 10% higher than the rated 3 x 230 volts AC.
- [2] - DC bus voltage with an unregulated power supply connected to three-phase mains rated at 3 x 230 volts AC (e.g., TVM 2, KDV 1, KDV 2, KDV 3 and DKS).
- [3] - DC bus voltage with an unregulated power supply connected to three-phase mains rated at 3 x 230 volts AC with 10% undervoltage (e.g., TVM 2, KDV 1, KDV 2, KDV 3 and DKS).
- [4] - DC bus voltage with an unregulated power supply (e.g., DKS) if AC mains voltage is connected to a single phase mains with 1 x 230 volts AC.
- [5] - DC bus voltage with an unregulated supply (e.g., DK) if the AC mains input voltage is 10% less than the rated 1 x 230 volts AC.

Operating curves

The operating curves depict the permissible continuous torque (operating mode S1) and the intermittent duty torque (operating mode S6 as per DIN 57530/VDE 0530, 07/91 edition).

The following allocations apply:

- S1-continuous operating curve of the motor with "natural convection"
- - - - - S1-continuous operating curve of a surface-cooled motor
- - - - - S6-intermittent operating curve:
at 25% ON time of a motor with natural convection, or the duration depicted in the curves for a surface-cooled motor. Maximum duty cycle time is depicted in Figure 2.21.

| MDD ... line of motors | Maximum Duty Cycle Time |
|------------------------------|-------------------------|
| 021, 025, 041 | 5 minutes |
| 065, 071, 090, 093, 112, 115 | 15 minutes |

Fig. 2.21: Maximum duty cycle time with intermittent operations

3. MDD 021

3.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | |
|--|-----------|-------------------|-------------------------|-------------------------|
| | | | 021 A-N-100 | 021 B-N-100 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 10000 | 10000 |
| Cont. torque at standstill ²⁾ | M_{dN} | Nm | 0.15 | 0.30 |
| Cont. current at standstill | I_{dN} | A | 0.8 | 1.6 |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 0.64 | 1.3 |
| Peak current | I_{max} | A | 3.6 | 7.1 |
| Moment of inertia of rotor | J_M | kgm ² | 0.22 x 10 ⁻⁴ | 0.31 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.19 | 0.19 |
| Windings resistance at 20 °C | R_A | Ohm | 18 | 6.8 |
| Windings inductance | L_A | mH | 9.5 | 4.5 |
| Thermal time constant | T_{th} | min | 15 | 15 |
| Mass | m_M | kg | 1.0 | 1.3 |

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curve.
²⁾ With 60K overtemperature at the motor housing.
³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

Fig 3.1: Type dependent motor data

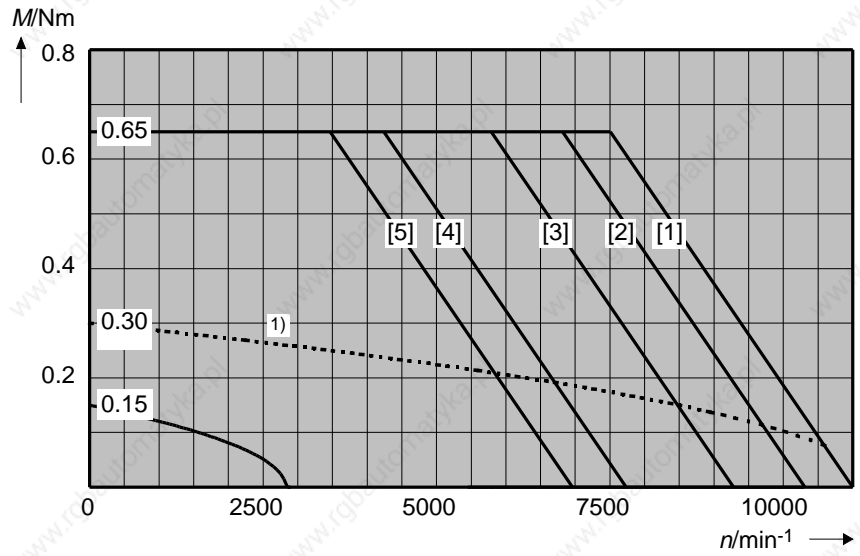
| Designation | Symbol | Unit | Data |
|--|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperatures | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 ¹⁾ |
| Insulation classification | | | F |
| Housing finish | | | Black prime coat (RAL 9005) |

¹⁾ Does not apply to the output shaft. Its protection category is IP 50.

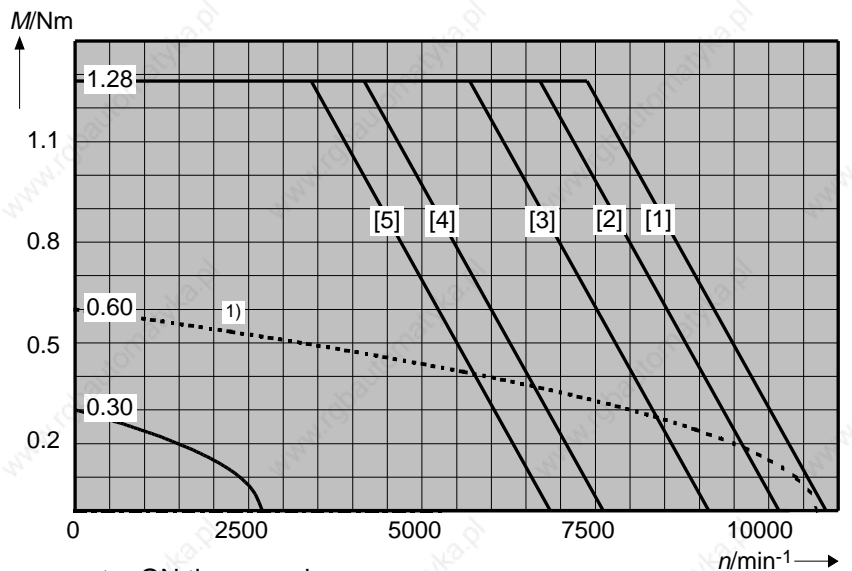
Fig 3.2: General data - MDD 021

3.2. Torque-Speed Characteristics

MDD 021 A at
10000 min⁻¹



MDD 021 B at
10000 min⁻¹



1) Shown: motor ON time equals 25%.
Maximum duty time equals five minutes.

Fig 3.3: Torque-speed characteristics curves - MDD 021

3.3. Shaft Load Capacity

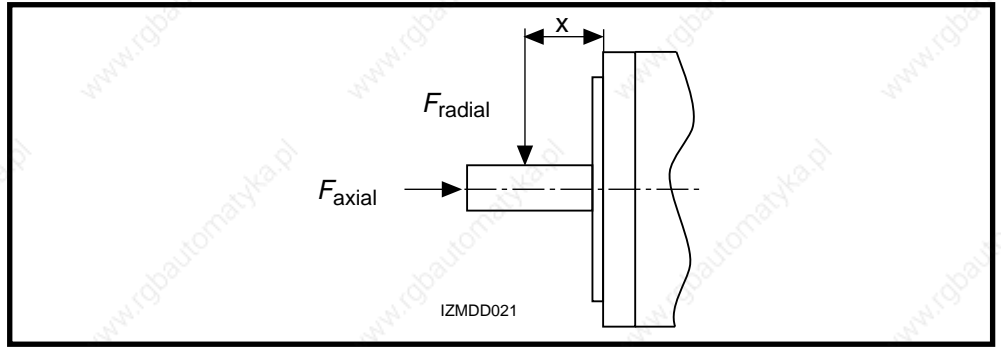


Fig 3.4: Shaft load

Permissible radial force
 F_{radial}

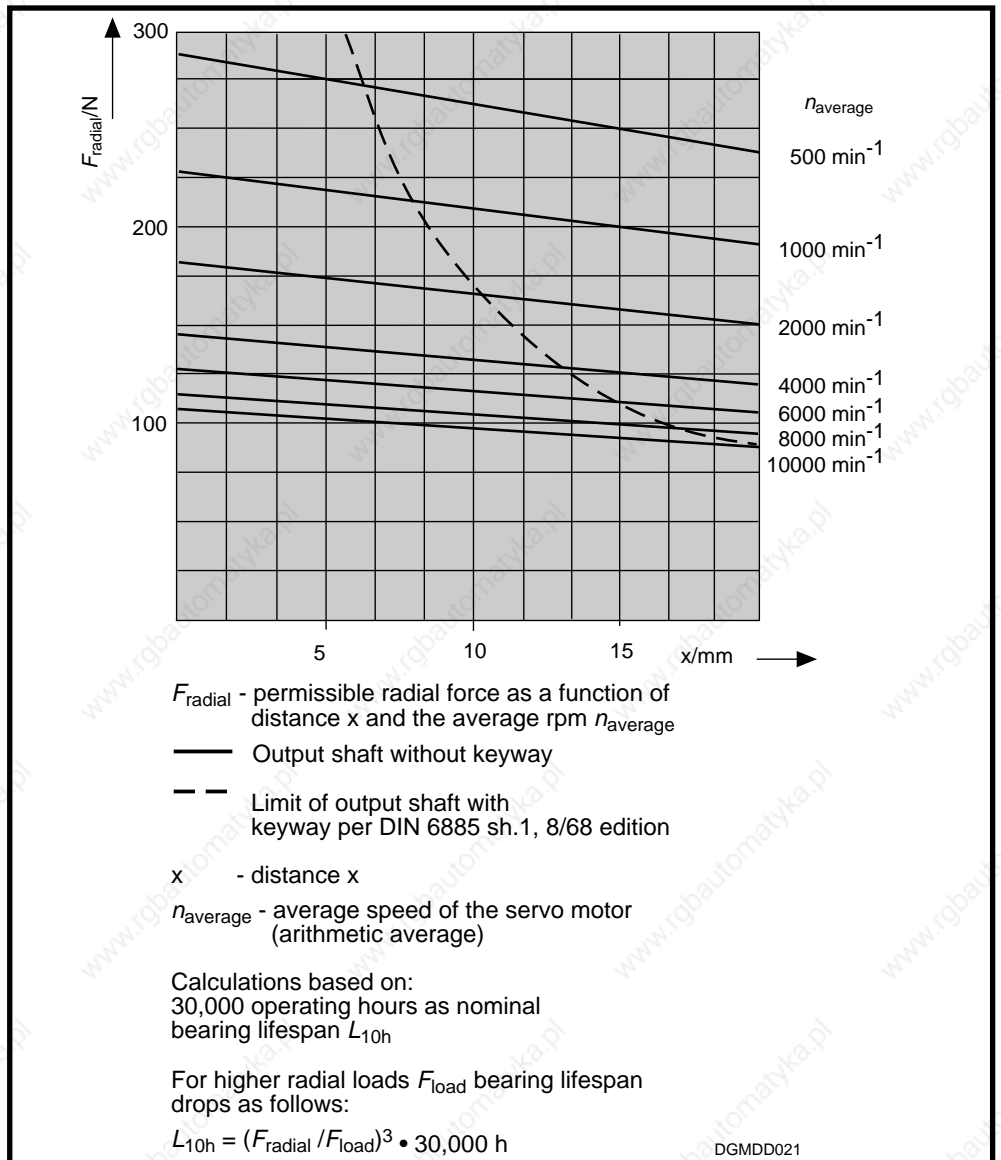


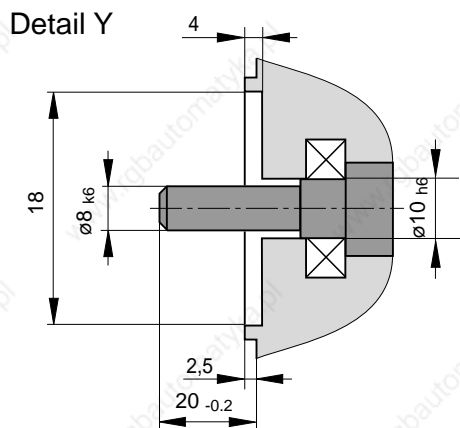
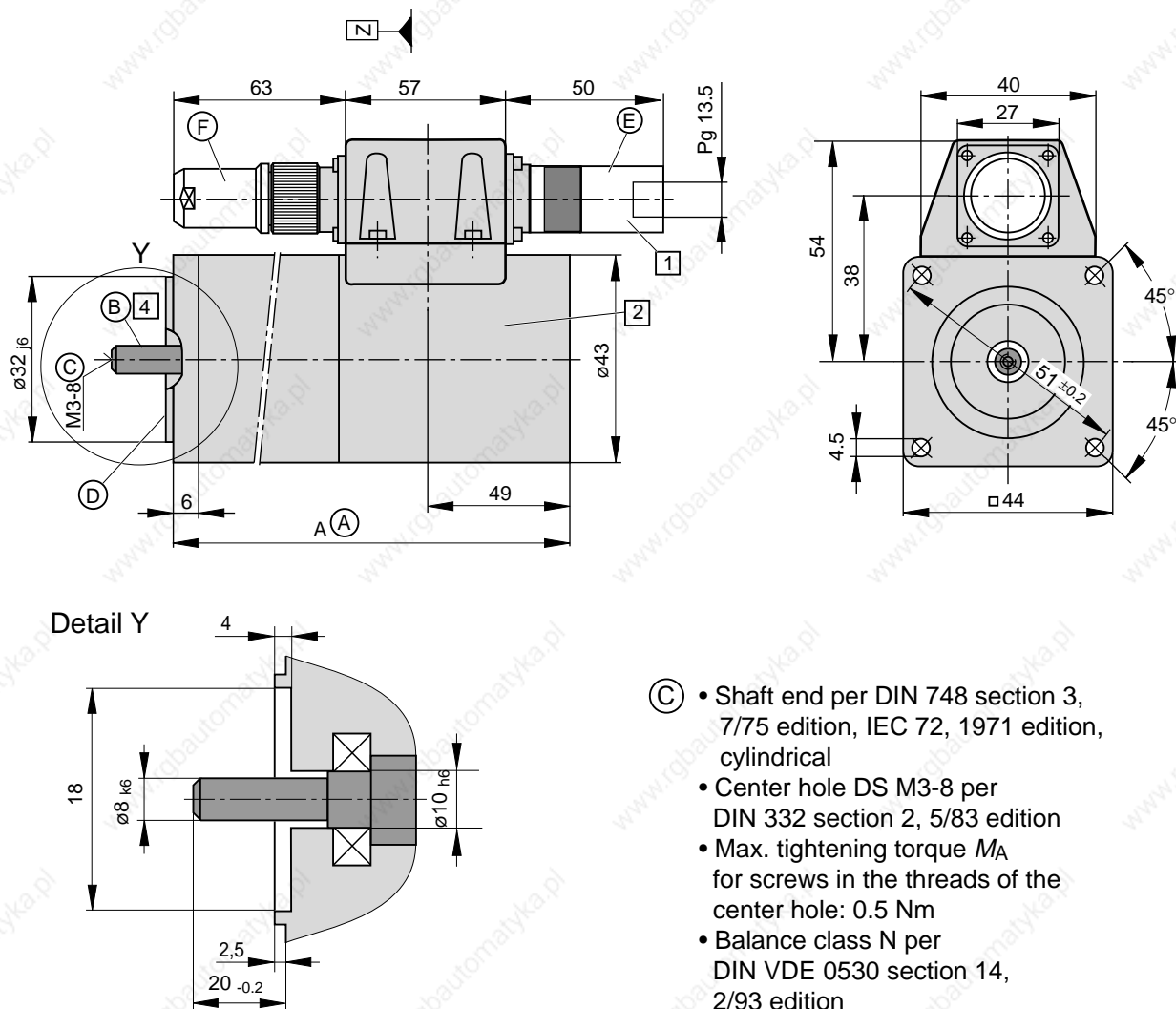
Fig 3.5: Permissible radial force

Permissible axial force
 F_{axial}

$$F_{axial} = 0.60 \cdot F_{radial}$$

F_{axial} - permissible axial force
 F_{radial} - permissible radial force

3.4. Dimensional Data



- (C) • Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
 • Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
 • Max. tightening torque M_A for screws in the threads of the center hole: 0.5 Nm
 • Balance class N per DIN VDE 0530 section 14, 2/93 edition

(A) Dimensional table Dim. A

| Size | Dim. A |
|-----------|--------|
| MDD 021 A | 173 |
| MDD 021 B | 213 |

- (B) Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

- (D) Flange type per DIN 42948, 11/65 edition, makes mounting possible
 • as per design B5 (throughholes in flange)
 • as per design B14 (threads in flange)

- (E) **Motor power connector**
 INS 252 must be ordered separately.

- (F) **Feedback connector:**
 INS 513 and INS 512 must be ordered separately as possible types.

MBMDD021_1

Fig 3.6: Dimensional data - MDD 021

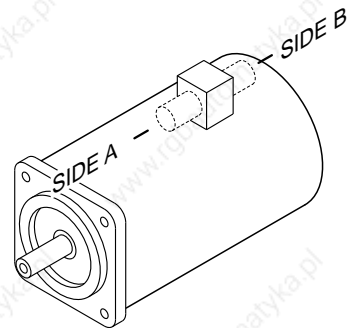
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B

The drawing depicts side B as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



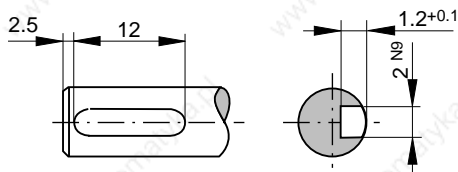
2 Motor feedback

- Resolver feedback
- Resolver feedback with integrated pulse wire absolute encoder

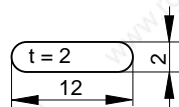
The dimensions are identical.

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 2 x 2 x 12



MBMDD021_2

Fig 3.7: Dimensional data - MDD 021 - selectable options

3.5. Available Versions

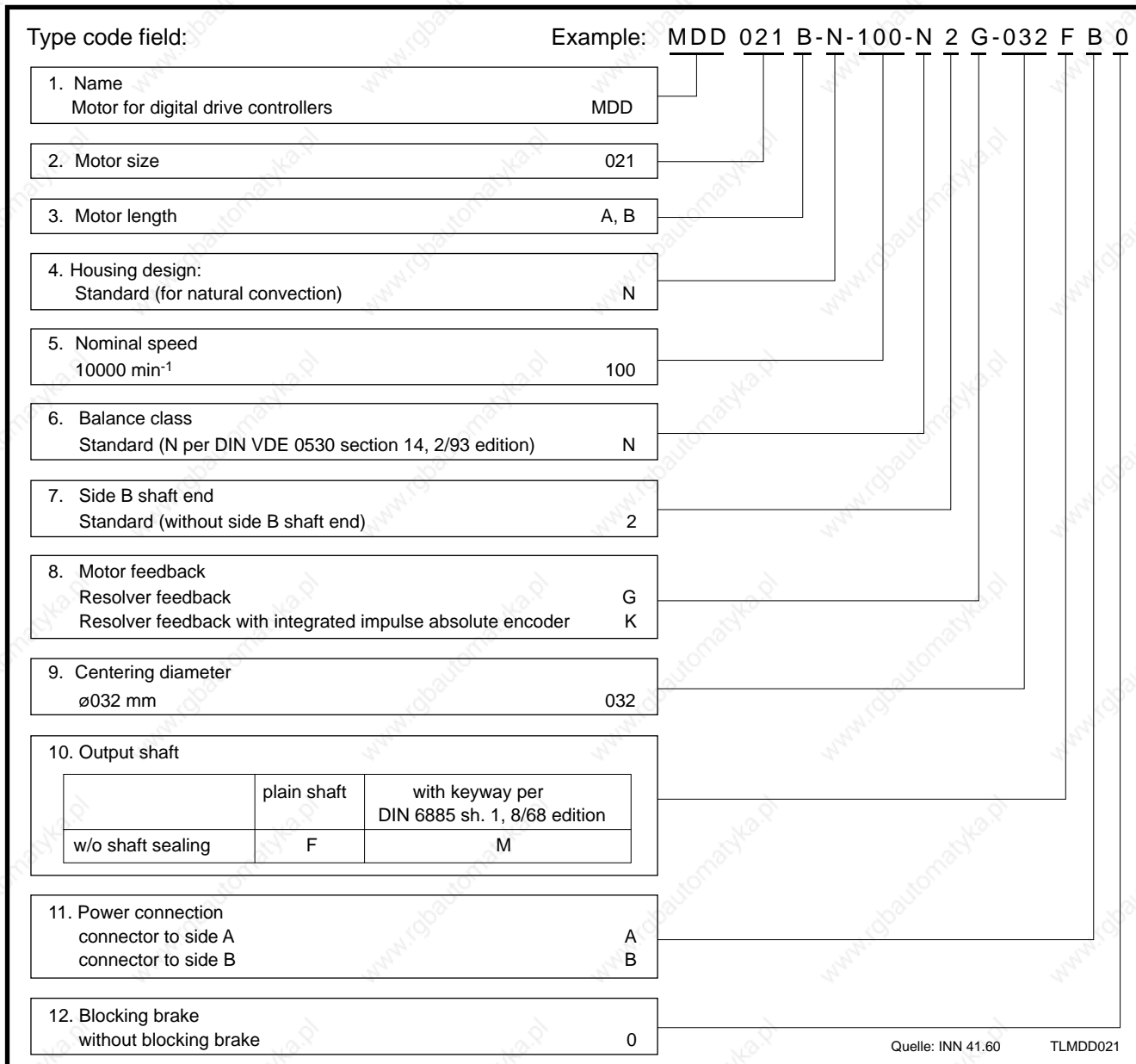


Fig 3.8: Type codes - MDD 021

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4. MDD 025

4.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | |
|--|-----------|-------------------|---------------------------|---------------------------|---------------------------|
| | | | 025 A-N-100 | 025 B-N-100 | 025 C-N-100 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 10000 | 10000 | 10000 |
| Cont. torque at standstill ²⁾ | M_{dN} | Nm | 0.33 (0.27) ⁵⁾ | 0.60 (0.51) ⁵⁾ | 0.90 (0.75) ⁵⁾ |
| Cont. current at standstill | I_{dN} | A | 1.5 | 2.7 | 3.9 |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 1.,44 | 2.61 | 3.94 |
| Peak current | I_{max} | A | 6.8 | 12.3 | 17.6 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 0.23 x 10 ⁻⁴ | 0.32 x 10 ⁻⁴ | 0.41 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.22 | 0.22 | 0.23 |
| Windings resistance at 20 °C | R_A | Ohm | 7.5 | 2.75 | 1.8 |
| Windings inductance | L_A | mH | 9.7 | 4.8 | 3.5 |
| Thermal time constant | T_{th} | min | 15 | 15 | 15 |
| Mass ⁴⁾ | m_M | kg | 1.5 | 2.0 | 2.5 |

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curve.
²⁾ With 60K overtemperature at the motor housing.
³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.
⁴⁾ Without blocking brake.
⁵⁾ Parenthetical values apply to motors with blocking brake.

Fig 4.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|--|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperatures | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 ¹⁾ |
| Insulation classification | | | F |
| Housing finish | | | Black prime coat (RAL 9005) |

¹⁾Does not apply to the output shaft: Without shaft sealing protection category is IP 50.
 With shaft sealing protection category is IP 65.

Fig 4.2: General data - MDD 025

| Designation | Symbol | Unit | Data Blocking Brake |
|---------------------|--------|------------------|--------------------------------|
| Principle of action | | | electrically- actuated release |
| Holding torque | M_H | Nm | 1.0 |
| Nominal voltage | U_N | V | DC 24 ± 10% |
| Nominal current | I_N | A | 0.4 |
| Moment of inertia | J_B | kgm ² | 0.08 x 10 ⁻⁴ |
| Release delay | t_L | ms | 30 |
| Clamping delay | t_K | ms | 5 |
| Mass | m_B | kg | 0.25 |

Fig 4.3: Technical data - blocking brake

4.2. Torque-Speed Characteristics

The torque-speed characteristics of the MDD 025 line of motors deviates from those depicted in section 2.5.

Figure 4.4 illustrates that the operating curves are differentiated in terms of motors "with or without" blocking brakes and "with or without" shaft sealing.

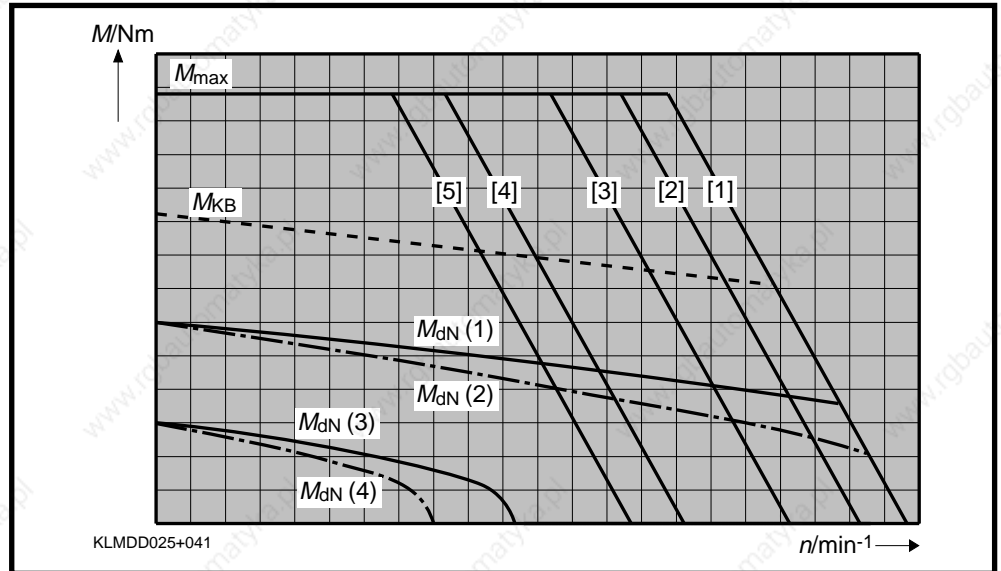


Fig 4.4: Schematic diagram of the torque-speed characteristics with MDD 025

Operating curves The operating curves represent the permissible continuous torque M_{dN} (operating mode S1) and intermittent torque M_{KB} (operating mode S6 as per DIN VDE 0530; status of 7/91).

The following allocations apply:

M_{dN} (1) S1-continuous operating curve of the motor without blocking brake / without shaft sealing

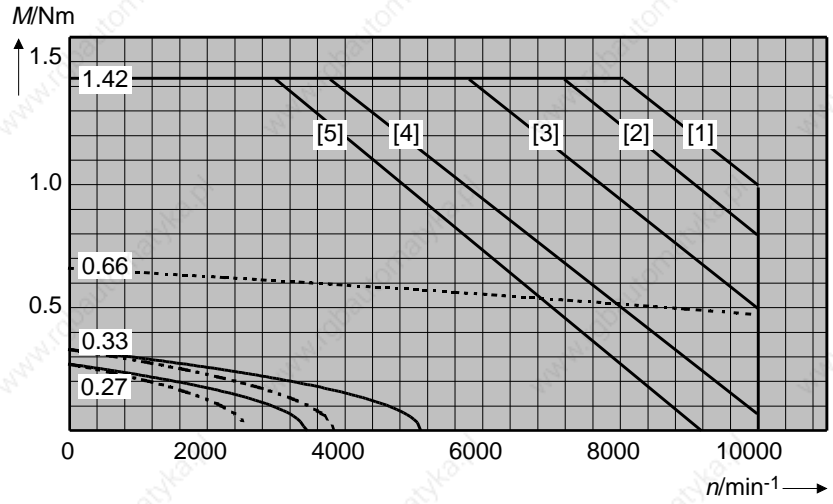
- · - · - M_{dN} (2) S1-continuous operating curve of the motor without blocking brake / with shaft sealing

M_{dN} (3) S1-continuous operating curve of the motor with blocking brake / without shaft sealing

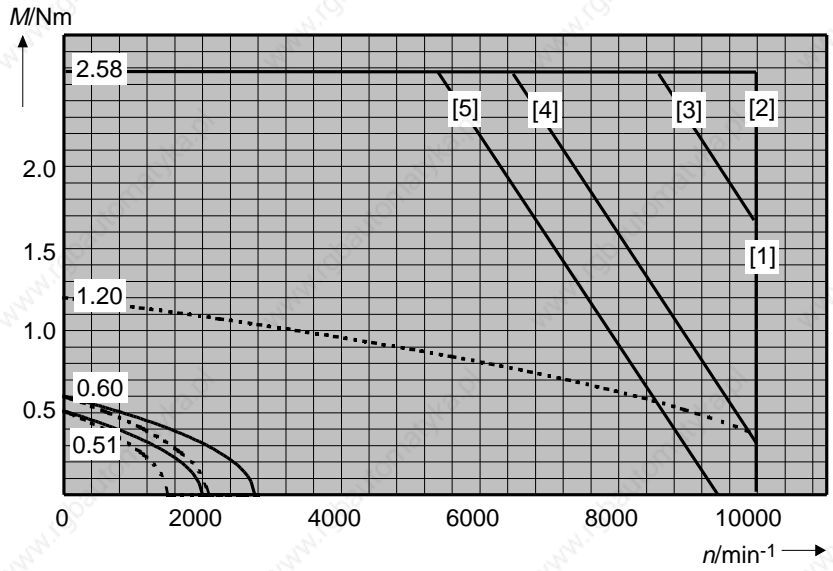
- · - · - M_{dN} (4) S1-continuous operating curve of the motor with blocking brake / with shaft sealing

- - - - - S6-intermittent operating curve at 25 % ON time of the motor Maximum duty cycle time equals five minutes.

MDD 025 A at
10000 min⁻¹



MDD 025 B at
10000 min⁻¹



MDD 025 C at
10000 min⁻¹

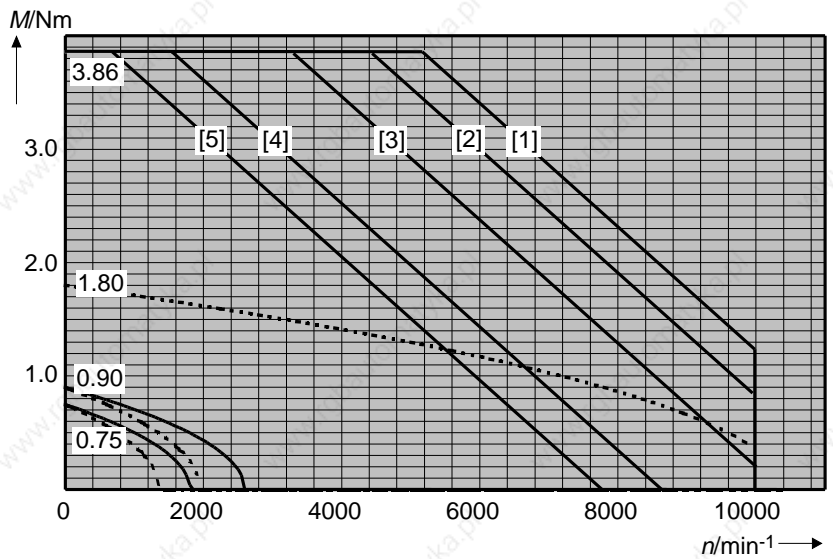


Fig 4.5: Torque-speed characteristics curves - MDD 025

4.3. Shaft Load Capacity

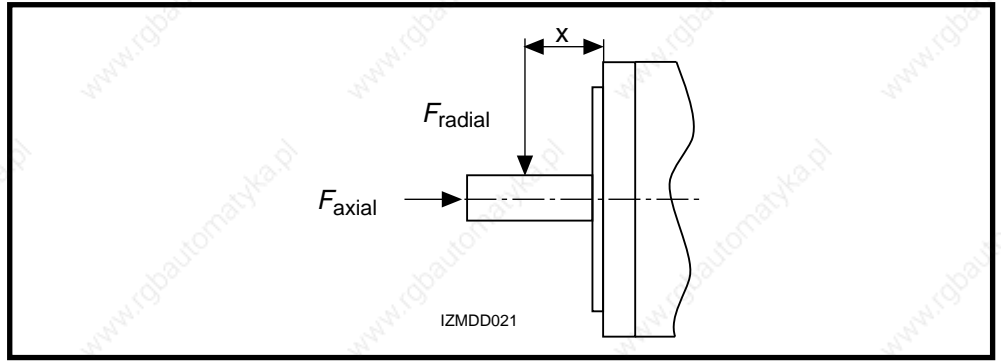


Fig 4.6: Shaft load

Permissible radial force

F_{radial}

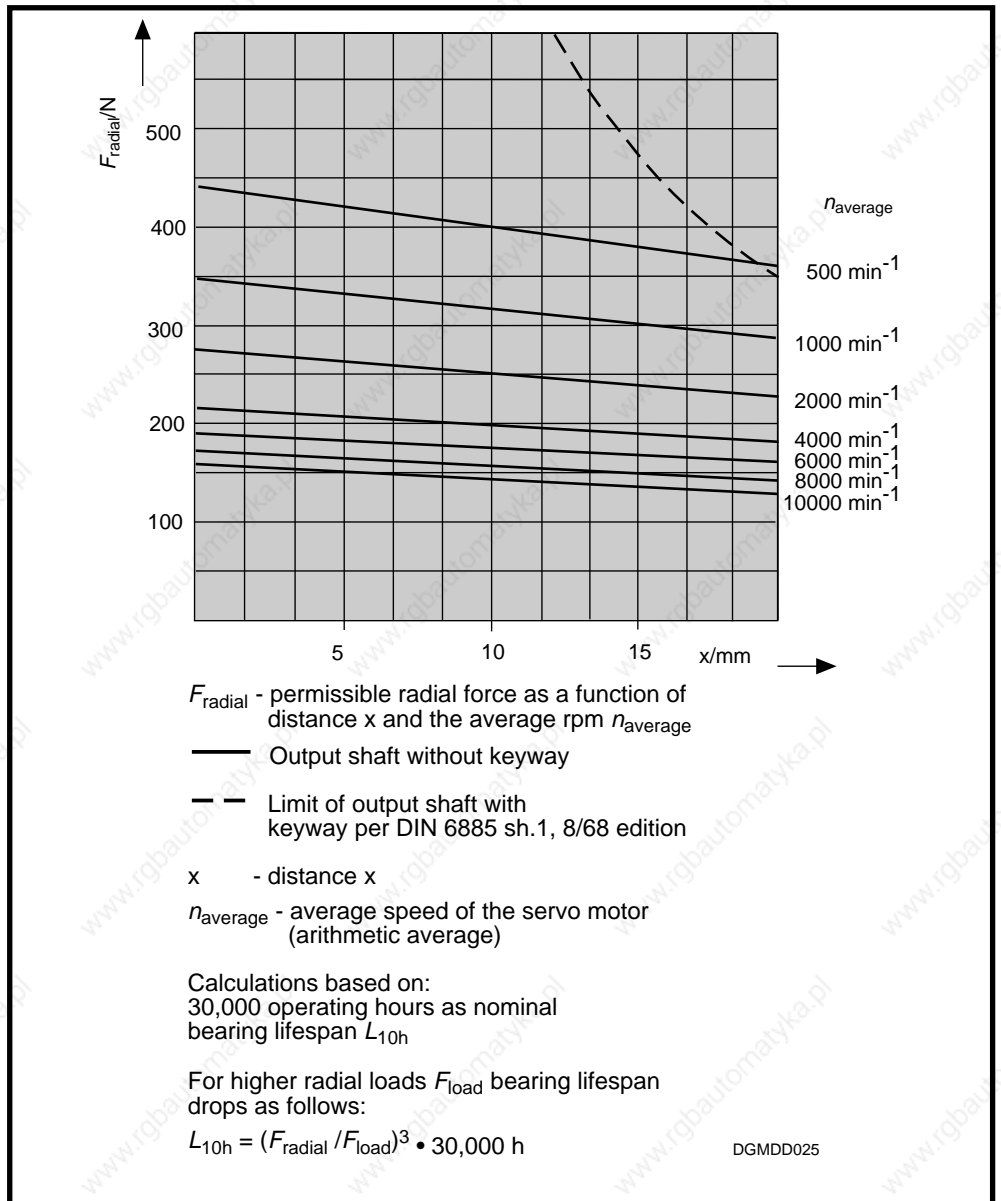


Fig 4.7: Permissible radial force

Permissible axial force

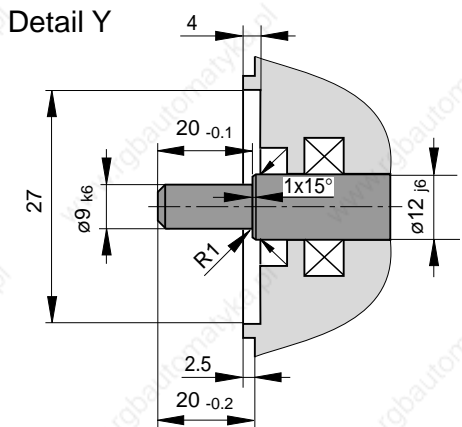
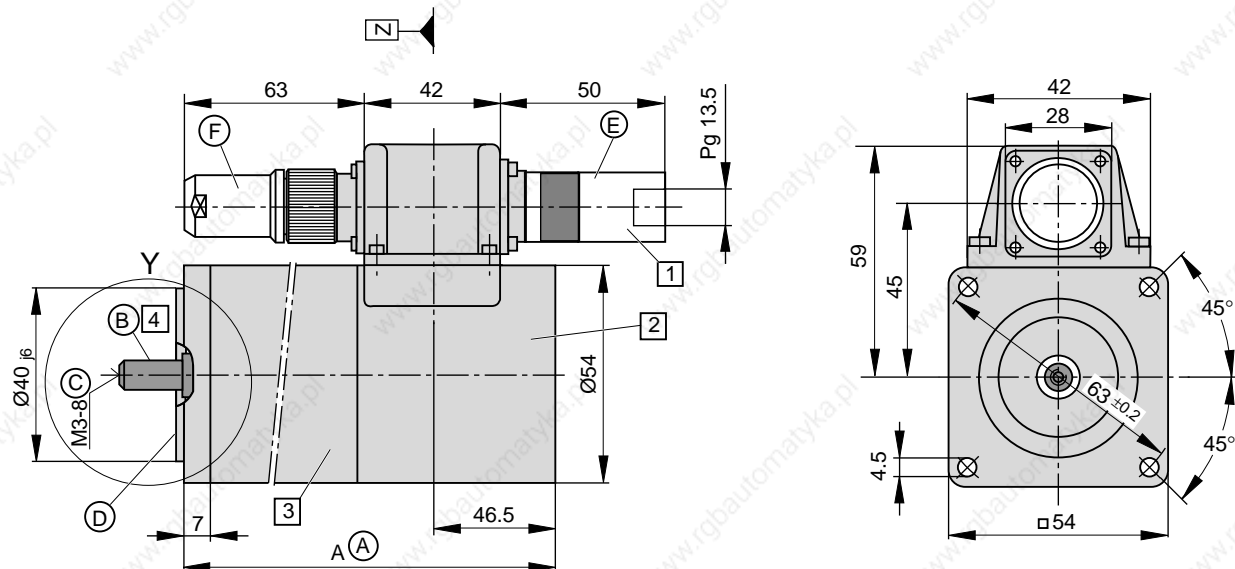
F_{axial}

$$F_{axial} = 0.55 \cdot F_{radial}$$

F_{axial} - permissible axial force

F_{radial} - permissible radial force

4.4. Dimensional Data



- Ⓒ • Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center hole: 0.5 Nm
- Balance class N per DIN VDE 0530 section 14, 2/93 edition

Ⓐ **Dimensional table Dim. A**

| Size | Dim. A 1) |
|-----------|-----------|
| MDD 025 A | 182 |
| MDD 025 B | 219 |
| MDD 025 C | 257 |

1) Bigger with some options. The then applicable dimension is indicated under the respective feature.

- Ⓑ Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

- Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
 - as per design B5 (throughholes in flange)
 - as per design B14 (threads in flange)

- Ⓔ **Motor power connector**
INS 252 must be ordered separately.

- Ⓕ **Feedback connector:**
INS 513 and INS 512 must be ordered separately as possible types.

MBMDD025_1

Fig 4.8: Dimensional data - MDD 025 (with flanged socket)

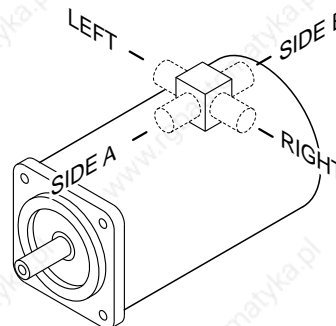
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side B as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Resolver feedback
 - Resolver feedback with integrated pulse wire absolute encoder
- The dimensions are identical.

3 Blocking brake

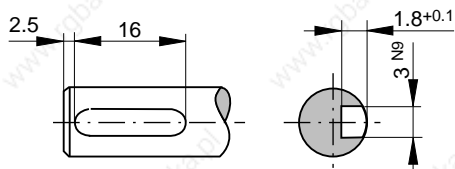
- without blocking brake
- with blocking brake: 1.0 Nm

Dimensional table for motors with blocking brake

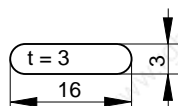
| Size | Dim. A |
|-----------|--------|
| MDD 025 A | 207 |
| MDD 025 B | 244 |
| MDD 025 C | 282 |

4 Output shaft

- plain shaft (preferred type)
 - with keyway per DIN 6885 sheet 1, 8/68 edition
- (Note: balanced with entire key!)



Matching key: DIN 6885-A 3 x 3 x 16



MBMDD025_2

Fig 4.9: Dimensional data MDD 025 (with flanged socket) - available options

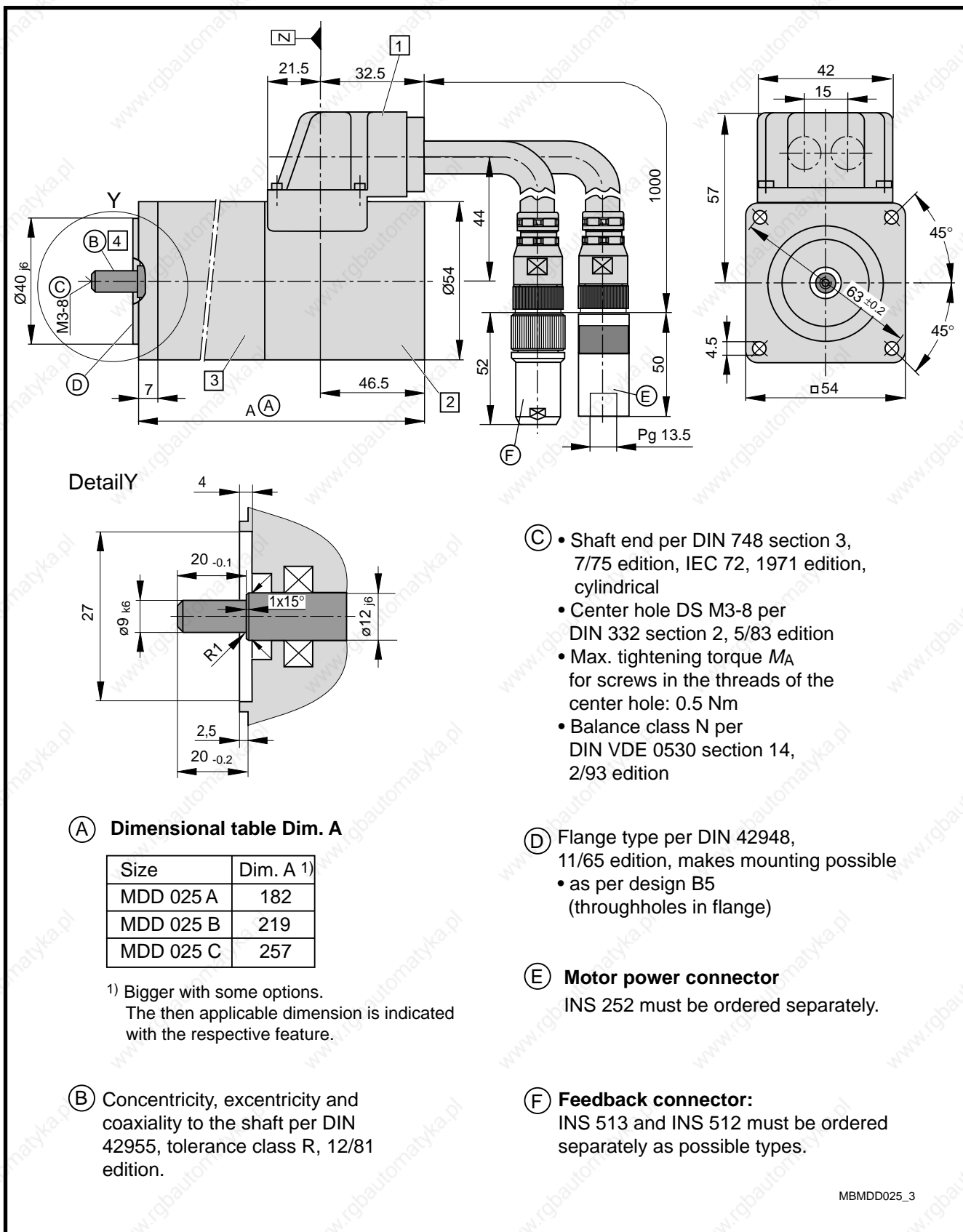


Fig 4.10: Dimensional data - MDD 025 (with connecting cable and coupling unit)

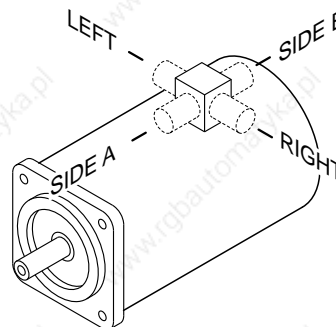
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side B as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Resolver feedback
 - Resolver feedback with integrated pulse wire absolute encoder
- The dimensions are identical.

3 Blocking brake

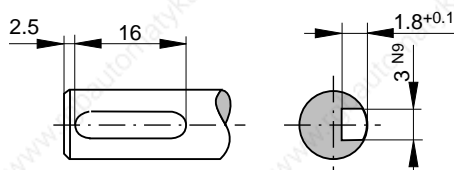
- without blocking brake
- with blocking brake: 1.0 Nm

Dimensional table for motors with blocking brake

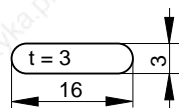
| Size | Dim. A |
|-----------|--------|
| MDD 025 A | 207 |
| MDD 025 B | 244 |
| MDD 025 C | 282 |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 3 x 3 x 16



MBMDD025_2

Fig 4.11: Dimensional data - MDD 025 (with connecting cable and coupling unit)
- available options

4.5. Available Versions

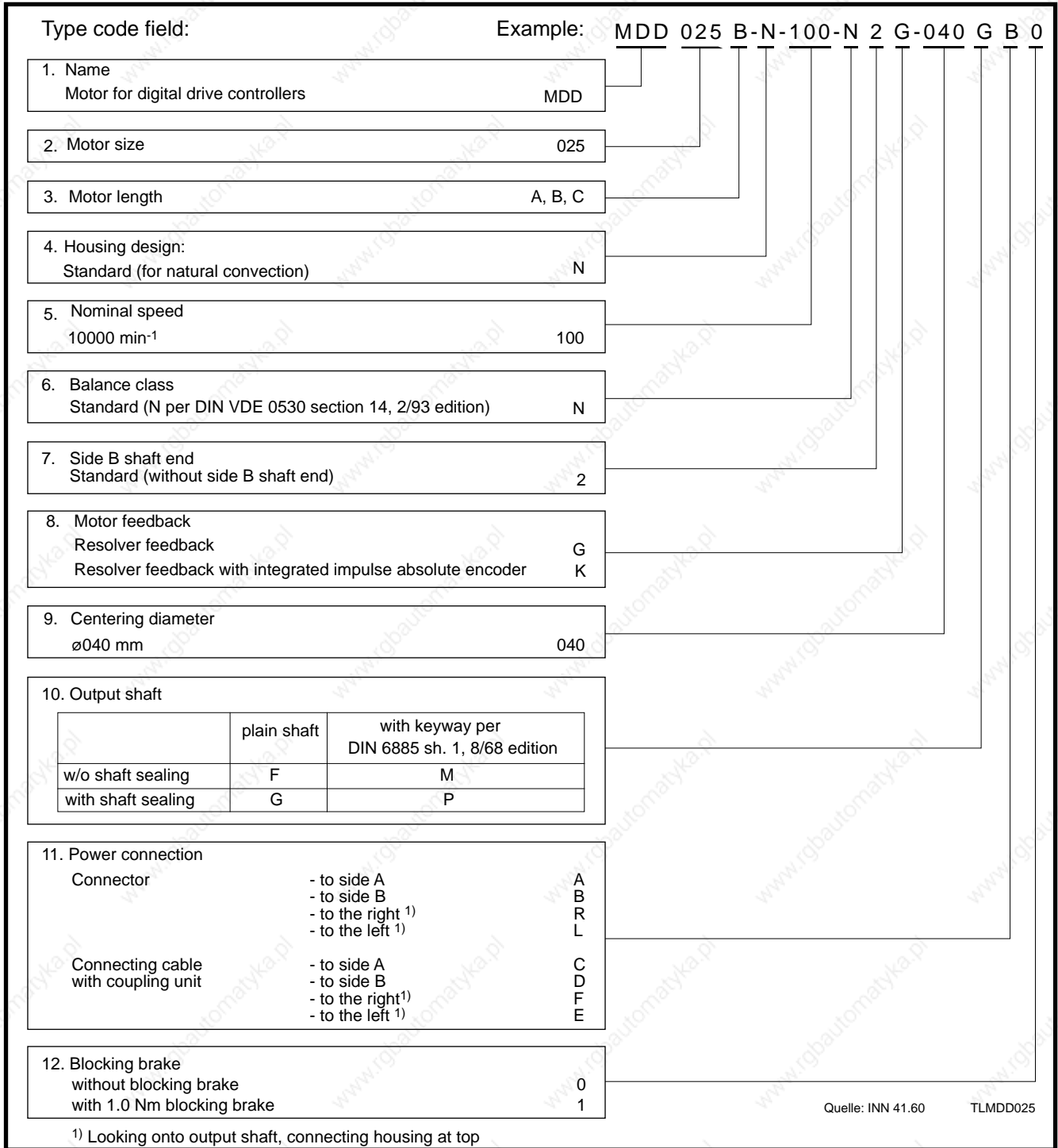


Fig 4.12: Type codes - MDD 025

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5. MDD 041

5.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | |
|---|-----------|-------------------|---------------------------|---------------------------|---------------------------|
| | | | 041 A-N-100 | 041 B-N-100 | 041 C-N-100 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 10000 | 10000 | 10000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 0.64 (0.59) ⁵⁾ | 1.35 (1.26) ⁵⁾ | 2.05 (1.93) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 3.2 | 7.1 | 10.3 |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 3.0 | 5.85 | 9.01 |
| Peak current | I_{max} | A | 14.4 | 32.0 | 46.1 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 0.7×10^{-4} | 1.3×10^{-4} | 1.9×10^{-4} |
| Torque constant at 20 °C | K_m | Nm/A | 0.20 | 0.19 | 0.20 |
| Windings resistance at 20 °C | R_A | Ohm | 2.4 | 0.8 | 0.5 |
| Windings inductance | L_A | mH | 7.6 | 3.6 | 2.7 |
| Thermal time constant | T_{th} | min | 25 | 25 | 25 |
| Mass ⁴⁾ | m_M | kg | 2.8 | 3.7 | 4.6 |

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves.
²⁾ With 60 K overtemperature at the motor housing.
³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.
⁴⁾ without blocking brake
⁵⁾ Parenthetical values apply to motors with blocking brake.

Fig 5.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|--|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperatures | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 ¹⁾ |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

¹⁾ Does not apply to output shaft: Without shaft sealing protection category is IP 50.
 With shaft sealing protection category is IP 65.

Fig 5.2: General data - MDD 041

| Designation | Symbol | Unit | Blocking Brake Data |
|---------------------|--------|------------------|--------------------------------|
| Principle of action | | | electrically -actuated release |
| Holding torque | M_H | Nm | 1.2 |
| Nominal voltage | U_N | V | DC 24 ± 10% |
| Nominal current | I_N | A | 0.4 |
| Moment of inertia | J_B | kgm ² | 0.08×10^{-4} |
| Release delay | t_L | ms | 30 |
| Clamping delay | t_K | ms | 5 |
| Mass | m_B | kg | 0.3 |

Fig 5.3: Technical data - blocking brake

5.2. Torque-Speed Characteristics

The torque-speed characteristics of the MDD 041 line of motors deviate from those depicted in section 2.5.

Figure 5.4 depicts the operating curves of the various motors differentiated in terms of "with or without" blocking brake and "with or without" shaft sealing.

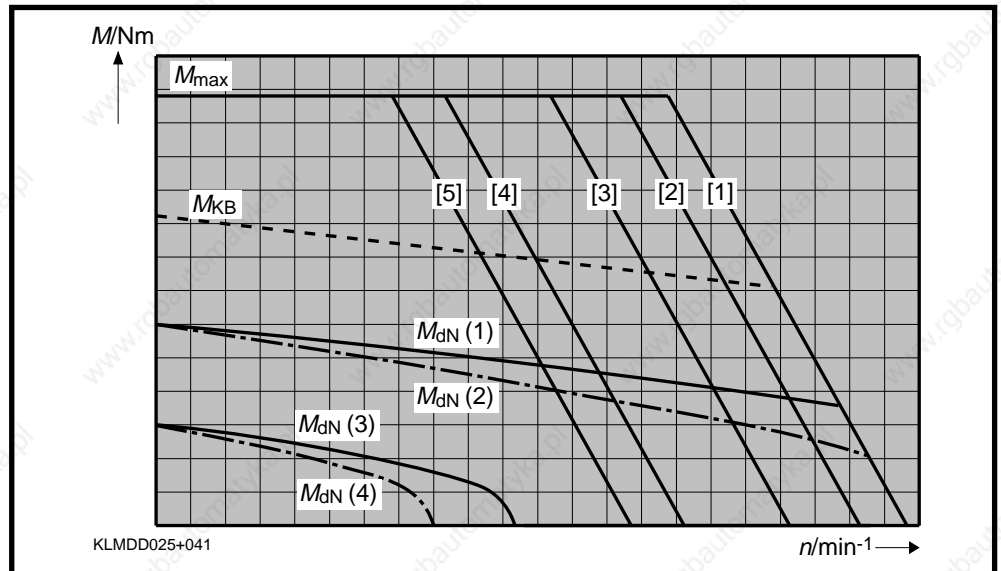


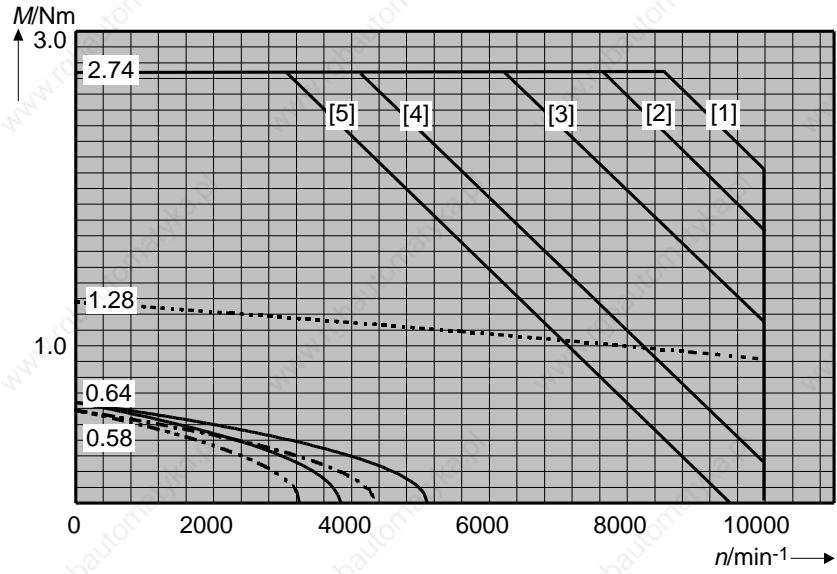
Fig 5.4: Schematic diagram of torque-speed characteristic of an MDD 041

Operating curves Operating curves depict the permissible continuous torque M_{dN} (operating mode S1) and intermittent torque M_{KB} (operating mode S6 as per DIN VDE 0530; status 7/91).

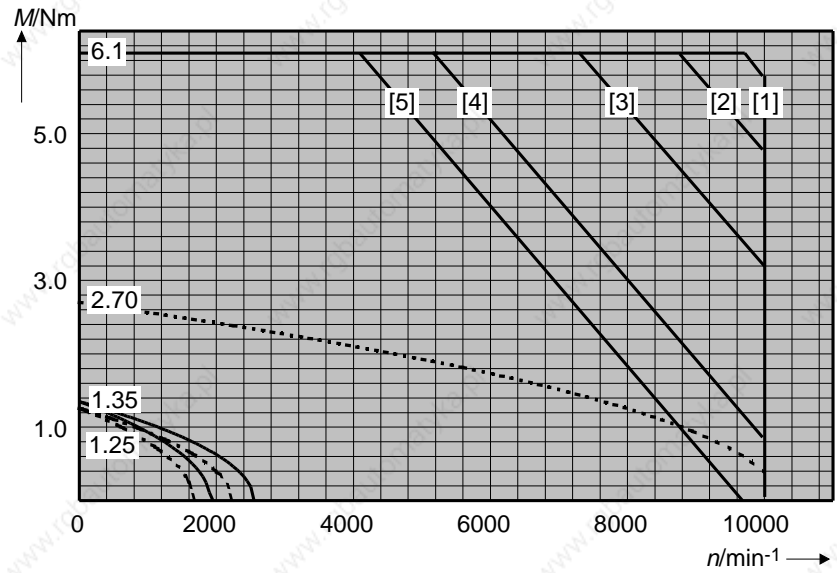
The following allocations apply:

- M_{dN} (1) S1-continuous operating curve of the motor without blocking brake / without shaft sealing
- - - M_{dN} (2) S1-continuous operating curve of the motor without blocking brake / with shaft sealing
- M_{dN} (3) S1-continuous operating curve of the motor with blocking brake / without shaft sealing
- - - M_{dN} (4) S1-continuous operating curve of the motor with blocking brake / with shaft sealing
- - - - - S6-intermittent operating curve at 25 % of ON time of the motor
Maximum duty cycle time equals five minutes.

MDD 041 A at
10000 min⁻¹



MDD 041 B at
10000 min⁻¹



MDD 041 C at
10000 min⁻¹

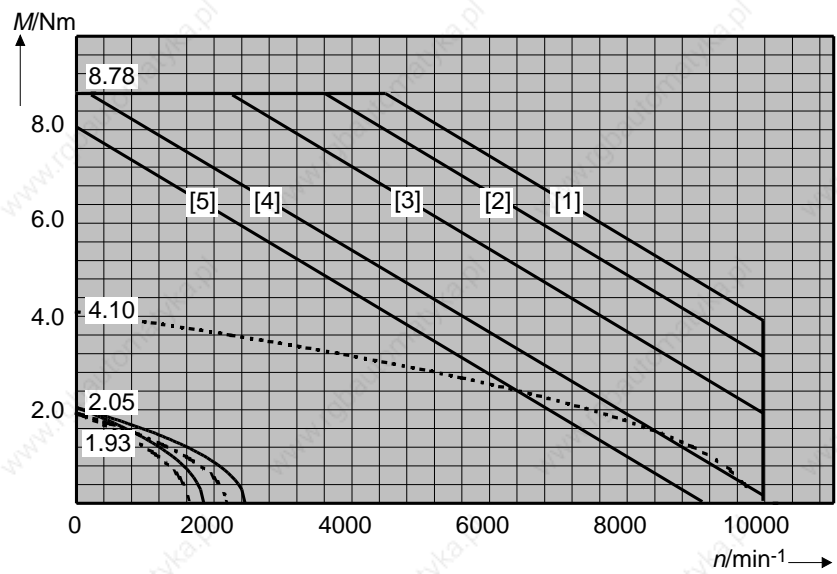


Fig 5.5: Torque-speed characteristics curves - MDD 041

5.3. Shaft Load Capacity

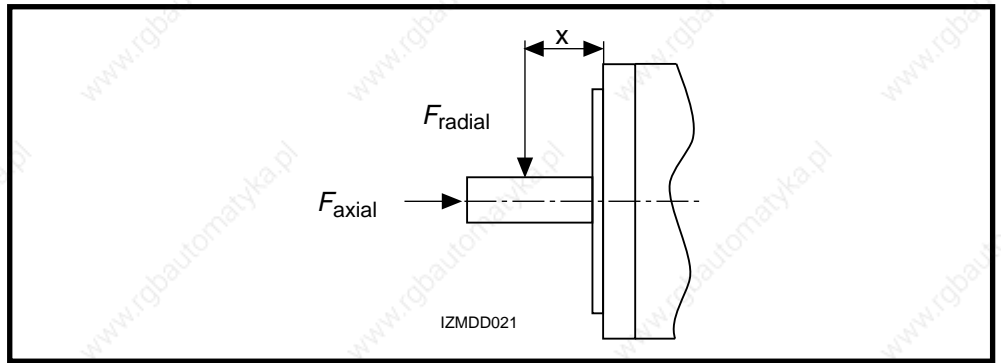


Fig 5.6: Shaft load

Permissible radial force

F_{radial}

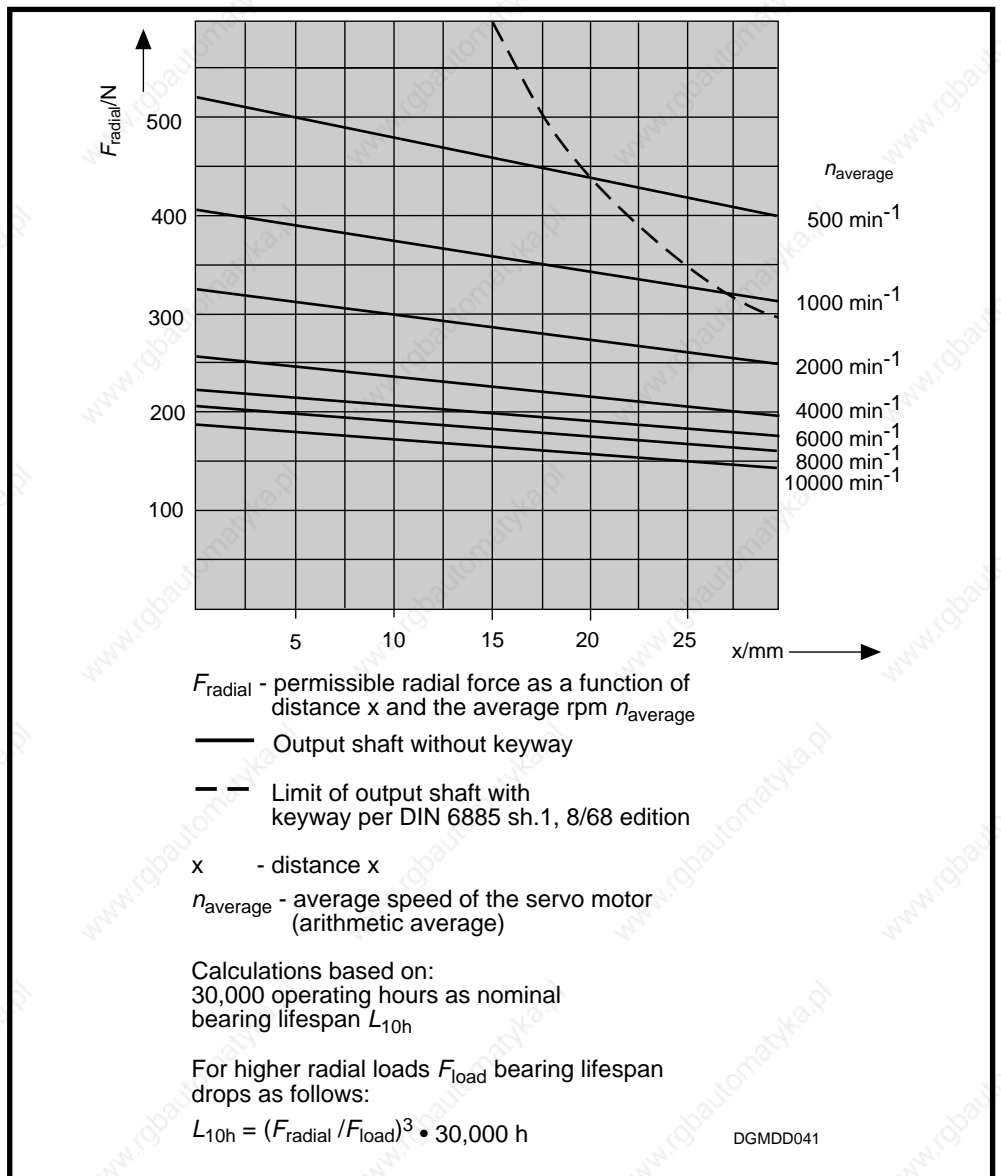


Fig 5.7: Permissible radial force

Permissible axial force

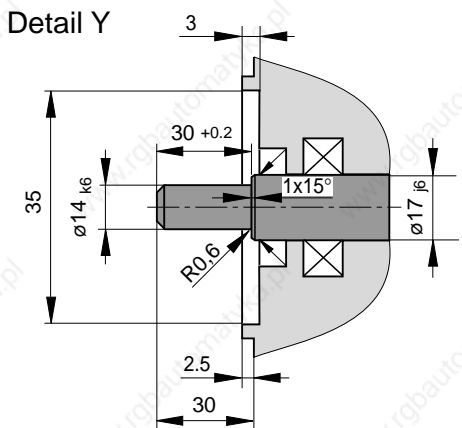
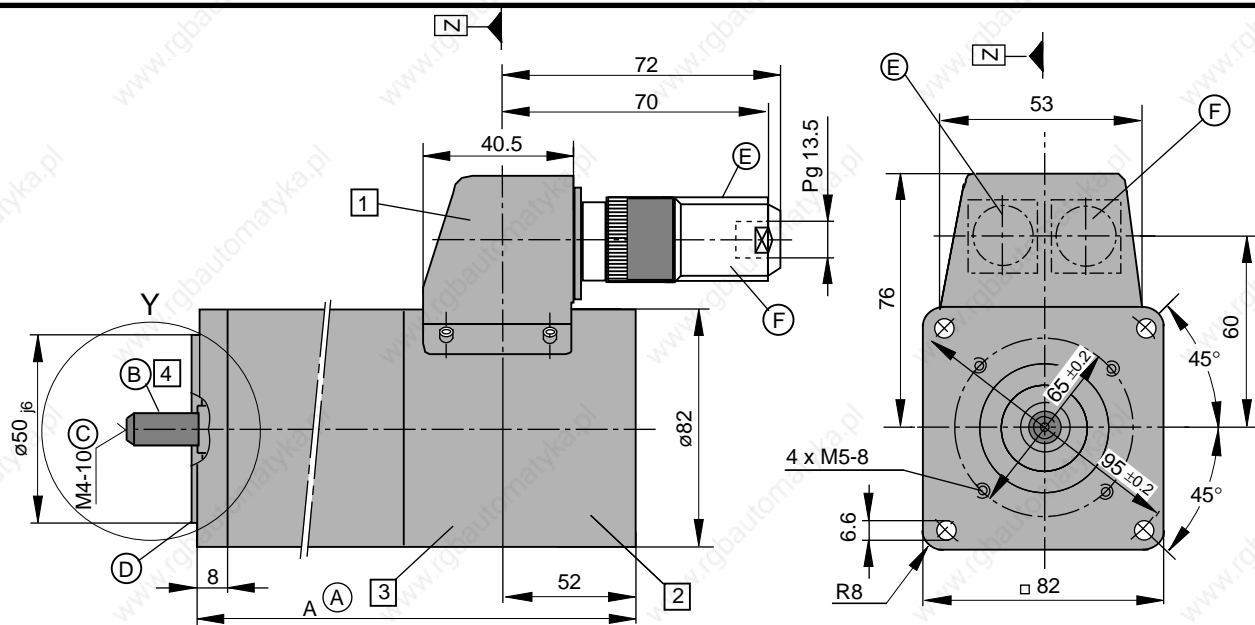
F_{axial}

$$F_{axial} = 0.53 \cdot F_{radial}$$

F_{axial} - permissible axial force

F_{radial} - permissible radial force

5.4. Dimensional Data



- Ⓒ • Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center hole: 0.6 Nm
- Balance class N per DIN VDE 0530 section 14, 2/93 edition

- Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
 - as per design B5 (throughholes in flange)
 - as per design B14 (threads in flange)

- Ⓔ **Motor power connector**
INS 252 must be ordered separately.

- Ⓕ **Feedback connector:**
INS 513 and INS 512 must be ordered separately as possible types.

Ⓐ **Dimensional table Dim. A**

| Size | Dim. A 1) |
|-----------|-----------|
| MDD 041 A | 178 |
| MDD 041 B | 208 |
| MDD 041 C | 238 |

1) Bigger with some options.
The then applicable dimension is indicated with the respective feature.

- Ⓑ Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

MBMDD041_1

Fig 5.8: Dimensional data - MDD 041

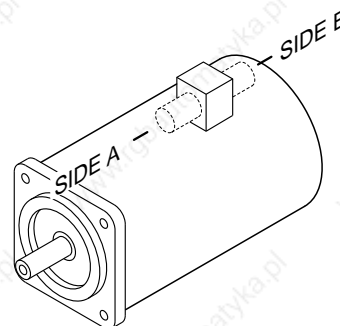
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B

The drawing depicts side B as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Resolver feedback
 - Resolver feedback with integrated pulse wire absolute encoder
- The dimensions are identical.

3 Blocking brake

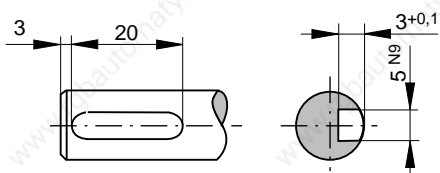
- without blocking brake
- with blocking brake: 1.0 Nm

Dimensional table for motors with blocking brake

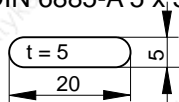
| Size | Dim. A |
|-----------|--------|
| MDD 041 A | 203 |
| MDD 041 B | 233 |
| MDD 041 C | 263 |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 5 x 5 x 20



MBMDD041_2

Fig 5.9: Dimensional data - MDD 041 - available options

5.5. Available Versions

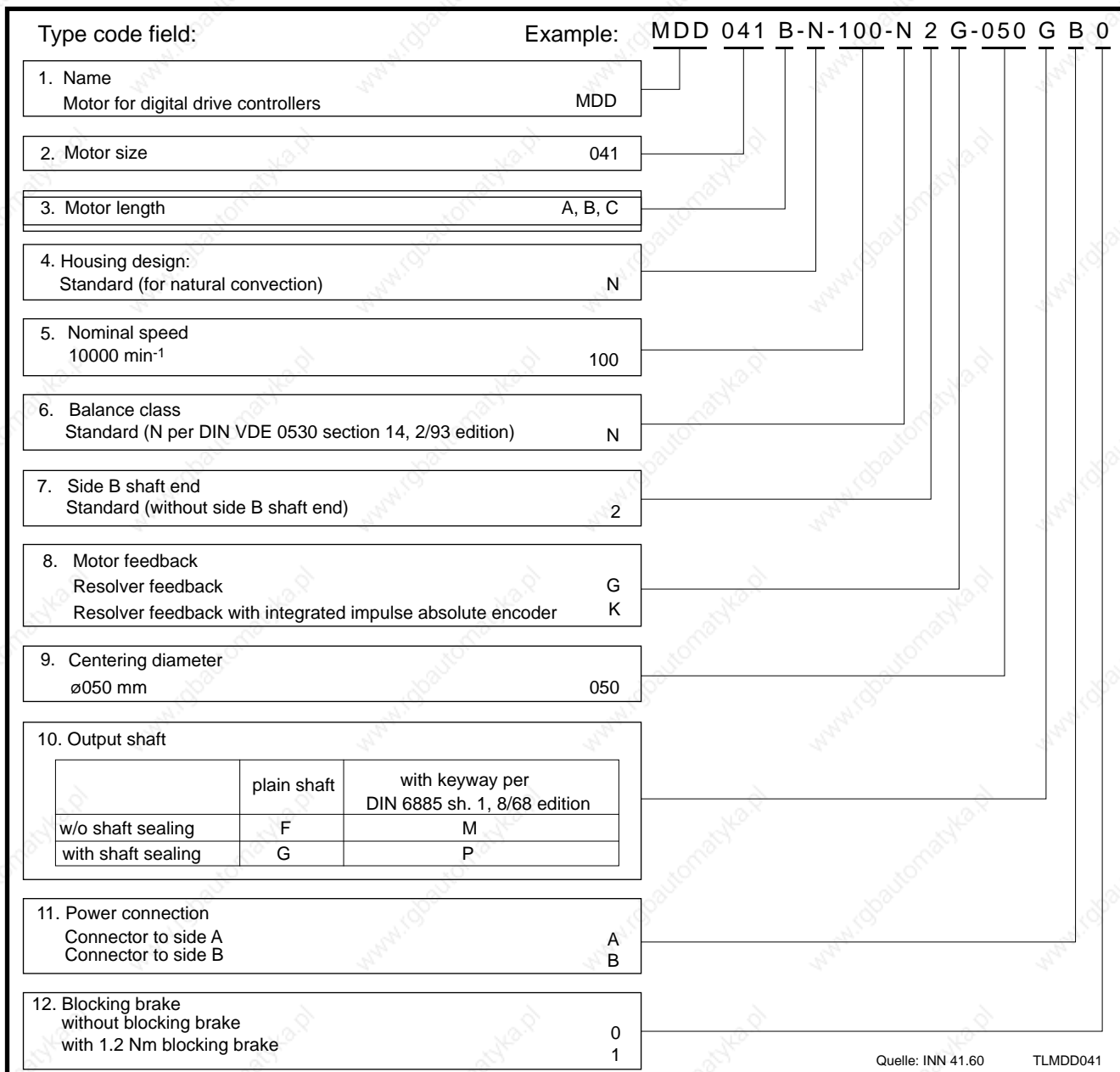


Fig 5.10: Type codes - MDD 041

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6. MDD 065

6.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD . . . | | | |
|---|-----------|-------------------|----------------------|-------------------------|--------------------------|---------------------------|
| | | | 065 A-N-040 | 065 B-N-040 | 065 C-N-040 | 065 D-N-040 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 4000 | 4000 | 4000 | 4000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 0.8 | 1.5 (1.7) ⁵⁾ | 2.1 (2.7) ⁵⁾ | 2.7 (3.5) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 1.8 | 3,5 (4.0) ⁵⁾ | 5.5 (7.1) ⁵⁾ | 6.3 (8.1) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 2.3 | 4,4 | 6.1 | 7.8 |
| Peak current | I_{max} | A | 8.1 | 15.9 | 24.6 | 28.5 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 1.4×10^{-4} | 2.2×10^{-4} | 3.0×10^{-4} | 3.8×10^{-4} |
| Torque constant at 20 °C | K_m | Nm/A | 0.44 | 0.43 | 0.38 | 0.43 |
| Windings resistance at 20 °C | R_A | Ohm | 16 | 5.22 | 2.25 | 2.0 |
| Windings inductance | L_A | mH | 20.3 | 7.4 | 3.6 | 2.6 |
| Thermal time constant | T_{th} | min | 30 | 30 (15) ⁵⁾ | 30 (15) ⁵⁾ | 30 (15) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 3.2 | 3.9 | 4.6 | 5.3 |
| | | | 065 A-N-060 | 065 B-N-060 | 065 C-N-060 | 065 D-N-060 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 6000 | 6000 | 6000 | 6000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 0.8 | 1.5 (1.7) ⁵⁾ | 2.1 (2.7) ⁵⁾ | 2.7 (3.5) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 2.6 | 5.9 (6.7) ⁵⁾ | 7.9 (10.2) ⁵⁾ | 10.3 (13.3) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 2.3 | 4.4 | 6.1 | 7.8 |
| Peak current | I_{max} | A | 11.6 | 26.3 | 35.4 | 46.2 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 1.4×10^{-4} | 2.2×10^{-4} | 3.0×10^{-4} | 3.8×10^{-4} |
| Torque constant at 20 °C | K_m | Nm/A | 0.31 | 0.26 | 0.27 | 0.26 |
| Windings resistance at 20 °C | R_A | Ohm | 7.75 | 2.0 | 1.16 | 0.74 |
| Windings inductance | L_A | mH | 6.4 | 2.2 | 1.3 | 0.9 |
| Thermal time constant | T_{th} | min | 30 | 30 (15) ⁵⁾ | 30 (15) ⁵⁾ | 30 (15) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 3.2 | 3.9 | 4.6 | 5.3 |

1) Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves.

2) With 60 K overtemperature at the motor housing.

3) Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

4) without blocking brake

5) Parenthetical values apply to motors with surface cooling

Fig 6.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|--|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperatures | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

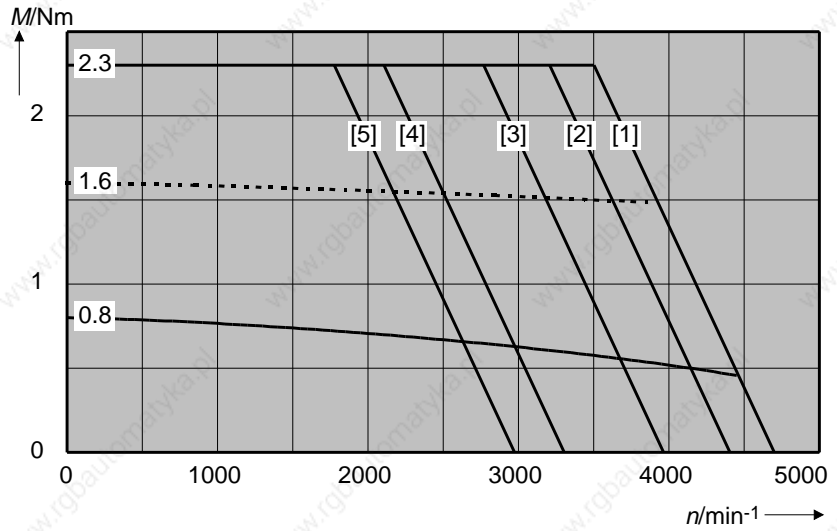
Fig 6.2: General data - MDD 065

| Designation | Symbol | Unit | Blocking Brake Data |
|---------------------|--------|------------------|-------------------------------|
| Principle of action | | | electrically actuated release |
| Holding torque | M_H | Nm | 3.0 |
| Nominal voltage | U_N | V | DC 24 ± 10% |
| Nominal current | I_N | A | 0.6 |
| Moment of inertia | J_B | kgm ² | 0.38 × 10 ⁻⁴ |
| Release delay | t_L | ms | 30 |
| Clamping delay | t_K | ms | 15 |
| Mass | m_B | kg | 0.55 |

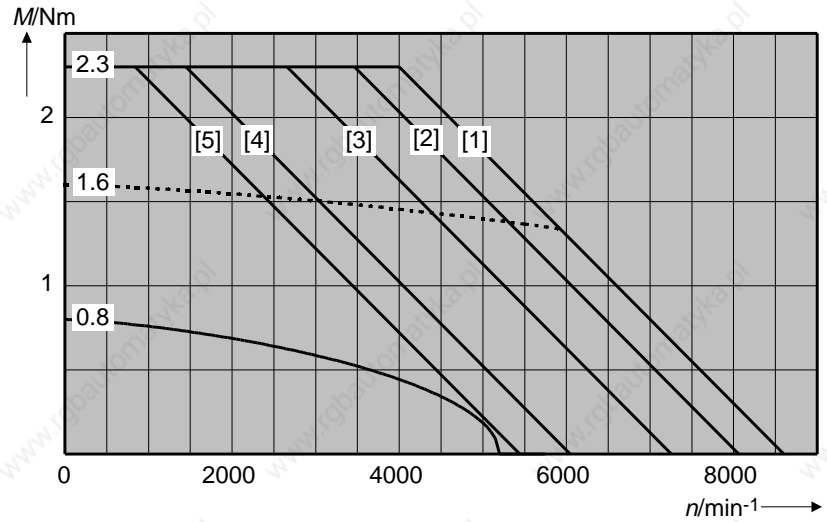
Fig 6.3: Technical data - blocking brake

6.2. Torque-Speed Characteristics

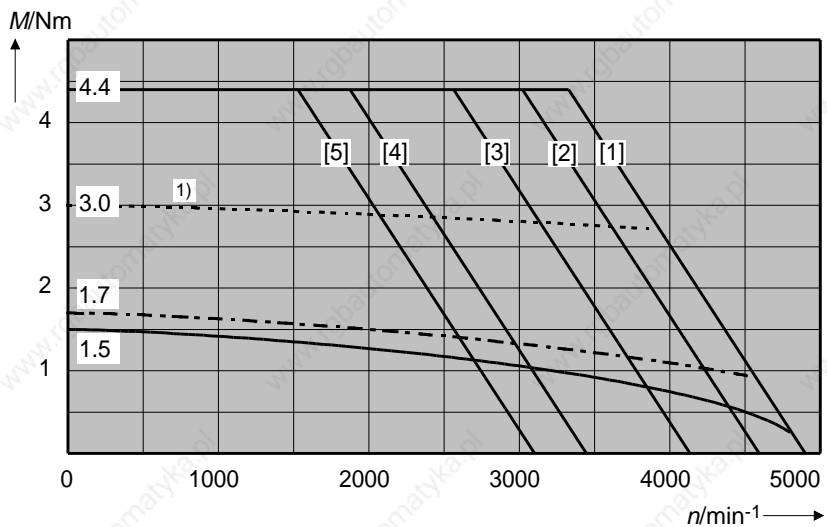
MDD 065 A at
4000 min⁻¹



MDD 065 A at
6000 min⁻¹



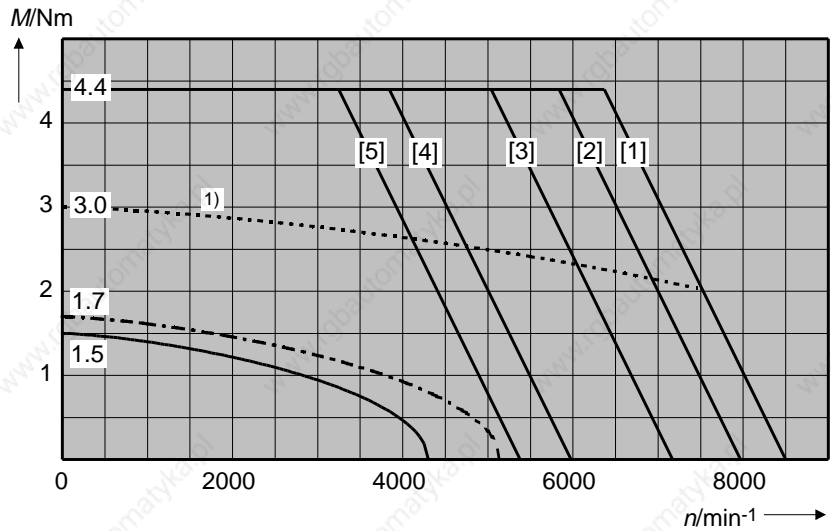
MDD 065 B at
4000 min⁻¹



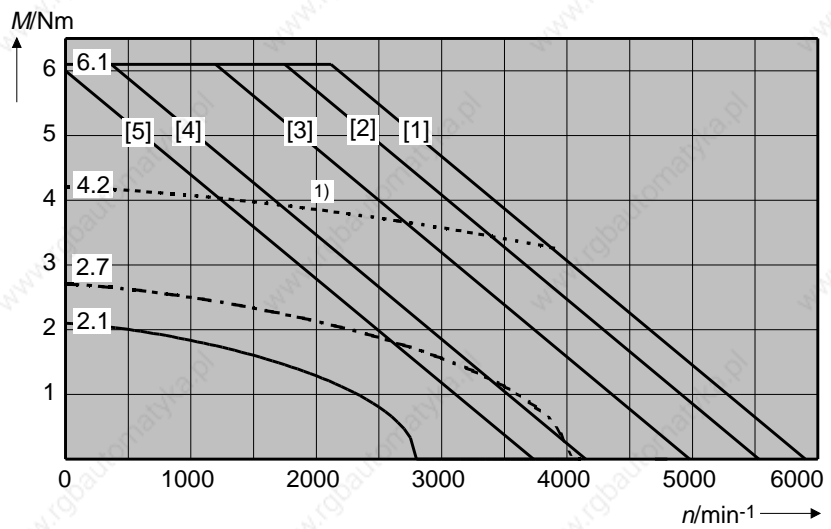
¹⁾ Shown: ON time of surface-cooled motor equals 40%.

Fig 6.4: Torque-speed characteristics curves - MDD 065

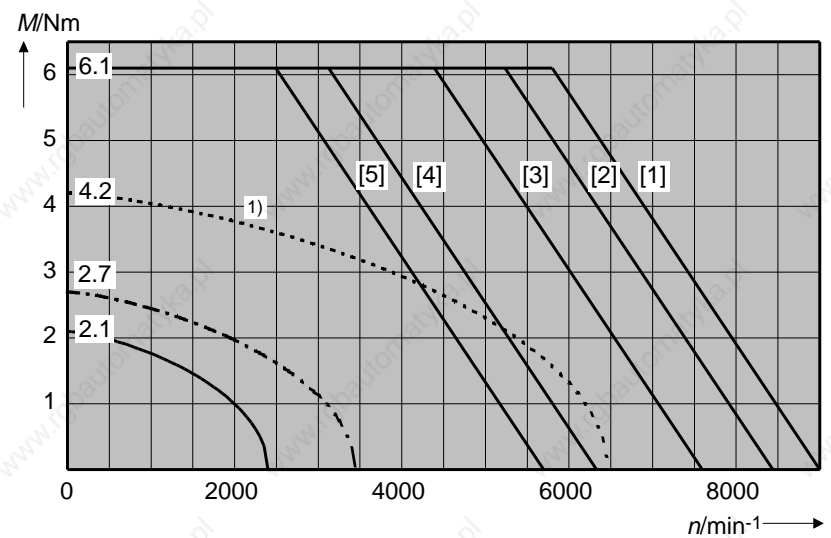
MDD 065 B at 6000 min⁻¹



MDD 065 C at 4000 min⁻¹



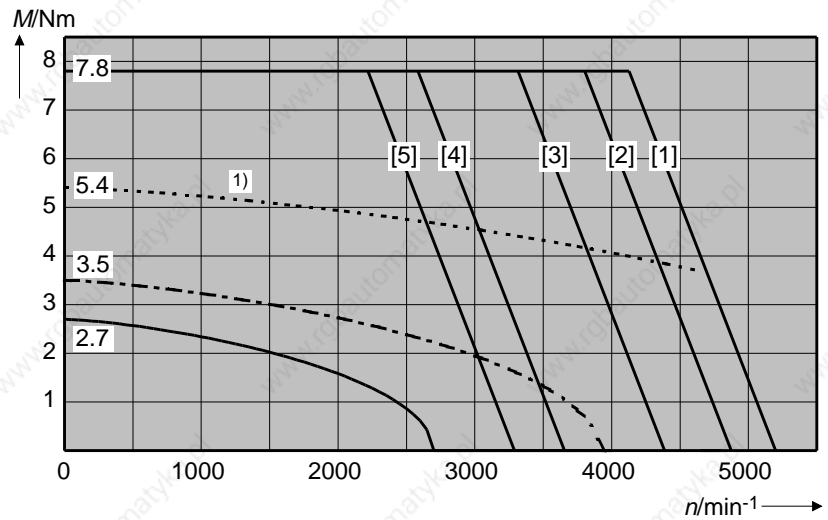
MDD 065 C at 6000 min⁻¹



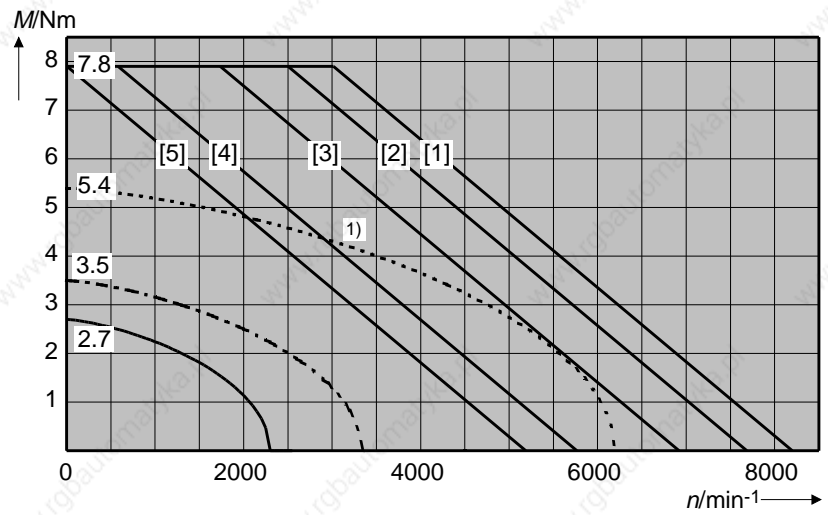
1) Shown: ON time of surface-cooled motor equals 40%.

Fig 6.5: Torque-speed characteristics curves - MDD 065

MDD 065 D at
4000 min⁻¹



MDD 065 D at
6000 min⁻¹



1) Shown: ON time of surface-cooled motor equals 40%.

Fig 6.6: Torque-speed characteristics curves - MDD 065

6.3. Shaft Load Capacity

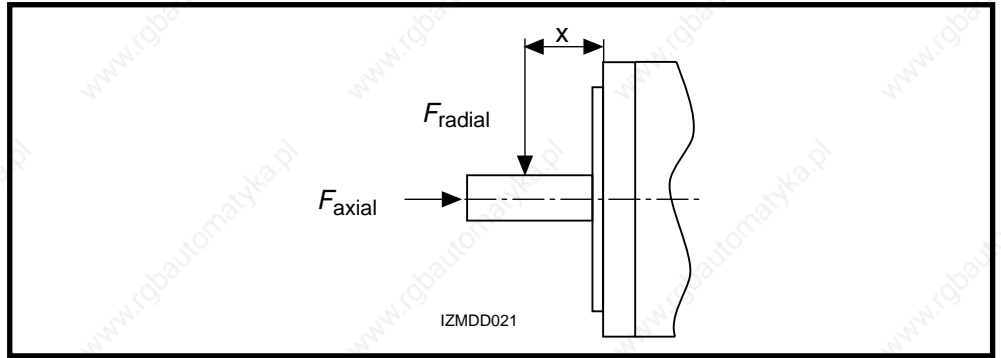


Fig 6.7: Shaft load

Permissible radial force

F_{radial}

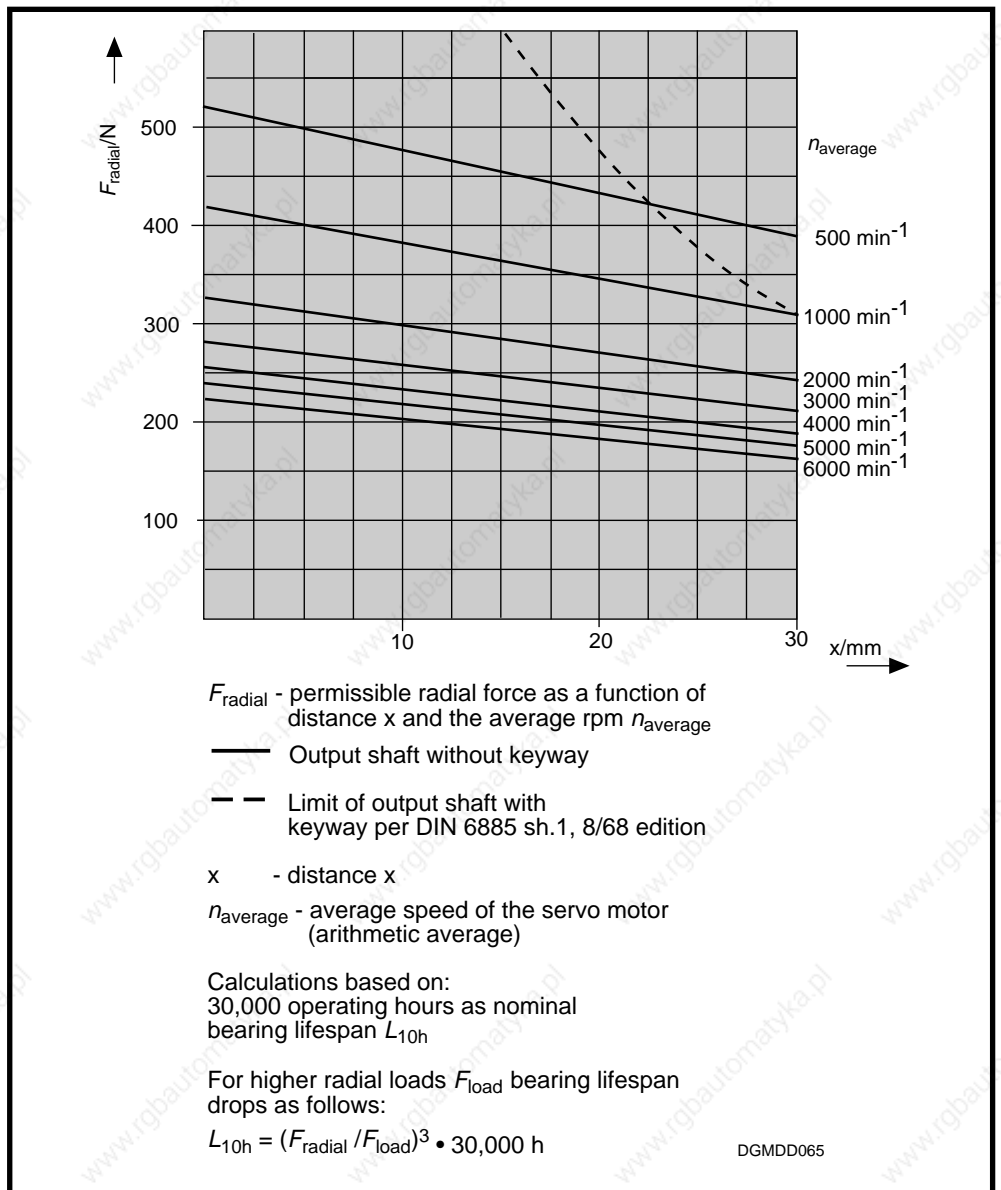


Fig 6.8: Permissible radial force

Permissible axial force

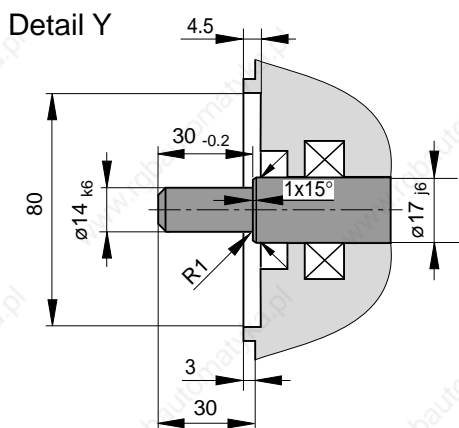
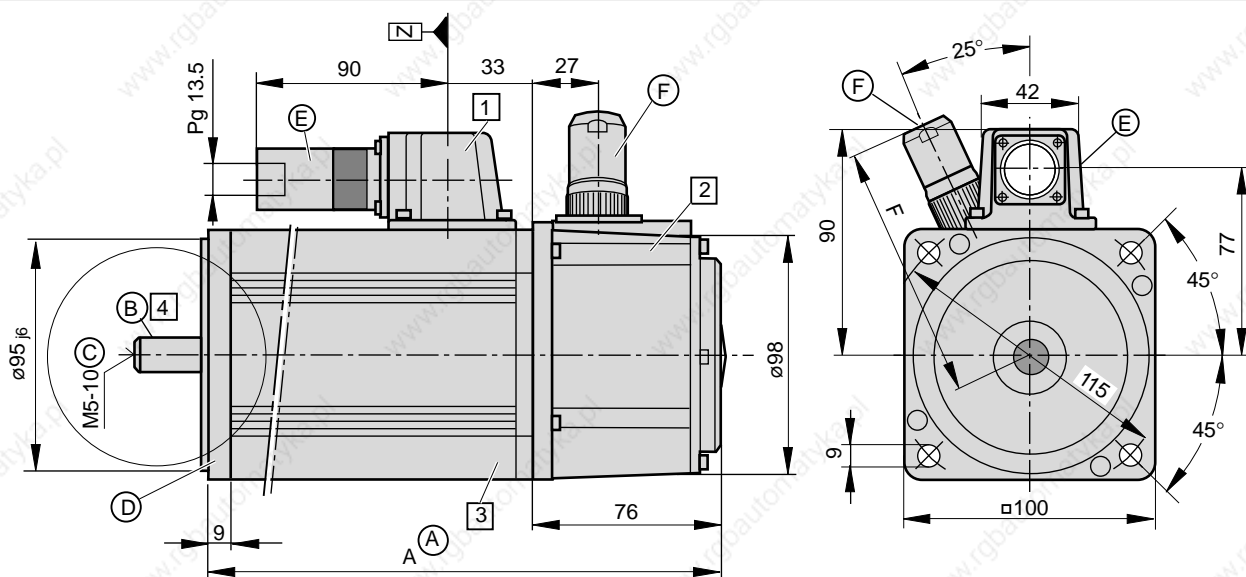
F_{axial}

$$F_{axial} = 0.57 \cdot F_{radial}$$

F_{axial} - permissible axial force

F_{radial} - permissible radial force

6.4. Dimensional Data



(A) Dimensional table Dim. A

| Size | Dim. A ¹⁾ |
|-----------|----------------------|
| MDD 065 A | 163 |
| MDD 065 B | 178 |
| MDD 065 C | 193 |
| MDD 065 D | 208 |

1) Bigger with some options.
The then applicable dimension is indicated with the respective feature.

(B) Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

- (C) • Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center hole: 1 Nm
- Balance class N per DIN VDE 0530 section 14, 2/93 edition

- (D) Flange type per DIN 42948, 11/65 edition, makes mounting possible
 - as per design B5 (throughholes in flange)
 - as per design B14 (threads in flange)

- (E) **Motor power connector**
INS 252 must be ordered separately.

- (F) **Feedback connector:**
INS 513 and INS 512 must be ordered separately as possible types.

Table of dimensions:

| Name | Connector type | Dim. F |
|----------------|----------------|--------|
| straight conn. | INS 513 | 110 |
| | INS 512 | 112 |
| angle conn. | INS 511 | 108 |
| | INS 510 | |

MBMDD065_1

Fig 6.9: Dimensional data - MDD 065

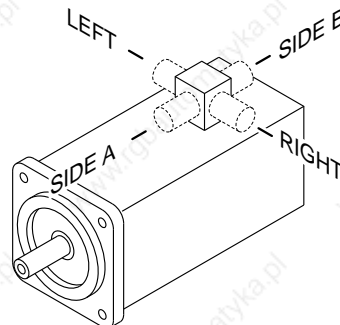
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Digital servo feedback (DSF)
 - Digital servo feedback (DSF) with integrated multturn absolute encoder
- The dimensions are identical.

3 Blocking brake

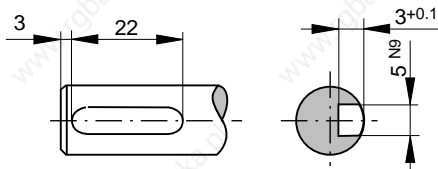
- without blocking brake
- with blocking brake: 3.0 Nm

Dimensional table for motors with blocking brake

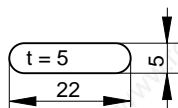
| Size | Dim. A |
|-----------|--------|
| MDD 065 A | 187 |
| MDD 065 B | 202 |
| MDD 065 C | 217 |
| MDD 065 D | 232 |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 5 x 5 x 22



MBMDD065_2

Fig 6.10: Dimensional data - MDD 065 - available options

6.5. Available Versions

| Type code field: | Example: | MDD | 065 | B-N | 040 | N | 2 | L | 095 | G | B | 0 |
|---|------------------|-----|-----|-----|-----|---|---|---|-----|---|---|---|
| 1. Name Motor for digital drive controllers | MDD | | | | | | | | | | | |
| 2. Motor size | 065 | | | | | | | | | | | |
| 3. Motor length | A, B, C, D | | | | | | | | | | | |
| 4. Housing design: Standard (suited for natural convection and surface-cooling) | N | | | | | | | | | | | |
| 5. Nominal speed 4000 min ⁻¹ 6000 min ⁻¹ | 040 060 | | | | | | | | | | | |
| 6. Balance class Standard (R per DIN VDE 0530 section 14, 2/93 edition) | N | | | | | | | | | | | |
| 7. Side B shaft end Standard (without side B shaft end) | 2 | | | | | | | | | | | |
| 8. Motor feedback digital servo feedback digital servo feedback with integrated multiturn absolute encoder | L M | | | | | | | | | | | |
| 9. Centering diameter ø095 mm | 095 | | | | | | | | | | | |
| 10. Output shaft plain shaft shaft with keyway per DIN 6885 sh. 1, 8/68 edition | G P | | | | | | | | | | | |
| 11. Power connection connector to side A connector to side B connector to the right (looking onto motor shaft, connecting housing at top) connector to the left (looking onto motor shaft, connecting housing at top) | A B R L | | | | | | | | | | | |
| 12. Blocking brake without blocking brake with 3.0 Nm blocking brake | 0 1 | | | | | | | | | | | |

Quelle: INN 41.60 TLMD065

Fig 6.11: Type codes - MDD 065

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7. MDD 071

7.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | |
|---|-----------|-------------------|-----------------------|---------------------------|---------------------------|
| | | | 071 A-N-030 | 071 B-N-030 | 071 C-N-030 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 3000 | 3000 | 3000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 2.2 | 4.4 (6.6) ⁵⁾ | 6.6 (9.9) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 3.7 | 7.3 | 10.8 (16.2) ⁵⁾ |
| Theoretic maximum torque ³⁾ | M_{max} | Nm | 6.9 | 13.6 | 20.5 |
| Maximum current | I_{max} | A | 16.5 | 32.8 | 48.6 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 4.4×10^{-4} | 8.9×10^{-4} | 11.9×10^{-4} |
| Torque constant at 20 °C | K_m | Nm/A | 0.60 | 0.60 | 0.61 |
| Windings resistance at 20 °C | R_A | Ohm | 4.54 | 1.60 | 0.85 |
| Windings inductance | L_A | mH | 19.4 | 9.4 | 5.9 |
| Thermal time constant | T_{th} | min | 45 (20) ⁵⁾ | 45 (20) ⁵⁾ | 45 (20) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 6.5 | 8.8 | 11 |
| | | | 071 A-N-040 | 071 B-N-040 | 071 C-N-040 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 4000 | 4000 | 4000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 2.2 | 4.4 (6.6) ⁵⁾ | 6.6 (9.9) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 5.0 | 11.0 (16.6) ⁵⁾ | 14.6 (22.0) ⁵⁾ |
| Theoretic maximum torque ³⁾ | M_{max} | Nm | 6.9 | 13.6 | 20.5 |
| Maximum current | I_{max} | A | 22.6 | 49.3 | 65.9 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 4.4×10^{-4} | 8.9×10^{-4} | 11.9×10^{-4} |
| Torque constant at 20 °C | K_m | Nm/A | 0.44 | 0.40 | 0.45 |
| Windings resistance at 20 °C | R_A | Ohm | 2.61 | 0.67 | 0.50 |
| Windings inductance | L_A | mH | 11.5 | 4.1 | 3.4 |
| Thermal time constant | T_{th} | min | 45 (20) ⁵⁾ | 45 (20) ⁵⁾ | 45 (20) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 6.5 | 8.8 | 11 |
| | | | 071 A-N-060 | 071 B-N-060 | 071 C-N-060 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 6000 | 6000 | 6000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 2.2 | 4.4 (6.6) ⁵⁾ | 6.6 (9.9) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 7.5 | 15.0 (22.6) ⁵⁾ | 22.1 (33.2) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 6.8 | 13.6 | 20.6 |
| Maximum current | I_{max} | A | 33.6 | 67.7 | 99.3 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 4.4×10^{-4} | 8.9×10^{-4} | 11.9×10^{-4} |
| Torque constant at 20 °C | K_m | Nm/A | 0.29 | 0.29 | 0.30 |
| Windings resistance at 20 °C | R_A | Ohm | 1.18 | 0.37 | 0.22 |
| Windings inductance | L_A | mH | 5.2 | 2.2 | 1.4 |
| Thermal time constant | T_{th} | min | 45 (20) ⁵⁾ | 45 (20) ⁵⁾ | 45 (20) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 6.5 | 8.8 | 11 |

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

²⁾ With 60 K overtemperature at the motor housing.

³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

⁴⁾ Without blocking brake, without blower

⁵⁾ Parenthetical values apply to motors with surface cooling.

Fig 7.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|---|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperature | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

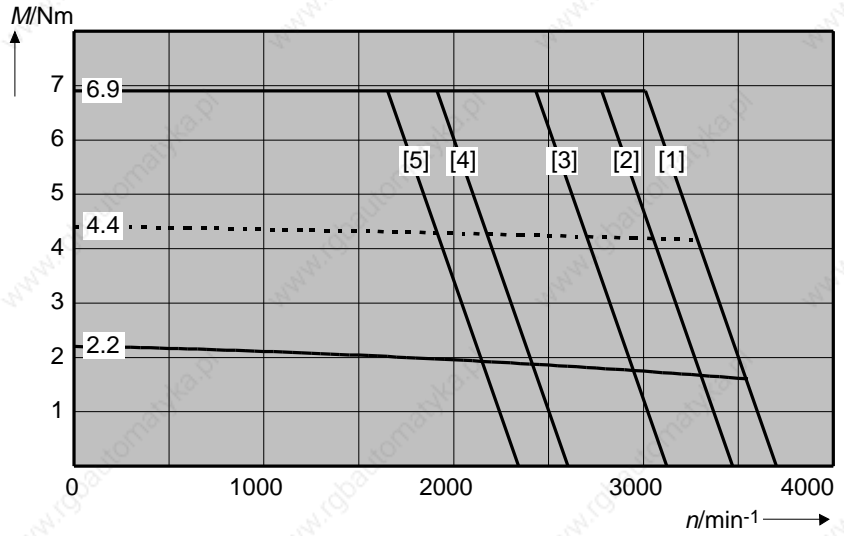
Fig 7.2: General data - MDD 071

| Designation | Symbol | Unit | Data Blocking Brake | |
|---------------------|--------|------------------|--------------------------------|-------------------------|
| Principle of action | | | electrically- actuated release | |
| Holding torque | M_H | Nm | 3.0 | 6.5 |
| Nominal voltage | U_N | V | DC 24 ± 10% | DC 24 ± 10% |
| Nominal current | I_N | A | 0.6 | 0.7 |
| Moment of inertia | J_B | kgm ² | 0.38 x 10 ⁻⁴ | 1.06 x 10 ⁻⁴ |
| Release delay | t_L | ms | 30 | 60 |
| Clamping delay | t_K | ms | 15 | 20 |
| Mass | m_B | kg | 0.3 | 0.5 |

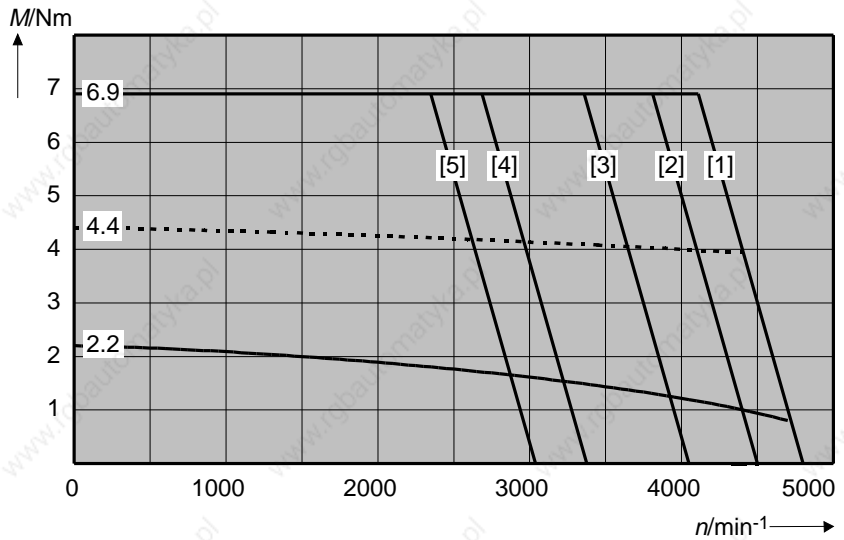
Fig 7.3: Technical data - blocking brake

7.2. Torque-Speed Characteristics

MDD 071 A at
3000 min⁻¹



MDD 071 A at
4000 min⁻¹



MDD 071 A at
6000 min⁻¹

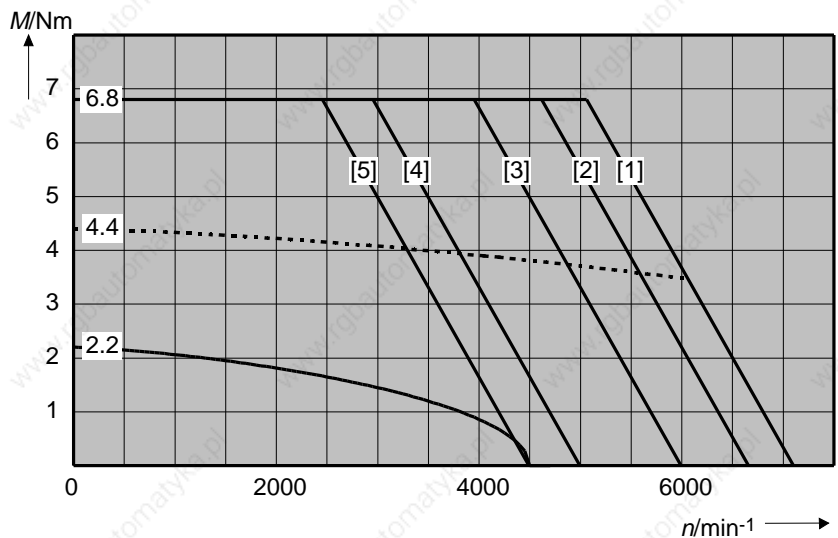
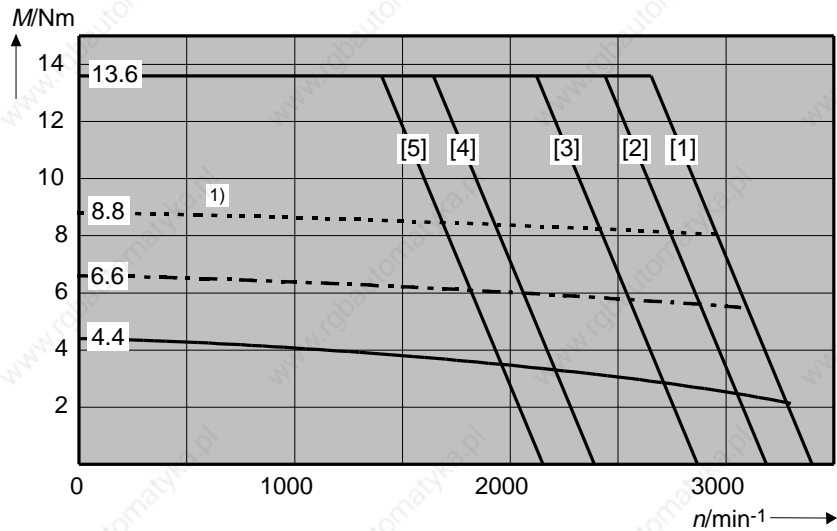
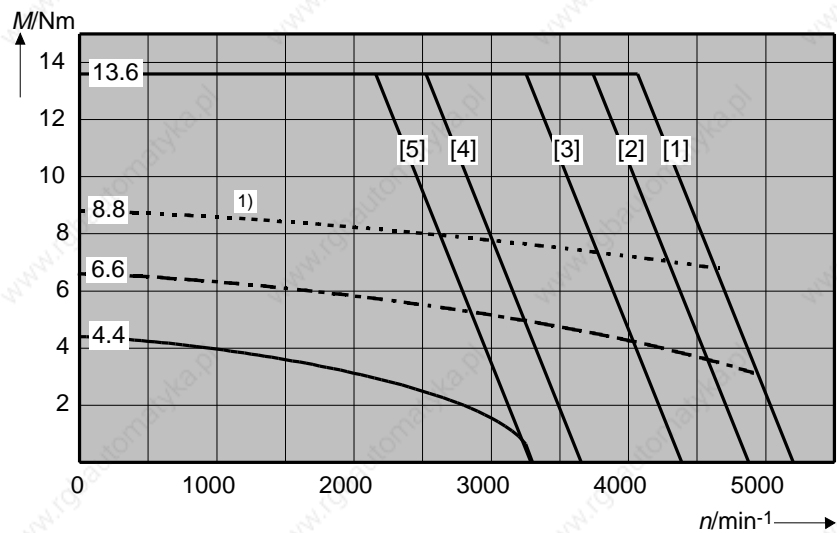


Fig 7.4: Torque-speed characteristics curves - MDD 071

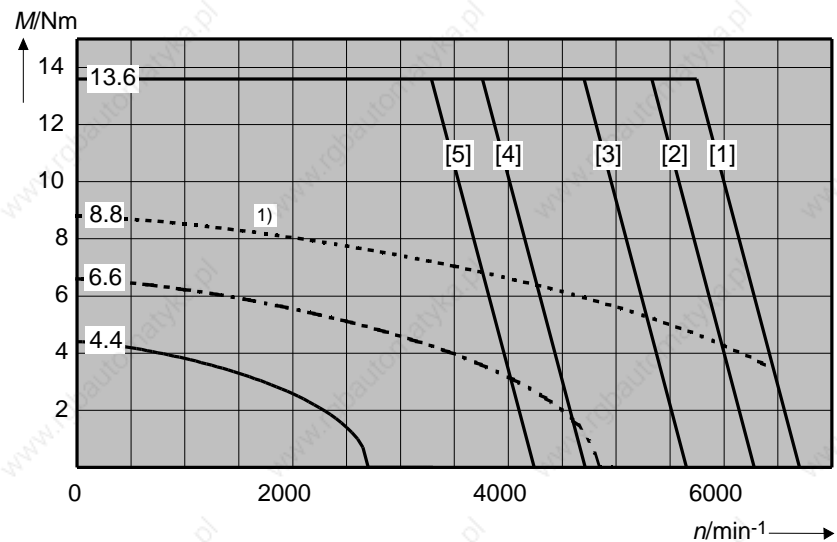
MDD 071 B at
3000 min⁻¹



MDD 071 B at
4000 min⁻¹



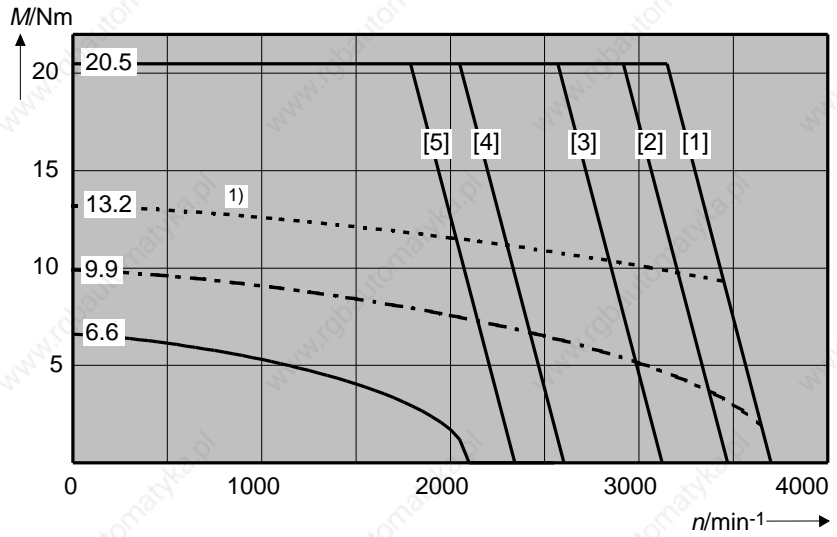
MDD 071 B at
6000 min⁻¹



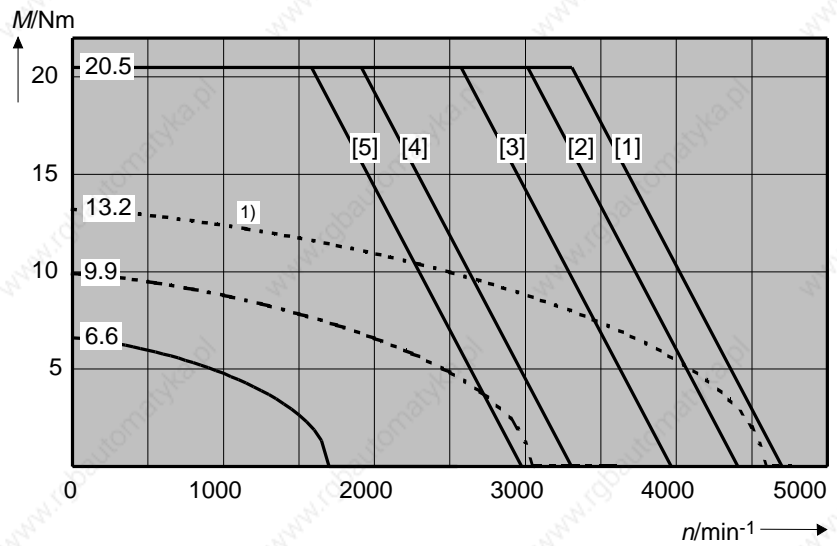
1) Shown: ON time of surface-cooled motor equals 56%.

Fig 7.5: Torque-speed characteristics curves - MDD 071

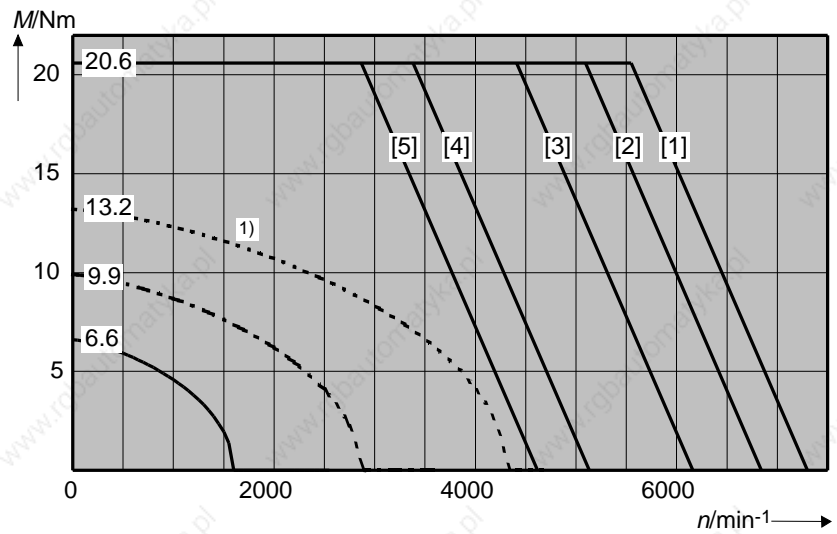
MDD 071 C at
3000 min⁻¹



MDD 071 C at
4000 min⁻¹



MDD 071 C at
6000 min⁻¹



1) Shown: ON time of surface-cooled motor equals 56%.

Fig 7.6: Torque-speed characteristics curves MDD 071

7.3. Shaft Load Capacity

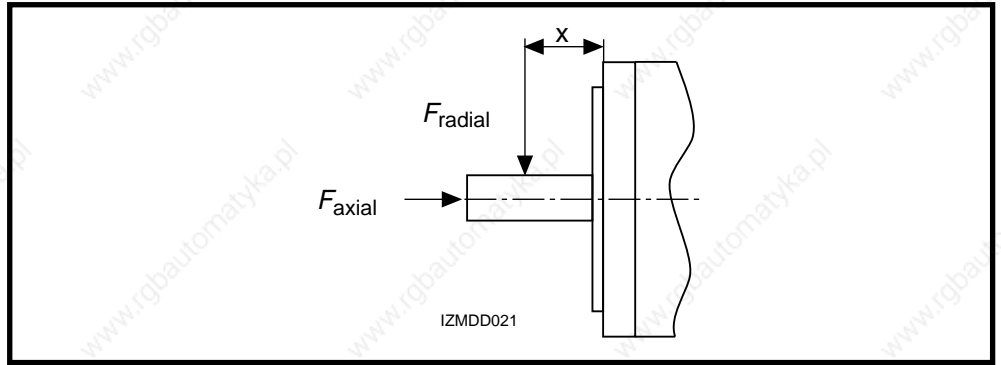


Fig 7.7: Shaft load

Permissible radial force

F_{radial}

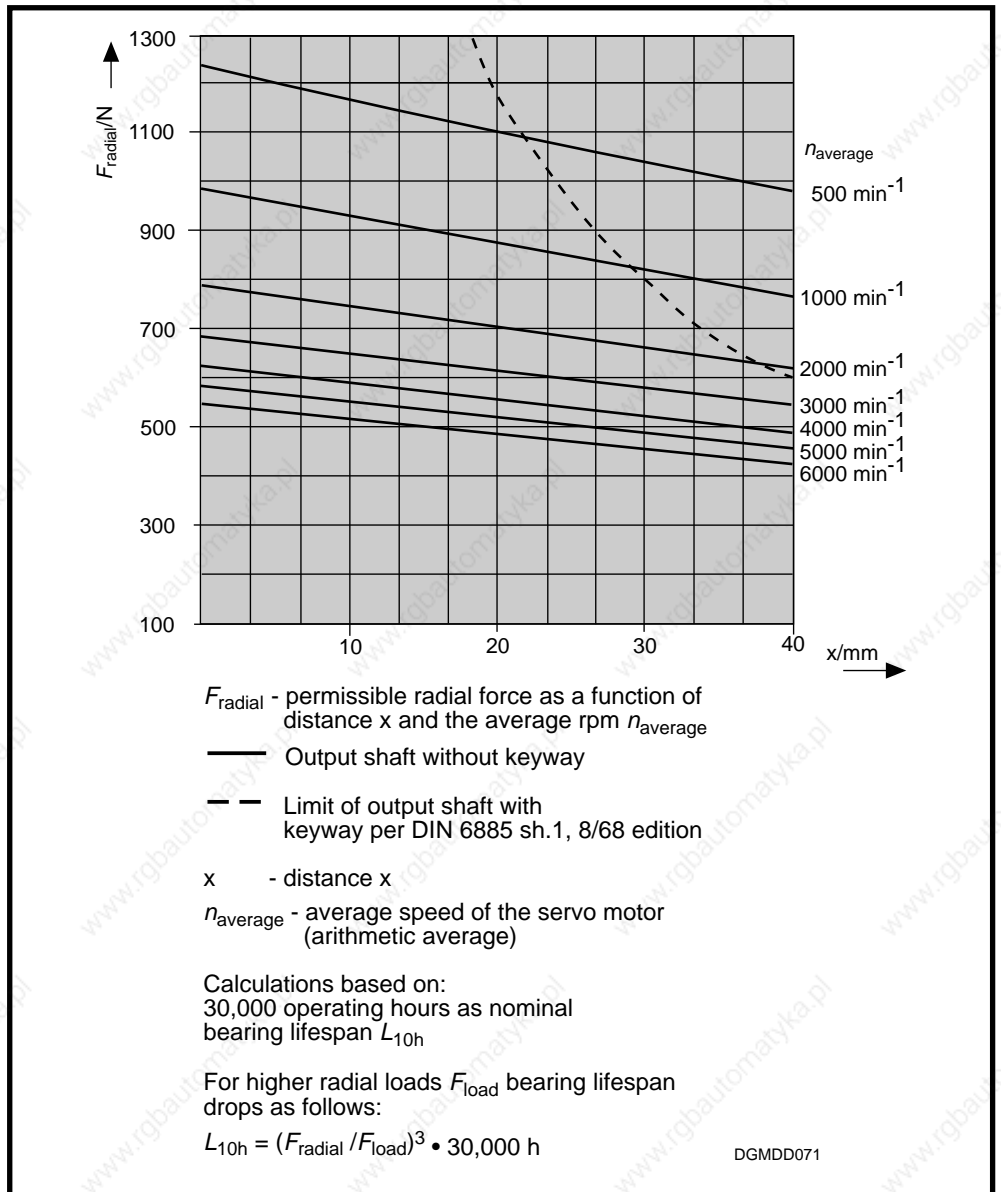


Fig 7.8: Permissible radial force

Permissible axial force

F_{axial}

$$F_{axial} = 0.50 \cdot F_{radial}$$

F_{axial} - permissible axial force

F_{radial} - permissible radial force

7.4. Dimensional Data

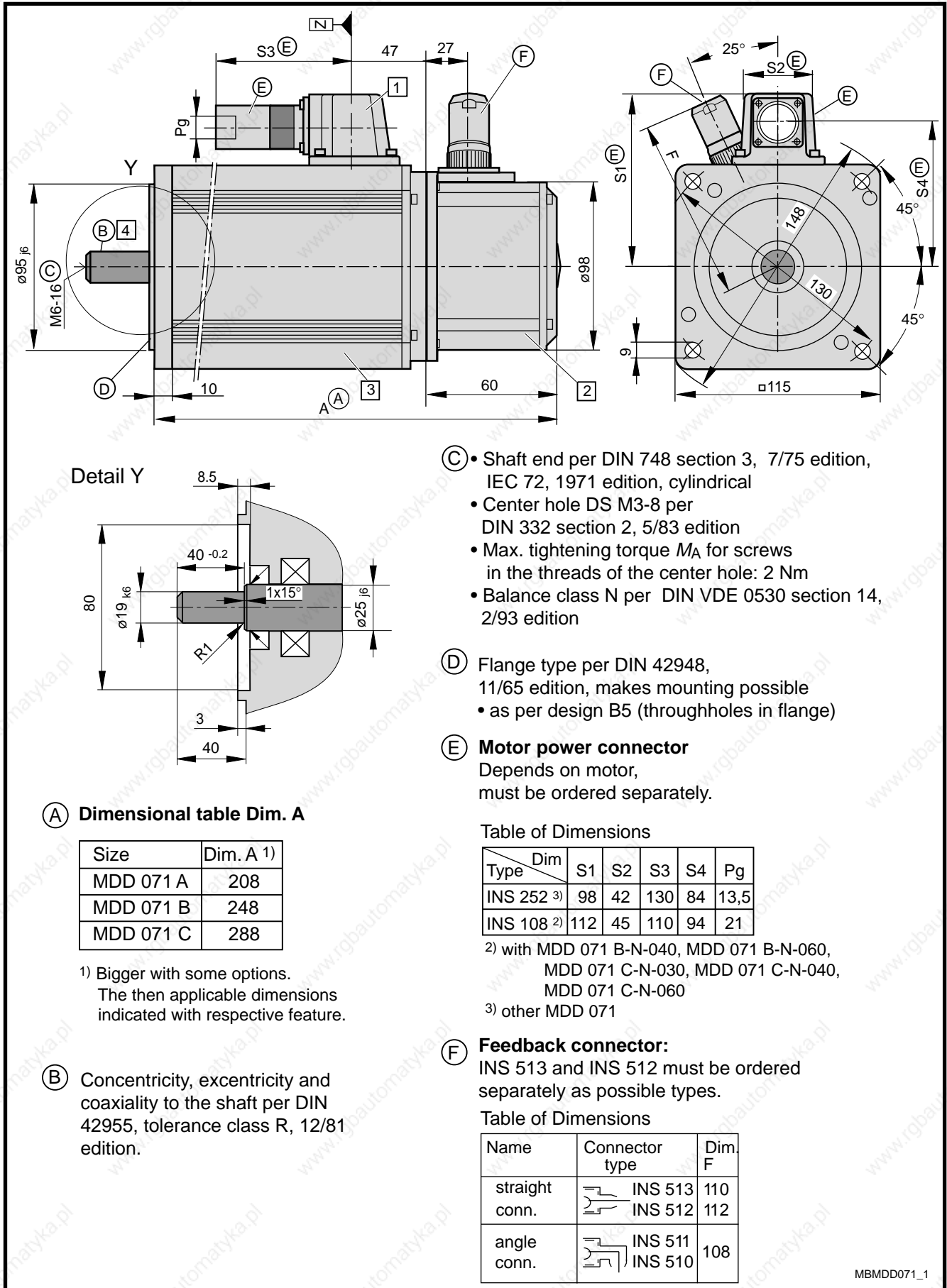


Fig 7.9: Dimensional data - MDD 071

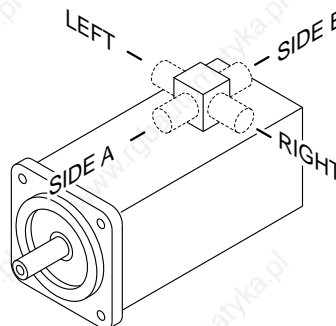
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Digital servo feedback (DSF)
 - Digital servo feedback (DSF) with integrated multiturn absolute encoder
- The dimensions are identical.

3 Blocking brake

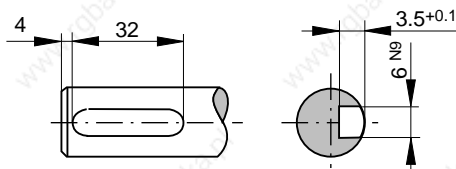
- without blocking brake
 - with blocking brake: 3.0 Nm
 - with blocking brake: 6.5 Nm
- The dimensions are identical.

Dimensional table for motor with blocking brake: 6.5 Nm

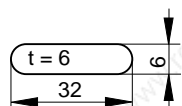
| Size | Dim. A |
|-----------|--------|
| MDD 071 A | 236 |
| MDD 071 B | 276 |
| MDD 071 C | 316 |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 6 x 6 x 32



MBMDD071_2

Fig 7.10: Dimensional data MDD 071 -available options

7.5. Available Versions

| Type code field: | Example: | MDD | 071 | B | N | 030 | N | 2 | S | 095 | G | B | 0 |
|--|-------------------|-----|-----|---|---|-----|---|---|---|-----|---|---|---|
| 1. Name Motor for digital drive controllers | MDD | | | | | | | | | | | | |
| 2. Motor size | 071 | | | | | | | | | | | | |
| 3. Motor length | A, B, C | | | | | | | | | | | | |
| 4. Housing design: Standard (suited for natural convection and surface-cooling) | N | | | | | | | | | | | | |
| 5. Nominal speed 3000 min ⁻¹ 4000 min ⁻¹ 6000 min ⁻¹ | 030 040 060 | | | | | | | | | | | | |
| 6. Balance class Standard (R per DIN VDE 0530 section 14, 2/93 edition) | N | | | | | | | | | | | | |
| 7. Side B shaft end Standard (without side B shaft end) | 2 | | | | | | | | | | | | |
| 8. Motor feedback digital servo feedback digital servo feedback with integrated multiturn absolute encoder | S T | | | | | | | | | | | | |
| 9. Centering diameter ø095 mm | 095 | | | | | | | | | | | | |
| 10. Output shaft plain shaft shaft with keyway per DIN 6885 sh. 1, 8/68 edition | G P | | | | | | | | | | | | |
| 11. Power connection connector to side A connector to side B connector to the right (looking onto motor shaft, connecting housing at top) connector to the left (ooking onto motor shaft, connecting housing at top) | A B R L | | | | | | | | | | | | |
| 12. Blocking brake without blocking brake with 3.0 Nm blocking brake with 6.5 Nm blocking brake | 0 1 2 | | | | | | | | | | | | |

Quelle: INN 41.60 TLMD071

Fig 7.11: Type codes - MDD 071

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8. MDD 090

8.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | |
|---|-----------|-------------------|--------------------------|---------------------------|---------------------------|
| | | | 090 A-N-020 | 090 B-N-020 | 090 C-N-020 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 2000 | 2000 | 2000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 3.7 (5.0) ⁵⁾ | 7.2 (10.5) ⁵⁾ | 10.4 (16.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 4.0 (5.4) ⁵⁾ | 8.3 (12.2) ⁵⁾ | 12.1 (18.6) ⁵⁾ |
| Theoretic maximum torque ³⁾ | M_{max} | Nm | 19.0 | 39.0 | 58.6 |
| Maximum current | I_{max} | A | 21.9 | 48.6 | 72.9 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 20 x 10 ⁻⁴ | 36 x 10 ⁻⁴ | 53 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.93 | 0.86 | 0.86 |
| Windings resistance at 20 °C | R_A | Ohm | 6.84 | 1.99 | 1.20 |
| Windings inductance | L_A | mH | 27.7 | 10.1 | 6.8 |
| Thermal time constante | T_{th} | min | 45 (30) ⁵⁾ | 60 (45) ⁵⁾ | 60 (45) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 12.5 | 18 | 23 |
| | | | 090 A-N-030 | 090 B-N-030 | 090 C-N-030 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 3000 | 3000 | 3000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 3.7 (5.0) ⁵⁾ | 7.2 (10.5) ⁵⁾ | 10.4 (16.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 6.3 (8.5) ⁵⁾ | 12.6 (18.4) ⁵⁾ | 19.5 (30.0) ⁵⁾ |
| Theoretic maximum torque ³⁾ | M_{max} | Nm | 17.7 | 38.9 | 56.3 |
| Maximum current | I_{max} | A | 32.2 | 72.9 | 117.8 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 20 x 10 ⁻⁴ | 36 x 10 ⁻⁴ | 53 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.59 | 0.57 | 0.53 |
| Windings resistance at 20 °C | R_A | Ohm | 3.1 | 0.91 | 0.46 |
| Windings inductance | L_A | mH | 13.4 | 4.7 | 2.6 |
| Thermal time constante | T_{th} | min | 45 (30) ⁵⁾ | 60 (45) ⁵⁾ | 60 (45) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 12.5 | 18 | 23 |
| | | | 090 A-N-040 | 090 B-N-040 | 090 C-N-040 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 4000 | 4000 | 4000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 3.7 (5.0) ⁵⁾ | 7.2 (10.5) ⁵⁾ | 10.4 (14.6) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 9.4 (12.7) ⁵⁾ | 16.7 (24.3) ⁵⁾ | 24.4 (34.3) ⁵⁾ |
| Theoretic maximum torque ³⁾ | M_{max} | Nm | 15.0 | 38.3 | 58.6 |
| Maximum current | I_{max} | A | 41.3 | 95.3 | 145.7 |
| Moment of inertia of rotor ⁴⁾ | J_M | kgm ² | 20 x 10 ⁻⁴ | 36 x 10 ⁻⁴ | 53 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.39 | 0.43 | 0.43 |
| Windings resistance at 20 °C | R_A | Ohm | 1.30 | 0.50 | 0.29 |
| Windings inductance | L_A | mH | 14.5 | 2.6 | 1.6 |
| Thermal time constante | T_{th} | min | 45 (30) ⁵⁾ | 60 (45) ⁵⁾ | 60 (45) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 12.5 | 18 | 23 |

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

²⁾ With 60 K overtemperature at the motor housing.

³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

⁴⁾ Without blocking brake, without blower

⁵⁾ Parenthetical values apply to motors with surface cooling.

Fig 8.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|---|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperature | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

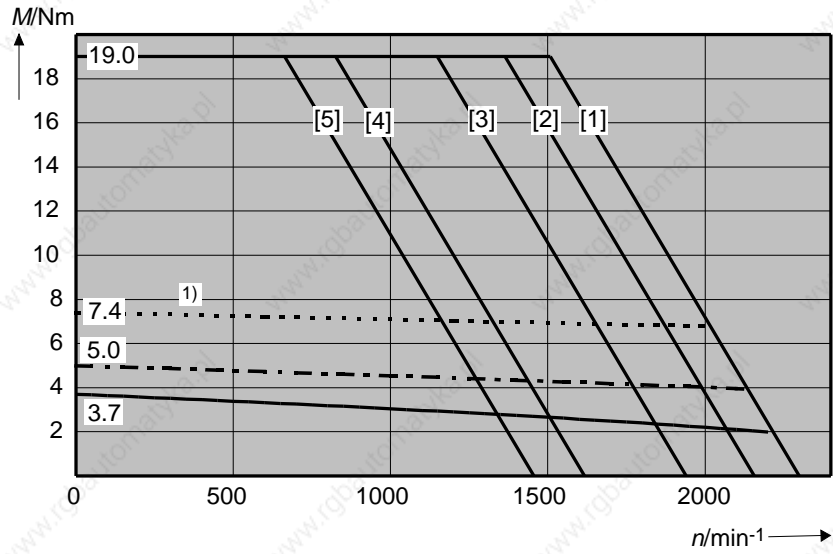
Fig 8.2: General data MDD 090

| Designation | Symbol | Unit | Data Blocking Brake | |
|---------------------|--------|------------------|-------------------------------|-------------------------|
| Principle of action | | | electrically actuated release | |
| Holding torque | M_H | Nm | 6.5 | 11 |
| Nominal voltage | U_N | V | DC 24 ± 10% | DC 24 ± 10% |
| Nominal current | I_N | A | 0.5 | 0.5 |
| Moment of inertia | J_B | kgm ² | 1.06 x 10 ⁻⁴ | 1.06 x 10 ⁻⁴ |
| Release delay | t_L | ms | 60 | 60 |
| Clamping delay | t_K | ms | 20 | 20 |
| Mass | m_B | kg | 0.5 | 0.5 |

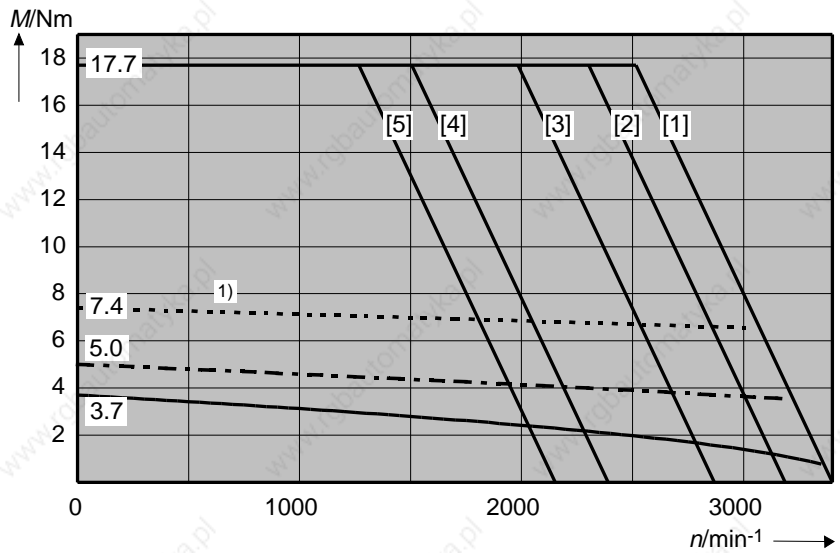
Fig 8.3: Technical data - blocking brake

8.2. Torque-Speed Characteristics

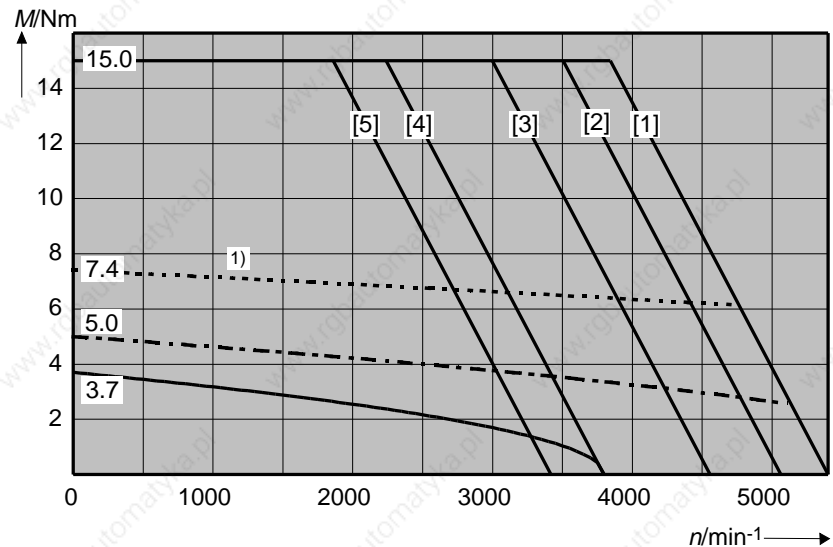
MDD 090 A at
2000 min⁻¹



MDD 090 A at
3000 min⁻¹



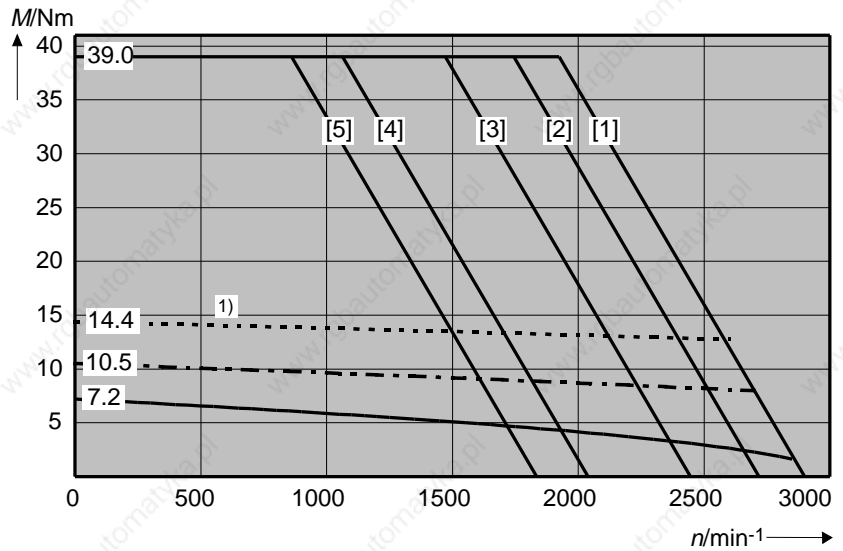
MDD 090 A at
4000 min⁻¹



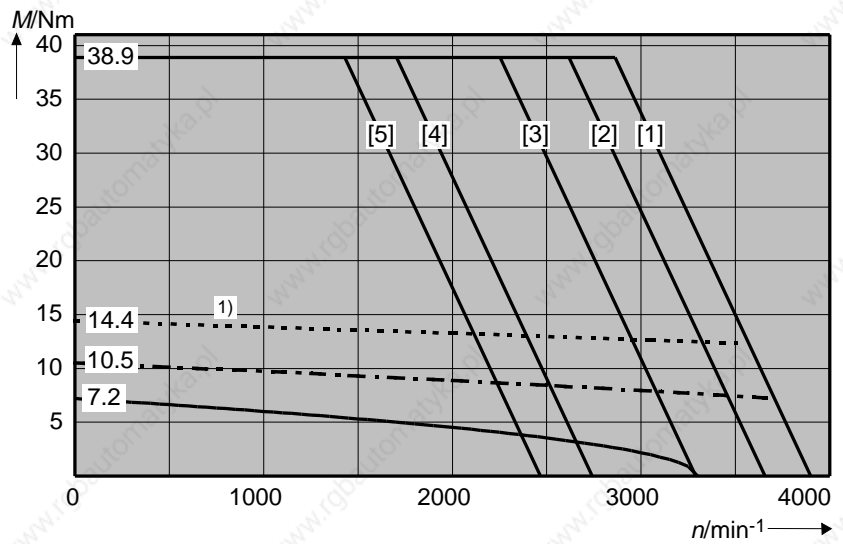
1) Shown: ON time of surface-cooled motor equals 45%.

Fig 8.4: Torque-speed characteristics curves - MDD 090

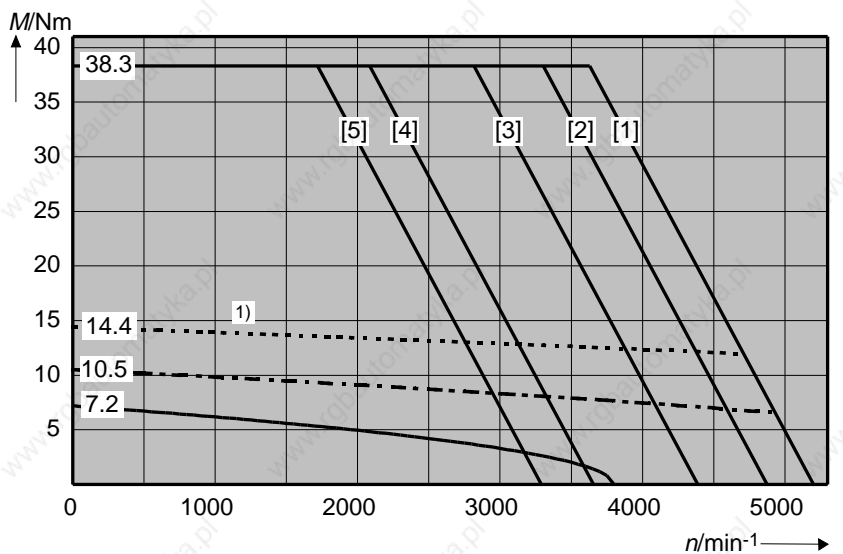
MDD 090 B at
2000 min⁻¹



MDD 090 B at
3000 min⁻¹



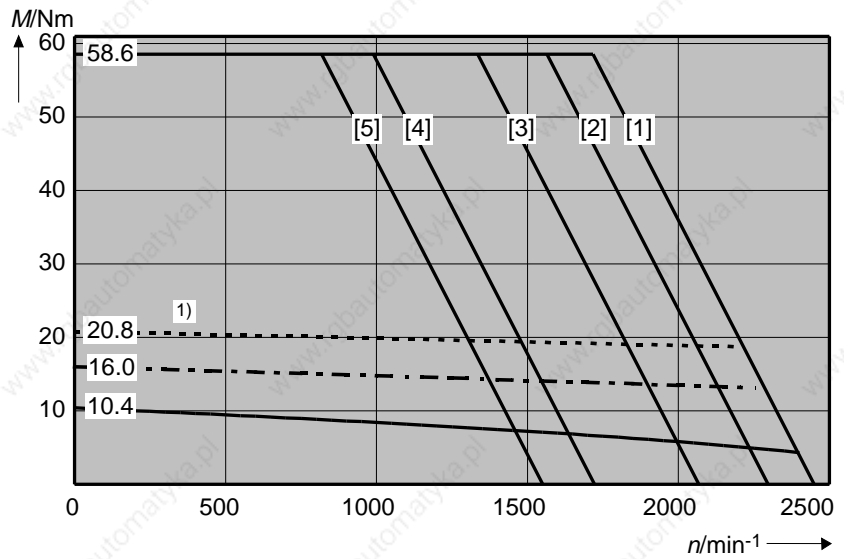
MDD 090 B at
4000 min⁻¹



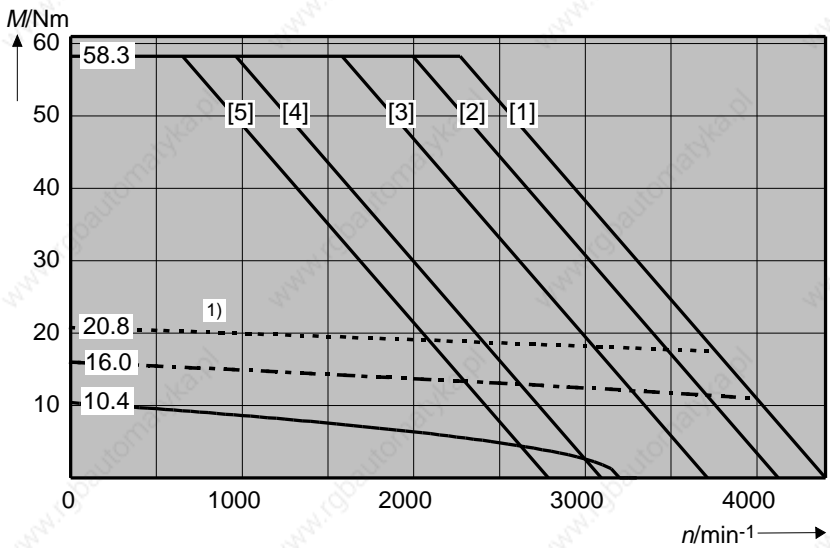
1) Shown: ON time of surface-cooled motor equals 53%.

Fig 8.5: Torque-speed characteristics curves - MDD 090

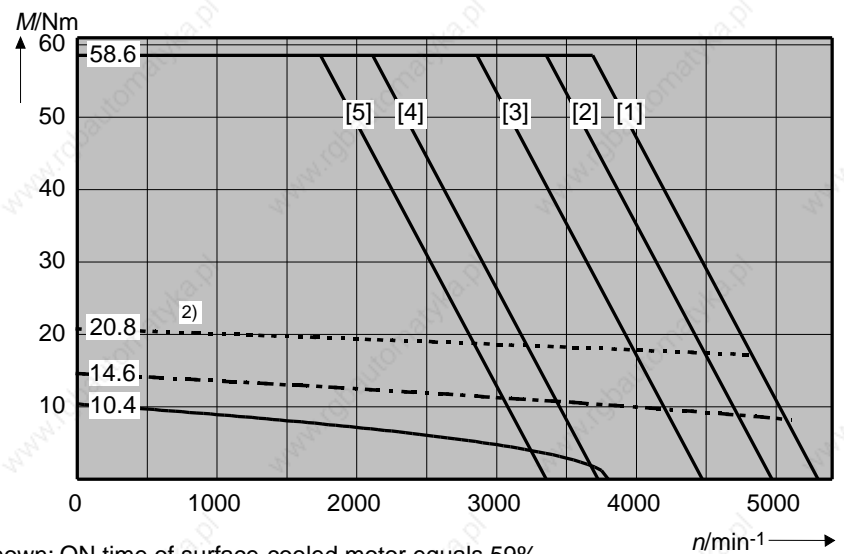
MDD 090 C at
2000 min⁻¹



MDD 090 C at
3000 min⁻¹



MDD 090 C at
4000 min⁻¹



- 1) Shown: ON time of surface-cooled motor equals 59%.
- 2) Shown: ON time of surface-cooled motor equals 49%.

Fig 8.6: Torque-speed characteristics curves - MDD 090

8.3. Shaft Load Capacity

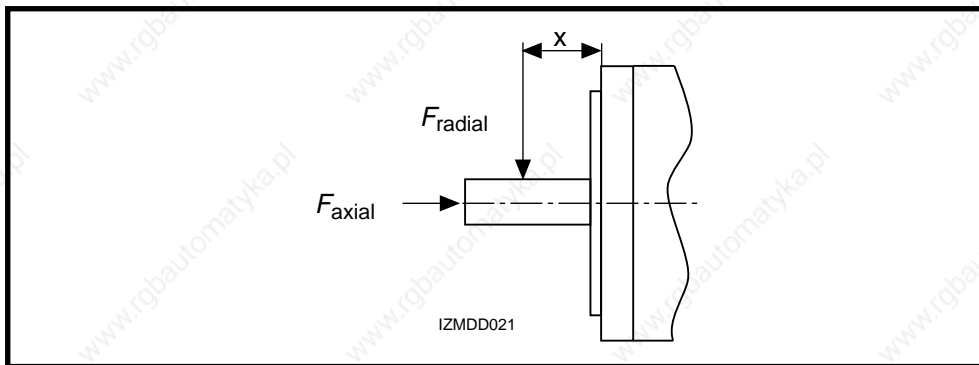


Fig 8.7: Shaft load

Permissible radial force
 F_{radial}

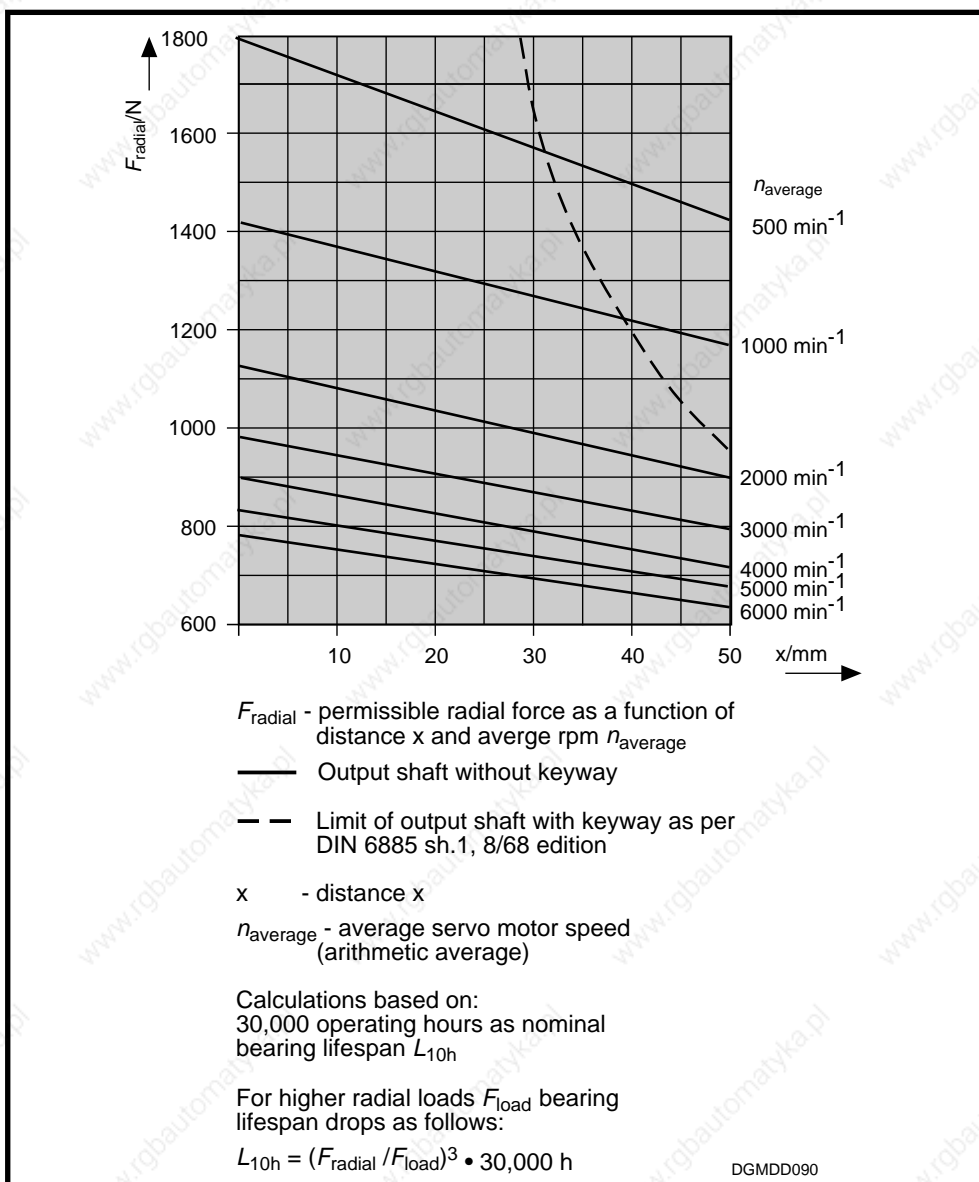


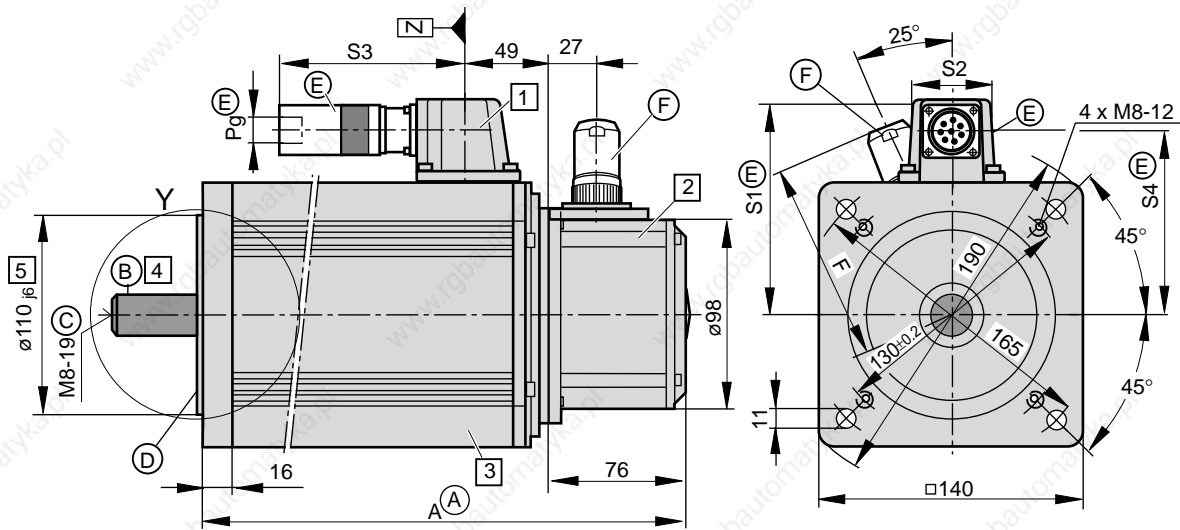
Fig 8.8: Permissible radial force

Permissible axial force
 F_{axial}

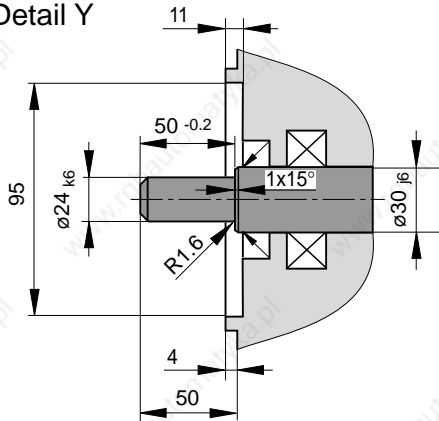
$$F_{axial} = 0.34 \cdot F_{radial}$$

F_{axial} - permissible axial force
 F_{radial} - permissible radial force

8.4. Dimensional Data



Detail Y



- Ⓒ • Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center hole: 5 Nm
- Balance class N per DIN VDE 0530 section 14, 2/93 edition

- Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
- as per design B5 (throughholes in flange)
- as per design B14 (threads in flange)

- Ⓔ **Motor power connector**
- Depends on the motor, must be ordered separately.

Ⓐ Dimensional table Dim. A

| Size | Dim. A 1) |
|-----------|-----------|
| MDD 090 A | 275 |
| MDD 090 B | 340 |
| MDD 090 C | 405 |

1) Bigger with some options. The then applicable dimension is indicated with the respective feature.

- Ⓑ Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

Table of dimensions

| type \ dim. | S1 | S2 | S3 | S4 | Pg |
|-------------|-----|----|-----|-----|------|
| INS 252 2) | 110 | 42 | 130 | 95 | 13,5 |
| INS 108 3) | 125 | 45 | 110 | 105 | 21 |

2) with MDD 090 A-N-020, MDD 090 A-N-030, MDD 090 A-N-040, MDD 090 B-N-020

3) other MDD 090

- Ⓕ **Feedback connector**
- Must be ordered separately.

Table of dimensions

| Name | Connector type | Dim. F |
|----------------|----------------|--------|
| straight conn. | INS 513 | 110 |
| | INS 512 | 112 |
| angle conn. | INS 511 | 108 |
| | INS 510 | |

MBMDD090_1

Fig 8.9: Dimensional data - MDD 090

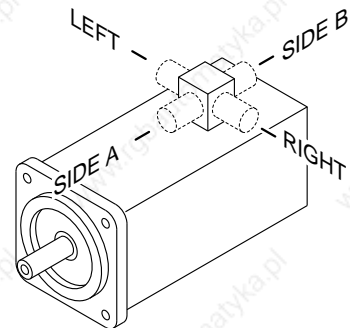
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Digital servo feedback (DSF)
- Digital servo feedback (DSF) with integrated multiturn absolute encoder

The dimensions are identical.

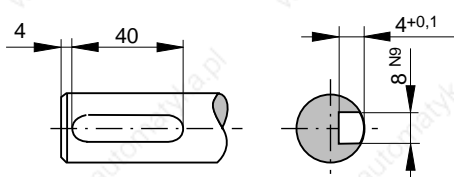
3 Blocking brake

- without blocking brake
- with blocking brake: 6.5 Nm
- with blocking brake: 11 Nm

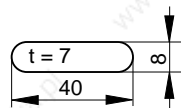
The dimensions are identical.

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 8 x 7 x 40



5 Special centering diameter

- $\varnothing 130_{j6}$

MBMDD090_2

Fig 8.10: Dimensional data - MDD 090 -available options

8.5. Available Versions

| Type code field: | Example: | MDD | 090 | B | N | 020 | N | 2 | L | 110 | G | B | 0 |
|--|-------------------|-----|-----|---|---|-----|---|---|---|-----|---|---|---|
| 1. Name Motor for digital drive controllers | MDD | | | | | | | | | | | | |
| 2. Motor size | 090 | | | | | | | | | | | | |
| 3. Motor length | A, B, C | | | | | | | | | | | | |
| 4. Housing design: Standard (suited for natural convection and surface-cooling) | N | | | | | | | | | | | | |
| 5. Nominal speed 2000 min ⁻¹ 3000 min ⁻¹ 4000 min ⁻¹ | 020 030 040 | | | | | | | | | | | | |
| 6. Balance class Standard (R per DIN VDE 0530 section 14, 2/93 edition) | N | | | | | | | | | | | | |
| 7. Side B shaft end Standard (without side B shaft end) | 2 | | | | | | | | | | | | |
| 8. Motor feedback digital servo feedback digital servo feedback with integrated multiturn absolute encoder | L M | | | | | | | | | | | | |
| 9. Centering diameter ø110 mm (Standard) ø130 mm | 110 130 | | | | | | | | | | | | |
| 10. Output shaft plain shaft shaft with keyway per DIN 6885 sh. 1, 8/68 edition | G P | | | | | | | | | | | | |
| 11. Power connection connector to side A connector to side B connector to the right (looking onto motor shaft, connecting housing at top) connector to the left (ooking onto motor shaft, connecting housing at top) | A B R L | | | | | | | | | | | | |
| 12. Blocking brake without blocking brake with 6.5 Nm blocking brake with 11.0 Nm blocking brake | 0 1 2 | | | | | | | | | | | | |

Quelle: INN 41.60 TLMD090

Fig 8.11: Type codes - MDD 090

9. MDD 093

9.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | | | |
|---|-----------|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | | | 093 A-N-020 | 093 B-N-020 | 093 C-N-020 | 093 D-N-020 | 093 D-N-015 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 2000 | 2000 | 2000 | 2000 | 1500 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 9.2 (12.0) ⁵⁾ | 14.5(20.0) ⁵⁾ | 19.5(28.0) ⁵⁾ | 24.0(35.0) ⁵⁾ | 24.0(35.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 10.2(13.3) ⁵⁾ | 16.9(23.3) ⁵⁾ | 21.4(30.8) ⁵⁾ | 31.2(45.5) ⁵⁾ | 24.7(36.1) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 28.6 | 45.1 | 60.6 | 74.6 | 74.6 |
| Peak current | I_{max} | A | 45.8 | 76.0 | 96.5 | 140.4 | 111.2 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 22 x 10 ⁻⁴ | 29 x 10 ⁻⁴ | 42 x 10 ⁻⁴ | 58 x 10 ⁻⁴ | 58 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.90 | 0.86 | 0.91 | 0.77 | 0.97 |
| Windings resistance at 20 °C | R_A | Ohm | 1.86 | 0.77 | 0.56 | 0.42 | 0.5 |
| Windings inductance | L_A | mH | 15.3 | 7.6 | 6.1 | 3.9 | 5.7 |
| Thermal time constant | T_{th} | min | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 13.0 | 16.5 | 22.0 | 28.0 | 28.0 |
| | | | 093 A-N-030 | 093 B-N-030 | 093 C-N-030 | 093 C-L-030 | 093 D-N-030 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 3000 | 3000 | 3000 | 3000 | 3000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 9.2 (12.0) ⁵⁾ | 14.5(20.0) ⁵⁾ | 19.5(20.8) ⁵⁾ | 19.5(28.0) ⁵⁾ | 24.0(35.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 17.8(23.2) ⁵⁾ | 24.1(33.2) ⁵⁾ | 32.2(34.3) ⁵⁾ | 32.2(46.2) ⁵⁾ | 41.4(60.3) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 28.6 | 45.1 | 60.6 | 60.6 | 74.6 |
| Peak current | I_{max} | A | 79.9 | 108.2 | 145.0 | 145.0 | 186.0 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 22 x 10 ⁻⁴ | 29 x 10 ⁻⁴ | 42 x 10 ⁻⁴ | 42 x 10 ⁻⁴ | 58 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.52 | 0.60 | 0.61 | 0.61 | 0.58 |
| Windings resistance at 20 °C | R_A | Ohm | 0.61 | 0.43 | 0.25 | 0.25 | 0.18 |
| Windings inductance | L_A | mH | 4.9 | 4.4 | 2.7 | 2.7 | 2.1 |
| Thermal time constant | T_{th} | min | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 13.0 | 16.5 | 22.0 | 22.0 | 28.0 |
| | | | 093 A-N-040 | 093 B-N-040 | 093 C-N-040 | 093 D-N-040 | |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 4000 | 4000 | 4000 | 4000 | |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 9.2 (12.0) ⁵⁾ | 14.5(20.0) ⁵⁾ | 19.5(28.0) ⁵⁾ | 24.0(35.0) ⁵⁾ | |
| Continuous current at standstill | I_{dN} | A | 23.3(30.4) ⁵⁾ | 36.6(50.5) ⁵⁾ | 45.3(65.0) ⁵⁾ | 63.2(92.1) ⁵⁾ | |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 28.6 | 45.1 | 60.6 | 74.6 | |
| Peak current | I_{max} | A | 104.8 | 164.8 | 204.0 | 284.0 | |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 22 x 10 ⁻⁴ | 29 x 10 ⁻⁴ | 42 x 10 ⁻⁴ | 58 x 10 ⁻⁴ | |
| Torque constant at 20 °C | K_m | Nm/A | 0.39 | 0.40 | 0.43 | 0.38 | |
| Windings resistance at 20 °C | R_A | Ohm | 0.36 | 0.20 | 0.14 | 0.09 | |
| Windings inductance | L_A | mH | 2.8 | 1.9 | 1.6 | 1.3 | |
| Thermal time constant | T_{th} | min | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | |
| Mass ⁴⁾ | m_M | kg | 13.0 | 16.5 | 22.0 | 28.0 | |

Continued on next page

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

²⁾ With 60 K overtemperature at the motor housing.

³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

⁴⁾ Without blocking brake, without blower

⁵⁾ Parenthetical values apply to motors with surface cooling.

| Designation | Symbol | Unit | Motor type MDD ... | | |
|---|-----------|-------------------|---------------------------|---------------------------|---------------------------|
| | | | 093 A-N-060 | 093 B-N-060 | 093 C-N-060 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 6000 | 6000 | 6000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 9.2 (12.0) ⁵⁾ | 14.5 (20.0) ⁵⁾ | 19.5 (28.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 36.8 (48.0) ⁵⁾ | 46.7 (64.5) ⁵⁾ | 65.2 (93.6) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 28.6 | 45.1 | 60.6 |
| Peak current | I_{max} | A | 165.8 | 210.3 | 293.3 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 22 x 10 ⁻⁴ | 29 x 10 ⁻⁴ | 42 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.25 | 0.31 | 0.30 |
| Windings resistance at 20 °C | R_A | Ohm | 0.16 | 0.11 | 0.07 |
| Windings inductance | L_A | mH | 1.3 | 1.1 | 0.7 |
| Thermal time constant | T_{th} | min | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ | 50 (45) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 13.0 | 16.5 | 22.0 |

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves
²⁾ With 60 K overtemperature at the motor housing.
³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.
⁴⁾ Without blocking brake, without blower
⁵⁾ Parenthetical values apply to motors with surface cooling.

Fig 9.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|---|----------|------|-----------------------------|
| Permissible ambient temp. | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperature | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

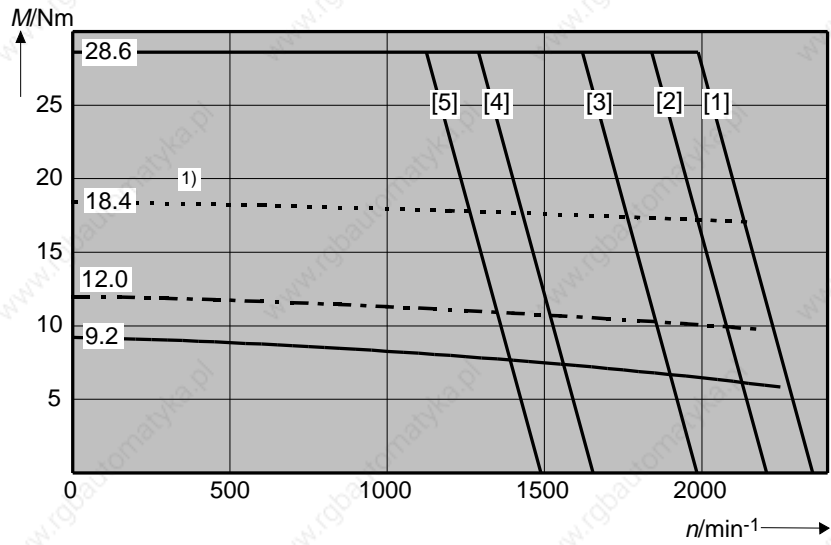
Fig 9.2: General data - MDD 093

| Designation | Symbol | Unit | Data Blocking Brake | |
|---------------------|--------|------------------|--------------------------------|------------------------|
| Principle of action | | | electrically- actuated release | |
| Holding torque | M_H | Nm | 11 | 22 |
| Nominal voltage | U_N | V | DC 24 ± 10% | DC 24 ± 10% |
| Nominal current | I_N | A | 0.5 | 0.7 |
| Moment of inertia | J_B | kgm ² | 1.06 x 10 ⁻⁴ | 3.6 x 10 ⁻⁴ |
| Release delay | t_L | ms | 60 | 70 |
| Clamping delay | t_K | ms | 20 | 30 |
| Mass | m_B | kg | 0.5 | 1.1 |

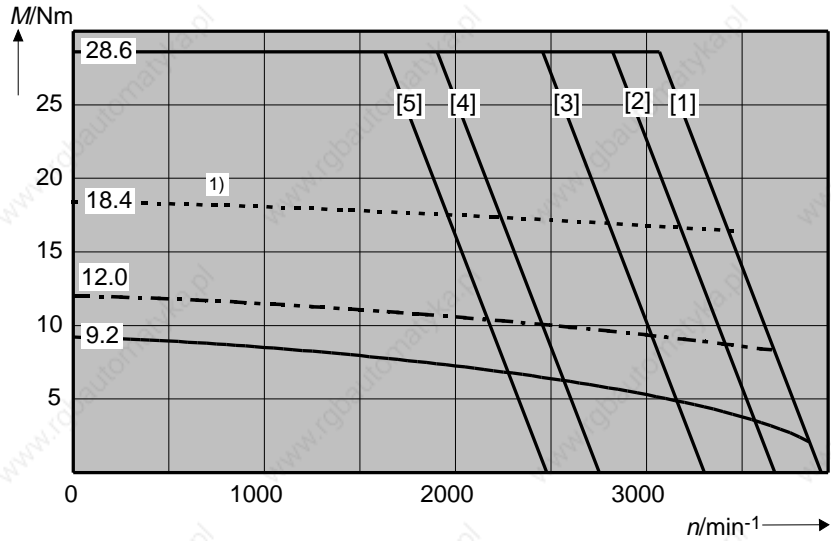
Fig 9.3: Technical data - blocking brake

9.2. Torque-Speed Characteristics

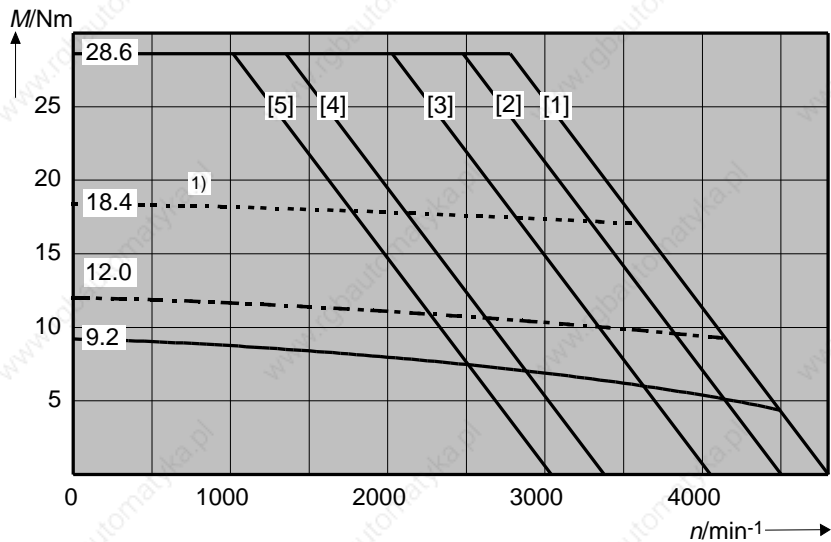
MDD 093 A-N at
2000 min⁻¹



MDD 093 A-N at
3000 min⁻¹



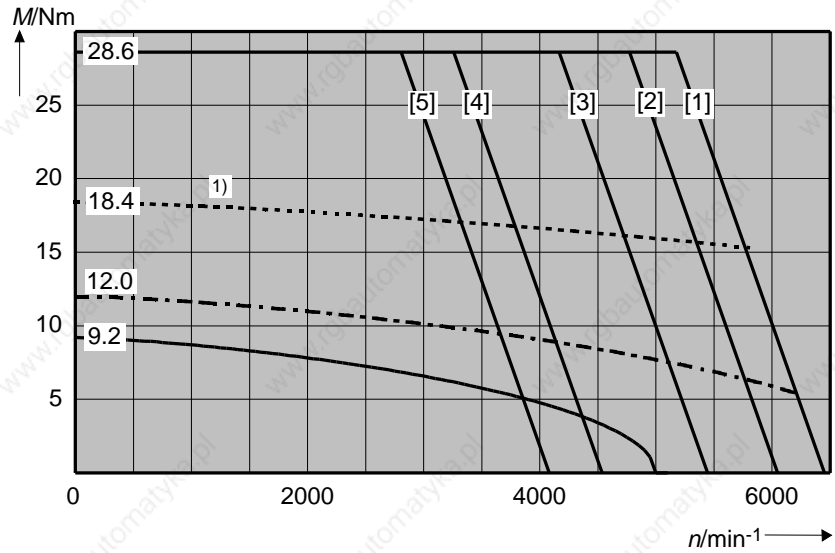
MDD 093 A-N at
4000 min⁻¹



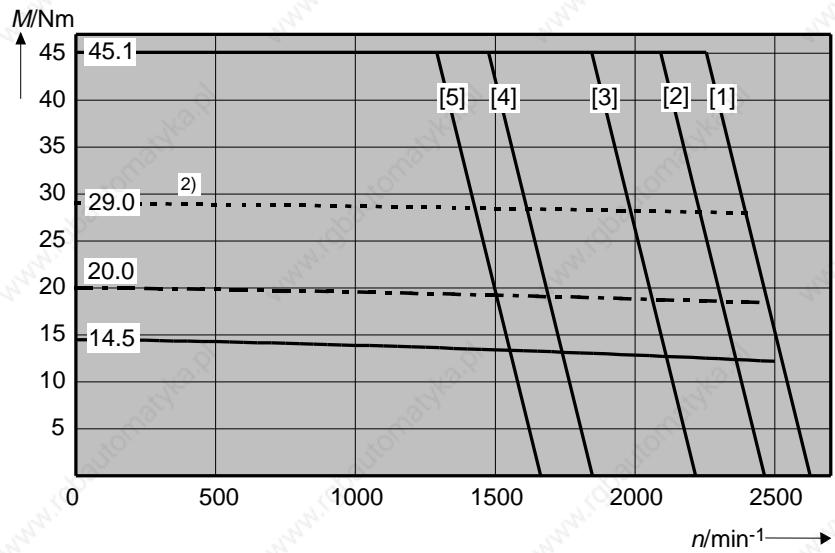
1) Shown: ON time of surface-cooled motor equals 42%

Fig 9.4: Torque-speed characteristics curve - surface MDD 093

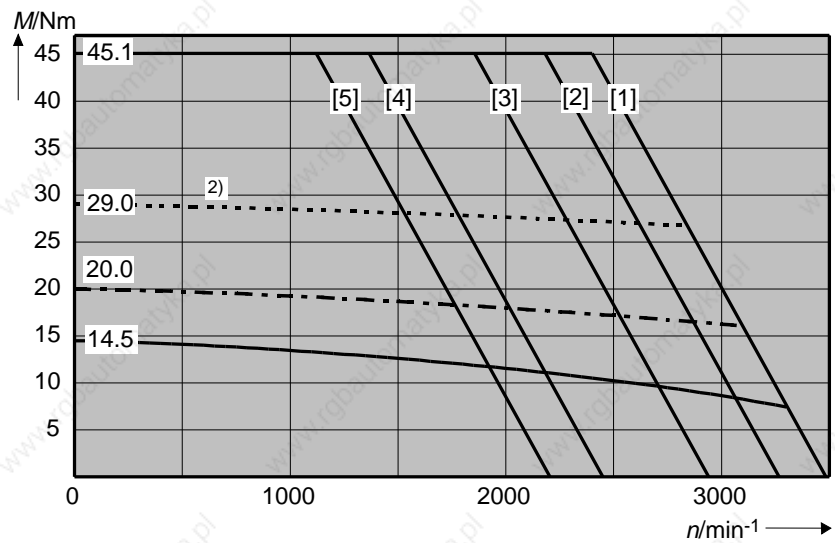
MDD 093 A-N at
6000 min⁻¹



MDD 093 B-N at
2000 min⁻¹



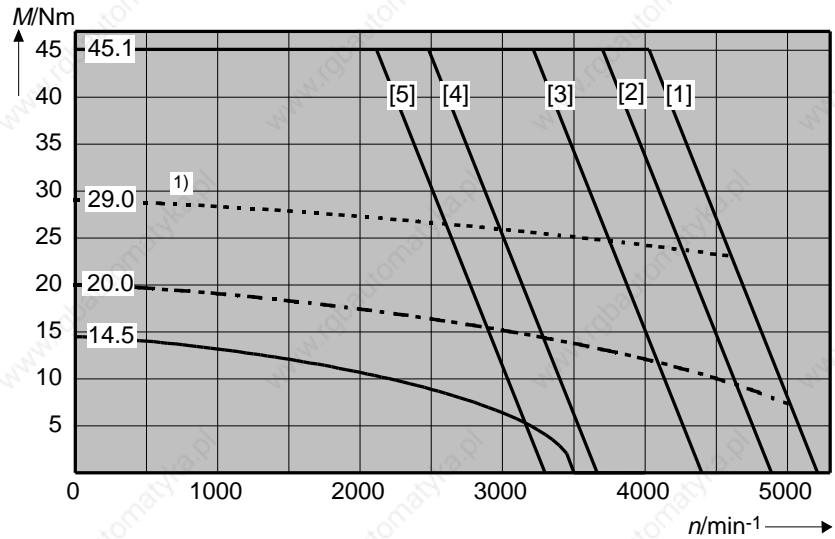
MDD 093 B-N at
3000 min⁻¹



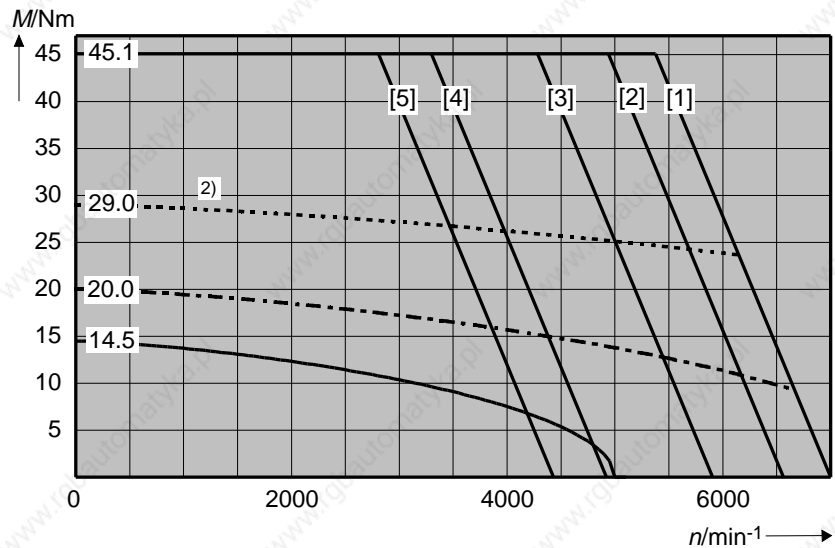
- 1) Shown: ON time of surface-cooled motor equals 42%.
- 2) Shown: ON time of surface-cooled motor equals 48%.

Fig 9.5: Torque-speed characteristics curve - MDD 093

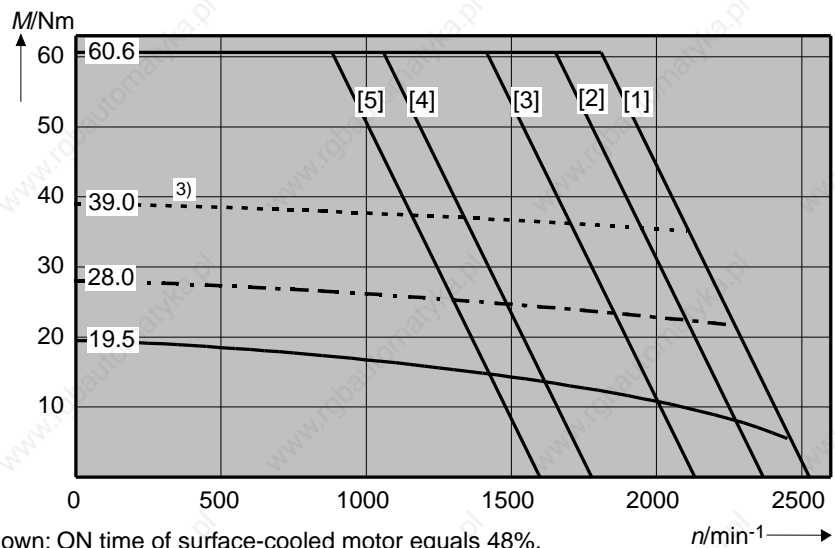
MDD 093 B-N at
4000 min⁻¹



MDD 093 B-N at
6000 min⁻¹



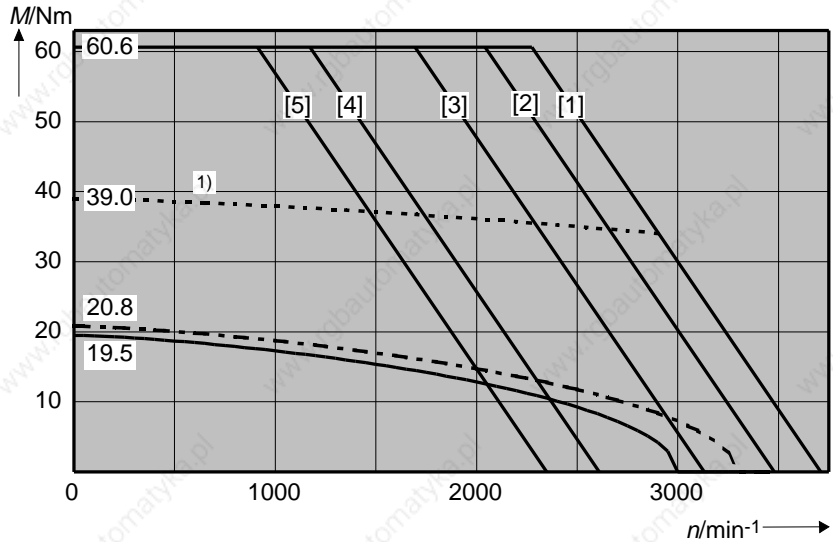
MDD 093 C-N at
2000 min⁻¹



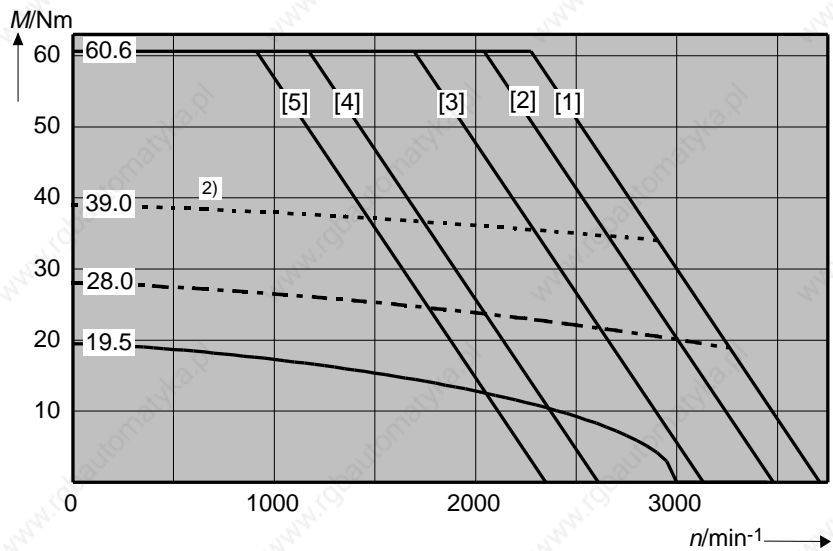
- 1) Shown: ON time of surface-cooled motor equals 48%.
- 2) Shown: ON time of surface-cooled motor equals 46%.
- 3) Shown: ON time of surface-cooled motor equals 52%.

Fig 9.6: Torque-speed characteristics curve - MDD 093

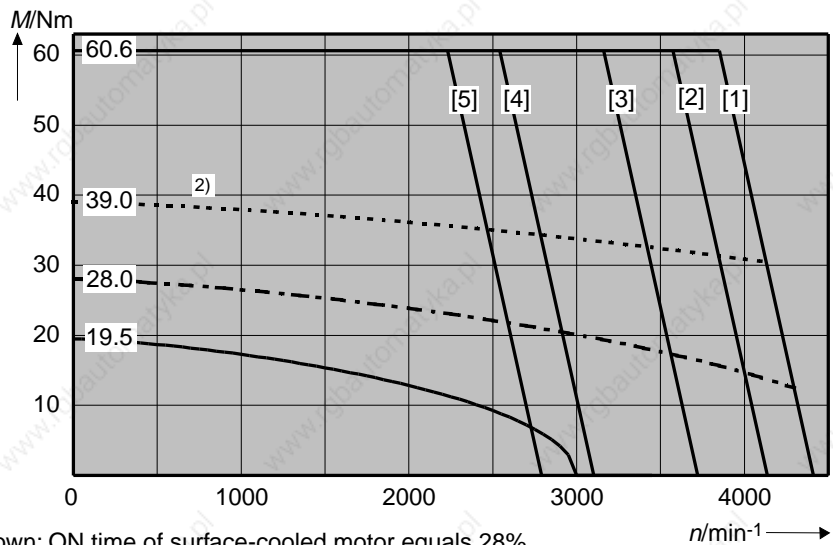
MDD 093 C-N at
3000 min⁻¹



MDD 093 C-L at
3000 min⁻¹



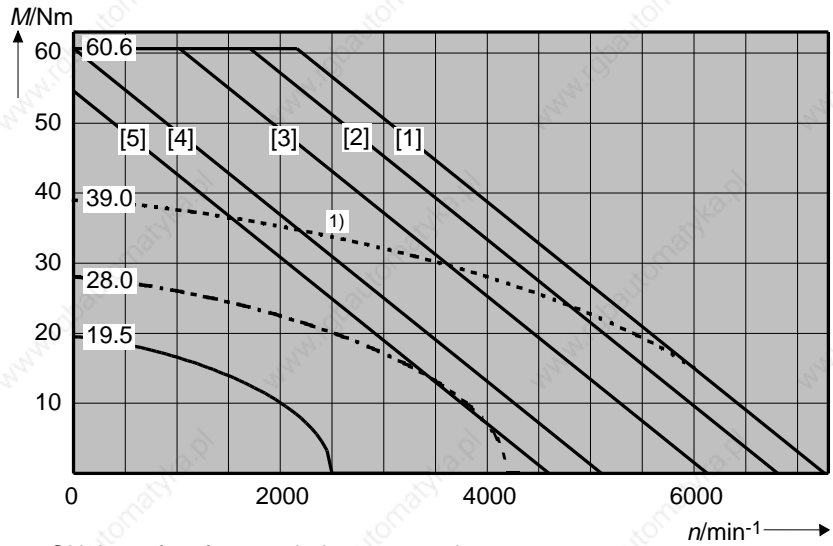
MDD 093 C-N at
4000 min⁻¹



- 1) Shown: ON time of surface-cooled motor equals 28%.
- 2) Shown: ON time of surface-cooled motor equals 52%.

Fig 9.7: Torque-speed characteristics curve - MDD 093

MDD 093 C-N at
6000 min⁻¹



1) Shown: ON time of surface-cooled motor equals 52%.

MDD 093 D-N at
1500 min⁻¹

in preparation

MDD 093 D-N at
2000 min⁻¹

in preparation

Fig 9.8: Torque-speed characteristics curve - MDD 093

*MDD 093 D-N at
3000 min⁻¹*

in preparation

*MDD 093 D-N at
4000 min⁻¹*

in preparation

Fig 9.9: Torque-speed characteristics curve - MDD 093

9.3. Shaft Load Capacity

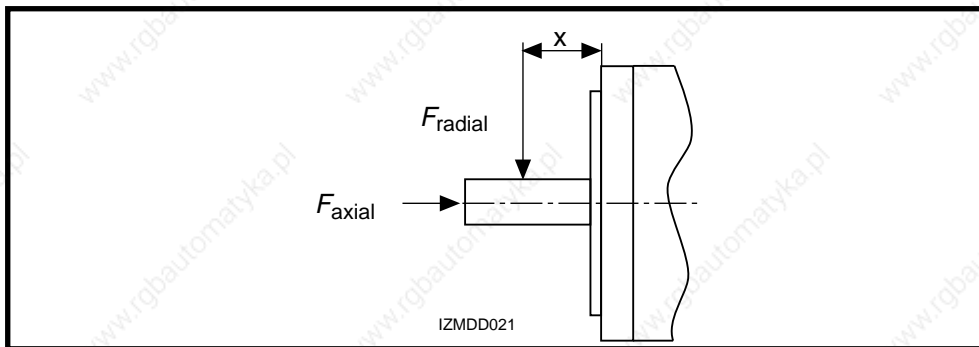


Fig 9.10: Shaft load

Permissible radial force
 F_{radial}

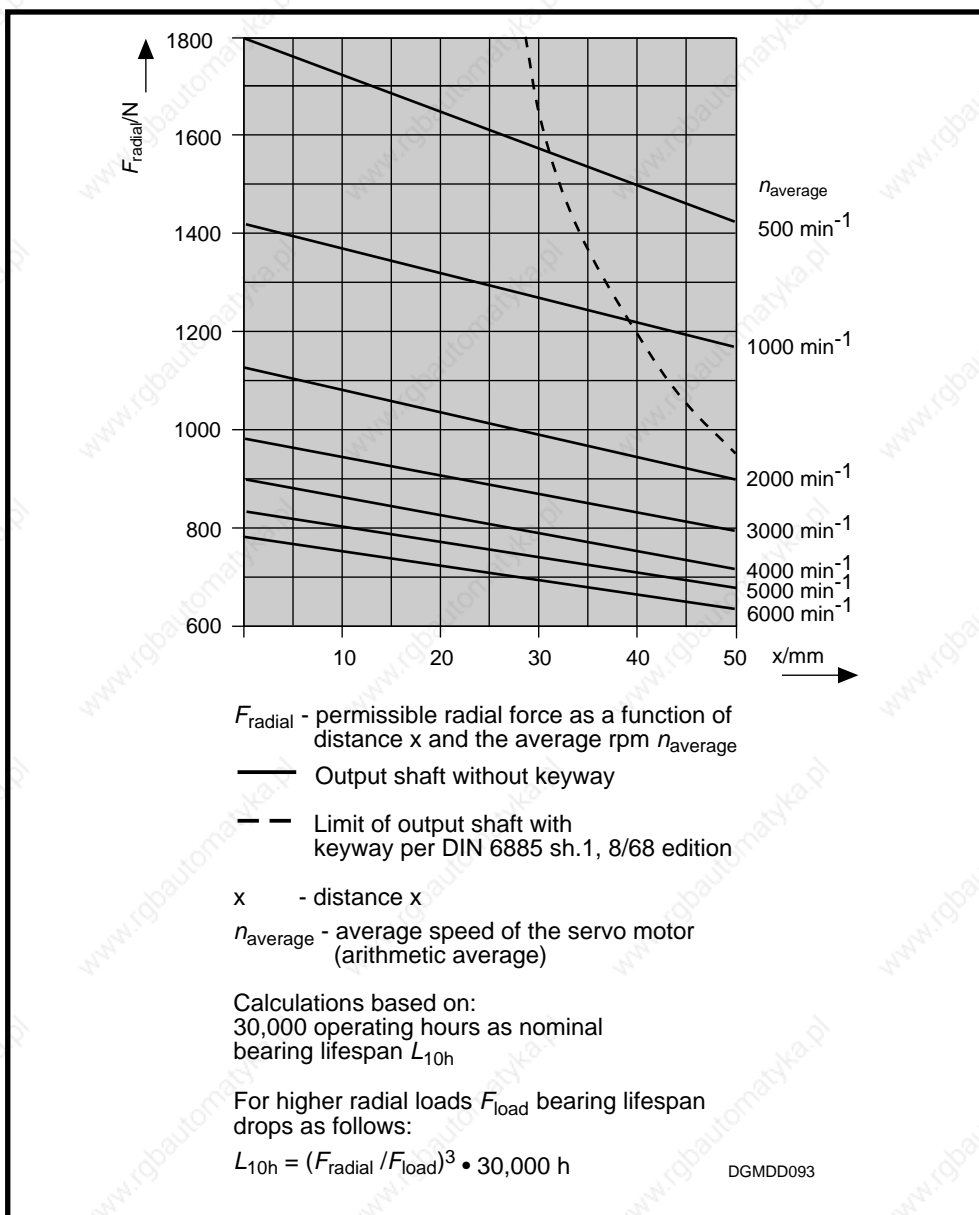


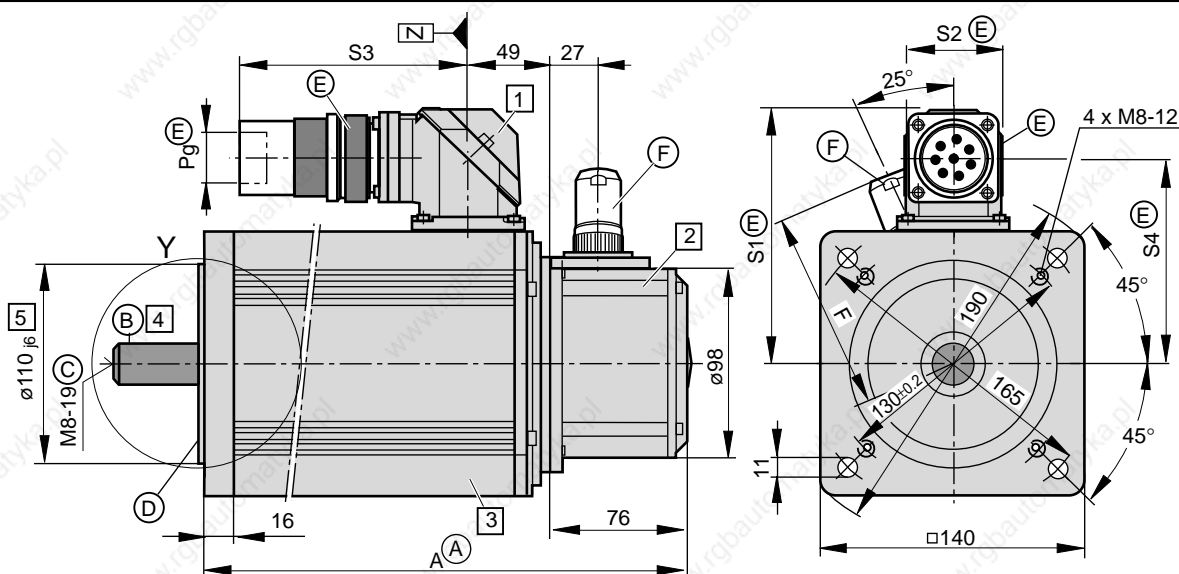
Fig 9.11: Permissible radial force

Permissible axial force
 F_{axial}

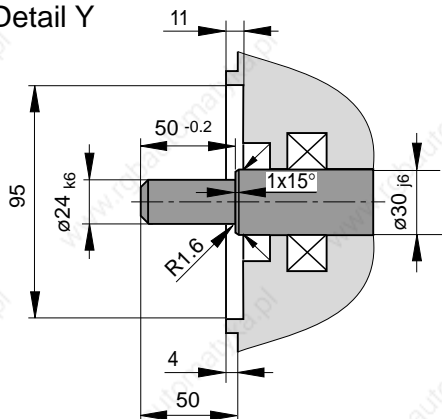
$$F_{axial} = 0.34 \cdot F_{radial}$$

F_{axial} - permissible axial force
 F_{radial} - permissible radial force

9.4. Dimensional Data



Detail Y



- Ⓒ Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
 - Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
 - Max. tightening torque M_A for screws in the threads of the center hole: 5 Nm
 - Balance class N per DIN VDE 0530 section 14, 2/93 edition

- Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
 - as per design B5 (throughhole in flange)
 - as per design B14 (threads in flange)

- Ⓔ **Motor power connector**
Depends on motor, must be ordered separately.

Ⓐ Dimensional table Dim. A

| Size | Dim. A 1) |
|-----------|-----------|
| MDD 093 A | 286 |
| MDD 093 B | 327 |
| MDD 093 C | 386 |
| MDD 093 D | 436 |

1) Bigger with some options.
The then valid dimensions is indicated with the respective feature.

- Ⓑ Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

Table of dimensions

| type \ dim | S1 | S2 | S3 | S4 | Pg |
|------------|-----|----|-----|-----|----|
| INS 108 2) | 125 | 45 | 110 | 105 | 21 |
| INS 172 3) | 135 | 53 | 145 | 108 | 36 |

2) with MDD 093 A-N-020, MDD 093 A-N-030, MDD 093 A-N-040, MDD 093 B-N-020, MDD 093 B-N-030, MDD 093 C-N-020, MDD 093 C-N-030

3) other MDD 093

- Ⓕ **Feedback connector**

Must be ordered separately.

Table of dimensions

| Name | Connector type | Dim. F |
|----------------|--------------------|--------|
| straight conn. | INS 513 | 110 |
| | INS 512 | 112 |
| angle conn. | INS 511 INS 510 | 108 |

MBMDD093_1

Fig 9.12: Dimensional data MDD 093

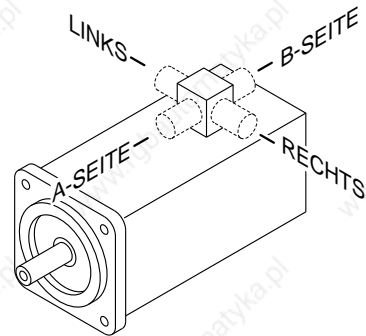
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Digital servo feedback (DSF)
- Digital servo feedback (DSF) with integrated multiturn absolute encoder

The dimensions are identical.

3 Blocking brake

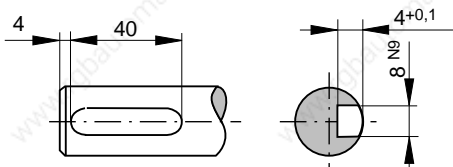
- without blocking brake
- with blocking brake: 11 Nm } The dimensions are identical.
- with blocking brake: 22 Nm

Dimensional table for motors with blocking brake: 22 Nm

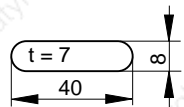
| Size | Dim. A |
|-----------|--------|
| MDD 093 A | 316 |
| MDD 093 B | 357 |
| MDD 093 C | 416 |
| MDD 093 D | 466 |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 8 x 7 x 40



5 Special centering diameter

- $\varnothing 130_{j6}$

MBMDD093_2

Fig 9.13: Dimensional data MDD 093 - available options

9.5. Available Versions

| Type code field: | Example: | MDD | 093 | B | N | 020 | N | 2 | L | 110 | G | B | 0 |
|---|---------------------------------------|-----|-----|---|---|-----|---|---|---|-----|---|---|---|
| 1. Name Motor for digital drive controllers | MDD | | | | | | | | | | | | |
| 2. Motor size | 093 | | | | | | | | | | | | |
| 3. Motor lengths | A, B, C, D | | | | | | | | | | | | |
| 4. Housing design: Standard (suited for natural convection and surface-cooling) for surface cooling with motors requiring a bigger power connector with housing design N | N L 1) | | | | | | | | | | | | |
| 5. Nominal speed 1500 min ⁻¹ 2000 min ⁻¹ 3000 min ⁻¹ 4000 min ⁻¹ 6000 min ⁻¹ | 015 2) 020 030 040 060 3) | | | | | | | | | | | | |
| 6. Balance class Standard (R per DIN VDE 0530 section 14, 2/93 edition) | N | | | | | | | | | | | | |
| 7. Side B shaft end Standard (without side B shaft end) | 2 | | | | | | | | | | | | |
| 8. Motor feedback digital servo feedback digital servo feedback with integrated multiturn absolute encoder | L M | | | | | | | | | | | | |
| 9. Centering diameter ø110 mm (standard) ø130 mm | 110 130 | | | | | | | | | | | | |
| 10. Output shaft plain shaft shaft with keyway per DIN 6885 sh. 1, 8/68 edition | G P | | | | | | | | | | | | |
| 11. Power connection connector to side A connector to side B connector to the right (looking onto motor shaft, connecting housing at top) connector to the left (looking onto motor shaft, connecting housing at top) | A B R L | | | | | | | | | | | | |
| 12. Blocking brake without blocking brake with 11.0 Nm blocking brake with 22.0 Nm blocking brake | 0 1 2 | | | | | | | | | | | | |

1) Housing design "L" only with motor types MDD 093C-L-030.
2) Only with motor length "D"
3) Only with motor length "D"

Quelle: INN 41.60 TLMD093

Fig 9.14: Type codes - MDD 093

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10. MDD 112

10.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | | | |
|---|-----------|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | | | 112 A-N-015 | 112 B-N-015 | 112 C-N-015 | 112 D-N-015 | 112 D-L-015 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 1500 | 1500 | 1500 | 1500 | 1500 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 10.5(13.0) ⁵⁾ | 17.5(29.0) ⁵⁾ | 28.0(43.2) ⁵⁾ | 38.0(44.0) ⁵⁾ | 38.0(57.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 8.3 (10.3) ⁵⁾ | 14.0(23.1) ⁵⁾ | 22.2(34.3) ⁵⁾ | 29.7(34.3) ⁵⁾ | 29.7(44.5) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 31.4 | 60.5 | 97.2 | 132.4 | 132.4 |
| Peak current | I_{max} | A | 26.7 | 55.3 | 82.6 | 110.5 | 110.5 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 61 x 10 ⁻⁴ | 120 x 10 ⁻⁴ | 170 x 10 ⁻⁴ | 230 x 10 ⁻⁴ | 230 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 1.26 | 1.25 | 1.26 | 1.28 | 1.28 |
| Windings resistance at 20 °C | R_A | Ohm | 2.94 | 0.85 | 0.56 | 0.39 | 0.39 |
| Windings inductance | L_A | mH | 32 | 13 | 7.9 | 5.9 | 5.9 |
| Thermal time constant | T_{th} | min | 100 (75) ⁵⁾ | 90 (60) ⁵⁾ | 100 (75) ⁵⁾ | 120 (90) ⁵⁾ | 120 (90) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 25 | 36 | 48 | 59 | 59 |
| | | | 112 A-N-020 | 112 B-N-020 | 112 C-N-020 | 112 C-L-020 | 112 D-N-020 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 2000 | 2000 | 2000 | 2000 | 2000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 10.5(13.0) ⁵⁾ | 17.5(28.9) ⁵⁾ | 28.0(32.3) ⁵⁾ | 28.0(44.0) ⁵⁾ | 38.0(57.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 11.8(14.6) ⁵⁾ | 20.7(34.3) ⁵⁾ | 29.7(34.3) ⁵⁾ | 29.7(46.8) ⁵⁾ | 43.8(65.8) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 30.7 | 65.1 | 97.3 | 97.3 | 134.8 |
| Peak current | I_{max} | A | 37.0 | 82.6 | 110.5 | 110.5 | 166.4 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 61 x 10 ⁻⁴ | 120 x 10 ⁻⁴ | 170 x 10 ⁻⁴ | 170 x 10 ⁻⁴ | 230 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.89 | 0.84 | 0.94 | 0.94 | 0.87 |
| Windings resistance at 20 °C | R_A | Ohm | 1.40 | 0.43 | 0.31 | 0.31 | 0.18 |
| Windings inductance | L_A | mH | 16 | 5.7 | 5.0 | 5.0 | 2.7 |
| Thermal time constant | T_{th} | min | 100 (75) ⁵⁾ | 90 (60) ⁵⁾ | 100 (75) ⁵⁾ | 100 (75) ⁵⁾ | 120 (90) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 25 | 36 | 48 | 48 | 59 |
| | | | 112 A-N-030 | 112 B-N-030 | 112 B-L-030 | 112 C-N-030 | 112 D-N-030 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 3000 | 3000 | 3000 | 3000 | 3000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 10.5(13.0) ⁵⁾ | 17.5(21.4) ⁵⁾ | 17.5(29.0) ⁵⁾ | 28.0(44.0) ⁵⁾ | 38.0(57.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 17.3(21.4) ⁵⁾ | 28.0(34.3) ⁵⁾ | 28.0(46.4) ⁵⁾ | 43.4(68.1) ⁵⁾ | 60.6(90.9) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 31.3 | 64.5 | 64.5 | 100.4 | 130.2 |
| Peak current | I_{max} | A | 55.3 | 110.5 | 110.5 | 166.4 | 222.2 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 61 x 10 ⁻⁴ | 120 x 10 ⁻⁴ | 120 x 10 ⁻⁴ | 170 x 10 ⁻⁴ | 230 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.61 | 0.62 | 0.62 | 0.65 | 0.63 |
| Windings resistance at 20 °C | R_A | Ohm | 0.66 | 0.25 | 0.25 | 0.14 | 0.10 |
| Windings inductance | L_A | mH | 6.8 | 3.1 | 3.1 | 2.0 | 1.5 |
| Thermal time constant | T_{th} | min | 100 (75) ⁵⁾ | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | 100 (75) ⁵⁾ | 120 (90) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 25 | 36 | 36 | 48 | 59 |

Continued on next page

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

²⁾ With 60 K overtemperature at the motor housing.

³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

⁴⁾ Without blocking brake, without blower

⁵⁾ Parenthetical values apply to motors with surface cooling.

| Designation | Symbol | Unit | Motor type MDD ... | | | | |
|---|-----------|-------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|
| | | | 112 A-N-040 | 112 B-N-040 | 112 C-N-040 | 112 D-N-040 | 112 C-N-060 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 4000 | 4000 | 4000 | 4000 | 6000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 10.5(13.0) ⁵⁾ | 17.5(29.0) ⁵⁾ | 28.0(44.0) ⁵⁾ | 38.0(44.2) ⁵⁾ | 28.0(32.9) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 23.0(28.4) ⁵⁾ | 41.5(68.8) ⁵⁾ | 58.1(91.3) ⁵⁾ | 88.4(102.9) ⁵⁾ | 87.5(102.9) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 31.3 | 65.5 | 100.1 | 132.2 | 77.0 |
| Peak current | I_{max} | A | 72.9 | 166.4 | 222.2 | 329.1 | 257.4 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 61 x 10 ⁻⁴ | 120 x 10 ⁻⁴ | 170 x 10 ⁻⁴ | 230 x 10 ⁻⁴ | 170 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 0.46 | 0.42 | 0.48 | 0.43 | 0.32 |
| Windings resistance at 20 °C | R_A | Ohm | 0.38 | 0.11 | 0.08 | 0.05 | 0.04 |
| Windings inductance | L_A | mH | 4.0 | 1.5 | 0.9 | 0.7 | 0.5 |
| Thermal time constant | T_{th} | min | 100 (75) ⁵⁾ | 90 (60) ⁵⁾ | 100 (75) ⁵⁾ | 120 (90) ⁵⁾ | 100 (75) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 25 | 36 | 48 | 59 | 48 |

1) Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

2) With 60 K overtemperature at the motor housing.

3) Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

4) Without blocking brake, without blower

5) Parenthetical values apply to motors with surface cooling.

Fig 10.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|---|----------|------|-----------------------------|
| Permissible ambient temperature | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperature | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

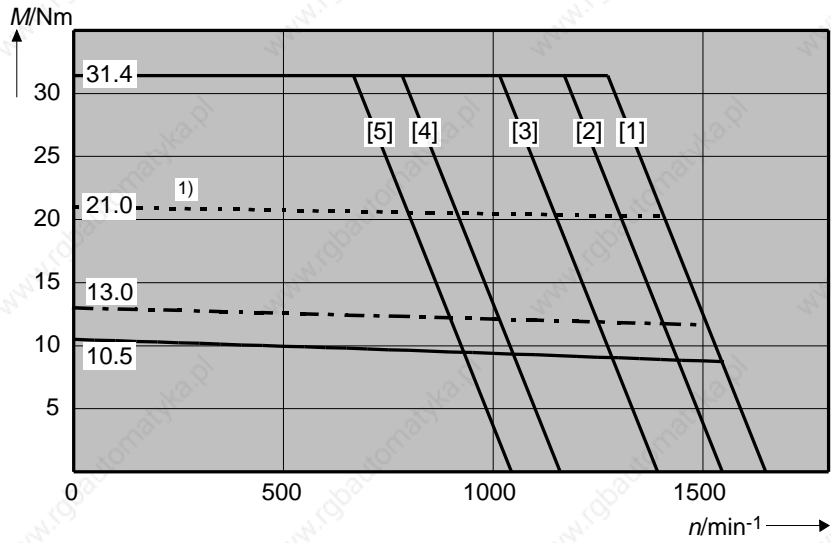
Fig 10.2: General data - MDD 112

| Designation | Symbol | Unit | Data Blocking Brake | | |
|---------------------|--------|------------------|-------------------------------|-----------------------|-----------------------|
| Principle of action | | | electrically actuated release | | |
| Blocking brake | M_H | Nm | 144,060 | | |
| Nominal voltage | U_N | V | DC 24 ± 10% | DC 24 ± 10% | DC 24 ± 10% |
| Nominal current | I_N | A | 0.75 | 1.35 | 1.35 |
| Moment of inertia | J_B | kgm ² | 3.6 x 10 ⁻⁴ | 32 x 10 ⁻⁴ | 32 x 10 ⁻⁴ |
| Release delay | t_L | ms | 70 | 150 | 150 |
| Clamping delay | t_K | ms | 30 | 30 | 30 |
| Mass | m_B | kg | 1.1 | 3.5 | 3.5 |

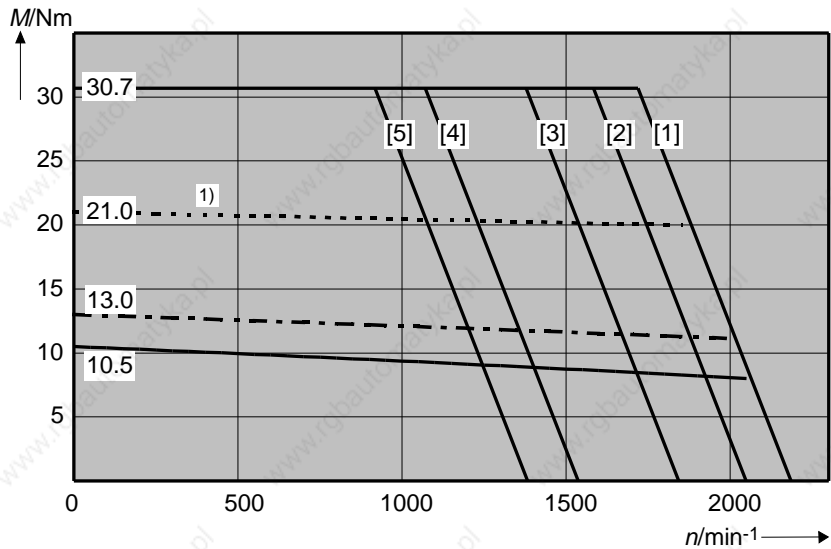
Fig 10.3: Technical data - blocking brake

10.2. Torque-Speed Characteristics

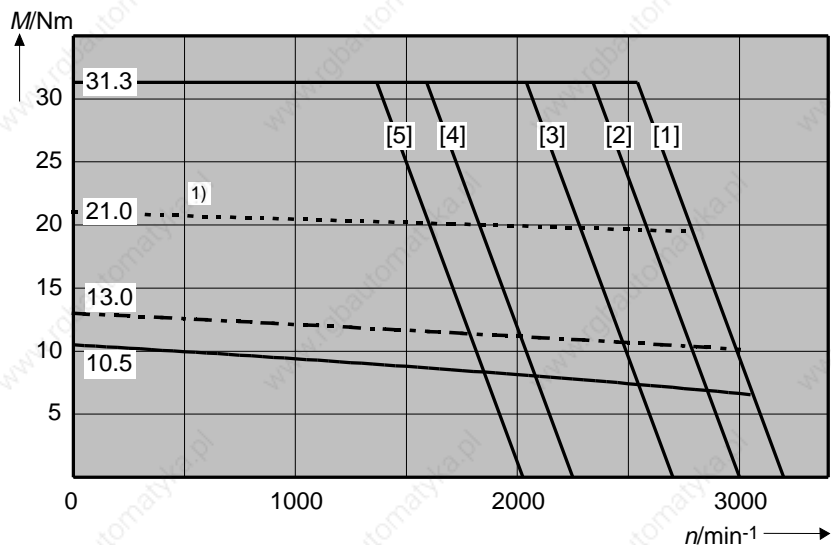
MDD 112 A-N at
1500 min⁻¹



MDD 112 A-N at
2000 min⁻¹



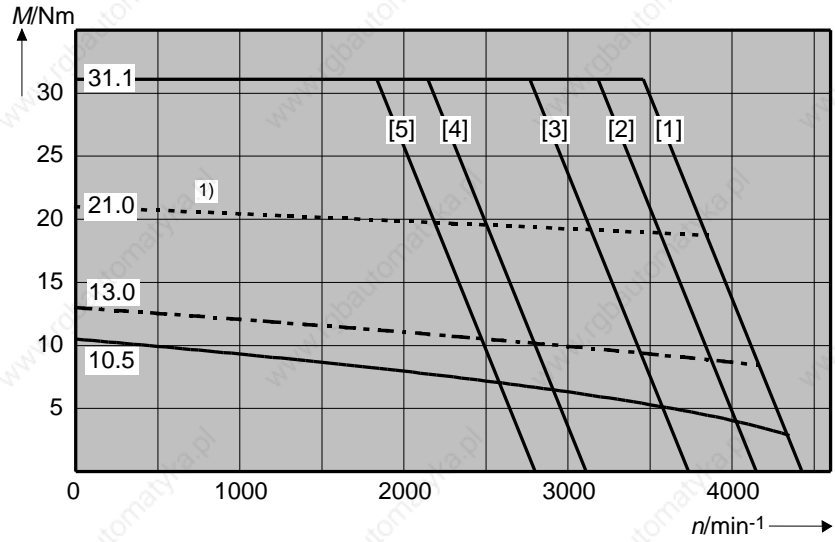
MDD 112 A-N at
3000 min⁻¹



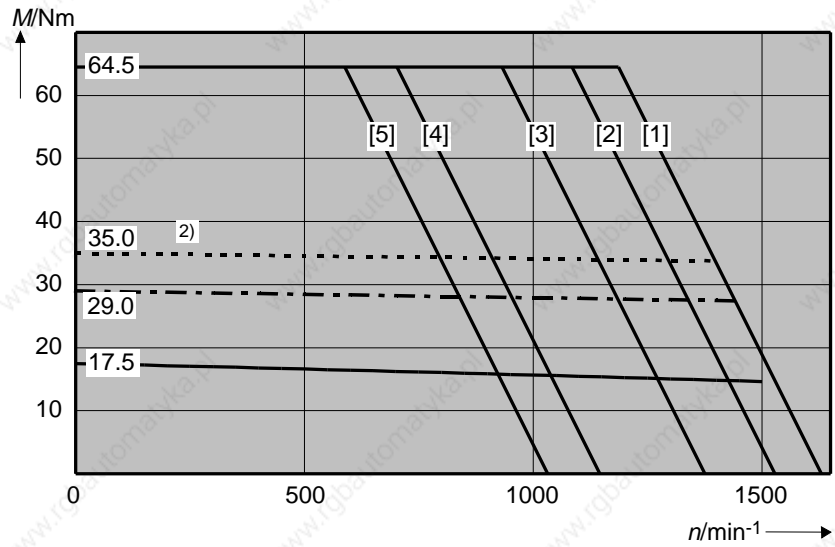
1) Shown: ON time of surface-cooled motor equals 38%.

Fig 10.4: Torque-speed characteristics curve MDD 112

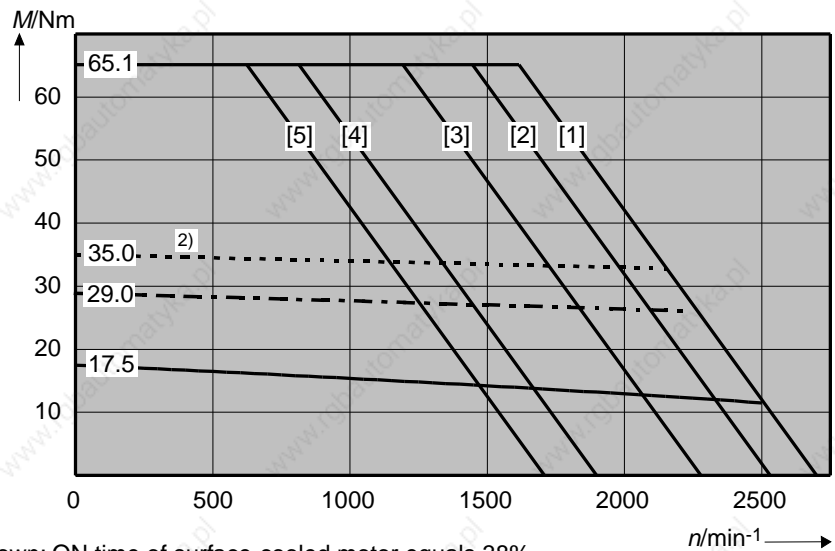
MDD 112 A-N at
4000 min⁻¹



MDD 112 B-N at
1500 min⁻¹



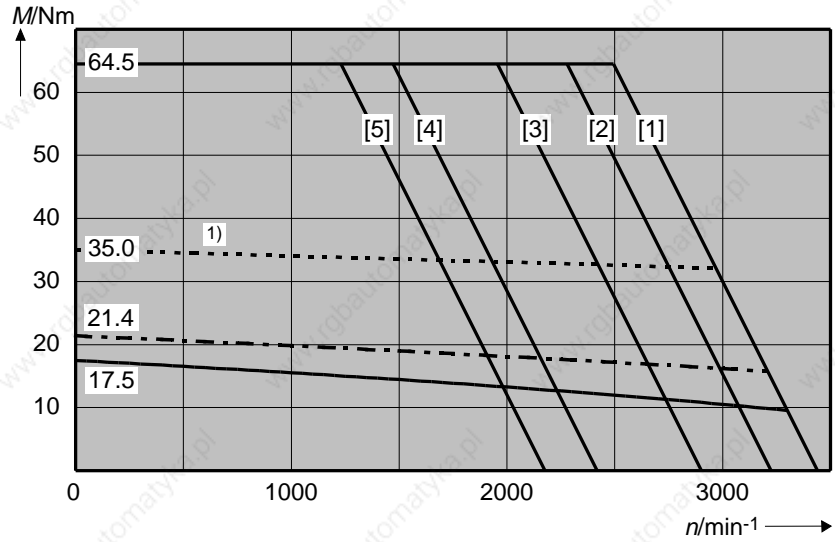
MDD 112 B-N at
2000 min⁻¹



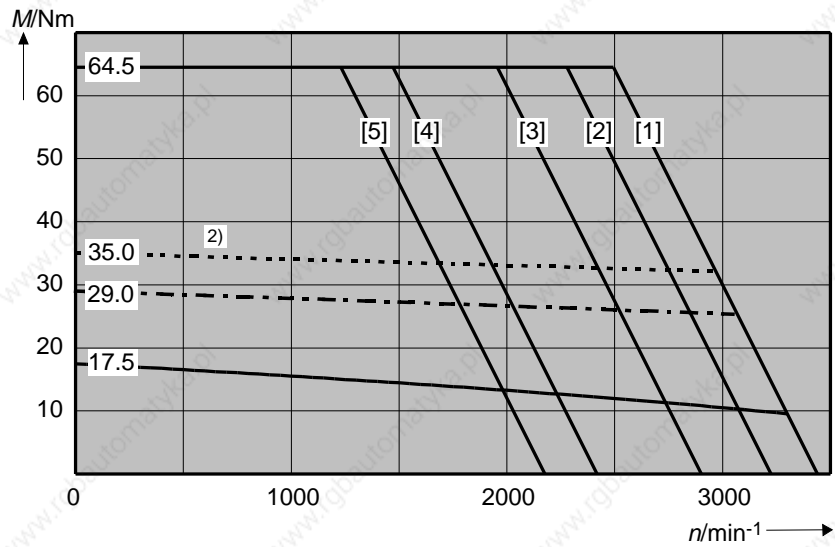
- 1) Shown: ON time of surface-cooled motor equals 38%.
- 2) Shown: ON time of surface-cooled motor equals 68%.

Fig 10.5: Torque-speed characteristics curve MDD 112

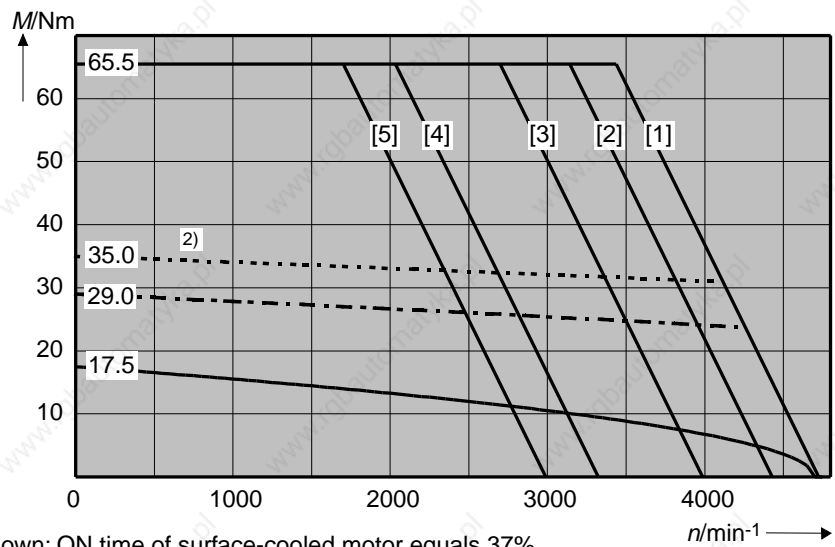
MDD 112 B-N at 3000 min⁻¹



MDD 112 B-L at 3000 min⁻¹



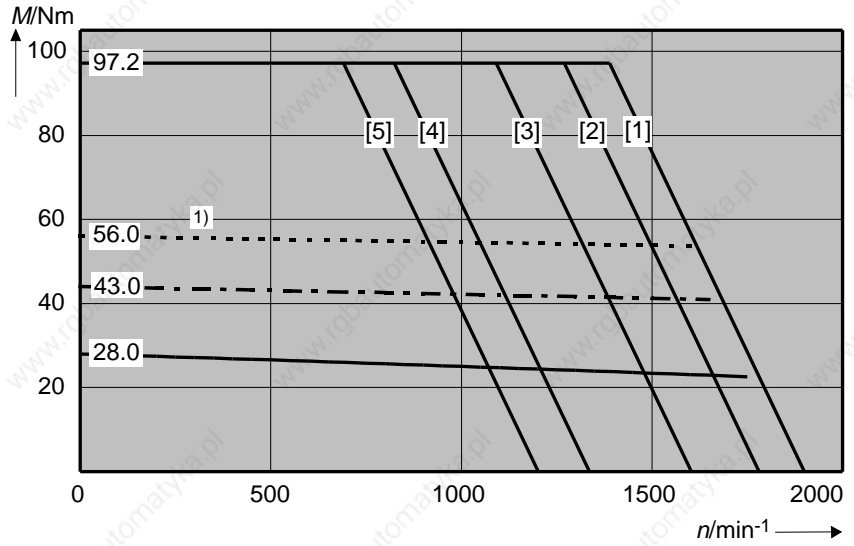
MDD 112 B-N at 4000 min⁻¹



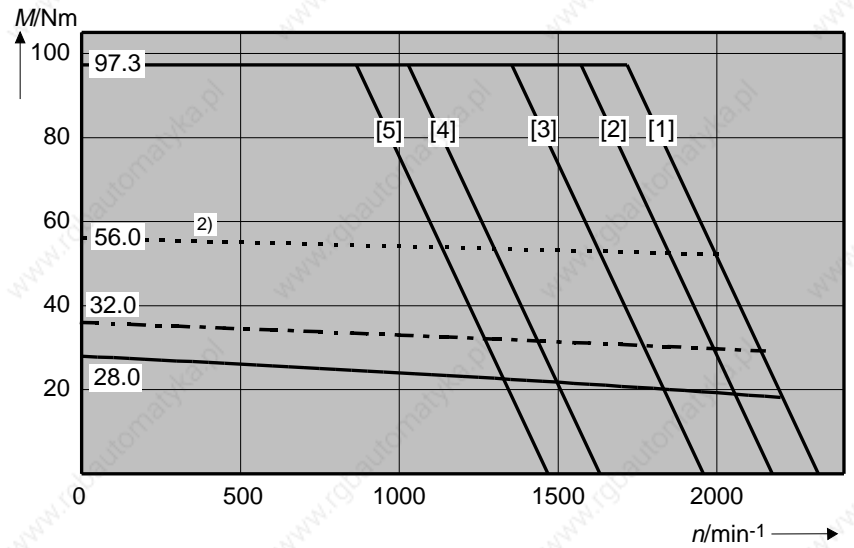
- 1) Shown: ON time of surface-cooled motor equals 37%.
- 2) Shown: ON time of surface-cooled motor equals 69%.

Fig 10.6: Torque-speed characteristics curve MDD 112

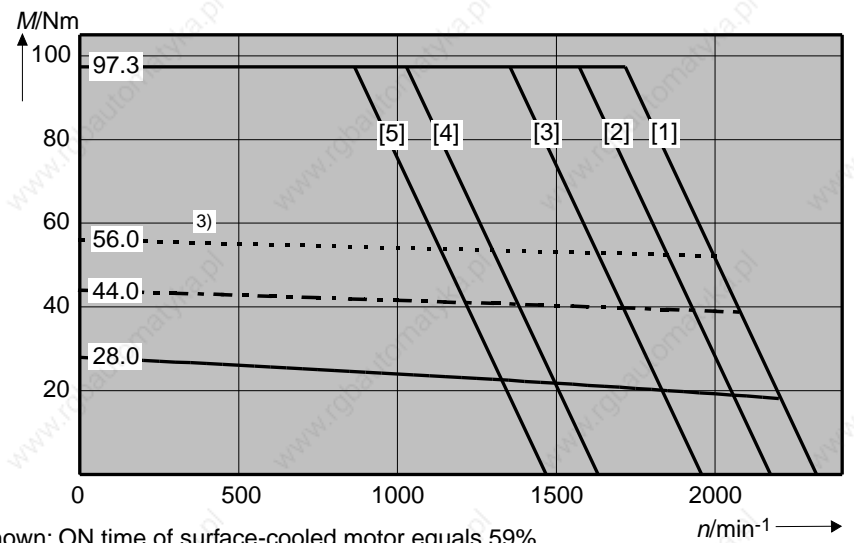
MDD 112 C-N at
1500 min⁻¹



MDD 112 C-N at
2000 min⁻¹



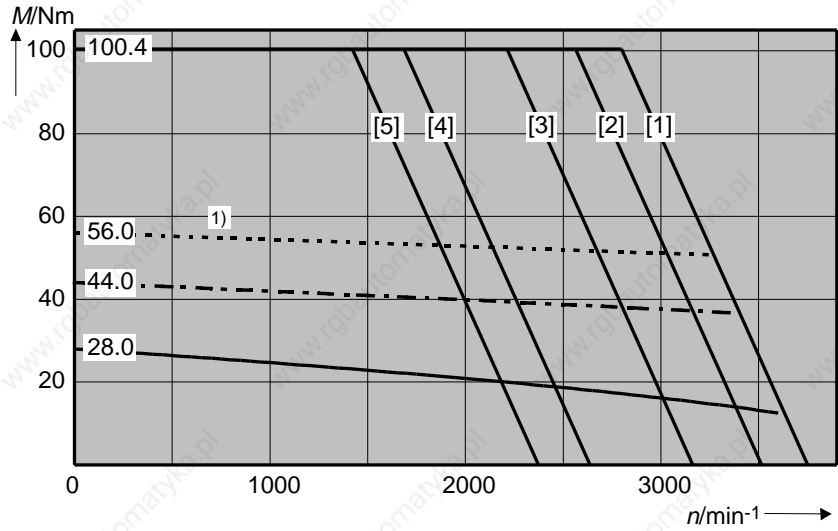
MDD 112 C-L at
2000 min⁻¹



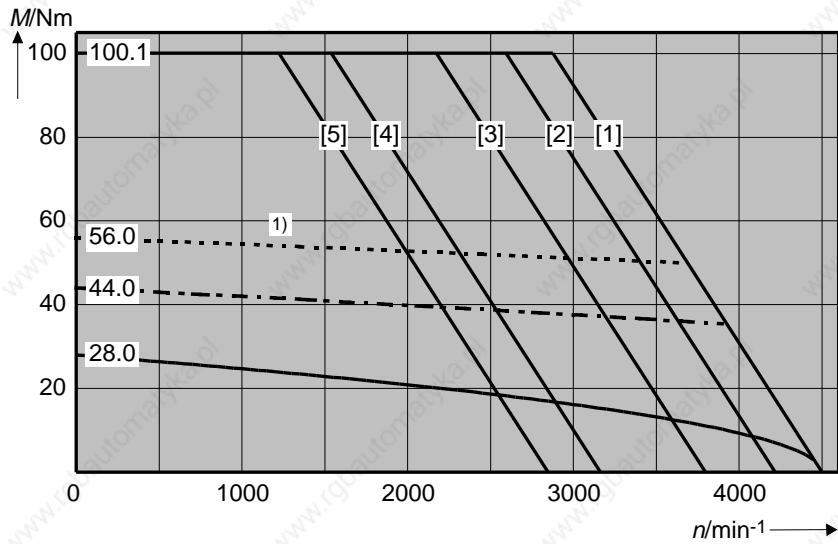
- 1) Shown: ON time of surface-cooled motor equals 59%.
- 2) Shown: ON time of surface-cooled motor equals 33%.
- 3) Shown: ON time of surface-cooled motor equals 62%.

Fig 10.7: Torque-speed characteristics curve MDD 112

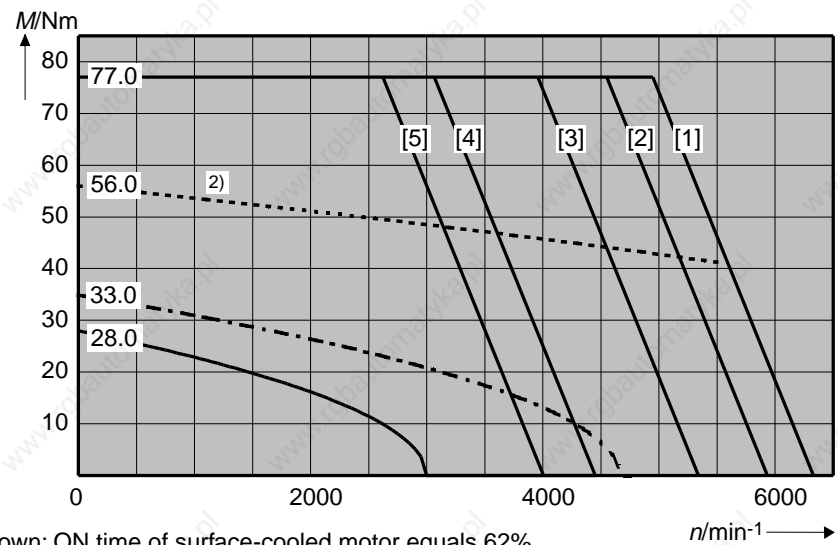
MDD 112 C-N at
3000 min⁻¹



MDD 112 C-N at
4000 min⁻¹



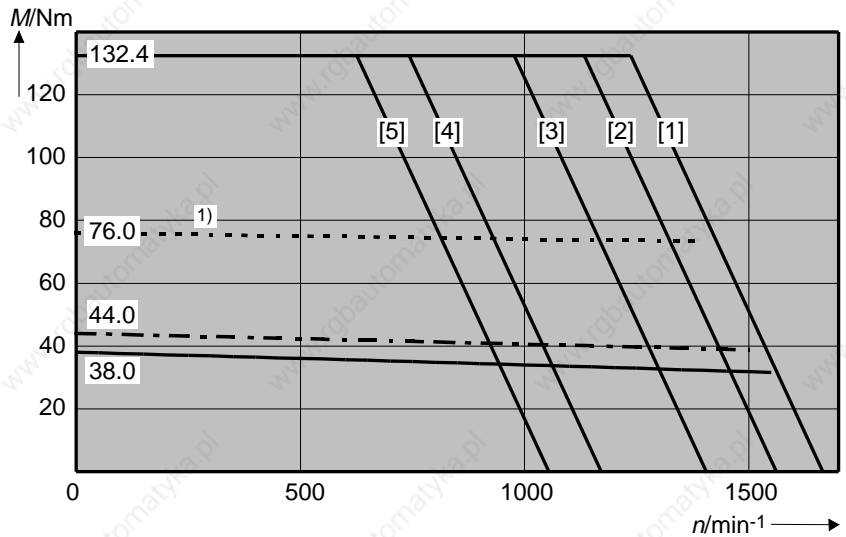
MDD 112 C-N at
6000 min⁻¹



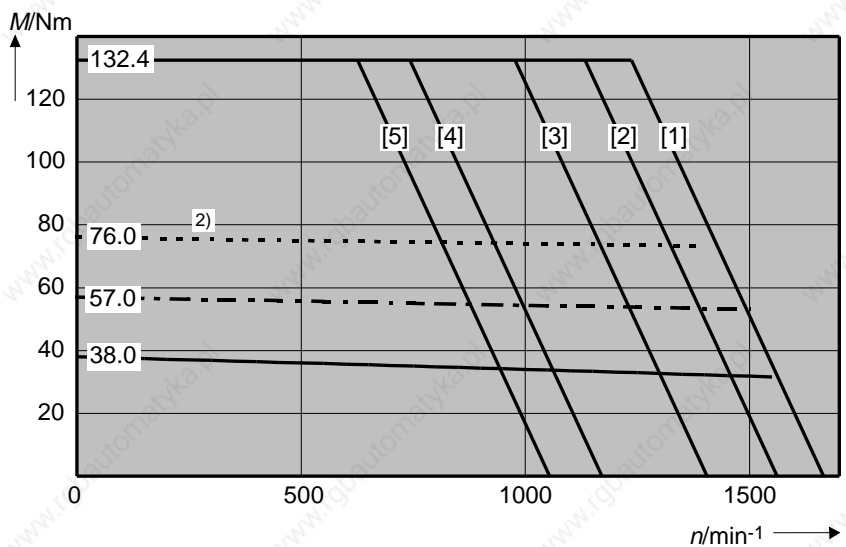
- 1) Shown: ON time of surface-cooled motor equals 62%.
- 2) Shown: ON time of surface-cooled motor equals 35%.

Fig 10.8: Torque-speed characteristics curve MDD 112

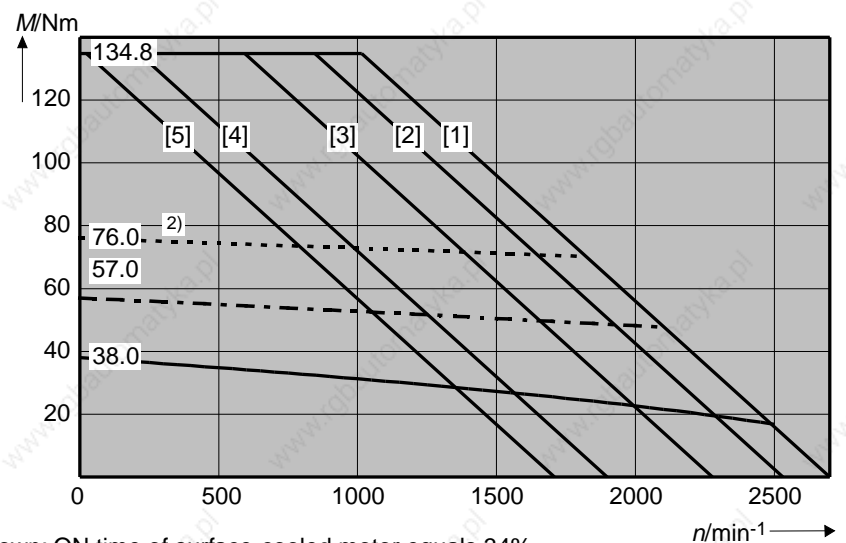
MDD 112 D-N at
1500 min⁻¹



MDD 112 D-L at
1500 min⁻¹



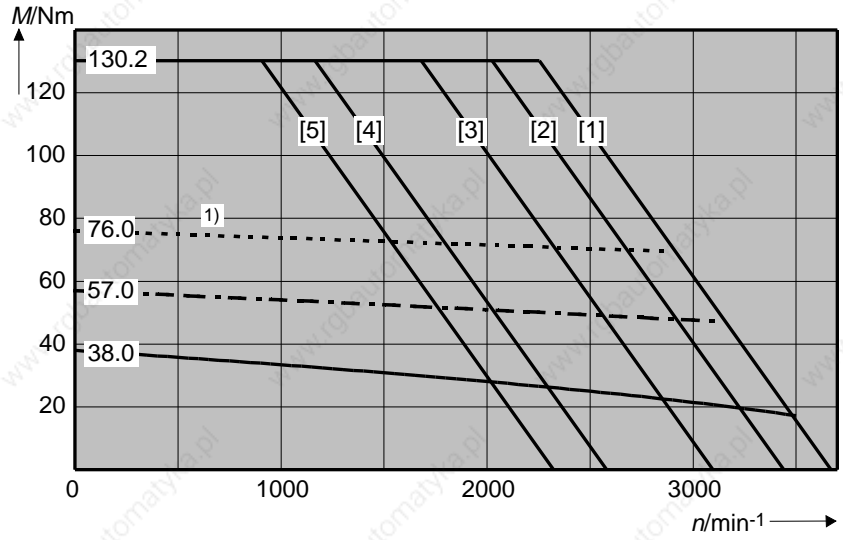
MDD 112 D-N at
2000 min⁻¹



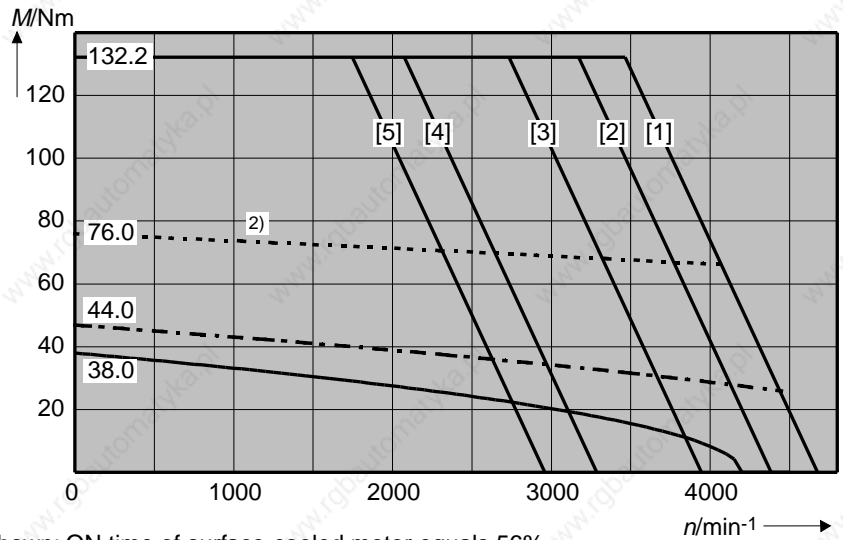
- 1) Shown: ON time of surface-cooled motor equals 34%.
- 2) Shown: ON time of surface-cooled motor equals 56%.

Fig 10.9: Torque-speed characteristics curve MDD 112

MDD 112 D-N at
3000 min⁻¹



MDD 112 D-N at
4000 min⁻¹



- 1) Shown: ON time of surface-cooled motor equals 56%.
- 2) Shown: ON time of surface-cooled motor equals 34%.

Fig 10.10: Torque-speed characteristics curve MDD 112

10.3. Shaft Load Capacity

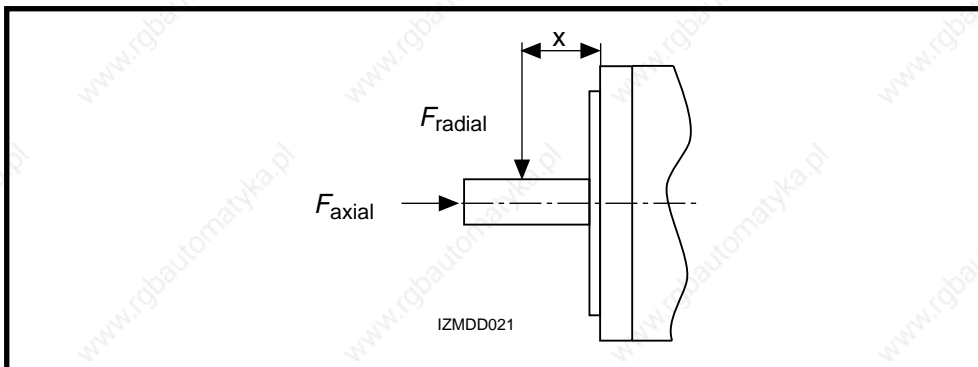


Fig 10.11: Shaft load

Permissible radial force

F_{radial}

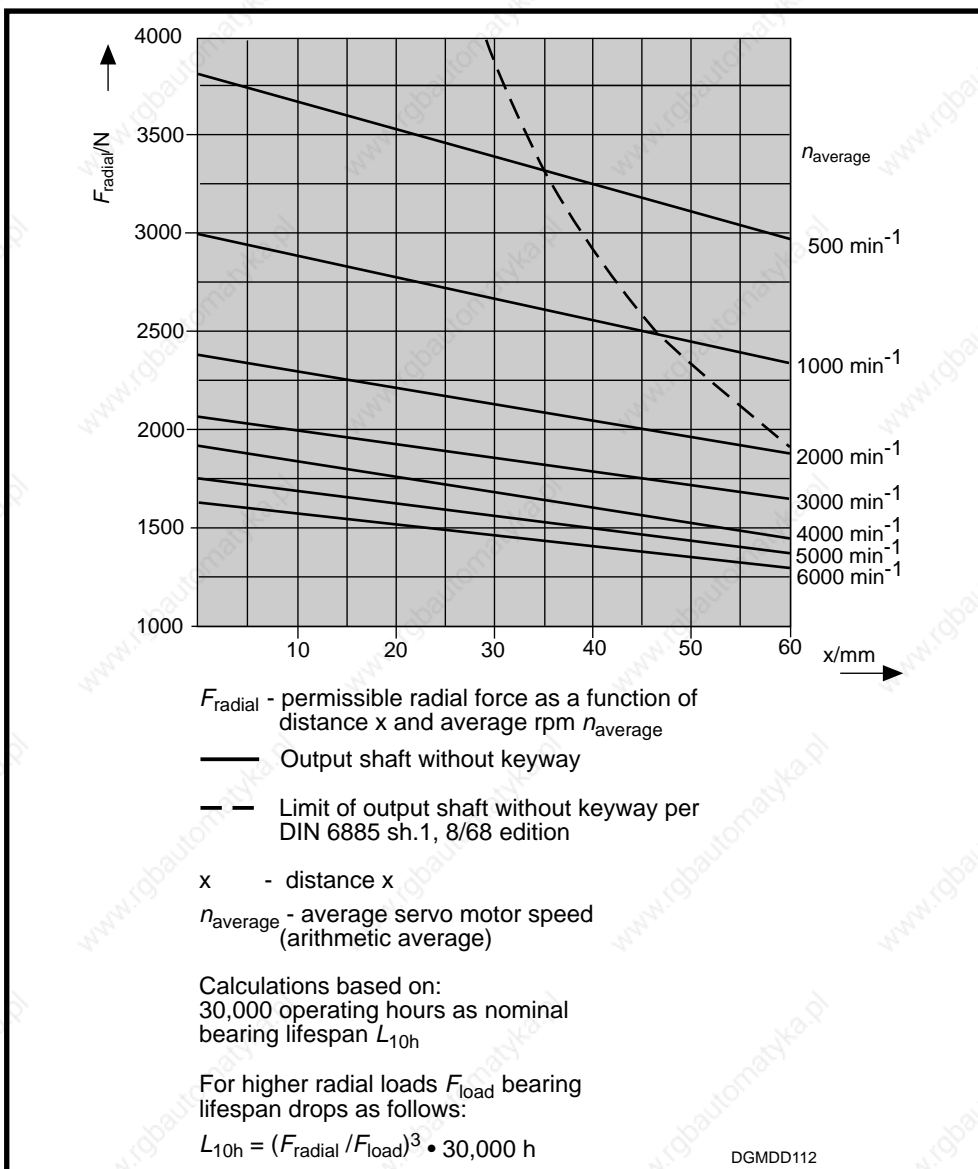


Fig 10.12: Permissible radial force

Permissible axial force

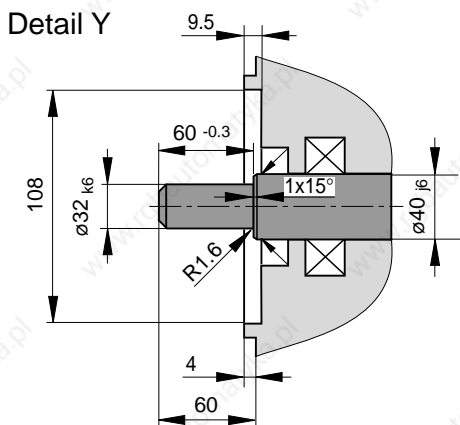
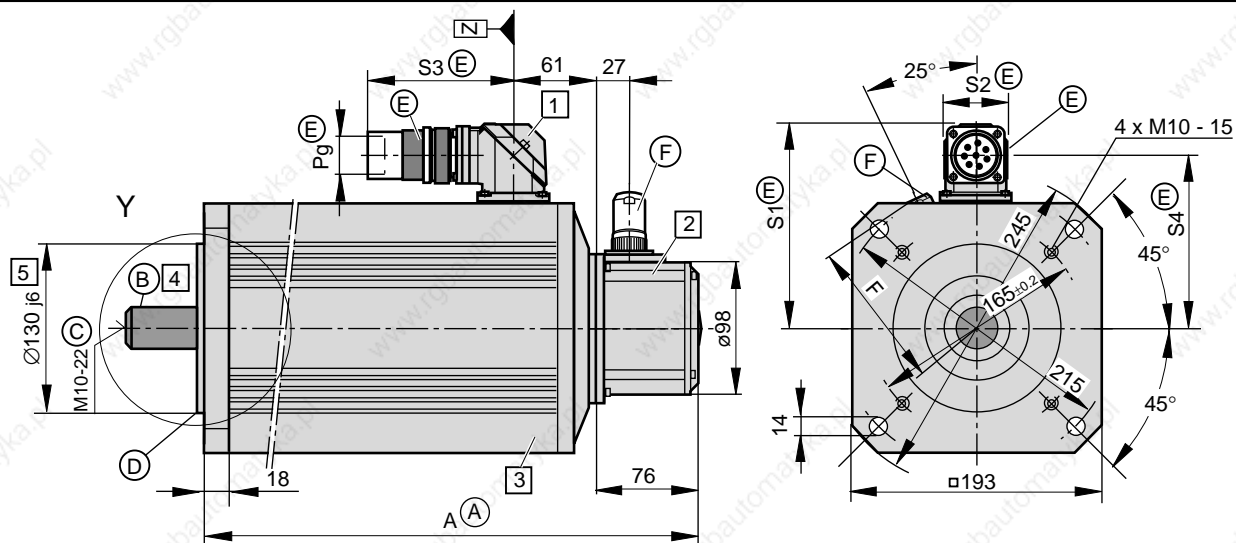
F_{axial}

$$F_{axial} = 0.35 \cdot F_{radial}$$

F_{axial} - permissible axial force

F_{radial} - permissible radial force

10.4. Dimensional Data



- Ⓒ Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
 - Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
 - Max. tightening torque M_A for screws in the threads of the center hole: 10 Nm
- Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
 - as per design B5 (throughholes in flange)
 - as per design B14 (threads in flange)
- Ⓔ **Motor power connector**
Depends on motor, must be ordered separately.

Ⓐ Dimensional table Dim. A

| Size | Dim. A 1) |
|-----------|-----------|
| MDD 112 A | 312 |
| MDD 112 B | 387 |
| MDD 112 C | 462 |
| MDD 112 D | 537 |

1) Bigger with some options.
The then valid dimensions is indicated with the respective feature.

Ⓑ Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

Table of dimensions

| type | dim. | S1 | S2 | S3 | S4 | Pg |
|------------|------|-----|----|-----|-----|----|
| INS 108 3) | | 151 | 45 | 110 | 133 | 21 |
| INS 172 2) | | 163 | 53 | 145 | 138 | 36 |

2) with MDD 112 B-N-040, MDD 112 C-N-030, MDD 112 C-N-040, MDD 112 C-N-060, MDD 112 D-N-020, MDD 112 D-N-030, MDD 112 D-N-040, MDD 112 B-L-030, MDD 112 C-L-020, MDD 112 D-L-015

3) other MDD 112

Ⓕ Feedback connector

Must be ordered separately.

Table of dimensions

| Name | Connector type | Dim. F |
|----------------|----------------|--------|
| straight conn. | INS 513 | 110 |
| | INS 512 | 112 |
| angle conn. 4) | INS 511 | 108 |
| | INS 510 | |

4) Do not use with axially surface-cooled motor.

MBMDD112_1

Fig 10.13: Dimensional data MDD 112

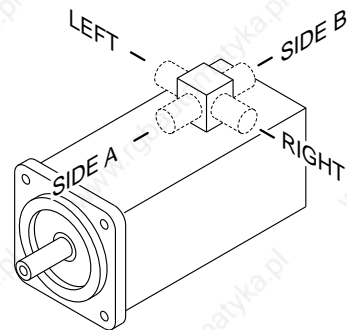
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Digital servo feedback (DSF)
- Digital servo feedback (DSF) with integrated multiturn absolute encoder

The dimensions are identical.

3 Blocking brake

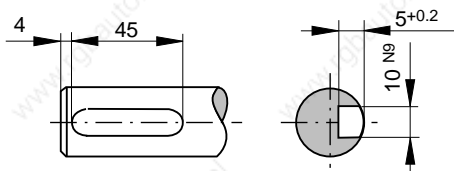
- without blocking brake
- with blocking brake: 14 Nm } The dimensions are identical.
- with blocking brake: 40 Nm (not available with MDD 112 A)
- with blocking brake: 60 Nm (not available with MDD 112)

Dimensional table for motor with holding brake of 40 Nm and 60 Nm

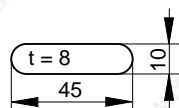
| Size | Dim. A |
|-----------|--------|
| MDD 112 B | 437 |
| MDD 112 C | 512 |
| MDD 112 D | 587 |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 10 x 8 x 45



5 Special centering diameter

- $\varnothing 180_{j6}$

MBMDD112_2

Fig 10.14: Dimensional data MDD 112 - available options

10.5. Available Versions

| Type code field: | Example: | MDD | 112 | B | N | 015 | N | 2 | L | 130 | G | B | 0 |
|---|---|-----|-----|---|---|-----|---|---|---|-----|---|---|---|
| 1. Name Motor for digital drive controllers | MDD | | | | | | | | | | | | |
| 2. Motor size | 112 | | | | | | | | | | | | |
| 3. Motor lengths | A, B, C, D | | | | | | | | | | | | |
| 4. Housing design: Standard (suitable for natural convection and surface cooling) for surface-cooling with motors requiring a bigger power connector with respect to housing design N | N L ¹⁾ | | | | | | | | | | | | |
| 5. Nominal speed 1500 min ⁻¹ 2000 min ⁻¹ 3000 min ⁻¹ 4000 min ⁻¹ 6000 min ⁻¹ | 015 020 030 040 060 ²⁾ | | | | | | | | | | | | |
| 6. Balance class N per DIN VDE 0530 section 14, 2/93 edition R per DIN VDE 0530 section 14, 2/93 edition | N R | | | | | | | | | | | | |
| 7. Side B shaft end Standard (without side B shaft end) | 2 | | | | | | | | | | | | |
| 8. Motor feedback digital servo feedback digital servo feedback with integrated multiturn encoder | L M | | | | | | | | | | | | |
| 9. Centering diameter ø130 mm (standard) ø180 mm | 130 180 | | | | | | | | | | | | |
| 10. Output shaft plain shaft shaft with keyway per DIN 6885 sh. 1, 8/68 edition | G P | | | | | | | | | | | | |
| 11. Power connection connector to side A connector to side B connector to the right (looking onto motor shaft, connecting housing at top) connector to the left (looking onto motor shaft, connecting housing at top) | A B R L | | | | | | | | | | | | |
| 12. Blocking brake without blocking brake with 14.0 Nm blocking brake with 40.0 Nm blocking brake with 60.0 Nm blocking brake | 0 1 2 ³⁾ 3 ³⁾ | | | | | | | | | | | | |

¹⁾ Housing type "L" only with motor types MDD 112B-L-030, MDD 112C-L-020 and MDD 112D-L-015, as indicated in Technical Data section.
²⁾ with MDD 112C only
³⁾ not with MDD 112A

Quelle: INN 41.60 TLMD112

Fig 10.15: Type codes - MDD 112

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11. MDD 115

11.1. Technical Data

| Designation | Symbol | Unit | Motor type MDD ... | | | |
|---|-----------|-------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| | | | 115 A-N-015 | 115 B-N-015 | 115 C-N-015 | 115 D-N-015 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 1500 | 1500 | 1500 | 1500 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 28.0 (42.0) ⁵⁾ | 38.0 (48.1) ⁵⁾ | 47.0 (75.0) ⁵⁾ | 57.0 (88.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 20.9 (31.3) ⁵⁾ | 27.1 (34.3) ⁵⁾ | 40.2 (64.1) ⁵⁾ | 38.5 (59.5) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 87.1 | 118.2 | 146.1 | 177.3 |
| Maximum current | I_{max} | A | 93.9 | 121.9 | 180.7 | 173.4 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 123 x 10 ⁻⁴ | 172 x 10 ⁻⁴ | 222 x 10 ⁻⁴ | 271 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 1.34 | 1.40 | 1.17 | 1.48 |
| Windings resistance at 20 °C | R_A | Ohm | 0.54 | 0.39 | 0.21 | 0.25 |
| Windings inductance | L_A | mH | 8.3 | 9.2 | 3.5 | 4.2 |
| Thermal time constant | T_{th} | min | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 33 | 41 | 52 | 60 |
| | | | 115 A-N-020 | 115 B-N-020 | 115 C-N-020 | 115 D-N-020 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 2000 | 2000 | 2000 | 2000 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 28.0 (34.5) ⁵⁾ | 38.0 (53.0) ⁵⁾ | 47.0 (75.0) ⁵⁾ | 57.0 (76.2) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 27.8 (34.3) ⁵⁾ | 42.3 (59.0) ⁵⁾ | 51.5 (82.2) ⁵⁾ | 77.0 (102.9) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 87.1 | 118.2 | 146.2 | 177.2 |
| Maximum current | I_{max} | A | 125.2 | 190.5 | 231.9 | 346.5 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 123 x 10 ⁻⁴ | 172 x 10 ⁻⁴ | 222 x 10 ⁻⁴ | 271 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 1.01 | 0.90 | 0.91 | 0.74 |
| Windings resistance at 20 °C | R_A | Ohm | 0.30 | 0.16 | 0.12 | 0.06 |
| Windings inductance | L_A | mH | 4.6 | 2.8 | 2.0 | 1.0 |
| Thermal time constant | T_{th} | min | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 33 | 41 | 52 | 60 |
| | | | 115 A-N-030 | 115 B-N-030 | 115 C-N-030 | |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 3000 | 3000 | 3000 | |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 28.0 (41.6) ⁵⁾ | 38.0 (47.3) ⁵⁾ | 47.0 (62.8) ⁵⁾ | |
| Continuous current at standstill | I_{dN} | A | 42.4 (63.0) ⁵⁾ | 81.9 (102.9) ⁵⁾ | 77.0 (102.9) ⁵⁾ | |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 87.1 | 118.1 | 146.2 | |
| Maximum current | I_{max} | A | 190.9 | 368.4 | 346.4 | |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 123 x 10 ⁻⁴ | 172 x 10 ⁻⁴ | 222 x 10 ⁻⁴ | |
| Torque constant at 20 °C | K_m | Nm/A | 0.66 | 0.46 | 0.61 | |
| Windings resistance at 20 °C | R_A | Ohm | 0.13 | 0.04 | 0.05 | |
| Windings inductance | L_A | mH | 2.0 | 1.2 | 0.9 | |
| Thermal time constant | T_{th} | min | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ | |
| Mass ⁴⁾ | m_M | kg | 33 | 41 | 52 | |

Continued on next page

¹⁾ Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

²⁾ With 60 K overtemperature at the motor housing.

³⁾ Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

⁴⁾ Without blocking brake, without blower

⁵⁾ Parenthetical values apply to motors with surface cooling.

| Designation | Symbol | Unit | Motor type MDD ... | |
|---|-----------|-------------------|---------------------------|---------------------------|
| | | | 115 A-L-020 | 115 B-L-015 |
| Nominal motor speed ¹⁾ | n | min ⁻¹ | 2000 | 1500 |
| Continuous torque at standstill ²⁾ | M_{dN} | Nm | 28.0 (42.0) ⁵⁾ | 38.0 (53.0) ⁵⁾ |
| Continuous current at standstill | I_{dN} | A | 27.8 (41.7) ⁵⁾ | 27.1 (37.8) ⁵⁾ |
| Theor. maximum torque ³⁾ | M_{max} | Nm | 87.1 | 118.2 |
| Maximum current | I_{max} | A | 125.2 | 121.9 |
| Rotor moment of inertia ⁴⁾ | J_M | kgm ² | 123 x 10 ⁻⁴ | 172 x 10 ⁻⁴ |
| Torque constant at 20 °C | K_m | Nm/A | 1.01 | 1.40 |
| Windings resistance at 20 °C | R_A | Ohm | 0.30 | 0.39 |
| Windings inductance | L_A | mH | 4.6 | 9.2 |
| Thermal time constant | T_{th} | min | 90 (60) ⁵⁾ | 90 (60) ⁵⁾ |
| Mass ⁴⁾ | m_M | kg | 33 | 41 |

1) Usable motor speed is determined by the torque requirements of the application. The usable speed n_{max} found in the selection lists of the motor-drive combinations are binding for **standard applications**. The usable speed for other applications can be found using the required torque in the torque-speed characteristics curves

2) With 60 K overtemperature at the motor housing.

3) Achievable maximum torque is dependent upon the drive used. **Only** those maximum torques M_{max} found in the selection list of the motor-drive combinations are binding.

4) Without blocking brake, without blower

5) Parenthetical values apply to motors with surface cooling.

Fig 11.1: Type dependent motor data

| Designation | Symbol | Unit | Data |
|---|----------|------|-----------------------------|
| Permissible ambient temp. | T_{um} | °C | 0 ... + 45 |
| Permissible storage and transport temperature | T_L | °C | -20 ... + 80 |
| Maximum installation elevation | | m | 1000 meters above sea level |
| Protection category | | | IP 65 |
| Insulation classification | | | F |
| Housing coat | | | Black prime coat (RAL 9005) |

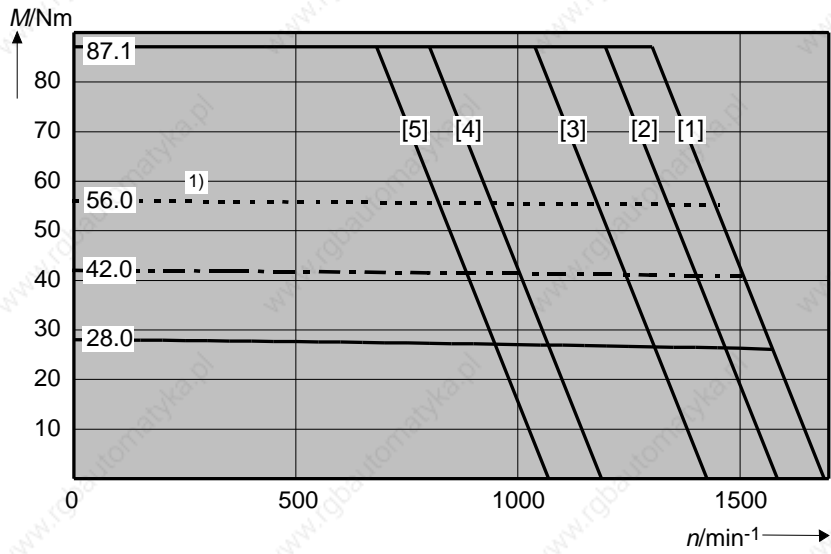
Fig 11.2: General data - MDD 115

| Designation | Symbol | Unit | Data Blocking Brake | |
|---------------------|--------|------------------|--------------------------------|-----------------------|
| Principle of action | | | electrically- actuated release | |
| Holding torque | M_H | Nm | 45 | 60 |
| Nominal voltage | U_N | V | DC 24 ± 10% | DC 24 ± 10% |
| Nominal current | I_N | A | 1.0 | 1.5 |
| Moment of inertia | J_B | kgm ² | 9.5 x 10 ⁻⁴ | 32 x 10 ⁻⁴ |
| Release delay | t_L | ms | 55 | 150 |
| Clamping delay | t_K | ms | 18 | 30 |
| Mass | m_B | kg | 1.9 | 3.5 |

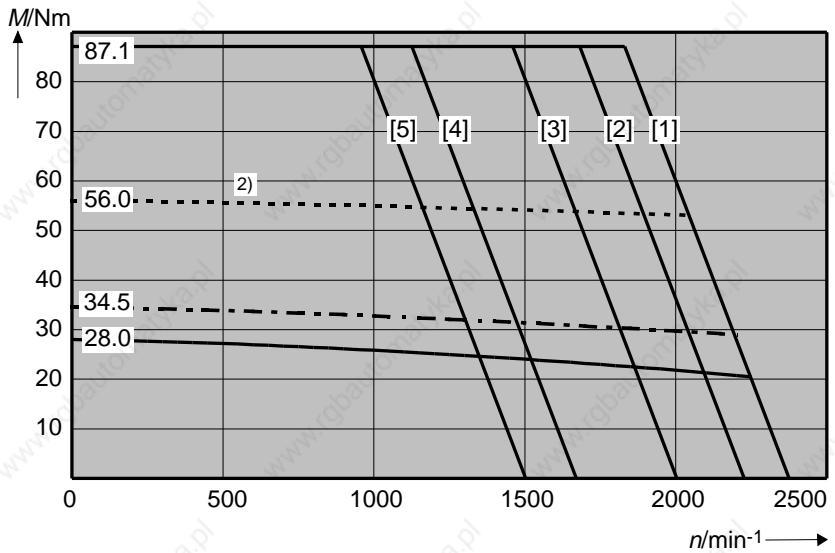
Fig 11.3: Technical data - blocking brake

11.2. Torque-Speed Characteristics

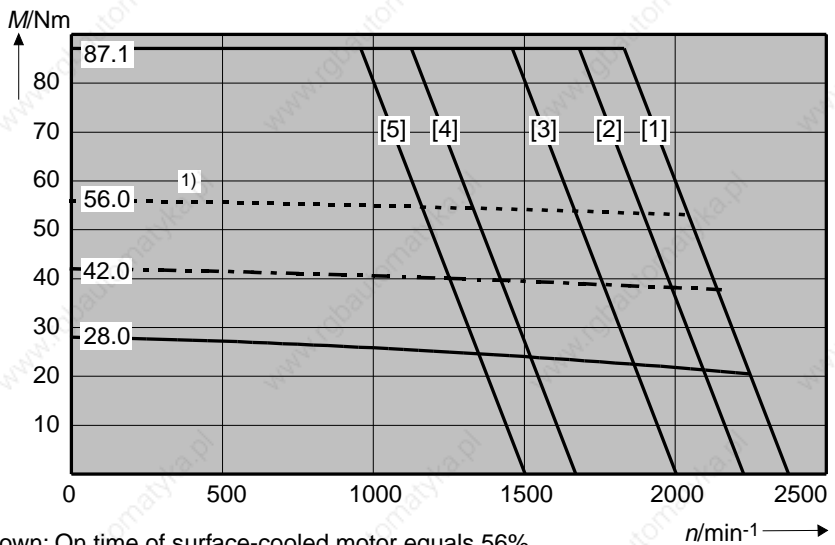
MDD 115 A-N at
1500 min⁻¹



MDD 115 A-N at
2000 min⁻¹



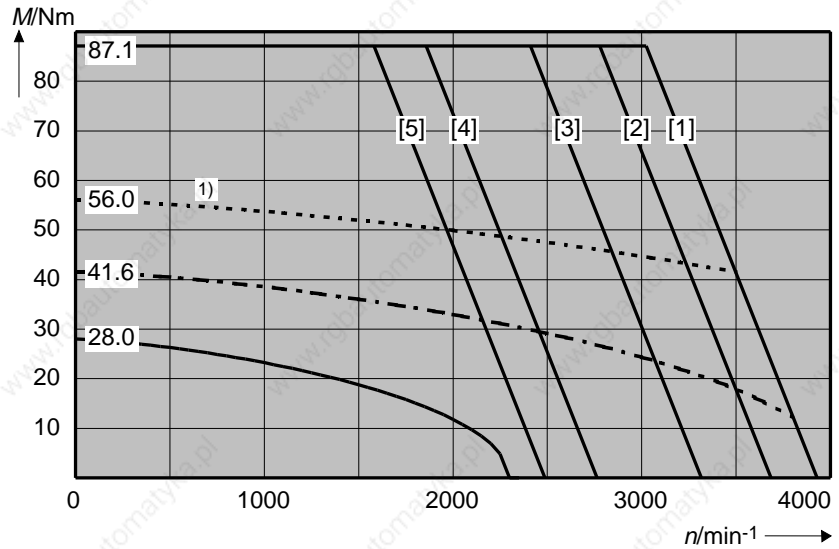
MDD 115 A-L at
2000 min⁻¹



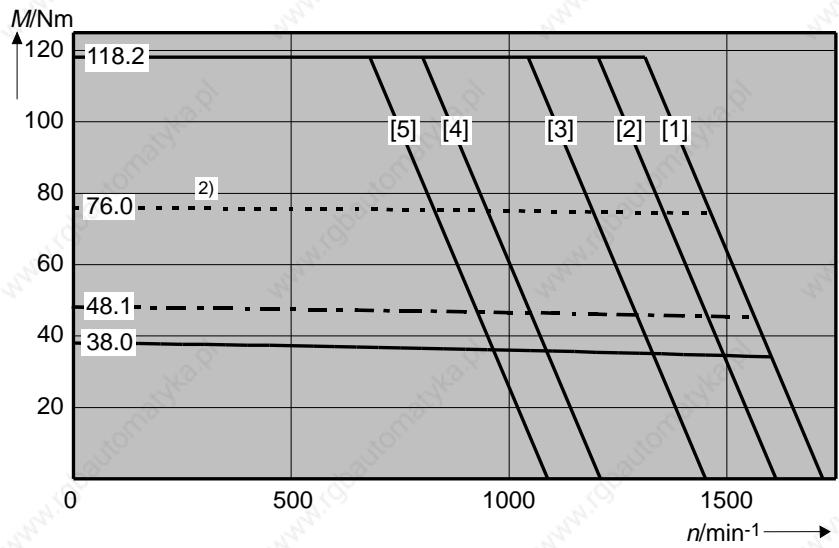
- 1) Shown: On time of surface-cooled motor equals 56%
- 2) Shown: On time of surface-cooled motor equals 38%

Fig 11.4: Torque-speed characteristics curve -MDD 115

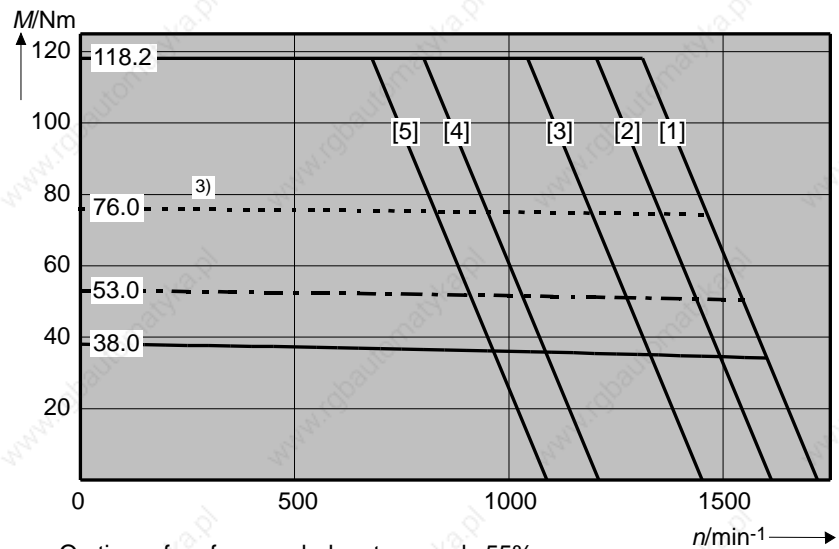
MDD 115 A-N at
3000 min⁻¹



MDD 115 B-N at
1500 min⁻¹



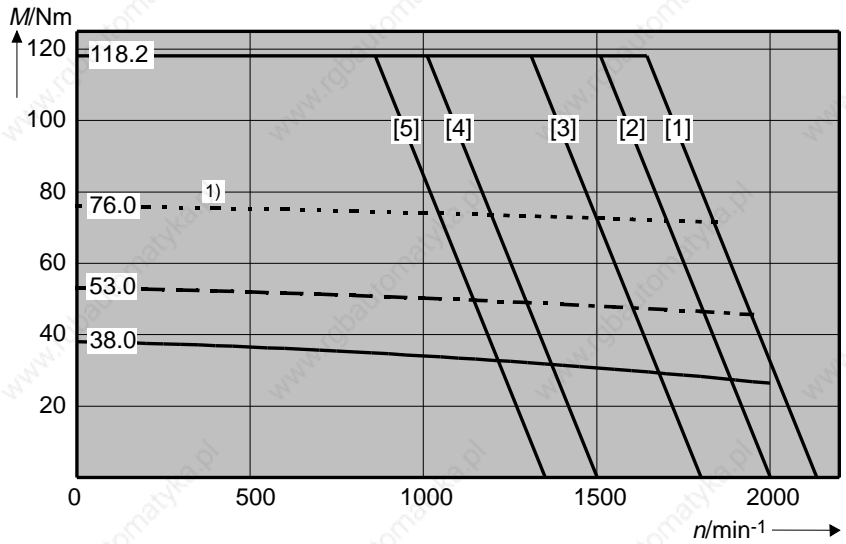
MDD 115 B-L at
1500 min⁻¹



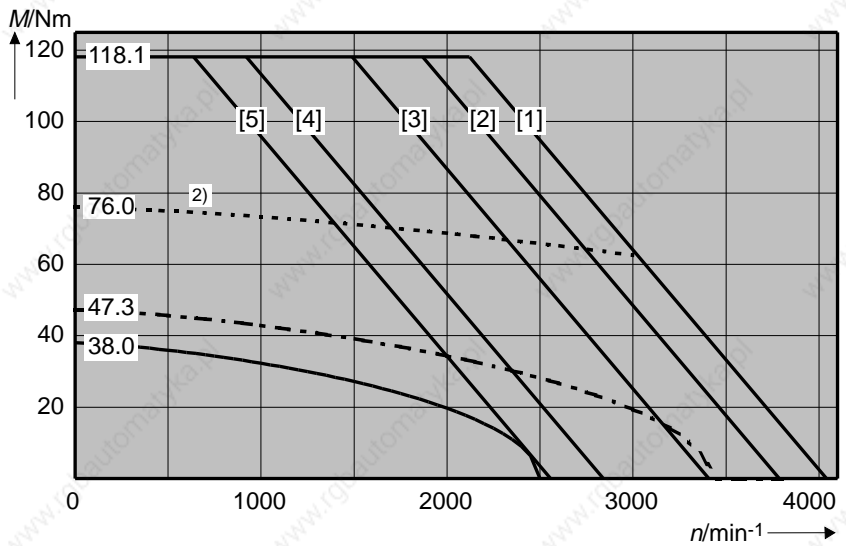
- 1) Shown: On time of surface-cooled motor equals 55%
- 2) Shown: On time of surface-cooled motor equals 40%
- 3) Shown: On time of surface-cooled motor equals 49%

Fig 11.5: Torque-speed characteristics curve - MDD 115

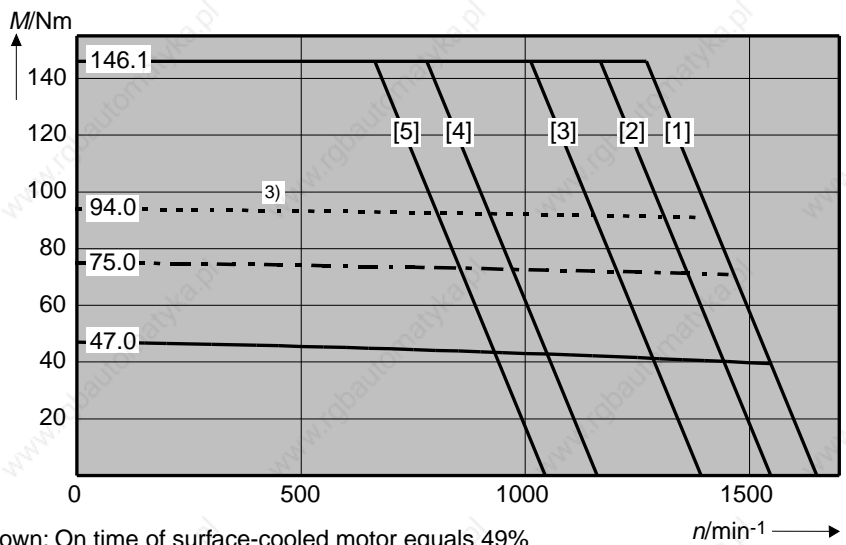
MDD 115 B-N at
2000 min⁻¹



MDD 115 B-N at
3000 min⁻¹



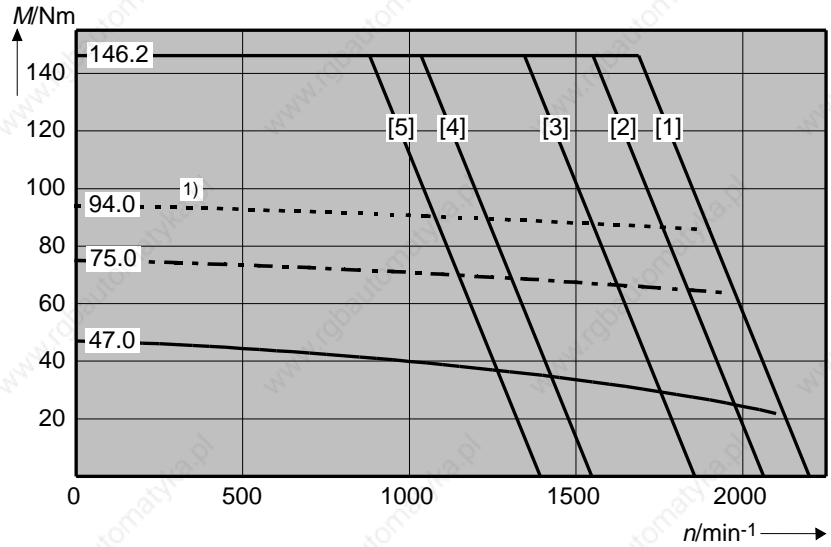
MDD 115 C-N at
1500 min⁻¹



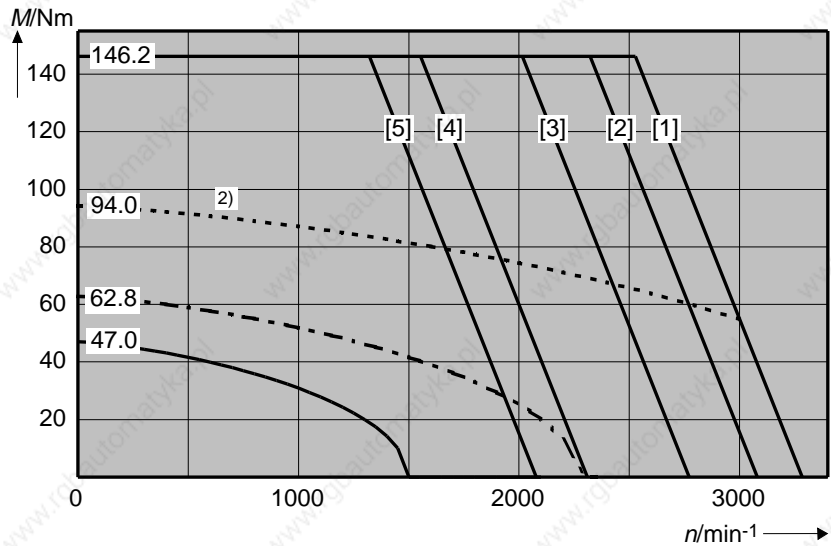
- 1) Shown: On time of surface-cooled motor equals 49%
- 2) Shown: On time of surface-cooled motor equals 39%
- 3) Shown: On time of surface-cooled motor equals 64%

Fig 11.6: Torque-speed characteristics curve - MDD 115

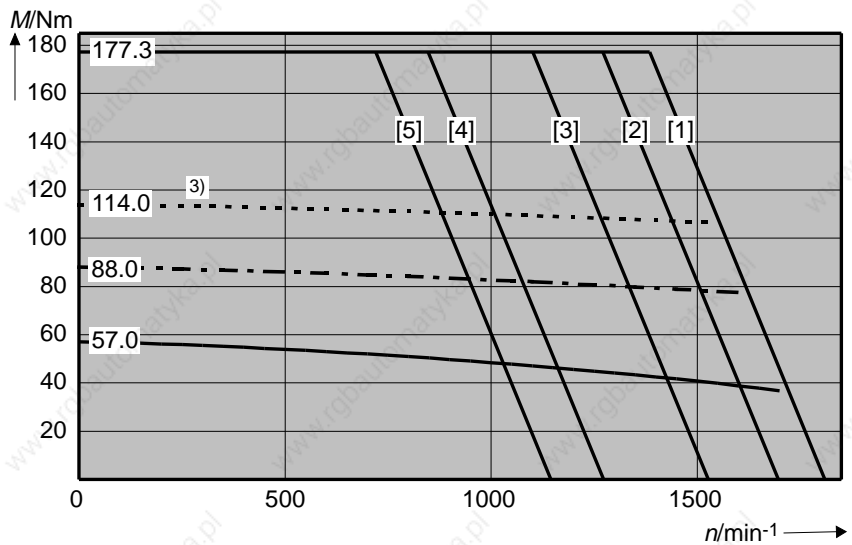
MDD 115 C-N at
2000 min⁻¹



MDD 115 C-N at
3000 min⁻¹



MDD 115 D-N at
1500 min⁻¹



- 1) Shown: On time of surface-cooled motor equals 64%.
- 2) Shown: On time of surface-cooled motor equals 45%.
- 3) Shown: On time of surface-cooled motor equals 60%.

Fig 11.7: Torque-speed characteristics curve - MDD 115

MDD 115 D-N at
2000 min⁻¹

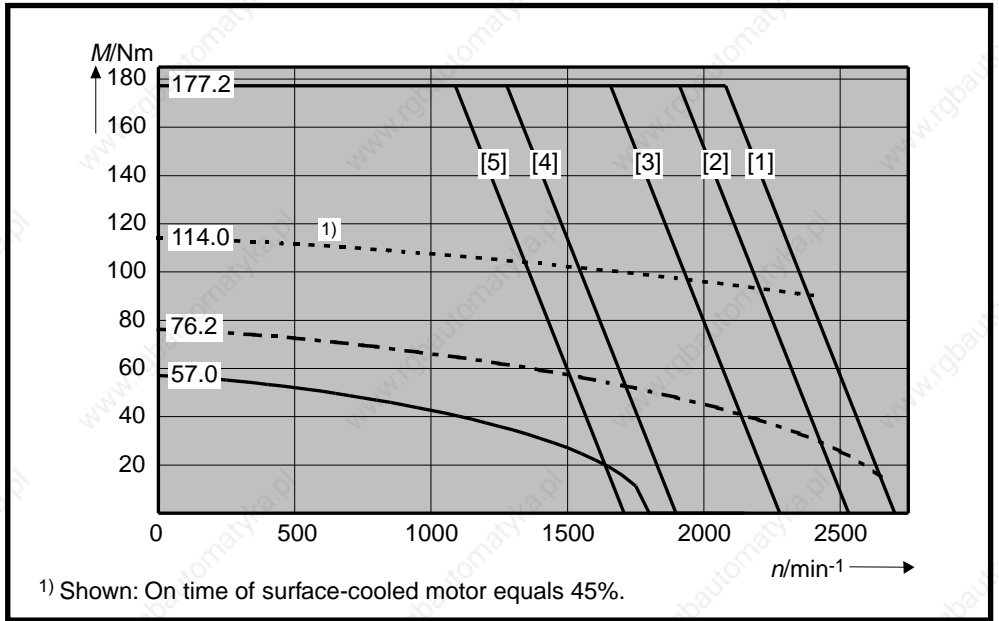


Fig 11.8: Torque-speed characteristics curve - MDD 115

11.3. Shaft Load Capacity

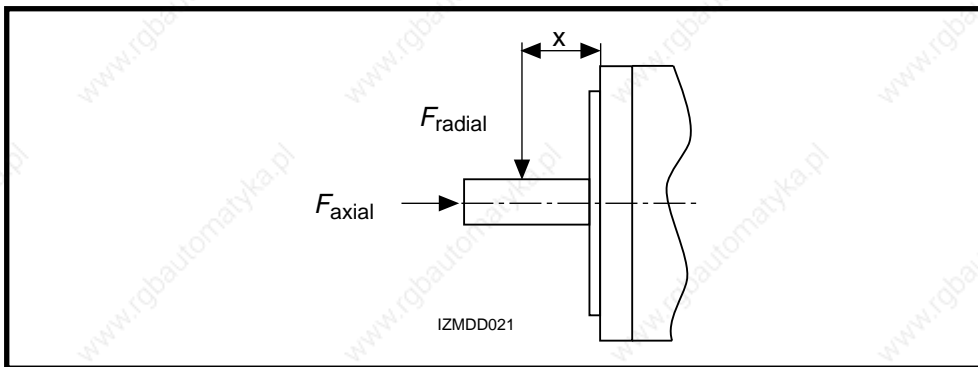


Fig 11.9: Shaft load

Permissible radial force

F_{radial}

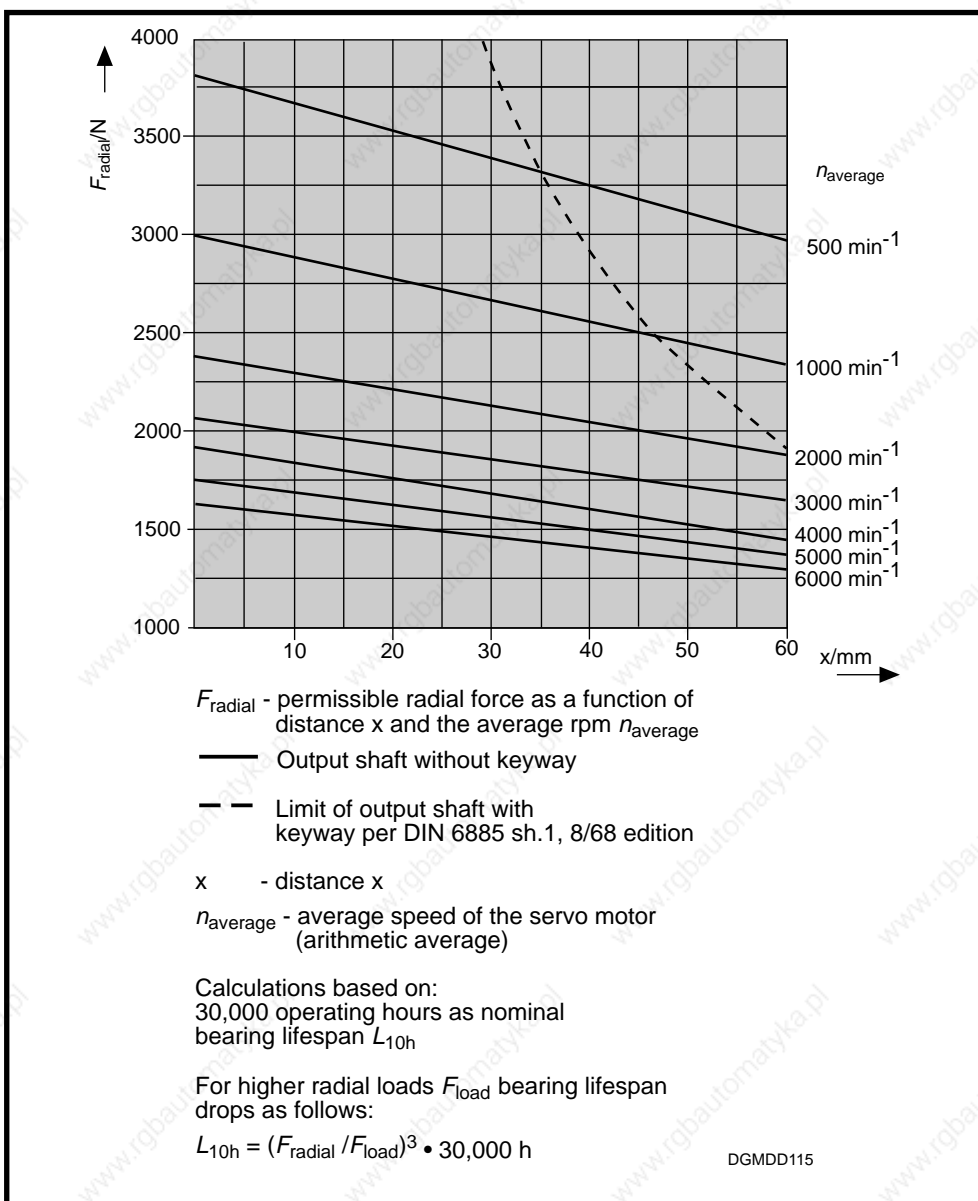


Fig 11.10: Permissible radial force

Permissible axial force

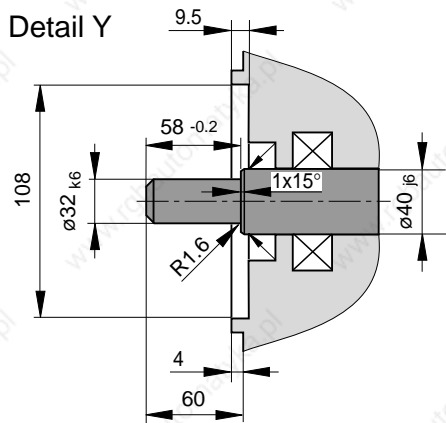
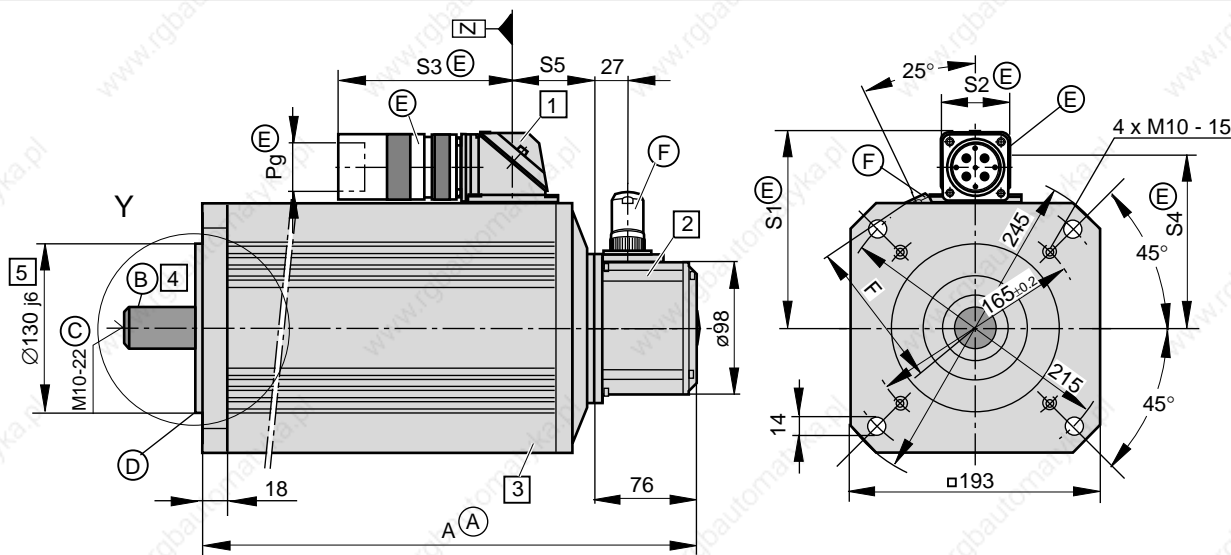
F_{axial}

$$F_{\text{axial}} = 0.35 \cdot F_{\text{radial}}$$

F_{axial} - permissible axial force

F_{radial} - permissible radial force

11.4. Dimensional Data



- Ⓒ Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
 - Center hole DS M3-8 per DIN 332 section 2, 5/83 edition
 - Max. tightening torque M_A for screws in the threads of the center hole: 10 Nm
- Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
 - as per design B5 (throughholes in flange)
 - as per design B14 (threads in flange)

Ⓐ Dimensional table Dim. A

| Size | Dim. A ¹⁾ |
|-----------|----------------------|
| MDD 115 A | 358 |
| MDD 115 B | 408 |
| MDD 115 C | 458 |
| MDD 115 D | 508 |

1) Bigger with some options. The then valid dimensions is indicated with the respective feature.

- Ⓑ Concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class R, 12/81 edition.

- Ⓔ **Motor power connector**
Depends on motor, must be ordered separately.

Table of dimensions

| type \ dim. | S1 | S2 | S3 | S4 | S5 ¹⁾ | Pg |
|-----------------------|-----|----|-----|-----|------------------|----|
| INS 108 ²⁾ | 151 | 45 | 110 | 133 | 61 | 21 |
| INS 172 ³⁾ | 163 | 53 | 145 | 138 | 73 | 36 |

²⁾ with MDD 115 A-N-015, MDD 115 A-N-020, MDD 115 B-N-015

³⁾ other MDD 115

- Ⓕ **Feedback connector**

Must be ordered separately.

Table of dimensions

| Name | Connector type | Dim. F |
|---------------------------|--------------------|--------|
| straight conn. | INS 513 | 110 |
| | INS 512 | 112 |
| angle conn. ⁴⁾ | INS 511 INS 510 | 108 |

⁴⁾ Do not use with axial, surface-cooled motor.

MBMDD115_1

Fig 11.11: Dimensional data - MDD 115

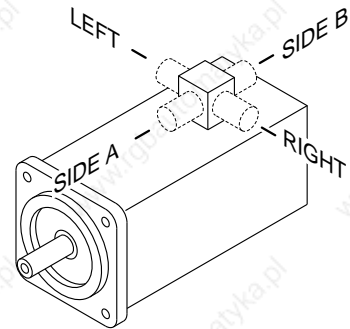
Available Options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output direction is either:

- side A or
- side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other output direction are obtained by virtually turning the connector housing around the Z axis.



2 Motor feedback

- Digital servo feedback (DSF)
- Digital servo feedback (DSF) with integrated multiturn absolute encoder

The dimensions are identical.

3 Blocking brake

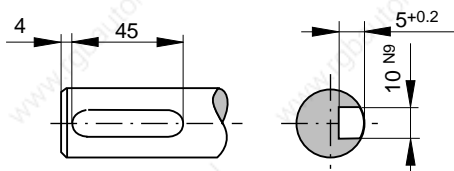
- without blocking brake
- with blocking brake: 45 Nm
- with blocking brake: 60 Nm

Dimensional table for motors with blocking brakes of 45 Nm and 60 Nm

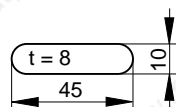
| S i z e | Dim. A | Dim. S5 | |
|-----------|--------|---------|---------|
| | | INS 108 | INS 172 |
| MDD 115 A | 418 | 104 | 116 |
| MDD 115 B | 468 | | |
| MDD 115 C | 518 | | |
| MDD 115 D | 568 | | |

4 Output shaft

- plain shaft (preferred type)
- with keyway per DIN 6885 sheet 1, 8/68 edition
(Note: balanced with entire key!)



Matching key: DIN 6885-A 10 x 8 x 45



5 Special centering diameter

- $\varnothing 180_{j6}$

MBMDD115_2

Fig 11.12: Dimensional data MDD 115 - available options

11.5. Available Versions

| Type code field: | Example: | MDD | 115 | B | N | 015 | N | 2 | L | 130 | G | B | 0 |
|---|---------------------------------|-----|-----|---|---|-----|---|---|---|-----|---|---|---|
| 1. Name Motor for digital drive controllers | MDD | | | | | | | | | | | | |
| 2. Motor size | 115 | | | | | | | | | | | | |
| 3. Motor lengths | A, B, C, D | | | | | | | | | | | | |
| 4. Housing design: Standard (suited for natural convection and surface cooling) for surface cooling in motors requiring a bigger power connector respective housing design N | N L ¹⁾ | | | | | | | | | | | | |
| 5. Nominal speed 1500 min ⁻¹ 2000 min ⁻¹ 3000 min ⁻¹ | 015 020 030 ²⁾ | | | | | | | | | | | | |
| 6. Balance class N per DIN VDE 0530 section 14, 2/93 edition R per DIN VDE 0530 section 14, 2/93 edition | N R | | | | | | | | | | | | |
| 7. Side B shaft end Standard (without side B shaft end) | 2 | | | | | | | | | | | | |
| 8. Motor feedback digital servo feedback digital servo feedback with integrated multiturn absolute encoder | L M | | | | | | | | | | | | |
| 9. Centering diameter ø130 mm (standard) ø180 mm | 130 180 | | | | | | | | | | | | |
| 10. Output shaft plain shaft shaft with keyway per DIN 6885 sh. 1, 8/68 edition | G P | | | | | | | | | | | | |
| 11. Power connection connector to side A connector to side B connector to the right (looking onto motor shaft, connecting housing at top) connector to the left (looking onto motor shaft, connecting housing at top) | A B R L | | | | | | | | | | | | |
| 12. Blocking brake without blocking brake with 45.0 Nm blocking brake with 60.0 Nm blocking brake | 0 1 2 | | | | | | | | | | | | |
| <p>¹⁾ Housing type "L" only possible with motors MDD 115A-L-020 and MDD 115B-L-015, as indicated in the Technical Data section.</p> <p>²⁾ Not with motor length "D"</p> | | | | | | | | | | | | | |

Quelle: INN 41.60 TLMD115

Fig 11.13: Type codes - MDD 115

12. Electrical Power Connection

12.1. Terminal Diagram

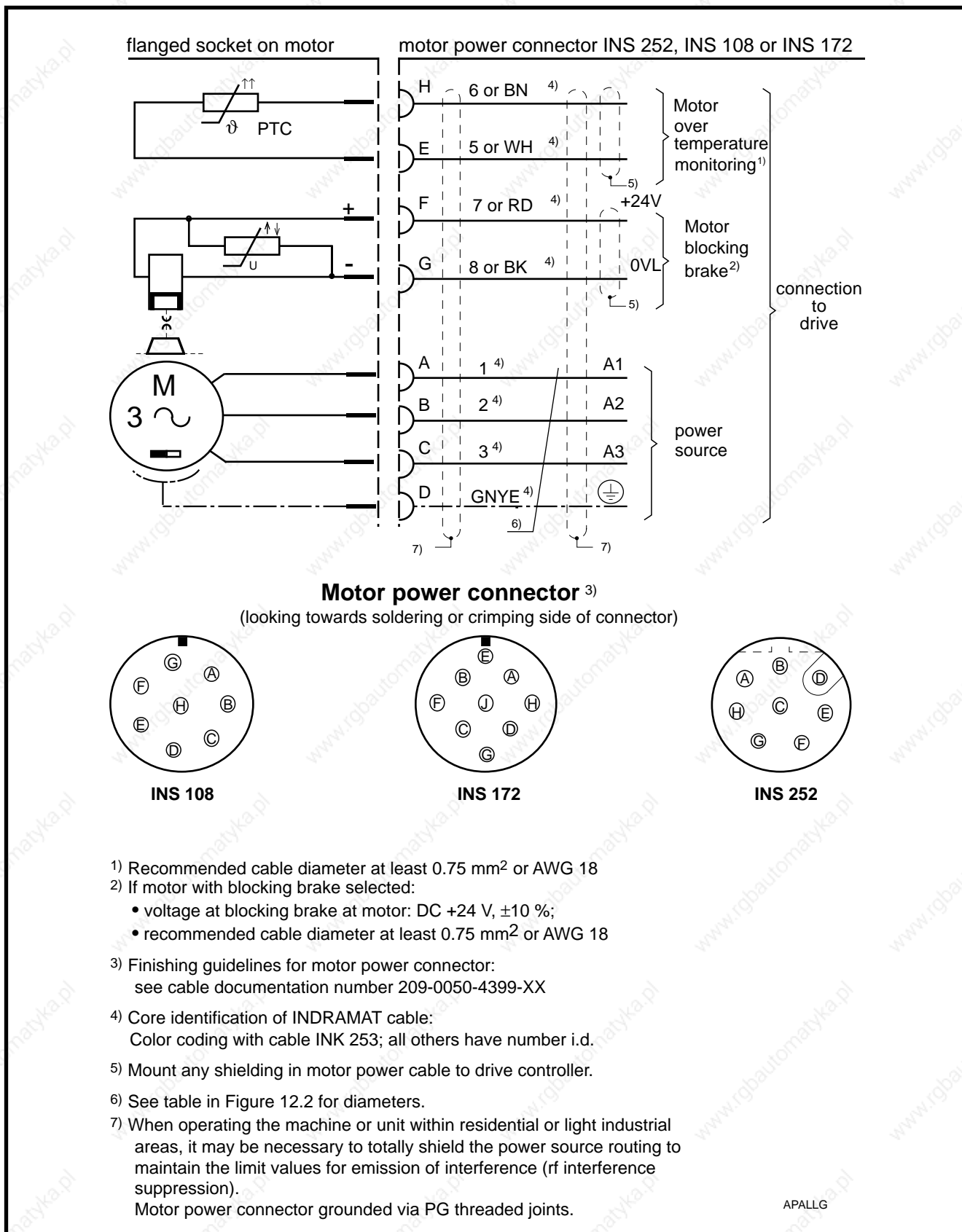


Fig 12.1: Power Connections

12.2. Connector to Cable Allocation

| Servo motor MDD ... | Cooling | Motor phase current ¹⁾ | Power connection minimum cross section ¹⁾ | | Motor power connector | | INDRAMAT Motor power cable | | | |
|------------------------|-----------------------|---|--|-------------------|--------------------------------|---------------------------------|-------------------------------|--------------|-------------------------|-------------------------------------|
| | | | mm ² | AWG ²⁾ | Crimping type ³⁾ | Soldering type ³⁾ | without total shield | | with total shield | Cross section mm ² |
| | | | | | | | standard | highly flex. | | |
| 021 A-N-100 | natural convection | 0.65 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 021 B-N-100 | | 1.3 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 025 A-N-100 | natural convection | 1.2 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 025 B-N-100 | | 2.2 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 025 C-N-100 | | 3.2 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 041 A-N-100 | natural convection | 2.6 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 041 B-N-100 | | 5.8 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 041 C-N-100 | | 8.4 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 A-N-040 | natural convection | 1.5 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 A-N-060 | | 2.1 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 B-N-040 | | 2.9 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 B-N-060 | | 4.8 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 C-N-040 | | 4.5 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 C-N-060 | | 6.4 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 D-N-040 | | 5.2 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 D-N-060 | | 8.4 | 0.75 | 16 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 B-N-040 | surface cooling | 3.2 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 B-N-060 | | 5.5 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 C-N-040 | | 5.8 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 C-N-060 | | 8.3 | 0.75 | 16 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 D-N-040 | | 6.6 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | | INK 653 | 1.0 |
| 065 D-N-060 | | 10.9 | 1.0 | 14 | INS 252 | INS 252 | INK 250 | | INK 650 | 1.5 |

Continued on next page

- 1) Motor phase currents and connection cross sections apply to S1 continuous and S6 intermittent operations with those limit values (respective ON time and duty cycle time), indicated in the torque-speed characteristics curves.
- 2) Minimum cross section of power connections as per EN 60 204, section 1, table 5, col. C or E or UL 508 table 50.2, but at least 0.75 mm² or AWG 18. Cables as per UL 508 can only be soldered not crimped to motor power connector.
- 3) The data following the slash define the type of bushing contact of the connector for either crimping or soldering.
- 4) For motor power connector as crimping type INS 108/04.
- 5) To be used only as soldering type with motor power connector.

| Servo motor MDD ... | Cooling | Motor phase current ¹⁾ | Power connection minimum cross section ¹⁾ | | Motor power connector | | INDRAMAT Motor power cable | | | |
|------------------------|-----------------------|---|--|-------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|-------------------------|-------------------------------------|
| | | | mm ² | AWG ²⁾ | Crimping type ³⁾ | Soldering type ³⁾ | without total shield | | with total shield | Cross section mm ² |
| | | | | | | | standard | highly flex. | | |
| 071 A-N-030 | natural convection | 3.0 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 071 A-N-040 | | 4.1 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 071 A-N-060 | | 6.1 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 071 B-N-030 | | 6.0 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 071 B-N-040 | | 8.9 | 0.75 | 16 | — | INS 108/06 | INK 253 | — | INK 653 | 1.0 |
| 071 B-N-060 | | 12.3 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 071 C-N-030 | | 8.8 | 0.75 | 16 | — | INS 108/06 | INK 253 | — | INK 653 | 1.0 |
| 071 C-N-040 | | 11.9 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 071 C-N-060 | | 18.0 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 071 B-N-030 | surface cooling | 9.0 | 0.75 | 16 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 071 B-N-040 | | 13.5 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 071 B-N-060 | | 18.4 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 071 C-N-030 | | 13.2 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 071 C-N-040 | | 18.0 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 071 C-N-060 | | 27.1 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 090 A-N-020 | | natural convection | 3.3 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 |
| 090 A-N-030 | 5.1 | | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 090 A-N-040 | 7.7 | | 0.75 | 16 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 090 B-N-020 | 6.8 | | 0.75 | 16 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 090 B-N-030 | 10.3 | | 1.0 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 090 B-N-040 | 13.7 | | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 090 C-N-020 | 9.8 | | 1.0 | 16 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 090 C-N-030 | 15.9 | | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 090 C-N-040 | 19.9 | | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 090 A-N-020 | surface cooling | 4.4 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 090 A-N-030 | | 6.9 | 0.75 | 18 | INS 252 | INS 252 | INK 253 | — | INK 653 | 1.0 |
| 090 A-N-040 | | 10.4 | 1.0 | 16 | INS 252 | INS 252 | INK 250 | — | INK 650 | 1.5 |
| 090 B-N-020 | | 10.0 | 1.0 | 16 | INS 252 | INS 252 | INK 250 | — | INK 650 | 1.5 |
| 090 B-N-030 | | 15.0 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 090 B-N-040 | | 19.8 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 090 C-N-020 | | 15.2 | 1.5 | 12 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 090 C-N-030 | | 24.5 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 090 C-N-040 | | 28.0 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |

Continued on next page

- 1) Motor phase currents and connection cross sections apply to S1 continuous and S6 intermittent operations with those limit values (respective ON time and duty cycle time), indicated in the torque-speed characteristics curves.
- 2) Minimum cross section of power connections as per EN 60 204, section 1, table 5, col. C or E or UL 508 table 50.2, but at least 0.75 mm² or AWG 18. Cables as per UL 508 can only be soldered not crimped to motor power connector.
- 3) The data following the slash define the type of bushing contact of the connector for either crimping or soldering.
- 4) For motor power connector as crimping type INS 108/04.
- 5) To be used only as soldering type with motor power connector.

| Servo motor MDD ... | Cooling | Motor phase current ¹⁾ | Power connection minimum cross section ¹⁾ | | Motor power connector | | INDRAMAT Motor power cable | | | | |
|------------------------|-----------------------|---|--|-------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|-------------------------|-------------------------------------|-----|
| | | | mm ² | AWG ²⁾ | Crimping type ³⁾ | Soldering type ³⁾ | without total shield | | with total shield | Cross section mm ² | |
| | | | | | | | standard | highly flex. | | | |
| 093 A-N-020 | natural convection | 8.3 | 0.75 | 16 | — | INS 108/06 | INK 253 | — | INK 653 | 1.0 | |
| 093 A-N-030 | | 14.5 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 | |
| 093 A-N-040 | | 19.0 | 2.5 | 10 | INS 108/03 | INS 108/06 | INK 202 | INK 402 | INK 602 | 2.5 | |
| 093 A-N-060 | | 30.1 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 093 B-N-020 | | 13.8 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 | |
| 093 B-N-030 | | 19.6 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 093 B-N-040 | | 29.9 | 6.0 | 10 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 093 B-N-060 | | 38.2 | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 C-N-020 | | 17.5 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 093 C-N-030 | | 26.3 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 093 C-L-030 | | 26.3 | 4.0 | 10 | — | INS 172/25 | INK 203 | INK 403 | INK 603 | 4.0 | |
| 093 C-N-040 | | 37.0 | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 C-N-060 | | 53.2 | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 093 D-N-015 | | 20.2 | 2.5 | 10 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 093 D-N-020 | | 25.5 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 093 D-N-030 | | 33.8 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 093 D-N-040 | | 51.6 | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 093 A-N-020 | | surface cooling | 10.9 | 1.0 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 093 A-N-030 | | | 18.9 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 093 A-N-040 | | | 24.8 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 093 A-N-060 | 39.2 | | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 B-N-020 | 19.0 | | 2.5 | 10 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 093 B-N-030 | 27.1 | | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 093 B-N-040 | 41.2 | | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 B-N-060 | 52.7 | | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 093 C-N-020 | 25.1 | | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 093 C-N-030 | 28.0 | | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 093 C-L-030 | 37.7 | | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 C-N-040 | 53.1 | | 16.0 | 4 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 093 C-N-060 | 76.4 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 093 D-N-015 | 29.5 | | 6.0 | 10 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 093 D-N-020 | 37.2 | | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 D-N-030 | 49.2 | | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 093 D-N-040 | 75.2 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |

Continued on next page

- 1) Motor phase currents and connection cross sections apply to S1 continuous and S6 intermittent operations with those limit values (respective ON time and duty cycle time), indicated in the torque-speed characteristics curves.
- 2) Minimum cross section of power connections as per EN 60 204, section 1, table 5, col. C or E or UL 508 table 50.2, but at least 0.75 mm² or AWG 18. Cables as per UL 508 can only be soldered not crimped to motor power connector.
- 3) The data following the slash define the type of bushing contact of the connector for either crimping or soldering.
- 4) For motor power connector as crimping type INS 108/04.
- 5) To be used only as soldering type with motor power connector.

| Servo motor MDD ... | Cooling | Motor phase current ¹⁾ | Power connection minimum cross section ¹⁾ | | Motor power connector | | INDRAMAT Motor power cable | | | | |
|------------------------|-----------------------|---|--|-------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|-------------------------|-------------------------------------|------|
| | | | mm ² | AWG ²⁾ | Crimping type ³⁾ | Soldering type ³⁾ | without total shield | | with total shield | Cross section mm ² | |
| | | | | | | | standard | highly flex. | | | |
| 112 A-N-015 | natural convection | 6.8 | 0.75 | 18 | — | INS 108/06 | INK 253 | — | INK 653 | 1.0 | |
| 112 A-N-020 | | 9.7 | 1.0 | 16 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 | |
| 112 A-N-030 | | 14.1 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 | |
| 112 A-N-040 | | 18.8 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 112 B-N-015 | | 11.4 | 1.0 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 | |
| 112 B-N-020 | | 16.9 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 112 B-N-030 | | 22.9 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 112 B-L-030 | | 22.9 | 4.0 | 10 | — | INS 172/25 | INK 203 | INK 403 | INK 603 | 4.0 | |
| 112 B-N-040 | | 33.9 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 112 C-N-015 | | 18.2 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 112 C-N-020 | | 24.3 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 112 C-L-020 | | 24.3 | 4.0 | 10 | — | INS 172/25 | INK 203 | INK 403 | INK 603 | 4.0 | |
| 112 C-N-030 | | 35.4 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 112 C-N-040 | | 47.5 | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 112 C-N-060 | | 71.4 | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 112 D-N-015 | | 24.2 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 112 D-L-015 | | 24.2 | 4.0 | 10 | — | INS 172/25 | INK 203 | INK 403 | INK 603 | 4.0 | |
| 112 D-N-020 | | 35.8 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 112 D-N-030 | | 49.5 | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 112 D-N-040 | | 72.1 | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 112 A-N-015 | | surface cooling | 8.4 | 0.75 | 16 | — | INS 108/06 | INK 253 | — | INK 653 | 1.0 |
| 112 A-N-020 | | | 11.9 | 1.5 | 14 | INS 108/02 | INS 108/06 | INK 250 | — | INK 650 | 1.5 |
| 112 A-N-030 | | | 17.5 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 112 A-N-040 | | | 23.2 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 112 B-N-015 | | | 18.9 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 |
| 112 B-N-020 | | | 28.0 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 112 B-N-030 | | | 28.0 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 112 B-L-030 | | | 37.9 | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 |
| 112 B-N-040 | 56.2 | | 16.0 | 4 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 112 C-N-015 | 28.0 | | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 112 C-N-020 | 28.0 | | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 112 C-L-020 | 38.2 | | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 112 C-N-030 | 55.6 | | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 112 C-N-040 | 74.5 | | 25.0 | 3 | INS 172/25 | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 112 C-N-060 | 84.0 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 112 D-N-015 | 28.0 | | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 112 D-L-015 | 36.3 | | 10.0 | 8 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 112 D-N-020 | 53.7 | | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 112 D-N-030 | 74.2 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 112 D-N-040 | 84.0 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |

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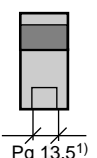

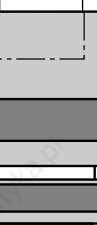
- 1) Motor phase currents and connection cross sections apply to S1 continuous and S6 intermittent operations with those limit values (respective ON time and duty cycle time), indicated in the torque-speed characteristics curves.
- 2) Minimum cross section of power connections as per EN 60 204, section 1, table 5, col. C or E or UL 508 table 50.2, but at least 0.75 mm² or AWG 18. Cables as per UL 508 can only be soldered not crimped to motor power connector.
- 3) The data following the slash define the type of bushing contact of the connector for either crimping or soldering.
- 4) For motor power connector as crimping type INS 108/04.
- 5) To be used only as soldering type with motor power connector.

| Servo motor MDD ... | Cooling | Motor phase current ¹⁾ | Power connection minimum cross section ¹⁾ | | Motor power connector | | INDRAMAT Motor power cable | | | | |
|------------------------|-----------------------|---|--|-------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|-------------------------|-------------------------------------|------|
| | | | mm ² | AWG ²⁾ | Crimping type ³⁾ | Soldering type ³⁾ | without total shield | | with total shield | Cross section mm ² | |
| | | | | | | | standard | highly flex. | | | |
| 115 A-N-015 | natural convection | 17.0 | 2.5 | 12 | INS 108/03 | INS 108/06 | INK 202 | INK 402 ⁴⁾ | INK 602 | 2.5 | |
| 115 A-N-020 | | 22.7 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 115 A-L-020 | | 22.7 | 4.0 | 10 | — | INS 172/25 | INK 203 | INK 403 | INK 603 | 4.0 | |
| 115 A-N-030 | | 34.6 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 115 B-N-015 | | 22.1 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 | |
| 115 B-L-015 | | 22.1 | 4.0 | 10 | — | INS 172/25 | INK 203 | INK 403 | INK 603 | 4.0 | |
| 115 B-N-020 | | 34.6 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 115 B-N-030 | | 66.8 | 25.0 | 4 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 115 C-N-015 | | 32.8 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 115 C-N-020 | | 42.1 | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 115 C-N-030 | | 62.9 | 16.0 | 4 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 115 D-N-015 | | 31.5 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 115 D-N-020 | | 62.9 | 16.0 | 4 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 115 A-N-015 | | surface cooling | 25.6 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 115 A-N-020 | | | 28.0 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 115 A-L-020 | | | 34.0 | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 |
| 115 A-N-030 | | | 51.4 | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 |
| 115 B-N-015 | | | 28.0 | 4.0 | 10 | INS 108/04 | INS 108/06 | INK 203 | INK 403 ⁵⁾ | INK 603 | 4.0 |
| 115 B-L-015 | 30.9 | | 6.0 | 8 | INS 172/06 | INS 172/25 | INK 204 | INK 404 | INK 604 | 6.0 | |
| 115 B-N-020 | 48.2 | | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 115 B-N-030 | 84.0 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 115 C-N-015 | 52.3 | | 16.0 | 6 | INS 172/16 | INS 172/25 | INK 206 | INK 406 | INK 606 | 16.0 | |
| 115 C-N-020 | 67.1 | | 25.0 | 4 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 115 C-N-030 | 84.0 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |
| 115 D-N-015 | 48.6 | | 10.0 | 6 | INS 172/10 | INS 172/25 | INK 205 | INK 405 | INK 605 | 10.0 | |
| 115 D-N-020 | 84.0 | | 25.0 | 3 | — | INS 172/25 | INK 207 | INK 407 | INK 607 | 25.0 | |

¹⁾ Motor phase currents and connection cross sections apply to S1 continuous and S6 intermittent operations with those limit values (respective ON time and duty cycle time), indicated in the torque-speed characteristics curves.
²⁾ Minimum cross section of power connections as per EN 60 204, section 1, table 5, col. C or E or UL 508 table 50.2, but at least 0.75 mm² or AWG 18. Cables as per UL 508 can only be soldered not crimped to motor power connector.
³⁾ The data following the slash define the type of bushing contact of the connector for either crimping or soldering.
⁴⁾ For motor power connector as crimping type INS 108/04.
⁵⁾ To be used only as soldering type with motor power connector.

Fig 12.2: Connector to cable allocations of the power connections

12.3. Power Connector (Motor Power Connector)

| | Crimping connection | | | | | Soldering connection | | | | |
|---|---------------------|-------------------------------|--|---|---|----------------------|---|------------------------------------|---|---|
| | Plug type | Max. connection cross section | | Strain relief ¹⁾ | | Plug type | Max. connection cross section | | Strain relief ¹⁾ | |
| | | Power core mm ² | Control core ²⁾ mm ² | Cable type INK | Part no. | | Power core | Control core ²⁾ max. | Cable type INK | Part no. |
|  <p>INS 252 Pg 13,5¹⁾</p> | INS 252 | 1.0 - 1.5 | 0.75 | 253 250 653 650 | 257 379 257 379 257 379 257 379 | INS 252 | 0.75 - 1.5 mm ² AWG 18-16 | 0.75 mm ² AWG 18 | 253 250 653 650 | 257 379 257 379 257 379 257 379 |
|  <p>INS 108 Pg 21¹⁾</p> | INS 108/02 | 1.5 | 1.5 | 250 650 | 225 404 258 787 ⁴⁾ | INS 108/06 | 0.75 - 6.0 mm ² | 1.5 mm ² | 253 250 202 203 204 | 260 097 225 404 219 857 218 767 218 767 |
| INS 108/03 | 2.5 | 1.5 | 202 602 | 219 857 227 526 | 402 403 404 | | | | 227 526 219 857 218 767 | |
| INS 108/04 | 4.0 | 1.5 | 203 402 603 | 218 767 227 526 218 767 | 653 650 602 603 604 | | | | 258 787 ⁴⁾ 258 787 ⁴⁾ 227 526 218 767 218 767 | |
|  <p>INS 172 Pg 36¹⁾</p> | INS 172/06 | 6.0 | 1.5 | 204 404 604 | 220 874 ³⁾ 220 874 ³⁾ 220 874 ³⁾ | INS 172/25 | 4.0 - 25.0 mm ² | 1.5 mm ² | 203 204 205 206 207 | 220 874 ³⁾ 220 874 ³⁾ 220 472 ³⁾ 220 472 ³⁾ 220 473 |
| INS 172/10 | 10.0 | 1.5 | 205 405 605 | 220 472 ³⁾ 221 554 ³⁾ 221 554 ³⁾ | 403 404 405 406 407 | | | | 228 864 ³⁾ 220 874 ³⁾ 221 554 ³⁾ 220 472 ³⁾ 220 472 ³⁾ | |
| INS 172/16 | 16.0 | 1.5 | 206 406 606 | 220 472 ³⁾ 220 472 ³⁾ 220 473 | 603 604 605 606 607 | | | | 220 874 ³⁾ 220 874 ³⁾ 221 554 ³⁾ 220 473 220 473 | |

¹⁾ Mount strain reliefs into the conduit threaded joint of the motor power connector to ensure interference-free operation. These must be ordered separately of the motor power connectors. Using the part no. indicated, the proper strain reliefs to correspond to the cable types can be ordered from INDRAMAT.
²⁾ For the motor blocking brake and motor temperature monitoring
³⁾ Part no. 220 474 needed for further reductions.
⁴⁾ Part no. 252 652 needed for further reductions.

Fig 12.3: Motor power connector

12.4. Motor Power Cable

12.4.1. Technical Data

| Type | Power core cross section mm ² | Control core ¹⁾ cross section mm ² | Total shield | Power cable diameter mm | Minimum Bending Radius | | Weight kg/m |
|---------|--|--|--------------|-------------------------|------------------------|---------------------|-------------|
| | | | | | Fixed Routing mm | Flexible Routing mm | |
| INK 253 | 1.0 | 0.5 | — | 10.3 ± 0.3 | 65 | 105 ²⁾ | 0.11 |
| INK 250 | 1.5 | 0.75 | — | 11.4 ± 0.4 | 90 | 140 ²⁾ | 0.19 |
| INK 202 | 2.5 | 1.5 | — | 17.8 ± 0.5 | 120 | 200 ²⁾ | 0.47 |
| INK 203 | 4.0 | 1.5 | — | 18.6 ± 0.5 | 120 | 270 ²⁾ | 0.57 |
| INK 204 | 6.0 | 1.5 | — | 19.8 ± 0.5 | 120 | 300 ²⁾ | 0.67 |
| INK 205 | 10.0 | 1.5 | — | 25.4 ± 0.7 | 200 | 380 ²⁾ | 1.10 |
| INK 206 | 16.0 | 1.5 | — | 26.8 ± 0.7 | 220 | 390 ²⁾ | 1.33 |
| INK 207 | 25.0 | 1.5 | — | 30.5 ± 0.7 | 240 | 430 ²⁾ | 1.70 |
| INK 402 | 2.5 | 0.75 | — | 13.6 ± 0.5 | 85 | 140 ³⁾ | 0.27 |
| INK 403 | 4.0 | 0.75 or 1.0 | — | 15.9 ± 0.6 | 100 | 160 ³⁾ | 0.37 |
| INK 404 | 6.0 | 0.75 or 1.0 | — | 18.4 ± 0.6 | 105 | 175 ³⁾ | 0.50 |
| INK 405 | 10.0 | 0.75 or 1.0 | — | 21.6 ± 0.8 | 130 | 220 ³⁾ | 0.74 |
| INK 406 | 16.0 | 1.0 | — | 25.6 ± 0.6 | 150 | 250 ³⁾ | 1.10 |
| INK 407 | 25.0 | 1.5 | — | 27.6 ± 0.7 | 180 | 270 ³⁾ | 1.52 |
| INK 653 | 1.0 | 0.75 | + | 11.5 ± 0.3 | 75 | 100 ²⁾ | 0.25 |
| INK 650 | 1.5 | 0.75 | + | 12.2 ± 0.4 | 80 | 120 ²⁾ | 0.39 |
| INK 602 | 2.5 | 0.75 | + | 14.8 ± 0.5 | 85 | 140 ²⁾ | 0.59 |
| INK 603 | 4.0 | 0.75 or 1.0 | + | 17.8 ± 0.6 | 110 | 180 ²⁾ | 0.60 |
| INK 604 | 6.0 | 0.75 or 1.0 | + | 19.8 ± 0.6 | 120 | 200 ²⁾ | 0.81 |
| INK 605 | 10.0 | 0.75 or 1.0 | + | 23.8 ± 0.6 | 150 | 240 ²⁾ | 1.10 |
| INK 606 | 16.0 | 1.0 | + | 28.2 ± 0.6 | 160 | 280 ²⁾ | 1.40 |
| INK 607 | 25.0 | 1.5 | + | 31.8 ± 0.8 | 180 | 300 ²⁾ | 1.73 |

¹⁾ For motor blocking brake and motor temperature monitoring
²⁾ Service life equals 1 000 000 bending loads.
³⁾ Service life equals 2 000 000 bending loads.

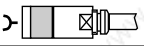
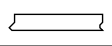
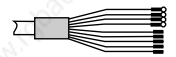
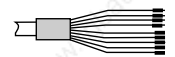
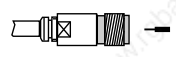
Fig 12.4: Type-dependent data of the motor power cable


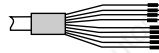
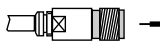
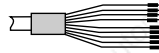
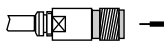
12.4.2. General Data

| Designation | Data |
|--|---|
| Transition cable to plug protection cat. | IP 65 |
| Chemical Features | absolute resistance to mineral oils and greases hydrolysis resistant, silicon and halogene free |
| Permissible ambient temperatures for operation and storage | -30 to + 80 °C |
| Cable surface | Poor adhesion, prevents sticking in drag chains. |
| Cable length | maximum of 75 meters |

Fig 12.5: General data - motor power cable

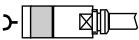

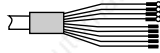
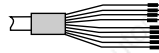
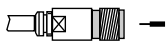
12.4.3. Ready-made motor power cable

| Servo motor MDD ... | Cooling mode | Motor power connector | Motor power cable mm ² | Cable end for ... | | | |
|---|--------------------|---|---|--|--|---|---------|
| | | | | Connection to drive using a terminal bolt (e.g.. DDS 2) | Intermediate clamp on terminal strip or connection to drive using terminal clamp (e.g.. DKS. DDS 3. DKC) | Intermediate connection using coupling 1) | |
| 021 A-N-100 | natural convection |  INS 252 |  1.0 |  IK• 001 |  IK• 002 |  IK• 005 | |
| 021 B-N-100 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 025 A-N-100 | natural convection | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 025 B-N-100 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 025 C-N-100 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 041 A-N-100 | natural convection | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 041 B-N-100 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 041 C-N-100 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 A-N-040 | natural convection | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 A-N-060 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 B-N-040 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 B-N-060 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 C-N-040 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 C-N-060 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 D-N-040 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 D-N-060 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 B-N-040 | | surface cooling | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 065 B-N-060 | | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 065 C-N-040 | INS 252 | | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 C-N-060 | INS 252 | | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 D-N-040 | INS 252 | | 1.0 | IK• 001 | IK• 002 | IK• 005 | |
| 065 D-N-060 | INS 252 | | 1.5 | — | — | — | |
| Continued on next page | | | | | | | |
| 1) For coupling connector mate: motor power connector | | | | | | | |

| Servo motor MDD ... | Cooling mode | Motor power connector | Motor power cable mm ² | Cable end for ... | | |
|---------------------|--------------------|---|---|--|--|---|
| | | | | Connection to drive using a terminal bolt (e.g.. DDS 2) | Intermediate clamp on terminal strip or connection to drive using terminal clamp (e.g.. DKS. DDS 3. DKC) | Intermediate connection using coupling 1) |
| | |  |  |  |  |  |
| 071 A-N-030 | natural convection | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 071 A-N-040 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 071 A-N-060 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 071 B-N-030 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 071 B-N-040 | | INS 108/06 | 1.0 | IK• 011 | IK• 012 | IK• 003 |
| 071 B-N-060 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 071 C-N-030 | | INS 108/06 | 1.0 | IK• 011 | IK• 012 | IK• 003 |
| 071 C-N-040 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 071 C-N-060 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 071 B-N-030 | surface cooling | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 071 B-N-040 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 071 B-N-060 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 071 C-N-030 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 071 C-N-040 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 071 C-N-060 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |
| 090 A-N-020 | natural convection | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 090 A-N-030 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 090 A-N-040 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 090 B-N-020 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 090 B-N-030 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 090 B-N-040 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 090 C-N-020 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 090 C-N-030 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 090 C-N-040 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 090 A-N-020 | surface cooling | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 090 A-N-030 | | INS 252 | 1.0 | IK• 001 | IK• 002 | IK• 005 |
| 090 A-N-040 | | INS 252 | 1.5 | — | — | — |
| 090 B-N-020 | | INS 252 | 1.5 | — | — | — |
| 090 B-N-030 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 090 B-N-040 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 090 C-N-020 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 090 C-N-030 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |
| 090 C-N-040 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |

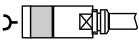
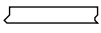
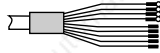
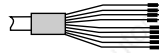
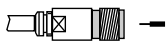
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1) For coupling connector mate: motor power connector

| Servo motor MDD ... | Cooling mode | Motor power connector  | Motor power cable mm ²  | Cable end for ... | | | |
|---------------------|--------------------|--|---|---|---|--|---------|
| | | | | Connection to drive using a terminal bolt (e.g.. DDS 2)  | Intermediate clamp on terminal strip or connection to drive using terminal clamp (e.g.. DKS. DDS 3. DKC)  | Intermediate connection using coupling 1)  | |
| 093 A-N-020 | natural convection | INS 108/06 | 1.0 | IK• 011 | IK• 012 | IK• 003 | |
| 093 A-N-030 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 | |
| 093 A-N-040 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 093 A-N-060 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 093 B-N-020 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 | |
| 093 B-N-030 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 093 B-N-040 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 093 B-N-060 | | INS 172/10 | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 C-N-020 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 093 C-N-030 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 093 C-L-030 | | INS 172/25 | 4.0 | — | — | — | |
| 093 C-N-040 | | INS 172/10 | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 C-N-060 | | INS 172/16 | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 093 D-N-015 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 093 D-N-020 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 093 D-N-030 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 093 D-N-040 | | INS 172/16 | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 093 A-N-020 | | surface cooling | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 093 A-N-030 | | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 093 A-N-040 | | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |
| 093 A-N-060 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 B-N-020 | INS 108/03 | | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 093 B-N-030 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 093 B-N-040 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 B-N-060 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 093 C-N-020 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 093 C-N-030 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 093 C-L-030 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 C-N-040 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 093 C-N-060 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 093 D-N-015 | INS 172/06 | | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 093 D-N-020 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 D-N-030 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 093 D-N-040 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |

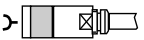

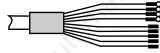
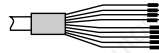
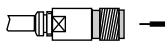
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1) For coupling connector mate: motor power connector

| Servo motor MDD ... | Cooling mode | Motor power connector | Motor power cable | Cable end for ... | | | |
|------------------------|-----------------------|---|---|--|---|---|---------|
| | | | | Connection to drive using a terminal bolt (e.g.. DDS 2) | Intermediate clamp on terminal strip or connection to drive using terminal clamp (e.g.. DKS. DDS 3. DKC) | Intermediate connection using coupling 1) | |
| | |  |  |  |  |  | |
| | | | mm ² | | | | |
| 112 A-N-015 | natural convection | INS 108/06 | 1.0 | IK• 011 | IK• 012 | IK• 003 | |
| 112 A-N-020 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 | |
| 112 A-N-030 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 | |
| 112 A-N-040 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 112 B-N-015 | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 | |
| 112 B-N-020 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 112 B-N-030 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 B-L-030 | | INS 172/25 | 4.0 | — | — | — | |
| 112 B-N-040 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 112 C-N-015 | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 112 C-N-020 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 C-L-020 | | INS 172/25 | 4.0 | — | — | — | |
| 112 C-N-030 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 112 C-N-040 | | INS 172/10 | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 112 C-N-060 | | INS 172/25 | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 112 D-N-015 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 D-L-015 | | INS 172/25 | 4.0 | — | — | — | |
| 112 D-N-020 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 112 D-N-030 | | INS 172/10 | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 112 D-N-040 | | INS 172/25 | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 112 A-N-015 | | surface cooling | INS 108/06 | 1.0 | IK• 011 | IK• 012 | IK• 003 |
| 112 A-N-020 | | | INS 108/02 | 1.5 | IK• 021 | IK• 022 | IK• 023 |
| 112 A-N-030 | | | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 |
| 112 A-N-040 | | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |
| 112 B-N-015 | INS 108/03 | | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 112 B-N-020 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 B-N-030 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 B-L-030 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 112 B-N-040 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 112 C-N-015 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 C-N-020 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 C-L-020 | INS 172/06 | | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 112 C-N-030 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 112 C-N-040 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 112 C-N-060 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 112 D-N-015 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 112 D-L-015 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 112 D-N-020 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 112 D-N-030 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 112 D-N-040 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |

Continued on next page

1) For coupling connector mate: motor power connector

| Servo motor MDD ... | Cooling mode | Motor power connector | Motor power cable mm ² | Cable end for ... | | | |
|------------------------|-----------------------|---|---|--|---|---|---------|
| | | | | Connection to drive using a terminal bolt (e.g.. DDS 2) | Intermediate clamp on terminal strip or connection to drive using terminal clamp (e.g.. DKS. DDS 3. DKC) | Intermediate connection using coupling 1) | |
| | |  |  |  |  |  | |
| 115 A-N-015 | natural convection | INS 108/03 | 2.5 | IK• 041 | IK• 042 | IK• 043 | |
| 115 A-N-020 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 115 A-L-020 | | INS 172/25 | 4.0 | — | — | — | |
| 115 A-N-030 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 115 B-N-015 | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 115 B-L-015 | | INS 172/25 | 4.0 | — | — | — | |
| 115 B-N-020 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 115 B-N-030 | | INS 172/25 | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 115 C-N-015 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 115 C-N-020 | | INS 172/10 | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 115 C-N-030 | | INS 172/16 | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 115 D-N-015 | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 115 D-N-020 | | INS 172/16 | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 115 A-N-015 | | surface cooling | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |
| 115 A-N-020 | | | INS 108/04 | 4.0 | IK• 061 | IK• 062 | IK• 063 |
| 115 A-L-020 | | | INS 172/06 | 6.0 | IK• 101 | IK• 102 | IK• 108 |
| 115 A-N-030 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 115 B-N-015 | INS 108/04 | | 4.0 | IK• 061 | IK• 062 | IK• 063 | |
| 115 B-L-015 | INS 172/06 | | 6.0 | IK• 101 | IK• 102 | IK• 108 | |
| 115 B-N-020 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 115 B-N-030 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 115 C-N-015 | INS 172/16 | | 16.0 | IK• 141 | IK• 142 | IK• 148 | |
| 115 C-N-020 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 115 C-N-030 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |
| 115 D-N-015 | INS 172/10 | | 10.0 | IK• 121 | IK• 122 | IK• 128 | |
| 115 D-N-020 | INS 172/25 | | 25.0 | IK• 161 | IK• 162 | IK• 168 | |

1) For coupling connector mate: motor power connector

Fig 12.6: Ready-made motor power cable

12.4.4. Order Guidelines

Example: IKL 001 / 12.0

Length in meters

L... standard cable without total shield

F... highly-flexible cable without total shield
(not available with power core diameters
0.75 and 1.5 mm²)

G... cable with total shield

The cables are available in increments of 0.5 meters from five meters and up. Shorter lengths are available upon request.

13. Electrical Motor Feedback Connections

13.1. Terminal Diagram

Terminal diagram for the motors with "resolver feedback"
MDD 021...
MDD 025...
MDD 041...

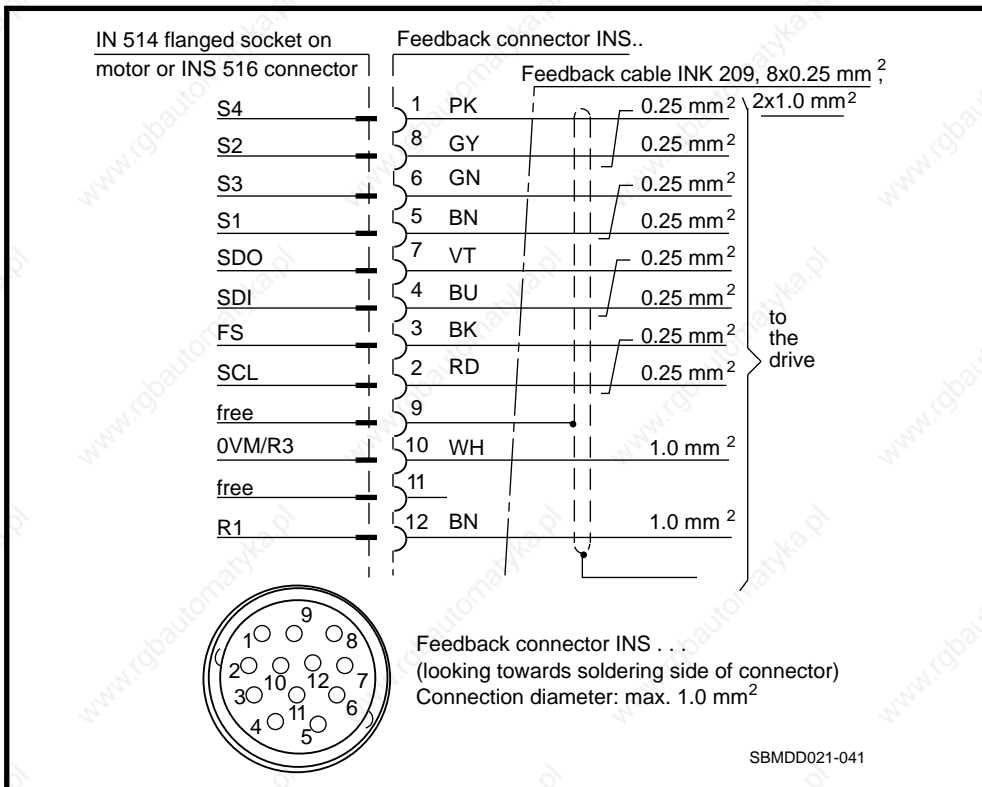


Fig 13.1: Terminal diagram for the motors with "resolver feedback"

Terminal diagram for the motors with "digital servo feedback"
MDD 065...
MDD 071...
MDD 090...
MDD 093...
MDD 112...
MDD 115...

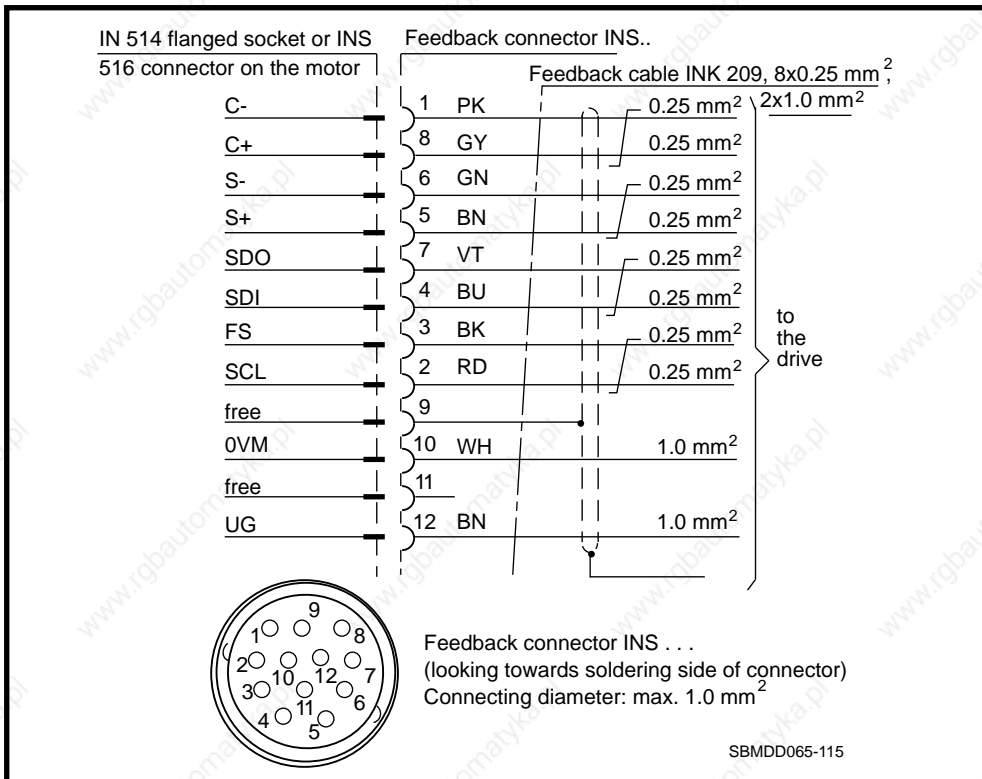


Fig 13.2: Terminal diagram for the motors with "digital servo feedback"



In the event that non-Indramat cables are used, then it is important that the allocation of cores between the flanged socket on the motor and the interface on the drive are absolutely correct. If connections are interchanged and not correctly stranded, then a fail function of the drive becomes highly probable.

13.2. Feedback Connector

| Motor type MDD... | Connectors for INDRAMAT cable INK 209 | | Connectors for cables with an outside diameter of 6 to 10 mm | |
|--------------------------------------|---------------------------------------|-------------------|--|-------------------|
| | Connector (straight) | Connector (angle) | Connector (straight) | Connector (angle) |
| 021... 025... 041... | INS 513 | — | INS 512 | — |
| 065... 071... 090... 093... | INS 513 | INS 511 | INS 512 | INS 510 |
| 112... 115... | INS 513 | INS 511 1) | INS 512 | INS 510 1) |

1) The angle connectors cannot be used with axial surface cooling.

Fig 13.3: The available feedback connectors

13.3. Feedback Cable

13.3.1. Technical Data

| | |
|---|--|
| Type designation | INK 209 |
| Cable to connector transition protection | IP 65 |
| Cable diameter | 8.8 ± 0.3 mm |
| Minimum bending loads / fixed routing | 40 mm |
| Minimum bending loads / flexible routing (service life = 1 000 000 bending loads) | 90 mm |
| Weight | 0.102 kg/m |
| Permissible ambient temperature for operation and storage | -30 °C to +80 °C |
| Cable surface | poor adhesion, prevents sticking in drag chains |
| Chemical features | absolute resistance to mineral oils and greases, hydrolysis resistant, silicone and halogen free |
| Maximum cable length | 75 meters |

Fig 13.4: Technical data of feedback cable INK 209

13.3.2. Ready-Made Feedback Cables

| Type code for ready-made feedback cables | Feedback connectors | INDRAMAT feedback cables | Cable end design |
|--|---------------------|--------------------------|---|
| IKS 374 | INS 513 | INK 209 | INS 439 |
| IKS 375 ²⁾ | INS 511 | INK 209 | INS 439 |
| IKS 376 | INS 513 | INK 209 | INS 516 |
| IKS 377 ²⁾ | INS 511 | INK 209 | INS 516 |
| IKS 378 | INS 513 | INK 209 | with ferrules for connecting to terminal strips |
| IKS 379 ²⁾ | INS 511 | INK 209 | with ferrules for connecting to terminal strips |

Plug-in connector: 15-pin D-Sub for connection to drive

with coupling unit for connecting to INS 513

with ferrules for connecting to terminal strips

- 1) To be avoided due to possible interference in shielding.
- 2) • Not to be used for MDD 021, MDD 025 and MDD 041 motors.
- Do not use in MDD 112 and MDD 115 motors with axial surface cooling.

MZFEEDBACK

Fig 13.5: Ready-made feedback cables

13.3.3. Order Guidelines

Example: IKS 374 / 12.0
 length in meters

Ready-made feedback cables are available in increments of 0.5 meters after a length of five meters. Shorter lengths available upon request.

14. Condition at Delivery

The motors are packed onto a palette or in cartons at the time of delivery. The way they are packed depends upon the numbers and/or sizes of the motor.

If a single motor is packed on a palette, then it is secured against sliding and movement by means of squared timbers and tightly lashed into place with taut metal bands. If several motors are simultaneously delivered, then up to three motors will be on one palette. Pieces of styrofoam or cartons are then used to prevent them from damaging each other.

To prevent damage from inclement weather, a carton is placed over a palette and then affixed to the palette with the use of taut bands.

To unpack without damaging the items, simply cut through the taut bands.



Caution! There is tension in the taut bands!

There exists the danger of injury from the uncontrolled lashing out of the taut bands!

Maintain sufficient distance! Cut taut bands open carefully!

There is an envelope containing the delivery slip attached to the carton.

There is also a barcode sticker (or stickers depending on the extent of the delivery) listing the following information:

- type designations of the motor
- customer
- delivery slip number
- consignment
- name of delivering agent

(See section 15: "Identifying the Merchandise".)

There is no further documentation accompanying the delivery unless specifically requested.

15. Identifying the Merchandise

There is one delivery slip accompanying the entire delivery. This slip lists the merchandise in terms of its name and order designations. In the event that some of the listed items are distributed over several cartons or transport containers, this will be noted in the delivery or freight slip.

Barcode Sticker

There is a barcode sticker on the packaging of the motor. If several motors are in one carton or container, then there is a sticker for each motor.

The sticker helps to identify the contents of the cartons and is required to complete the order procedure at INDRAMAT.

The following information is on the sticker:

- type designation of the motor
- customer
- delivery slip number
- consignment
- name of delivering agent



Fig 15.1: Example of a barcode sticker

Rating Plate The motor is delivered with a name plate attached to the motor housing.

If a second name plate is ordered, then it is placed over the original one with double-sided tape. Both are on the housing of the motor.

| | | | |
|--|----------------|--------------------------|--------|
| INDRAMAT | | Build Date 44 / 92 | |
| MDD090C-N-020-N2L-110GB0/S016 | | | |
| S.No. 123456 | Com.No. 234567 | Part No. 345678 | |
|  | | | |
| natural convection | surface cooled | I.Cl. F | IP 65 |
| Tcont 10.4 Nm | 16.0 Nm | n 2000 min ⁻¹ | |
| IdN 9.5 A | 14.6 A | Km 1.10 Nm/A | |
| | | m 50 kg | |
| Brake 14.0 Nm | 24 V ± 10 % | | 0,75 A |
| Made in Germany | | | |

Fig 15.2: Example of a name plate of an MDD AC servo motor per DIN 42961

16. Storage, Transport and Handling

There are guidelines on storage and transportation printed on the carton. These must be followed.



Fig 16.1: Guidelines on storage and transport on packaging

Storing the Motors

The motors must be stored in a dry, dust-free and shock-free environment.

Permissible temperature range: -25 °C to + 85 °C.

There are protective covers on the connector housing as well as the output shaft. These are made of plastic and protect the parts they cover against moisture and damage. Do not remove the protective covers until shortly prior to mounting into the machine.

Transport and Handling

Avoid impacts to the output shaft and heavy loads as otherwise the bearings in the motor could be damaged.

Note the different weights and sizes of the individual types of motors when selecting both the transport and lifting devices.



Do not pick up the motor at the blower. This will damage and possibly tear the blower off of the motor housing.

Figure 16.2 depicts how the heavy motors should be picked up with the help of a crane and belts. It is important that no load is applied to either output shaft or blower housing during this procedure!

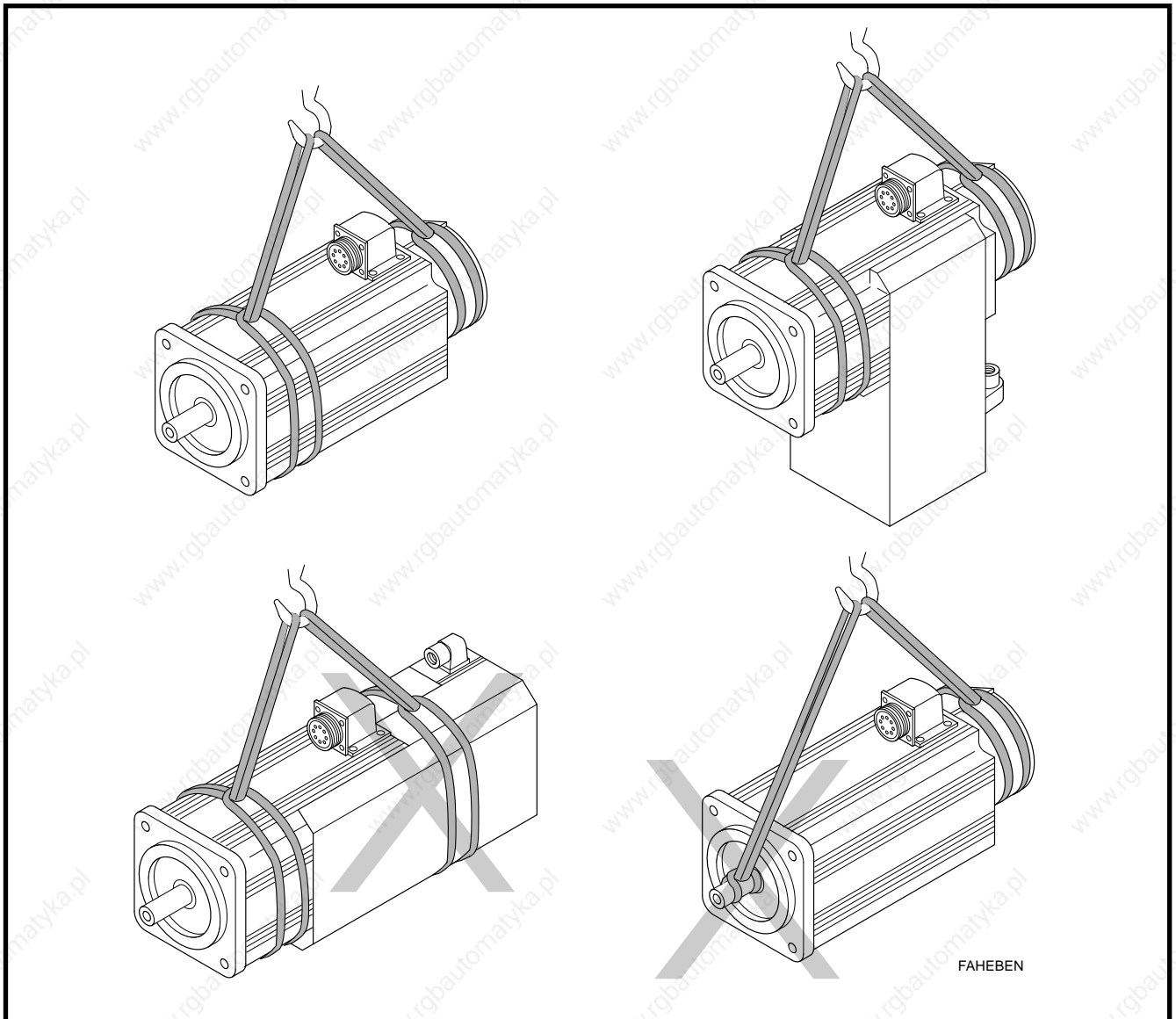


Fig 16.2: Picking up and transporting the motors with the help of the crane belts

There are two M8 tapped holes in the housing of the MDD 112 and MDD 115 line of motors. Lifting screws (per DIN 580) can be screwed into place here. These can then be used by for holding the motor in place by a suitable lifting device. The hooks of a chain tackle can, for example, be hooked into place here. (See Figure 16.3).

INDRAMAT does not automatically deliver these lifting screws with the motor. The user must, therefore, supply them.



If a blower for axially surface-cooling the motors of the MDD 112 and MDD 115 line is mounted, then these *may only* be picked up by the lifting screws.

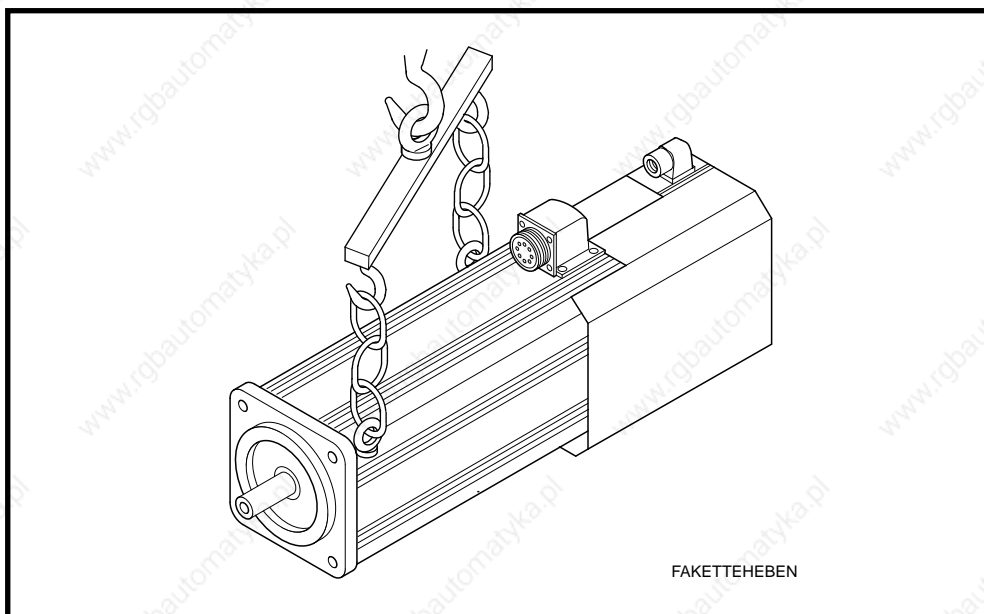


Fig 16.3: Picking up and transporting MDD 112 or MDD 115 motors with chain tackle

17. Mounting and Installation Guidelines

The following guidelines must be followed to avoid damaging the machine during mounting and commissioning.

- The bigger and thus heavier motors may only be transported with the use of suitable lifting devices as described in the guidelines of Section 16.
- Avoid impacts to the output shaft and heavy loads at the shaft as otherwise the bearings within the motor could be damaged.
- The motors should only be mounted to the machine by fully trained personnel.
- The spigot nuts on the connectors (motor power and feedback connectors) must be tightly screwed into place when connecting.
- The motor must be grounded to the drive amplifier.
- The terminal diagrams of the machine manufacturer should be followed when wiring the motor!
- The motor as well as machine/facility may only be started up by a fully trained electrician or personnel under the supervision of an electrician.

18. Service Guidelines

18.1. Contacting Customer Service

INDRAMAT customer service can be reached at the following Service Hotline Numbers:

Service Hotline Phone no.: 0172-6600406 or 0171-3338826

Monday - Friday 7 a.m. to 11 p.m. MEZ
Saturday 8 a.m. to 8 p.m. MEZ
Sundays and holidays 9 a.m. to 7 p.m. MEZ

We would appreciate your noting the following information prior to contacting INDRAMAT customer service:

- type data of motor and drive
- the problem
- all fault and diagnostics displays

This will make it possible to quickly and definitively locate the problem.

When returning a motor, please include a copy of the repair card. This can be copied from the example on the next page. Fill it out and send it in. This will enable us to locate the problem caused by this particular application.

18.2. Repair Card

| Repair Report Card for INDRAMAT equipment and components | | | |
|--|---|--|----------------------|
| Name: | | Company/Location: | |
| Date: | | | |
| Part number for exchange of single parts | | SN: | Consignment no.: |
| | | SN: | Delivery date: |
| Machine manufacturer/co.: | Type: | Machine no.: | Commissioning date: |
| Failure in axis: | <input type="checkbox"/> horizontal <input type="checkbox"/> vertical <input type="checkbox"/> | Operating time: | Date fault occurred: |
| Fault: Fault _____ _____ <input type="checkbox"/> constantly present <input type="checkbox"/> occurs sporadically <input type="checkbox"/> occurs after _____ hrs. <input type="checkbox"/> occurs with shocks <input type="checkbox"/> depends on temperature <input type="checkbox"/> other _____ _____ _____ | Additional data: (e.g., LED diagnosis, error in display) _____ _____ _____ _____ _____ _____ _____ | Cause of fault: <input type="checkbox"/> unknown <input type="checkbox"/> connection fault <input type="checkbox"/> external short circuit <input type="checkbox"/> mechanical damage <input type="checkbox"/> loose cable(s) <input type="checkbox"/> other _____ _____ _____ | |
| Additional Data | | | |
| General data: <input type="checkbox"/> no function <input type="checkbox"/> drive not running smooth <input type="checkbox"/> uncontrolled drive motions <input type="checkbox"/> error in one direction only <input type="checkbox"/> supply unit short-circuit fault <input type="checkbox"/> other | Concomitant phenomena: <input type="checkbox"/> Problems in mechanical sys. <input type="checkbox"/> Mains failure <input type="checkbox"/> Control failure <input type="checkbox"/> Motor failure <input type="checkbox"/> Break in cable <input type="checkbox"/> other | Drive, supply unit, amplifier, power section <input type="checkbox"/> control voltage faulty <input type="checkbox"/> power sect. circuit breaker F ____ <input type="checkbox"/> blower defective <input type="checkbox"/> bleeder resistor defective <input type="checkbox"/> power voltage faulty <input type="checkbox"/> connecting bolt broke <input type="checkbox"/> other | |
| Control: <input type="checkbox"/> no function <input type="checkbox"/> display failed <input type="checkbox"/> no command value output <input type="checkbox"/> diagnosis <input type="checkbox"/> dim. offset in _____ direction <input type="checkbox"/> E-stop loop interrupted <input type="checkbox"/> position control loop won't close <input type="checkbox"/> program sequence fault <input type="checkbox"/> interior auxiliary function faulty (outputs) <input type="checkbox"/> acknowledgements not accepted (inputs) <input type="checkbox"/> other _____ _____ | Motor: <input type="checkbox"/> temperature monitoring defective <input type="checkbox"/> brake defective <input type="checkbox"/> blower defective <input type="checkbox"/> feedback defective <input type="checkbox"/> tachometer signal faulty <input type="checkbox"/> BLC-signal faulty <input type="checkbox"/> short-circuit to ground <input type="checkbox"/> thermal overload <input type="checkbox"/> other _____ _____ _____ | Comments: _____ _____ _____ _____ _____ | |

PIRepBegI

Fig 18.1: Repair Card

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