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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".

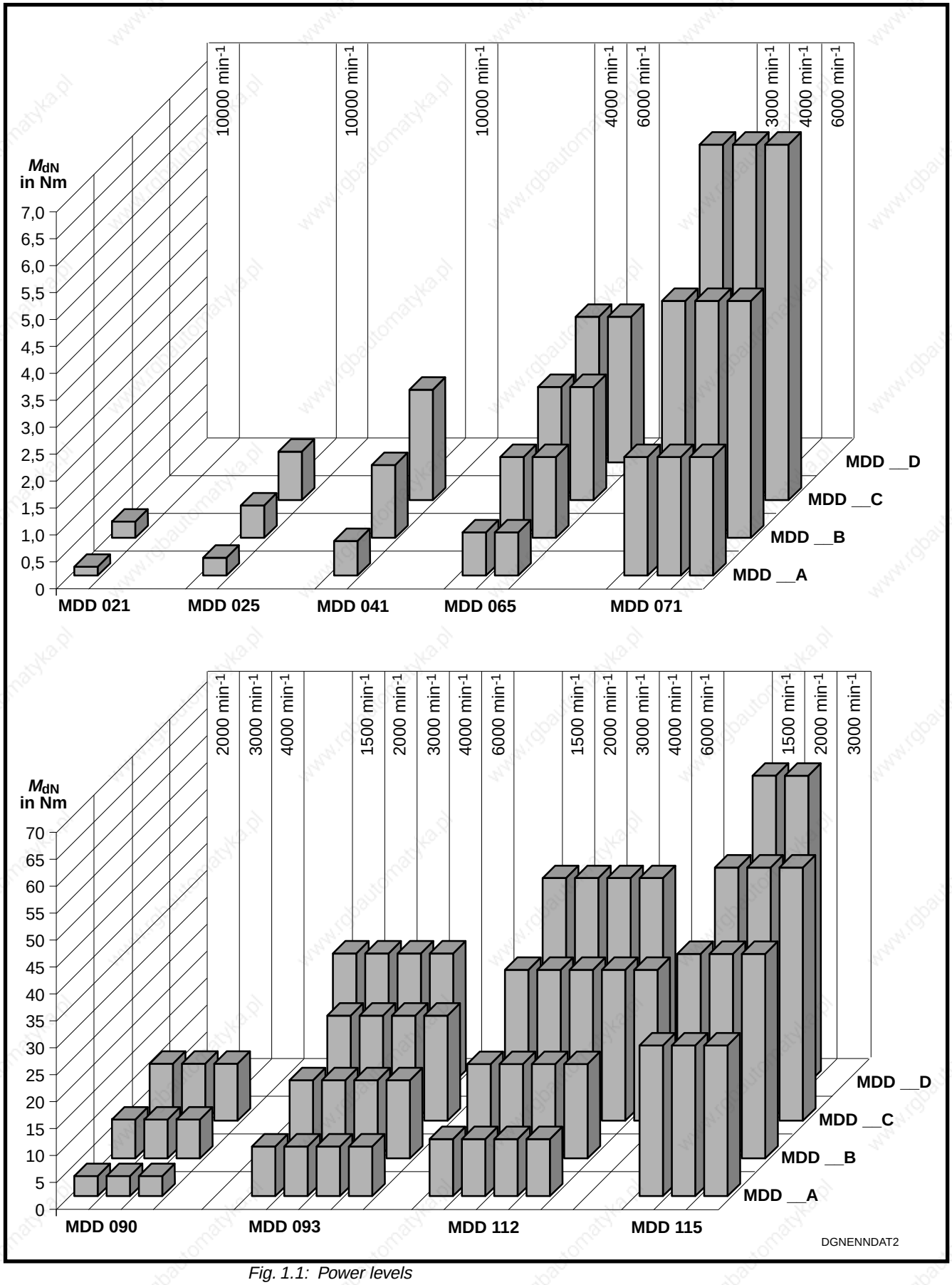


Fig. 1.1: Power levels

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.

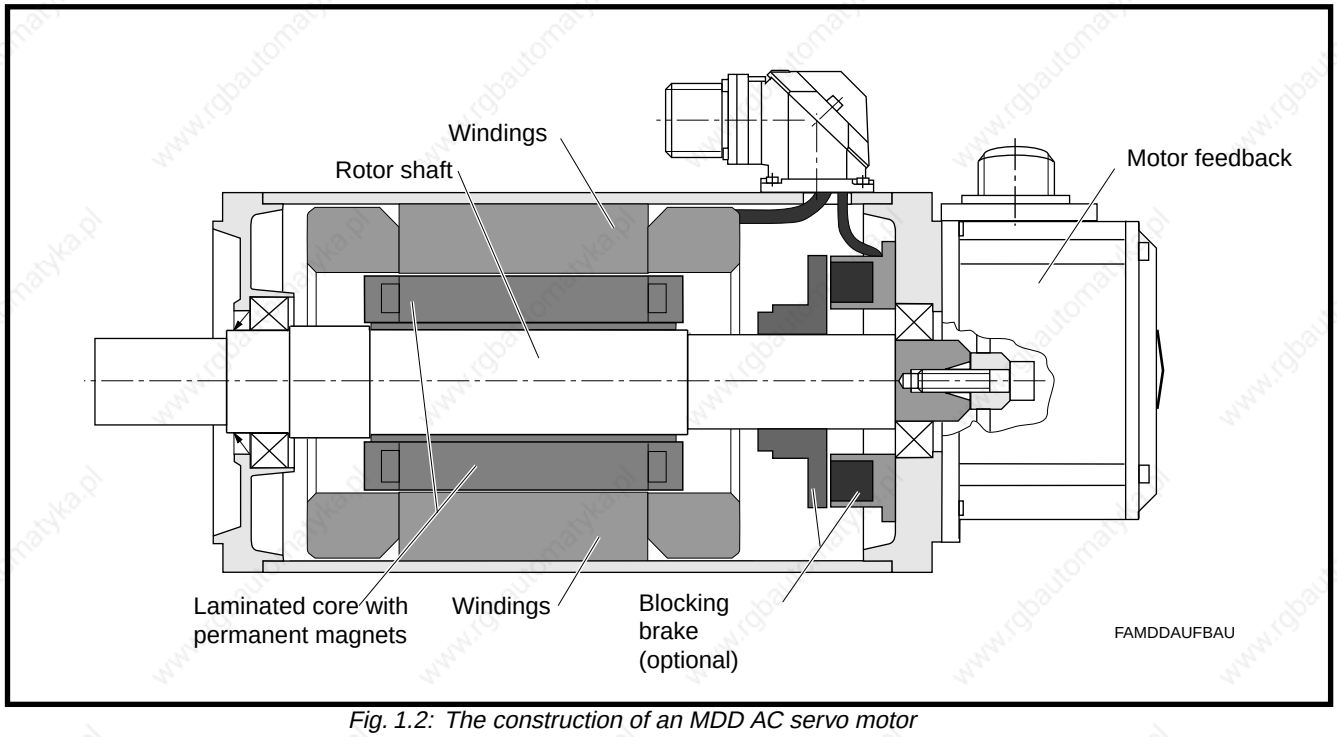


Fig. 1.2: The construction of an MDD AC servo motor

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.

Intallation 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 accomodate 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.

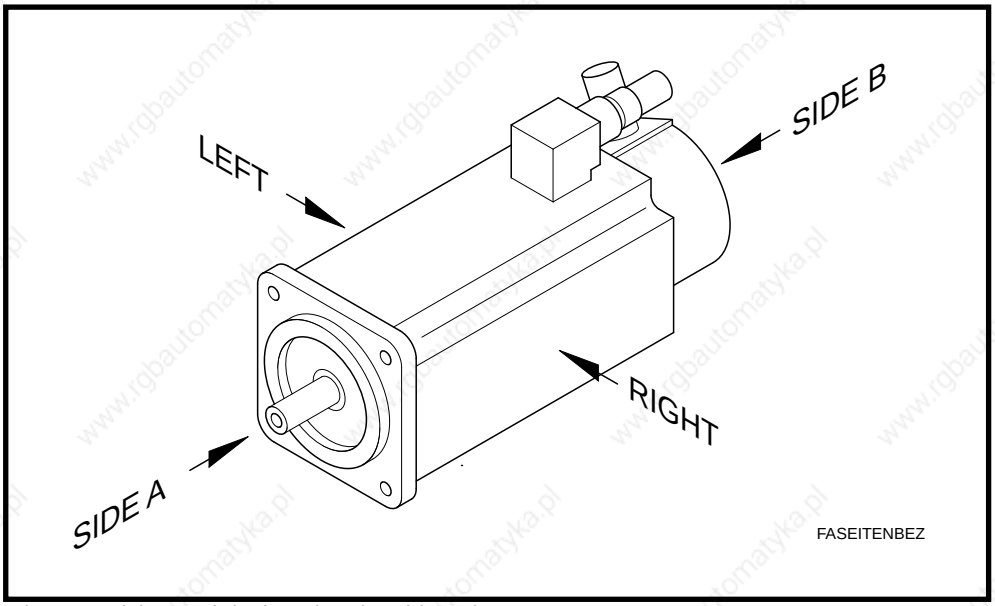


Fig. 1.3: Fixing and designating the sides of an MDD servo motor

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.

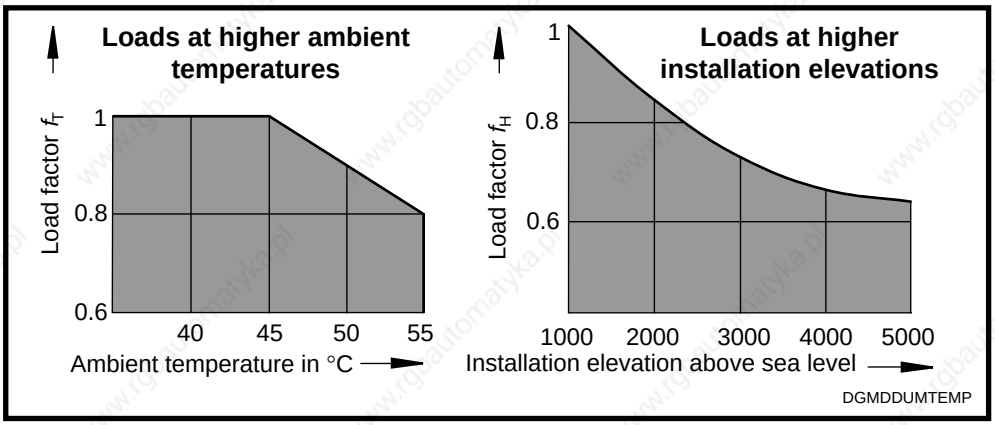


Fig. 2.1: Load capabilities at higher ambient temperatures and higher installation elevations

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 (**I**nternational **P**rotection) 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)

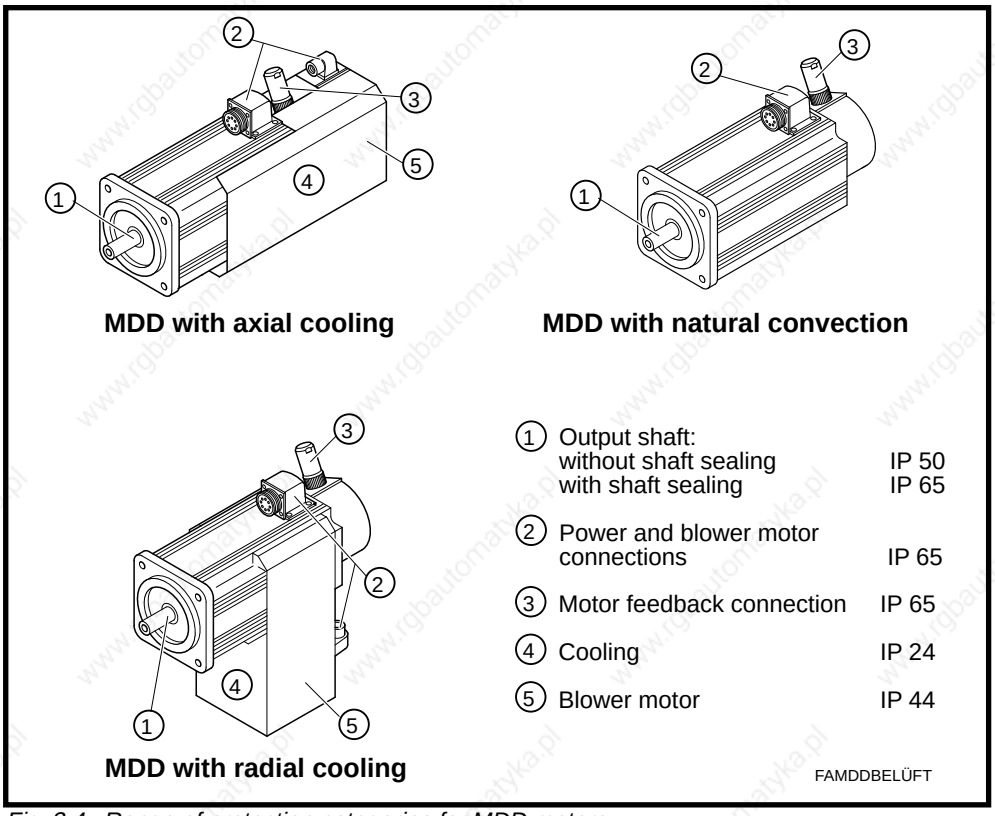


Fig. 2.4: Range of protection categories for MDD motors

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.

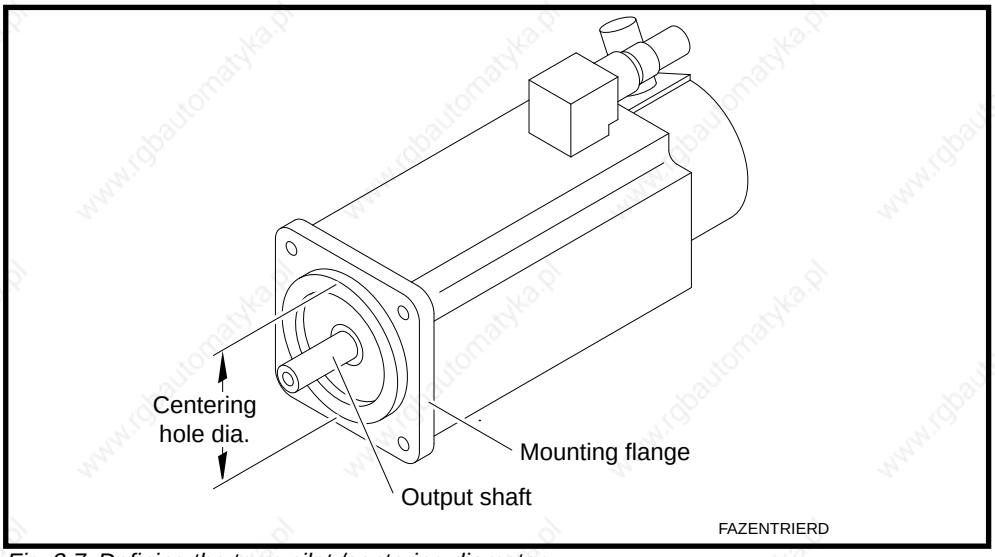


Fig. 2.7: Defining the term pilot /centering diameter

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**
- **occuring 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.

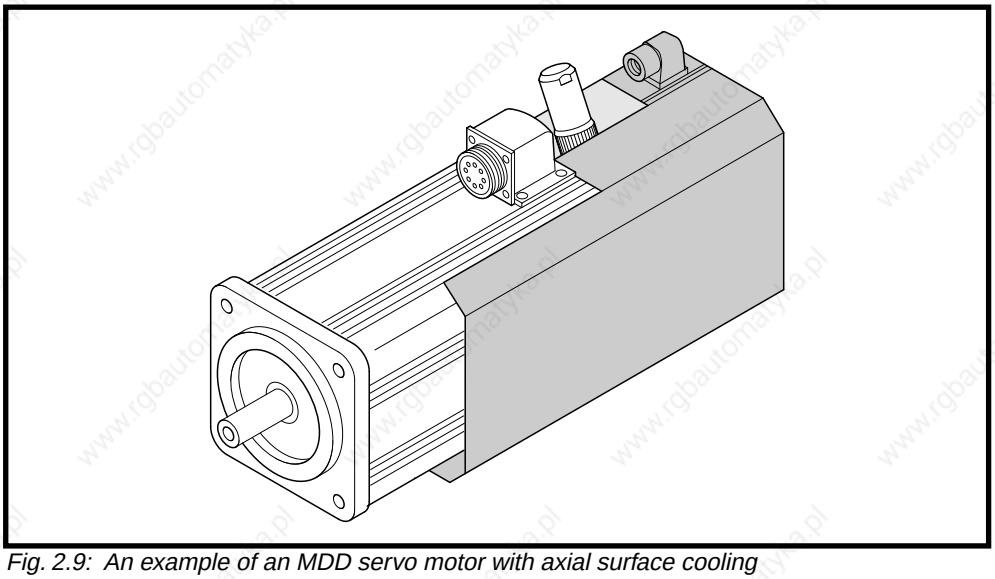


Fig. 2.9: An example of an MDD servo motor with axial surface cooling

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

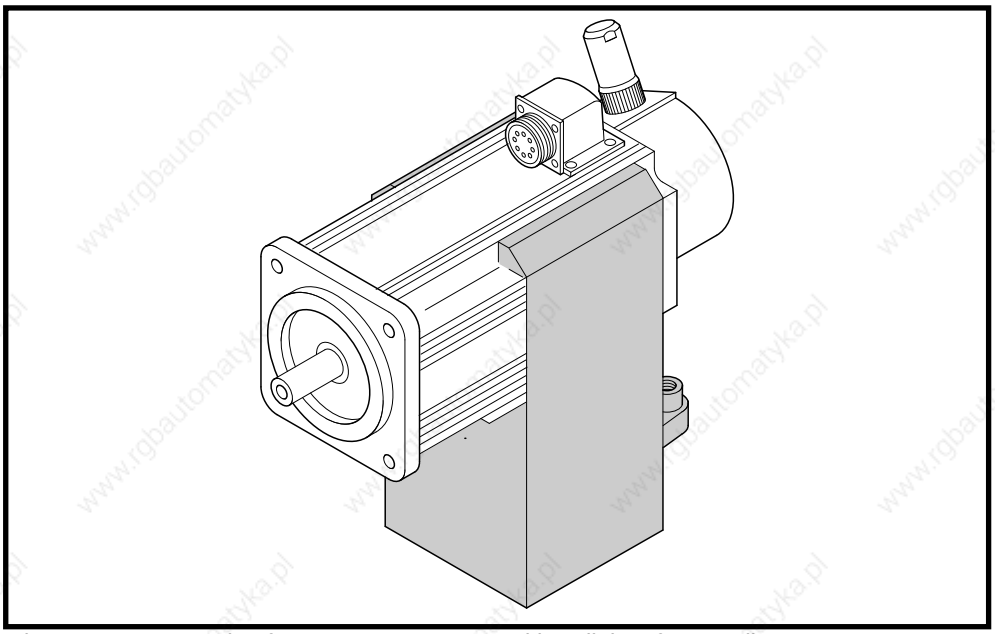


Fig. 2.10: An example of an MDD servo motor with radial surface cooling

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.

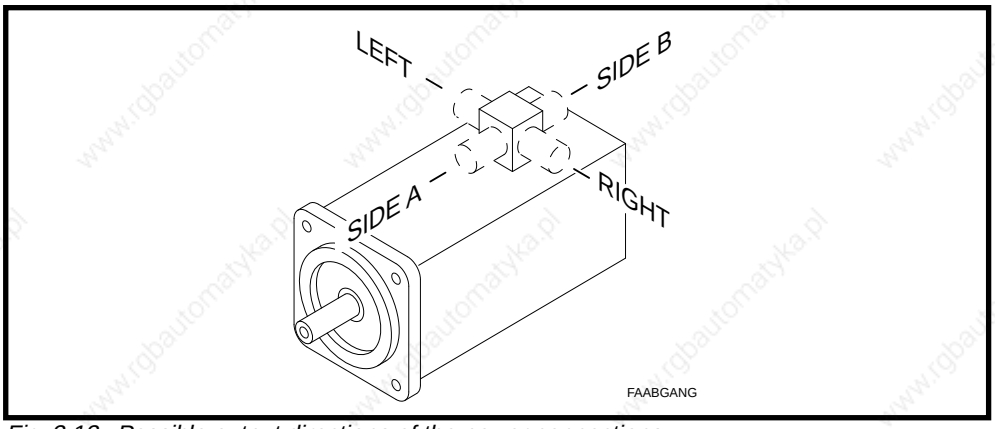


Fig. 2.12: Possible output directions of the power connections

Feedback connector

Different types of connectors can be selected for connecting the motor feedback cable depending upon the installaton 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.

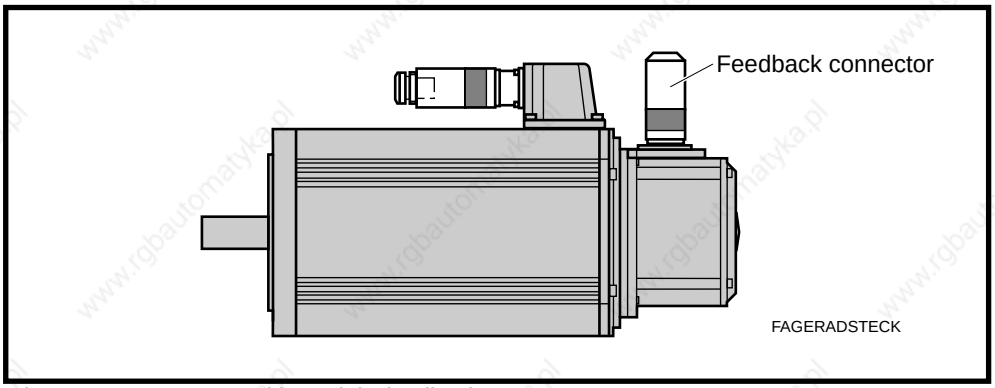


Fig. 2.13: MDD motor with straight feedback connector

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.

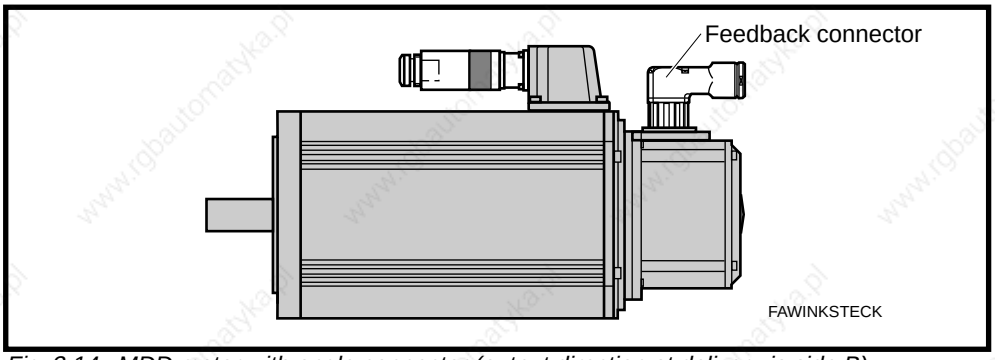


Fig. 2.14: MDD motor with angle connector (output direction at delivery is side B)

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.

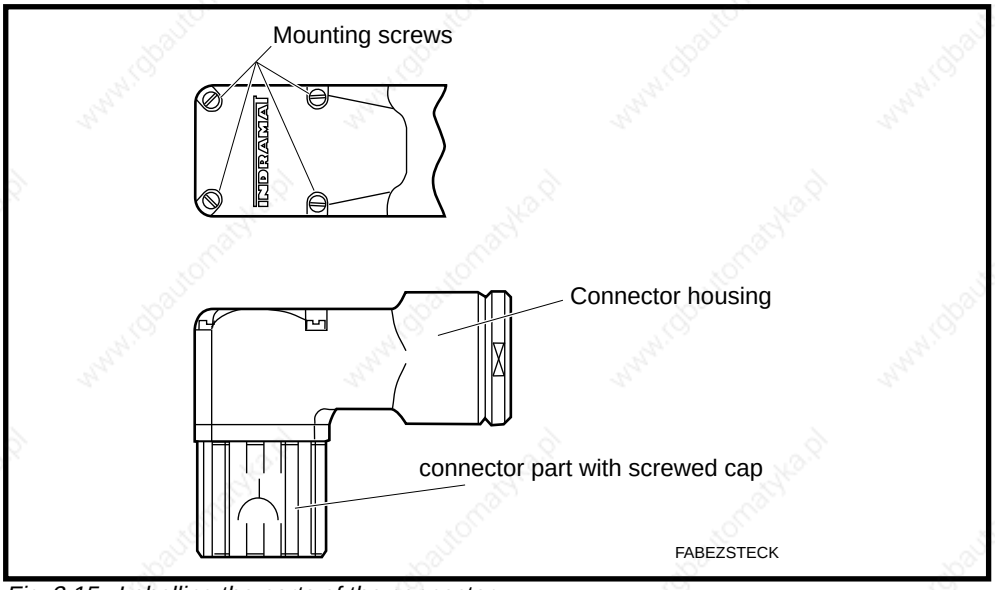


Fig. 2.15: Labelling the parts of the connector

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.

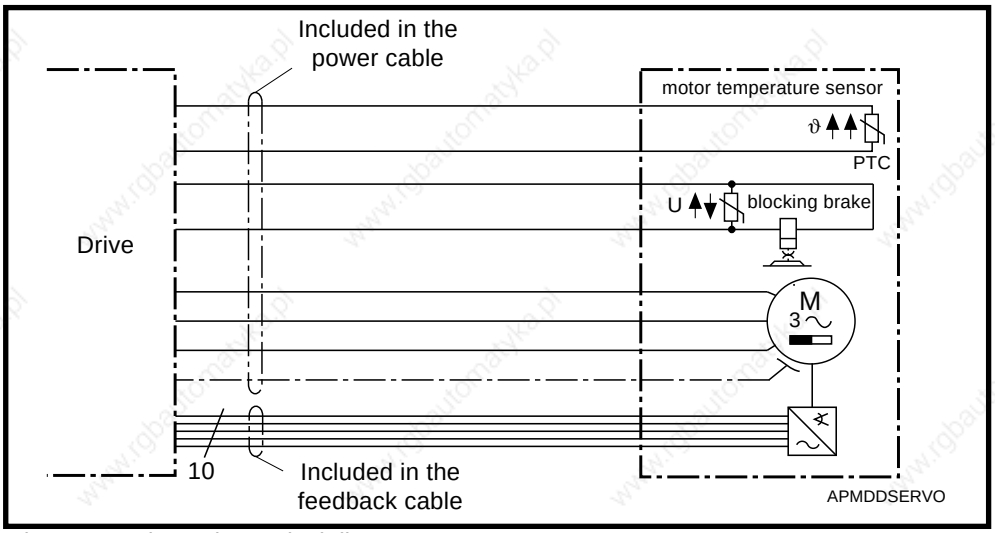


Fig. 2.16: Schematic terminal diagram

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	
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 multiturn 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 verison 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 x 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 x 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.

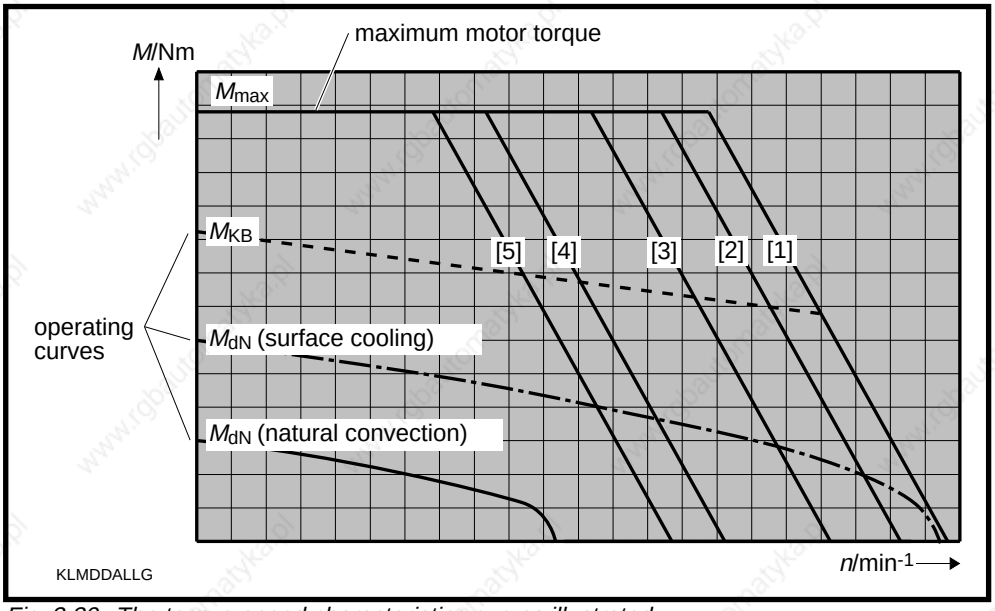


Fig. 2.20: The torque-speed characteristics curves illustrated

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	0.22×10^{-4}	0.31×10^{-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

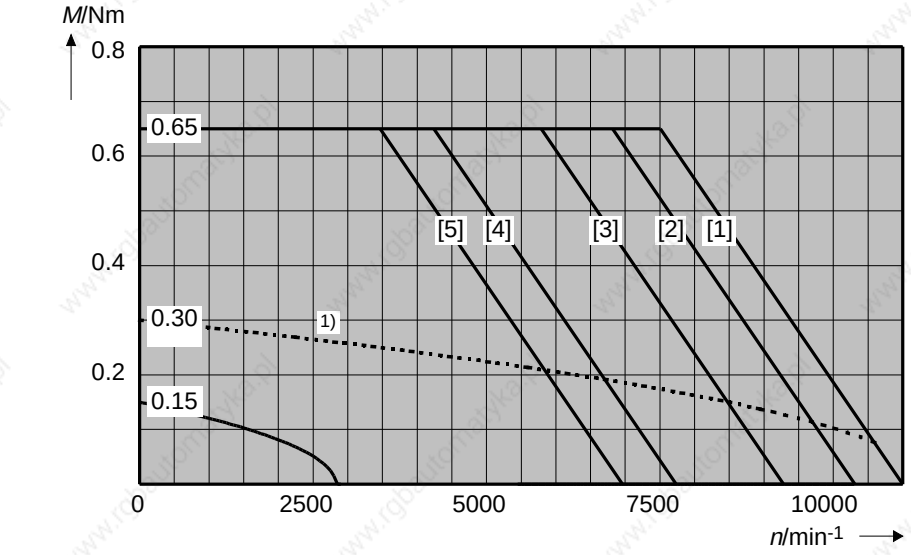
Designation	Symbol	Unit	Data
Permissible ambient temperature	T_{um}	°C	0 ... + 45
Permissible storage and transport temperatures	T_L	°C	-20 ... + 80
Maximum installation elevation		m	1000 meters above sea level
Protection category			IP 65 [1]
Insulation classification			F
Housing finish			Black prime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

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

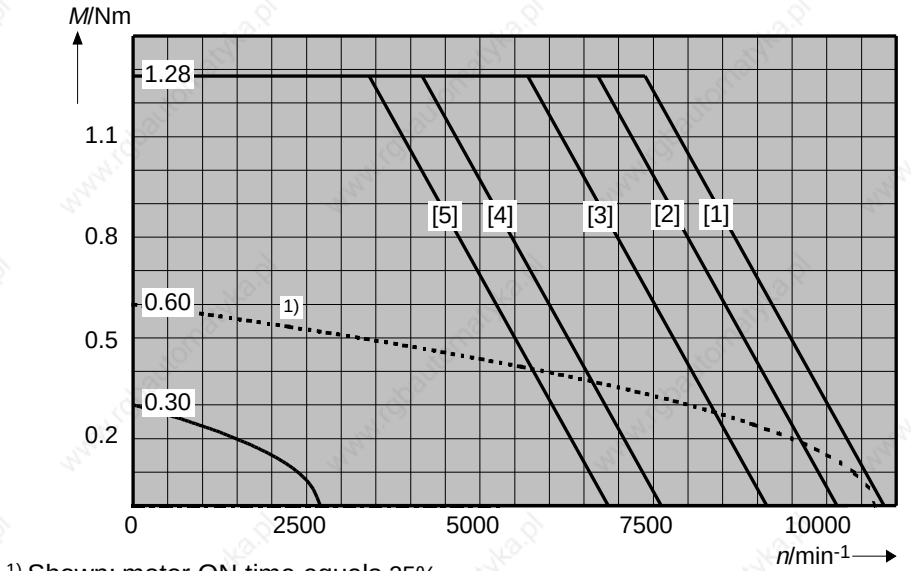
Fig 3.2: General data - MDD 021

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

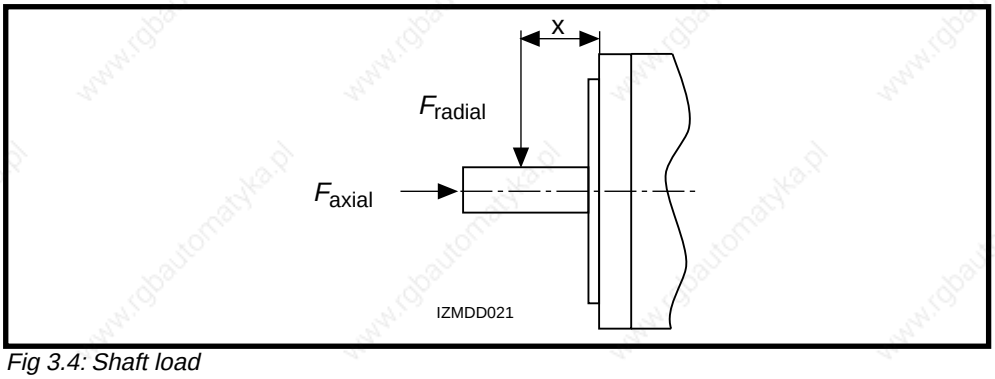


Fig 3.4: Shaft load

Permissible radial force F_{radial}

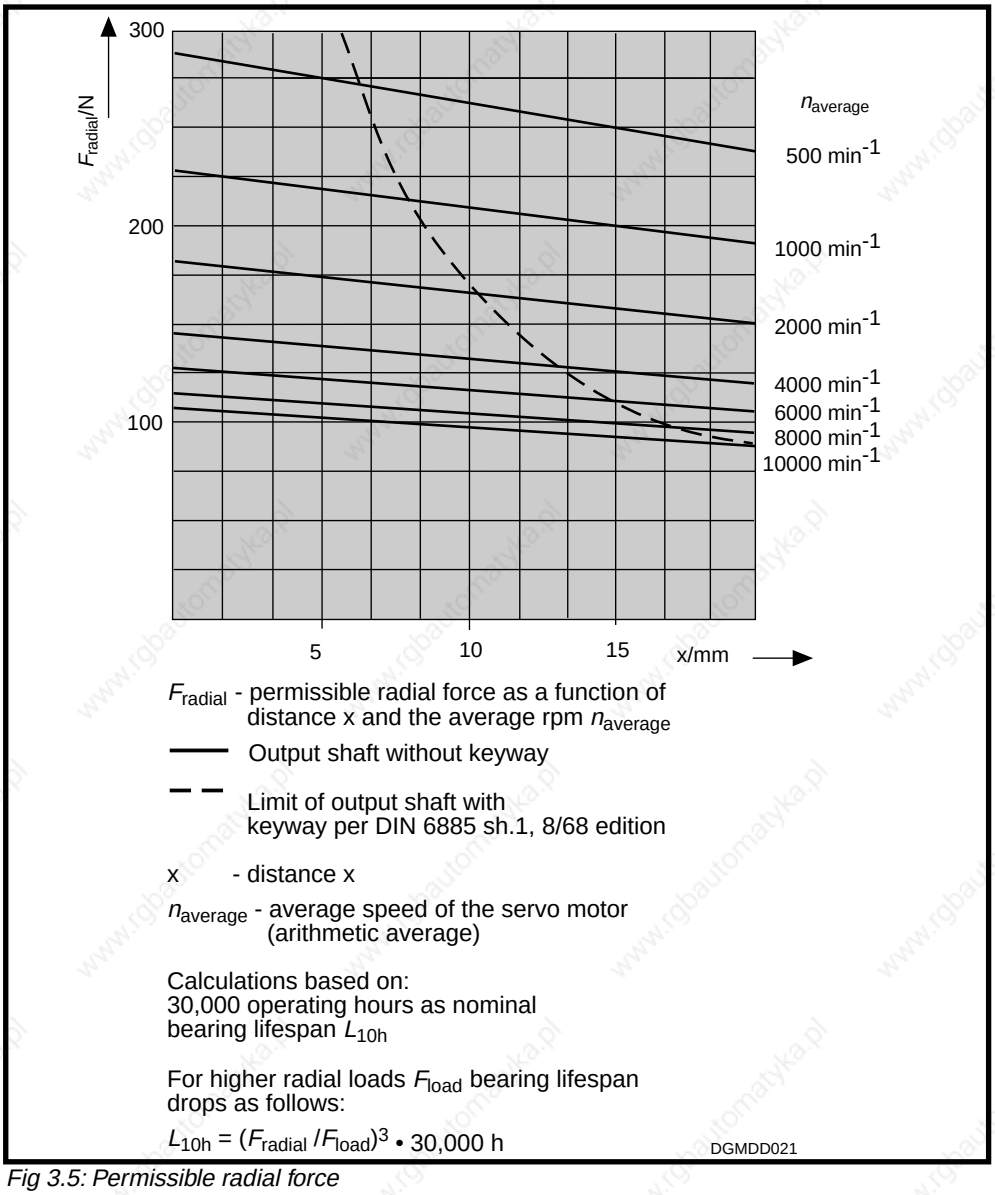


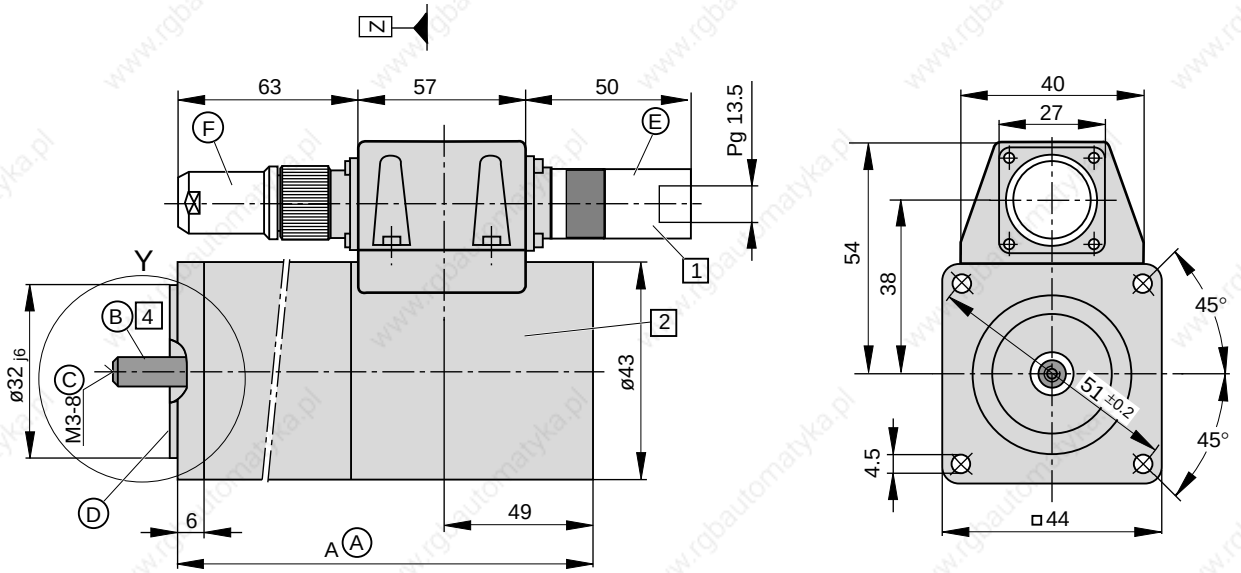
Fig 3.5: Permissible radial force

Permissible axial force F_{axial}

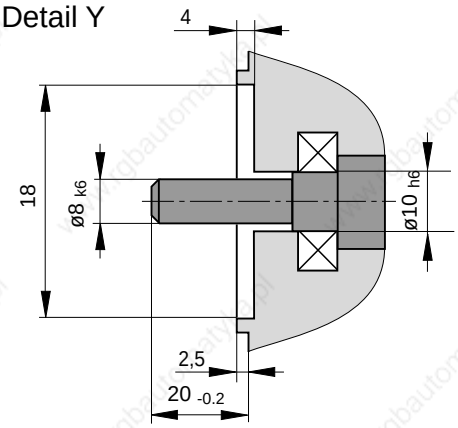
$$F_{axial} = 0.60 \cdot F_{radial}$$

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

3.4. Dimensional Data



Detail Y



Ⓐ **Dimensional table Dim. A**

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

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

Ⓒ
- 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

Ⓓ 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.

MBMDD021_1

Fig 3.6: Dimensional data - MDD 021

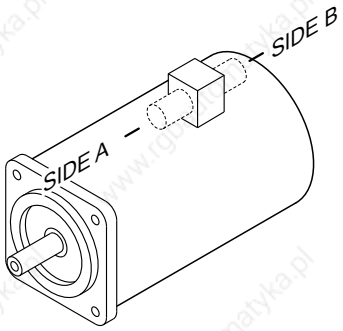
Available Options

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.



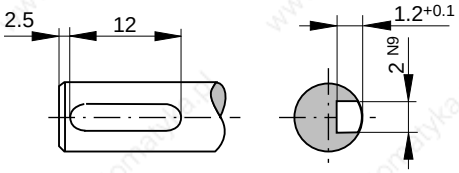
2 **Motor feedback**

- 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

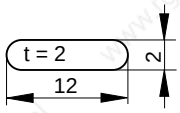


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Fig 3.7: Dimensional data - MDD 021 - selectable options

3.5. Available Versions

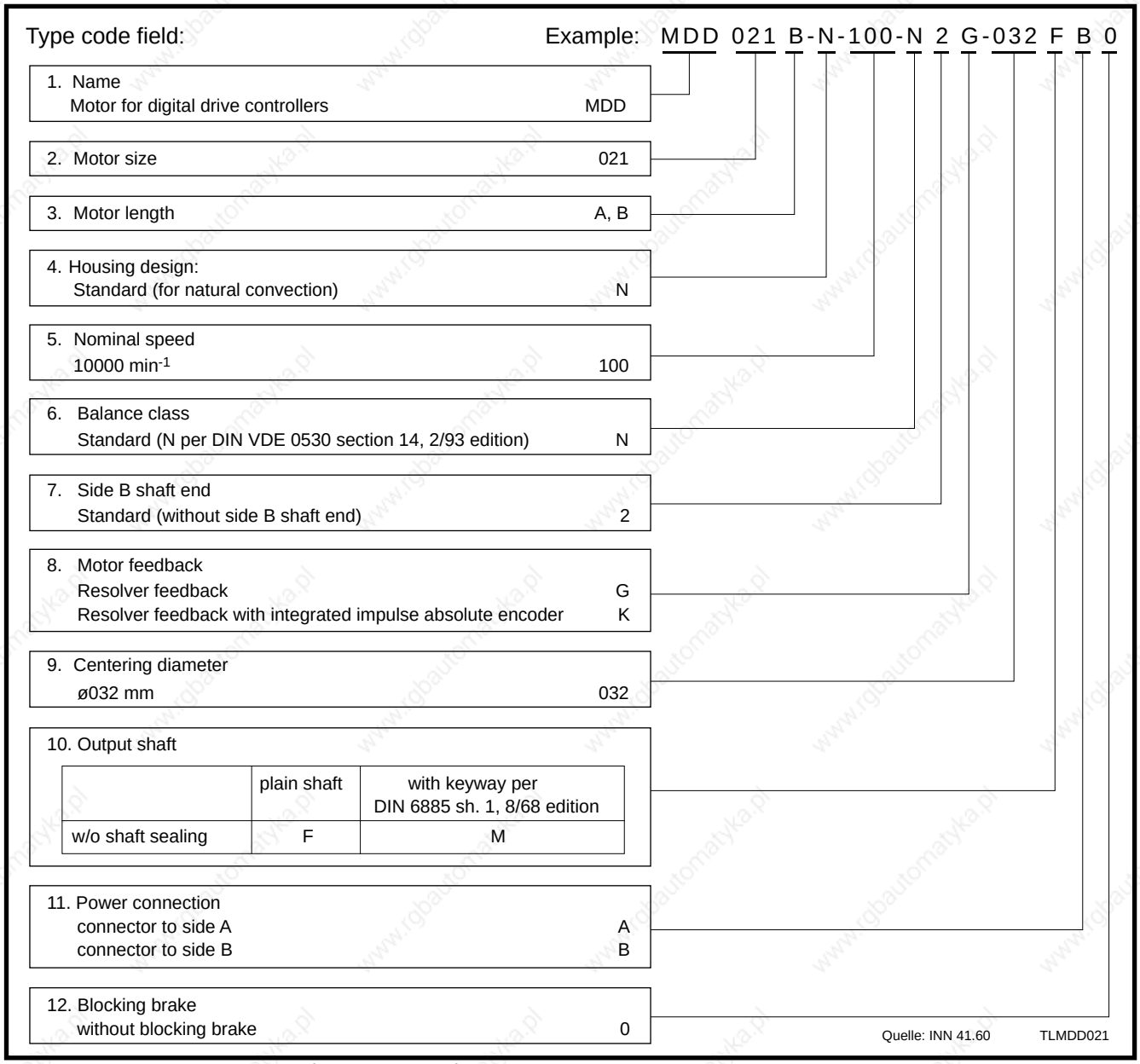

Fig 3.8: Type codes - MDD 021

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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	0.23×10^{-4}	0.32×10^{-4}	0.41×10^{-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	0.08×10^{-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.

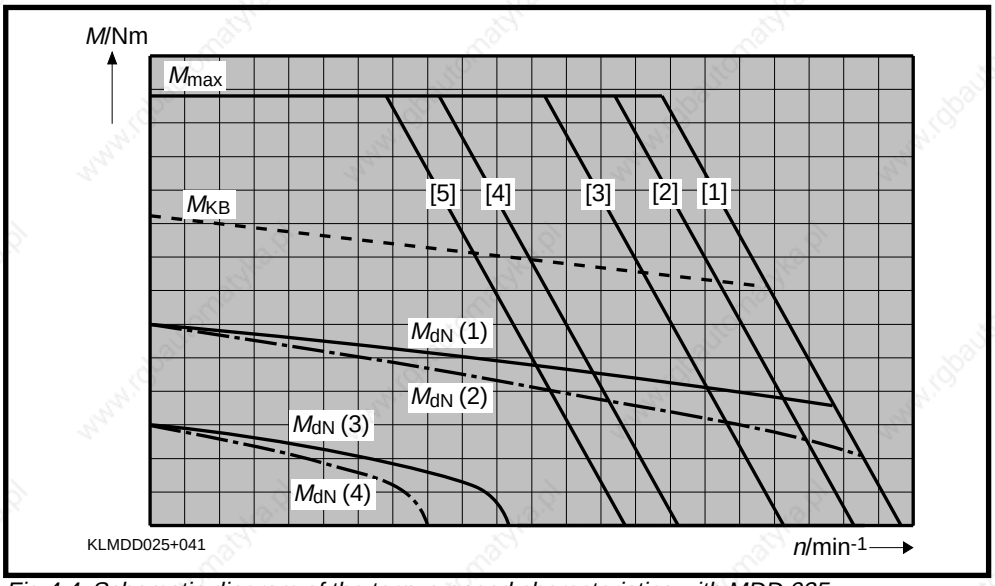


Fig 4.4: Schematic diagram of the torque-speed characteristics with MDD 025

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

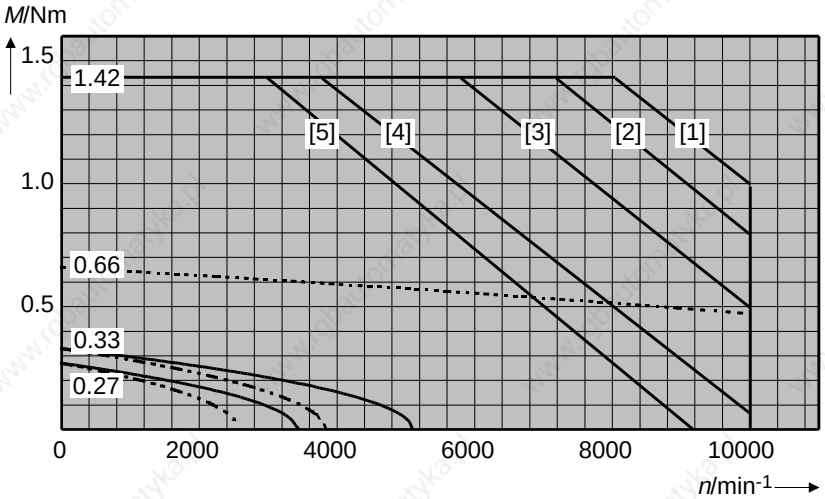
M_{dN} (2) — S1-continuous operating curve of the motor without blocking brake / with shaft sealing

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

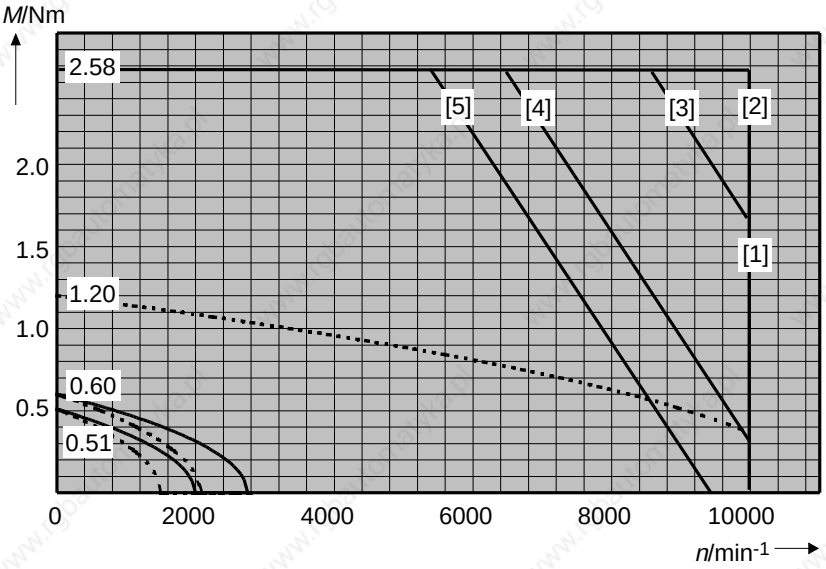
M_{dN} (4) — S1-continuous operating curve of the motor with blocking brake / with shaft sealing

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}

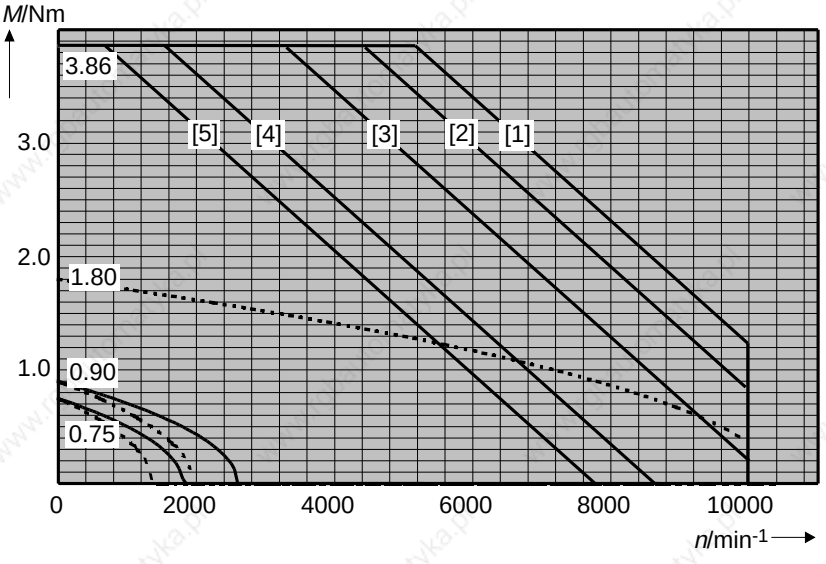


Fig 4.5: Torque-speed characteristics curves - MDD 025

4.3. Shaft Load Capacity

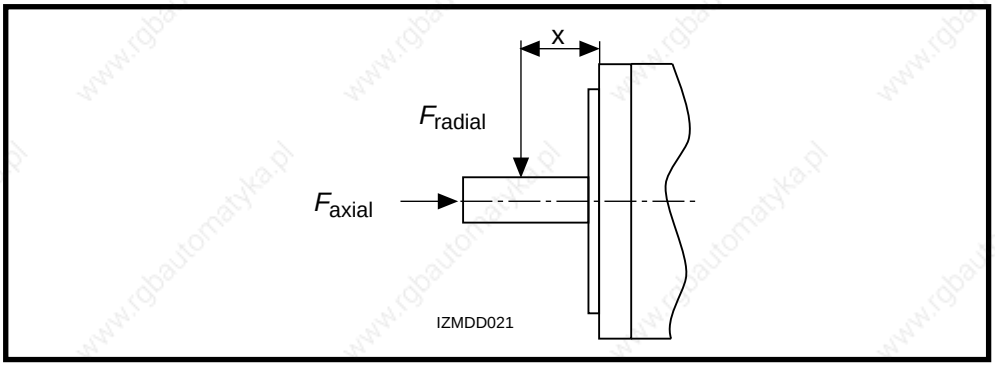


Fig 4.6: Shaft load

Permissible radial force
F_{radial}

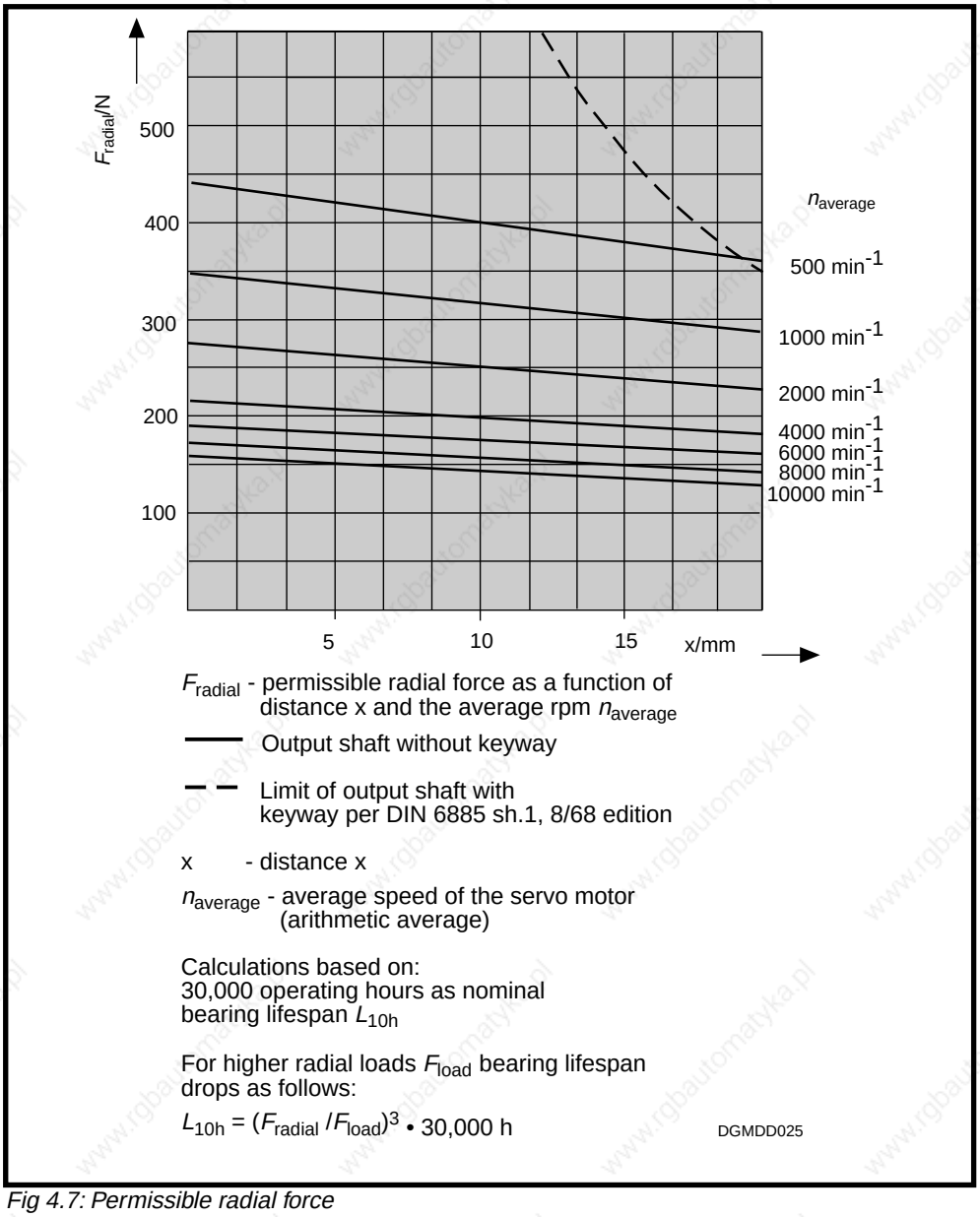


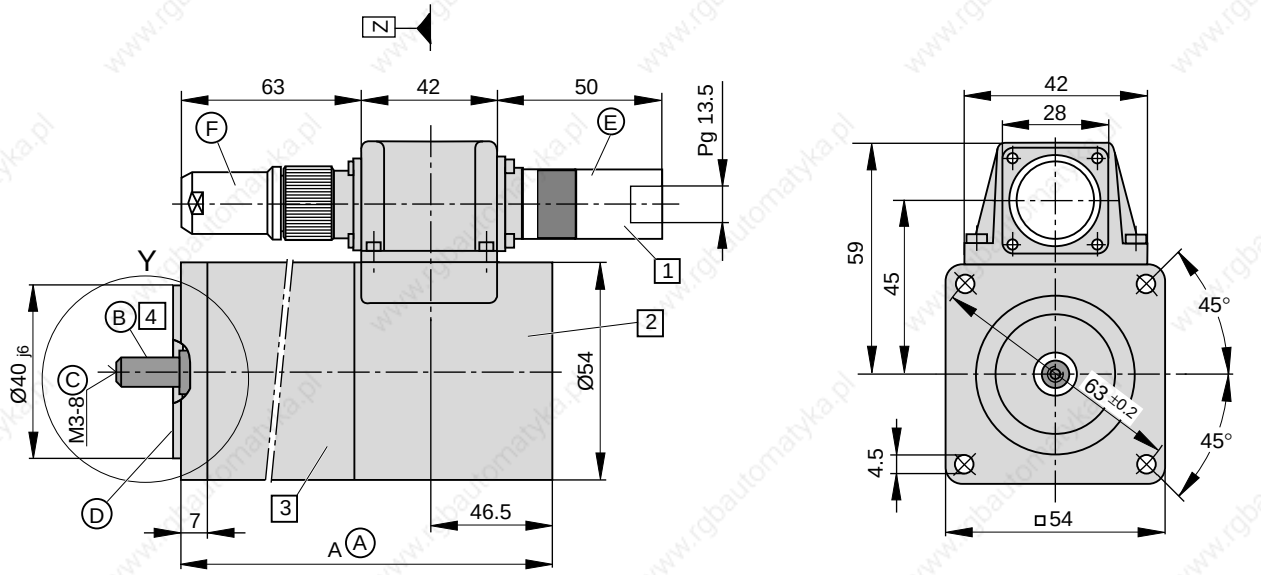
Fig 4.7: Permissible radial force

Permissible axial force
F_{axial}

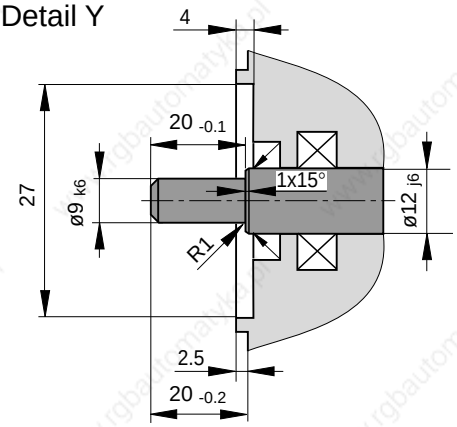
$$F_{axial} = 0.55 \bullet F_{radial}$$

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

4.4. 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: 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.

Ⓓ 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**.**

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

Ⓕ **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)

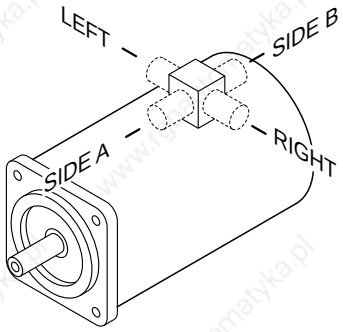
Available Options

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**

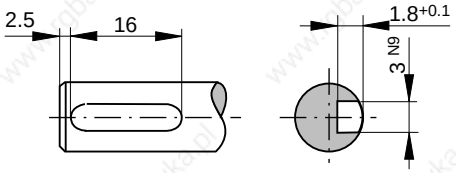
- without blocking brake
- with blocking brake: 1.0 Nm

Dimensional table for motors with blocking brake

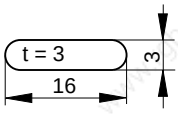
Size	Dim. A
MDD 025 A	207
MDD 025 B	244
MDD 025 C	282

4 **Output shaft**

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

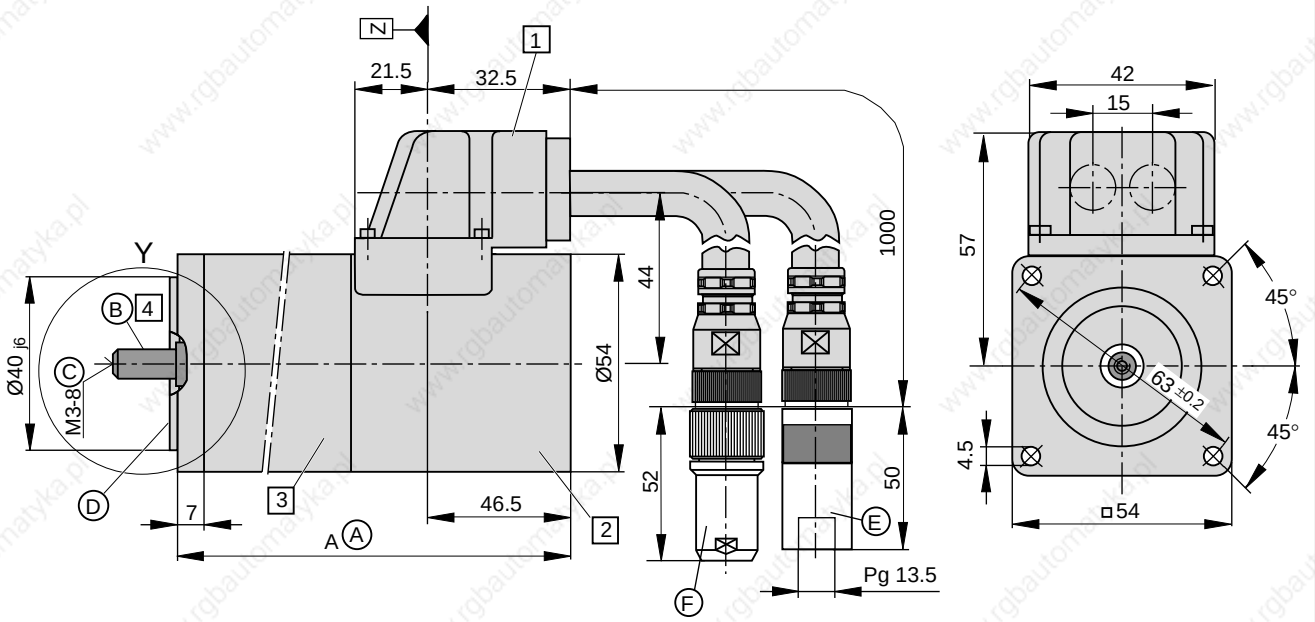


Matching key: DIN 6885-A 3 x 3 x 16

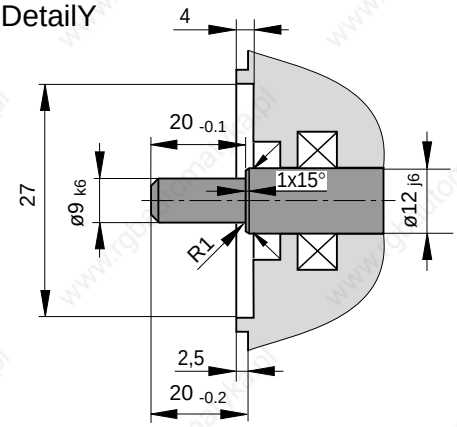


MBMDD025_2

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



DetailY



Ⓐ **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 with the respective feature.

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

Ⓒ
- 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

Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
- as per design B5 (throughholes 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_3

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

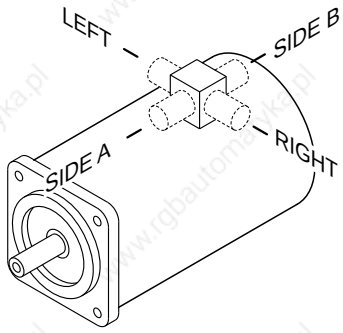
Available Options

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**

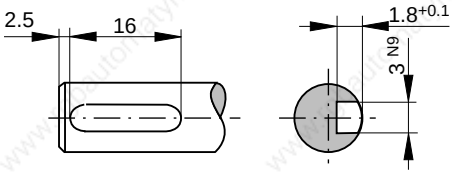
- without blocking brake
- with blocking brake: 1.0 Nm

Dimensional table for motors with blocking brake

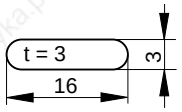
Size	Dim. A
MDD 025 A	207
MDD 025 B	244
MDD 025 C	282

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

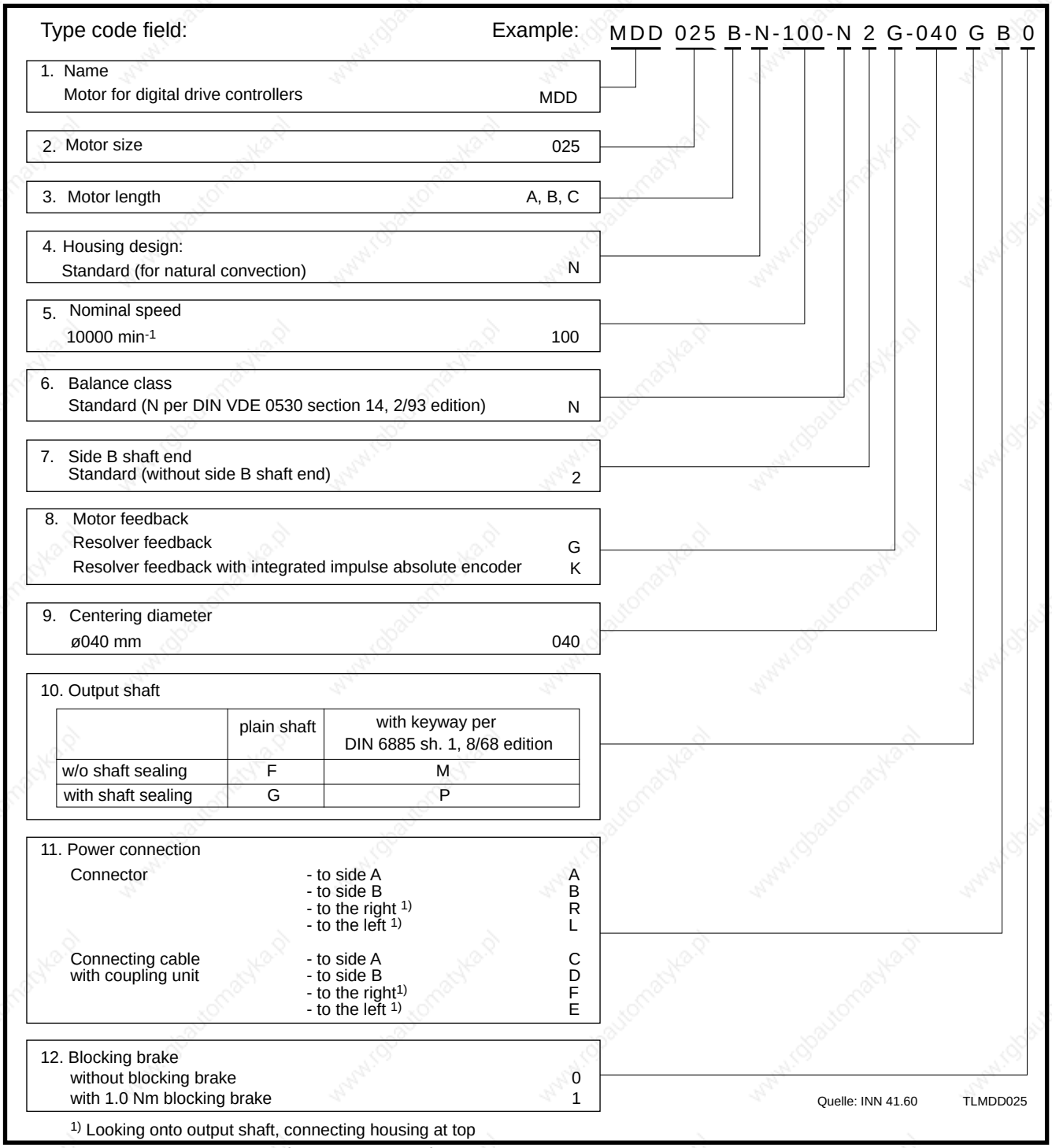


Fig 4.12: Type codes - MDD 025

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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 application**s. 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.

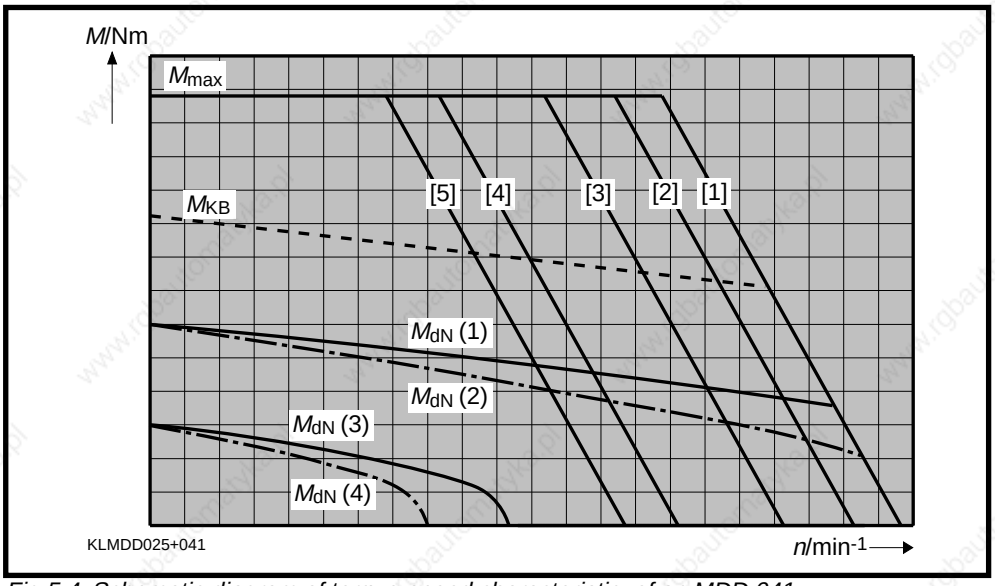


Fig 5.4: Schematic diagram of torque-speed characteristic of an MDD 041

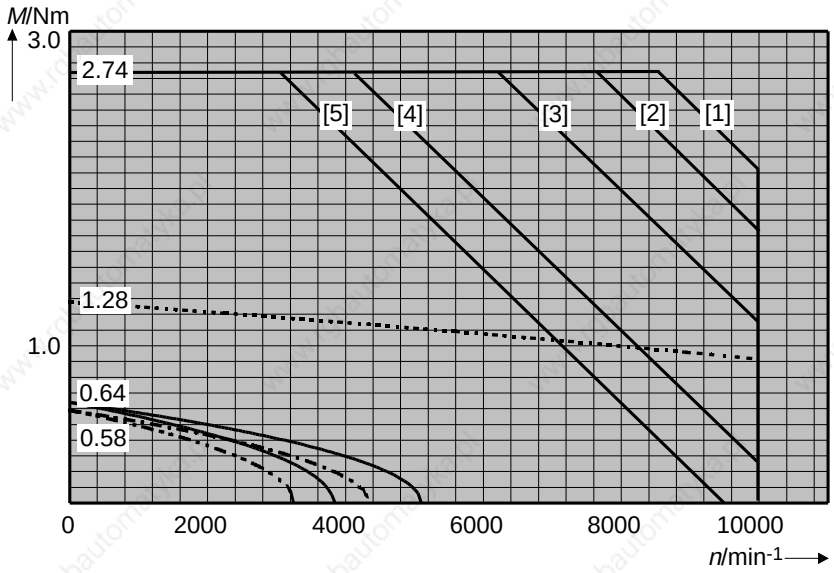
Operating curves

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).

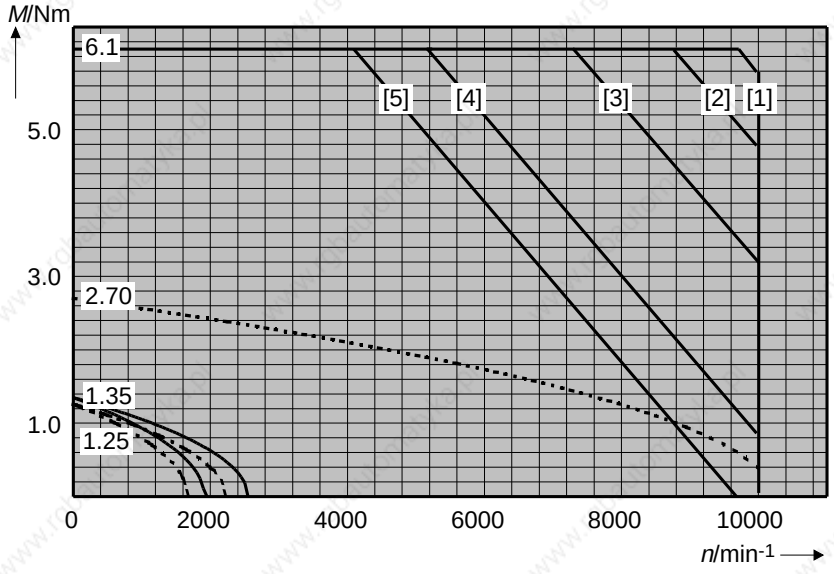
The following allocations apply:

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}

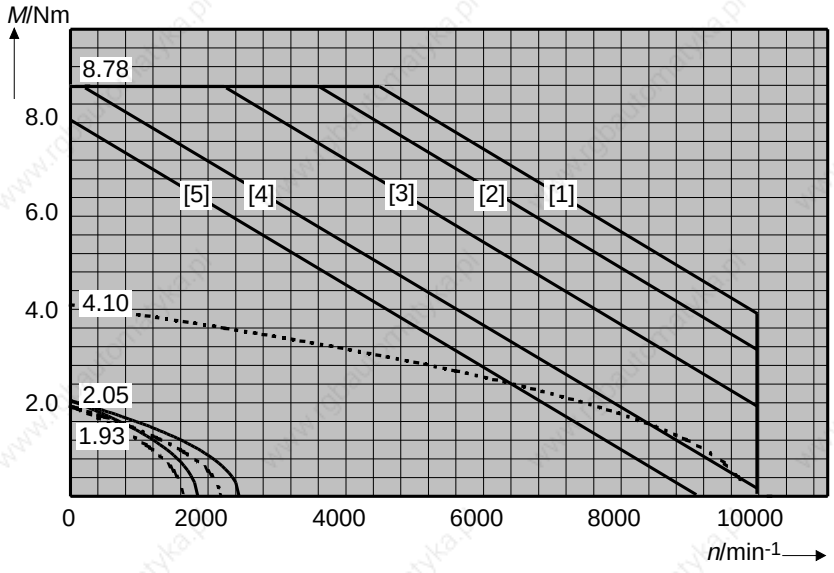


Fig 5.5: Torque-speed characteristics curves - MDD 041

5.3. Shaft Load Capacity

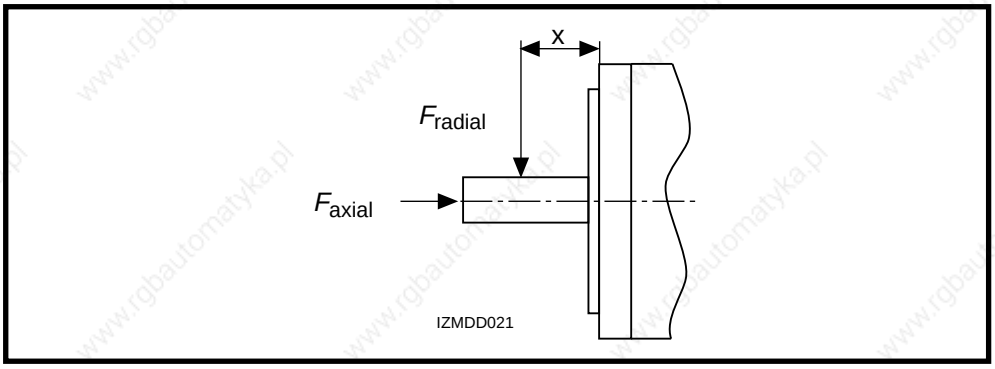


Fig 5.6: Shaft load

Permissible radial force F_{radial}

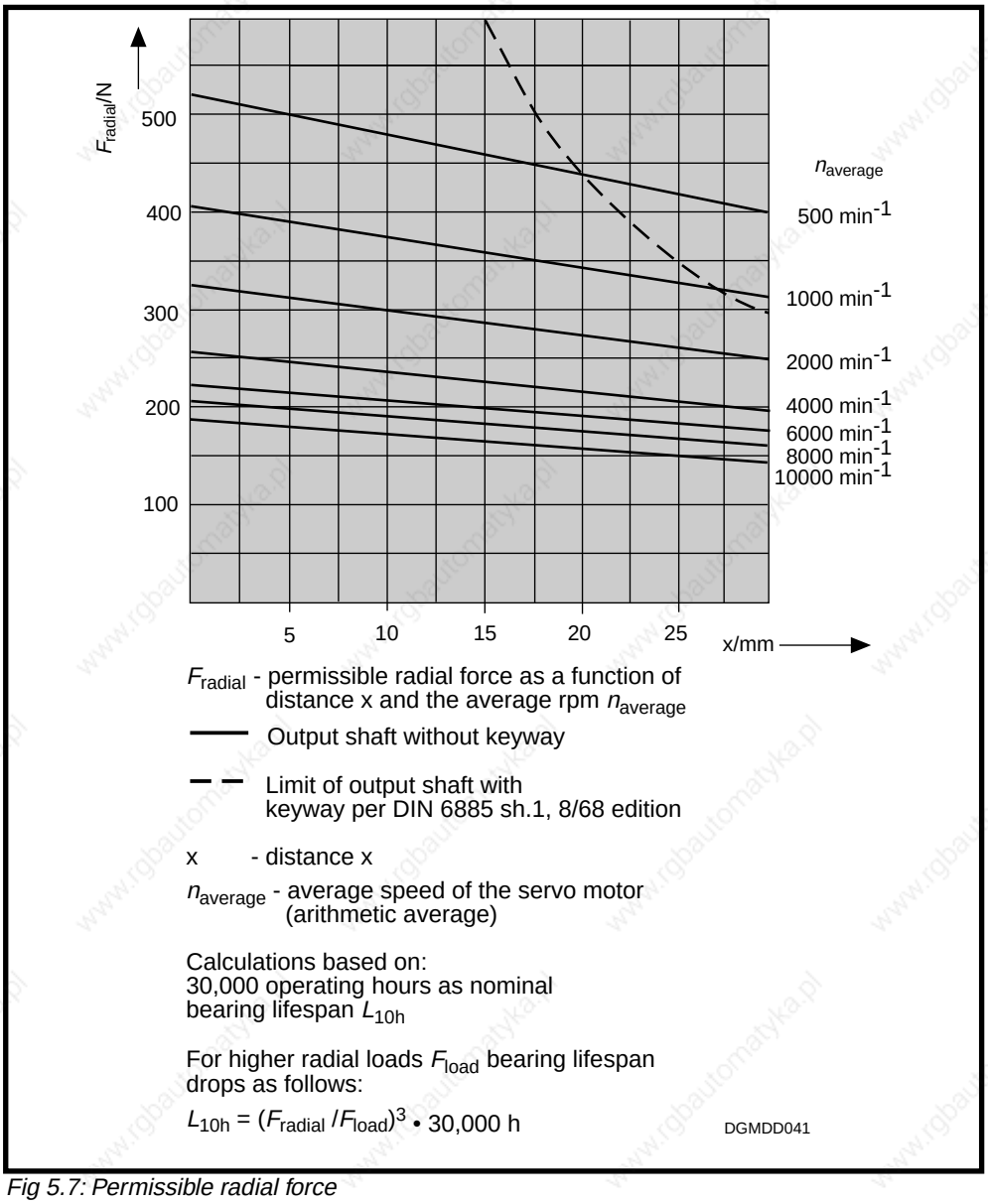


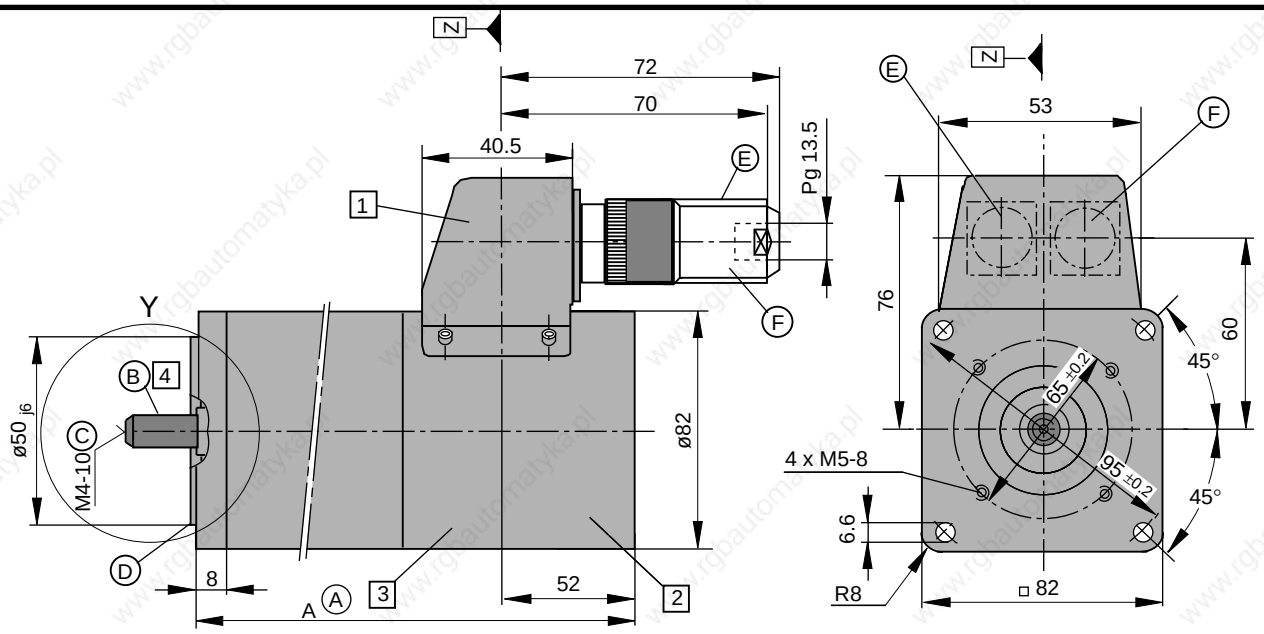
Fig 5.7: Permissible radial force

Permissible axial force F_{axial}

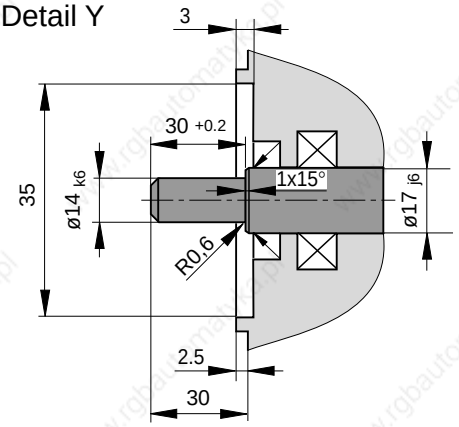
$$\boldsymbol{F_{axial} = 0.53 \bullet F_{radial}}$$

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

5.4. 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: 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)

Ⓐ **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.

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

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

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

MBMDD041_1

Fig 5.8: Dimensional data - MDD 041

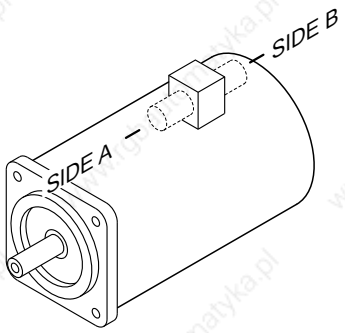
Available Options

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**

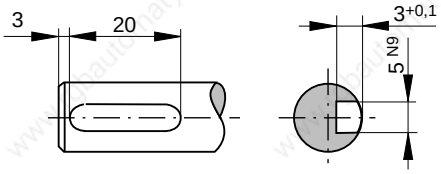
- without blocking brake
- with blocking brake: 1.0 Nm

Dimensional table for motors with blocking brake

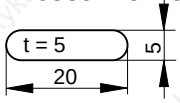
Size	Dim. A
MDD 041 A	203
MDD 041 B	233
MDD 041 C	263

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

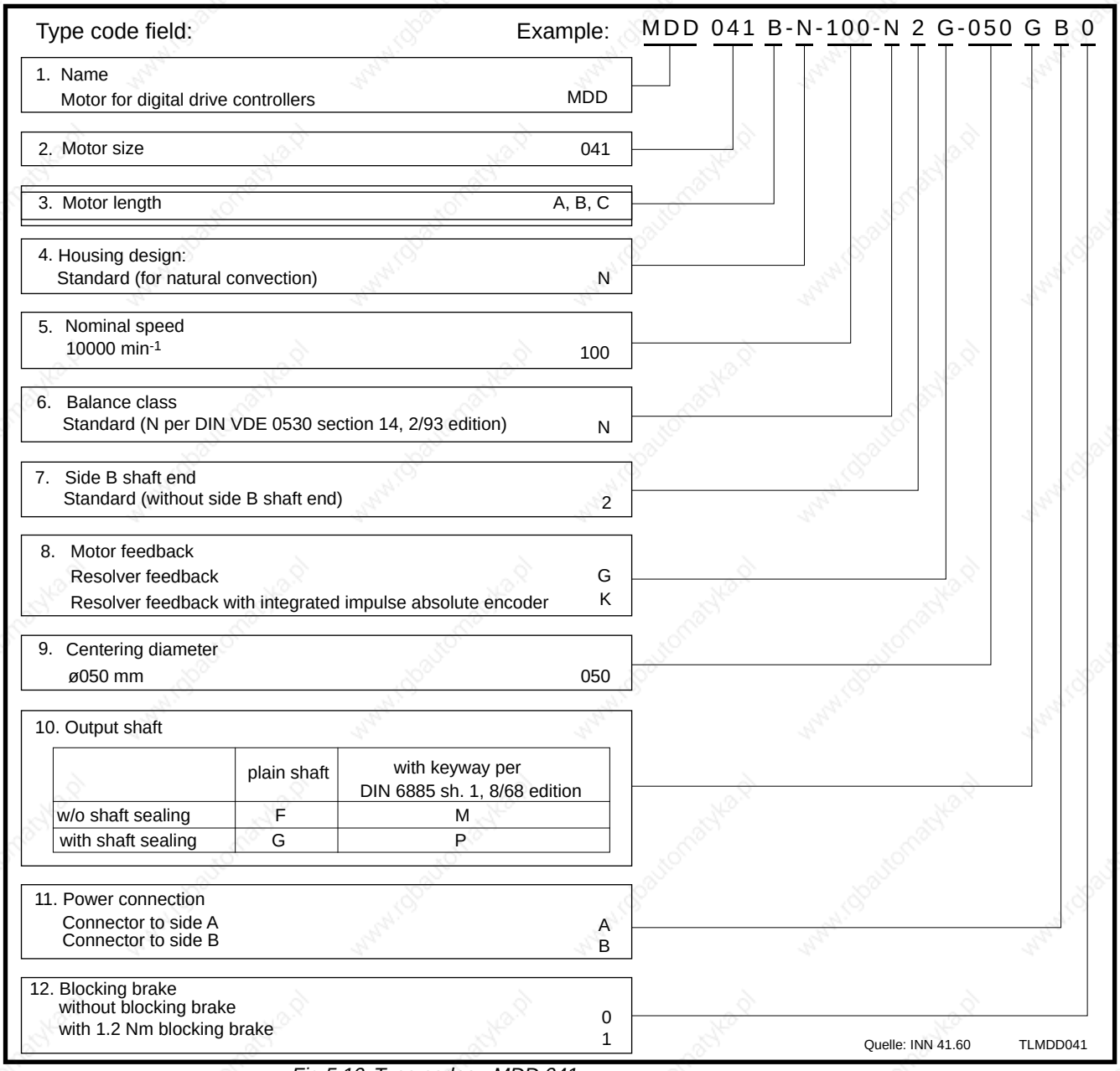


Fig 5.10: Type codes - MDD 041

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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 application**s. 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)

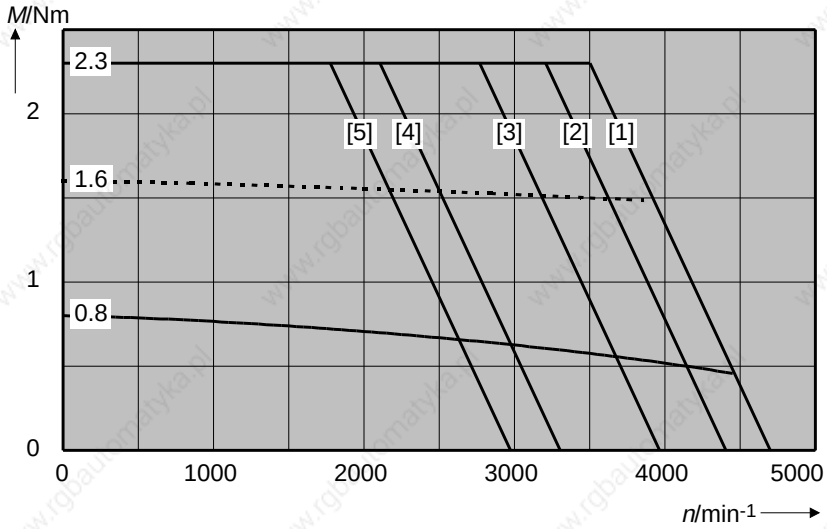
Fig 6.2: General data - MDD 065

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

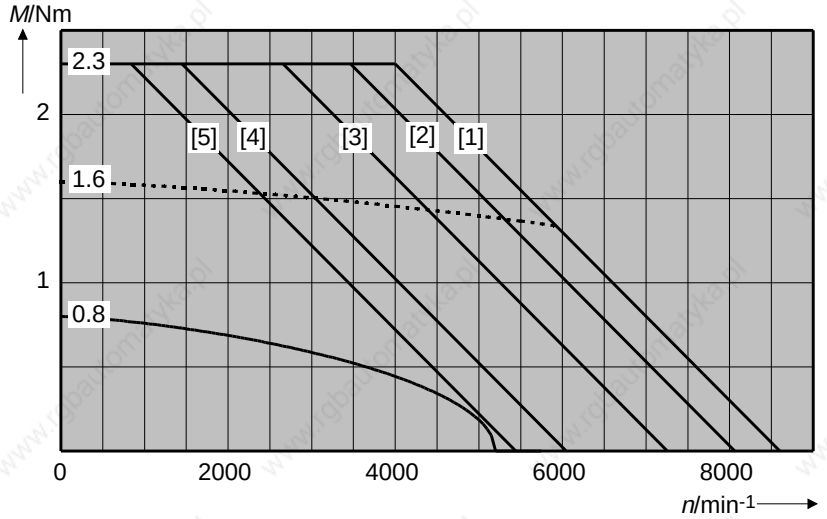
Fig 6.3: Technical data - blocking brake

6.2. Torque-Speed Characteristics

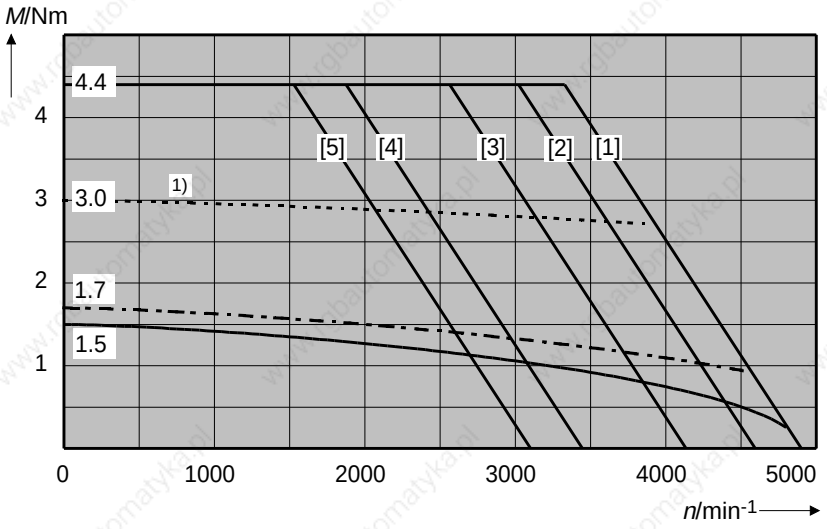
MDD 065 A at 4000 min^{-1}



MDD 065 A at 6000 min^{-1}



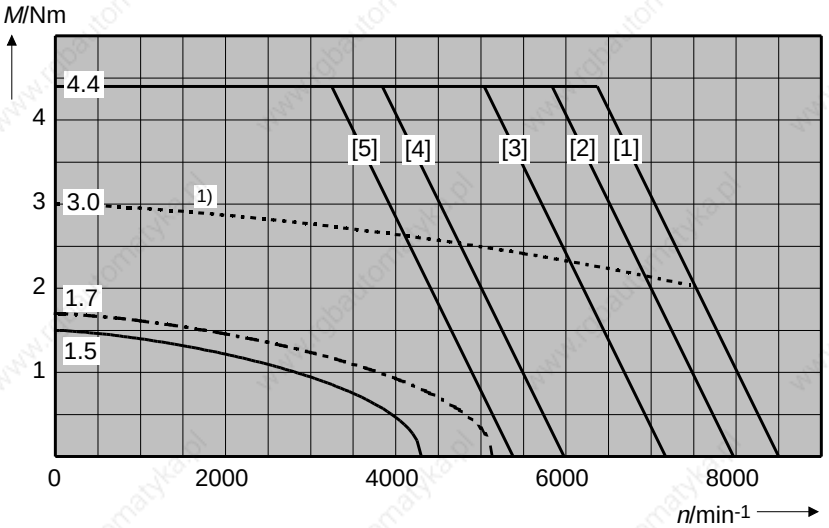
MDD 065 B at 4000 min^{-1}



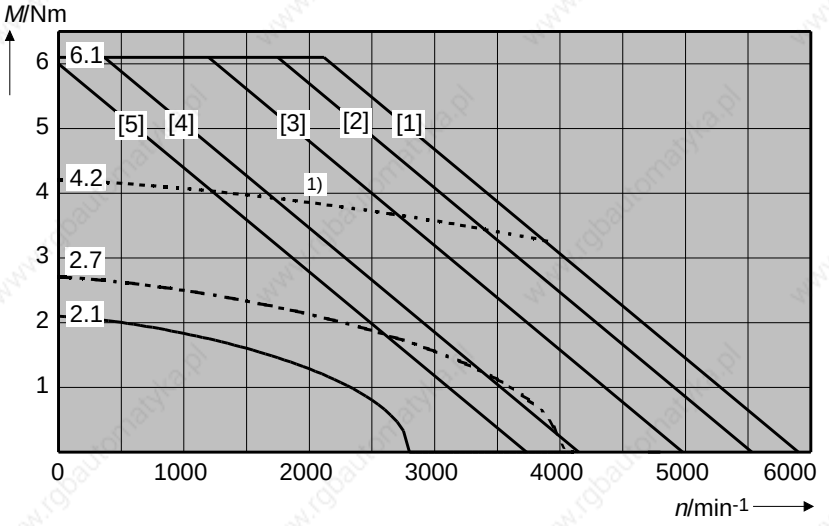
1) Shown: ON time of surface-cooled motor equals 40%.

Fig 6.4: Torque-speed characteristics curves - MDD 065

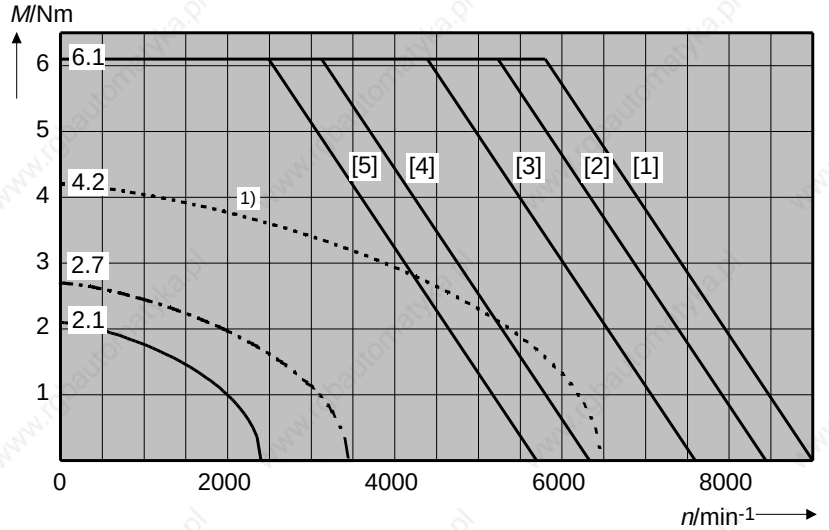
MDD 065 B at 6000 min^{-1}



MDD 065 C at 4000 min^{-1}



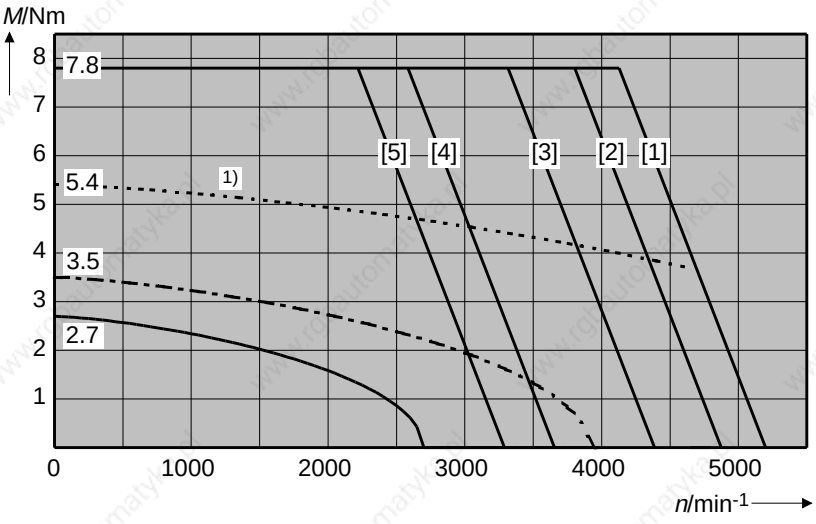
MDD 065 C at 6000 min^{-1}



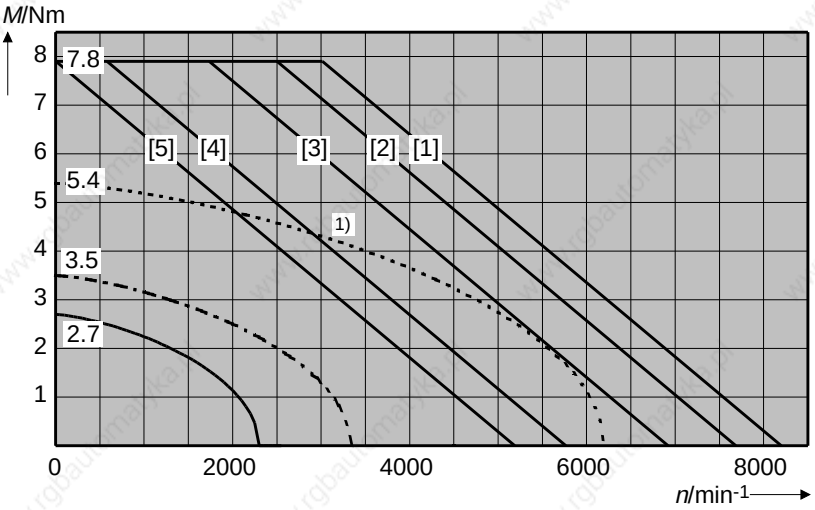
1) Shown: ON time of surface-cooled motor equals 40%.

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

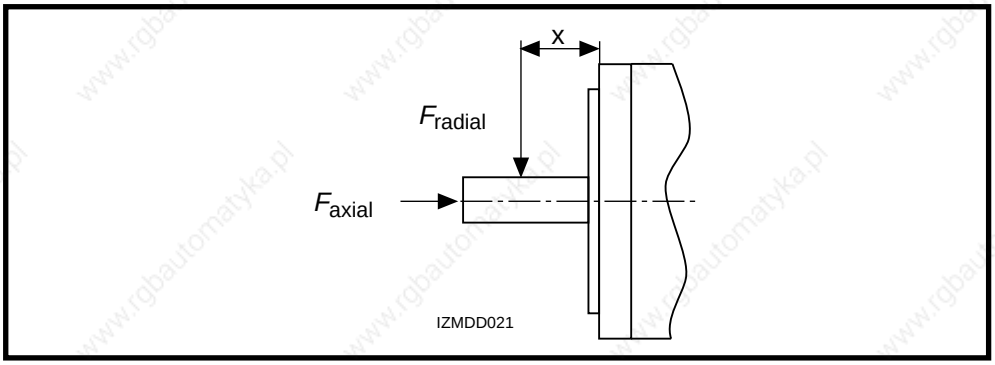


Fig 6.7: Shaft load

Permissible radial force F_{radial}

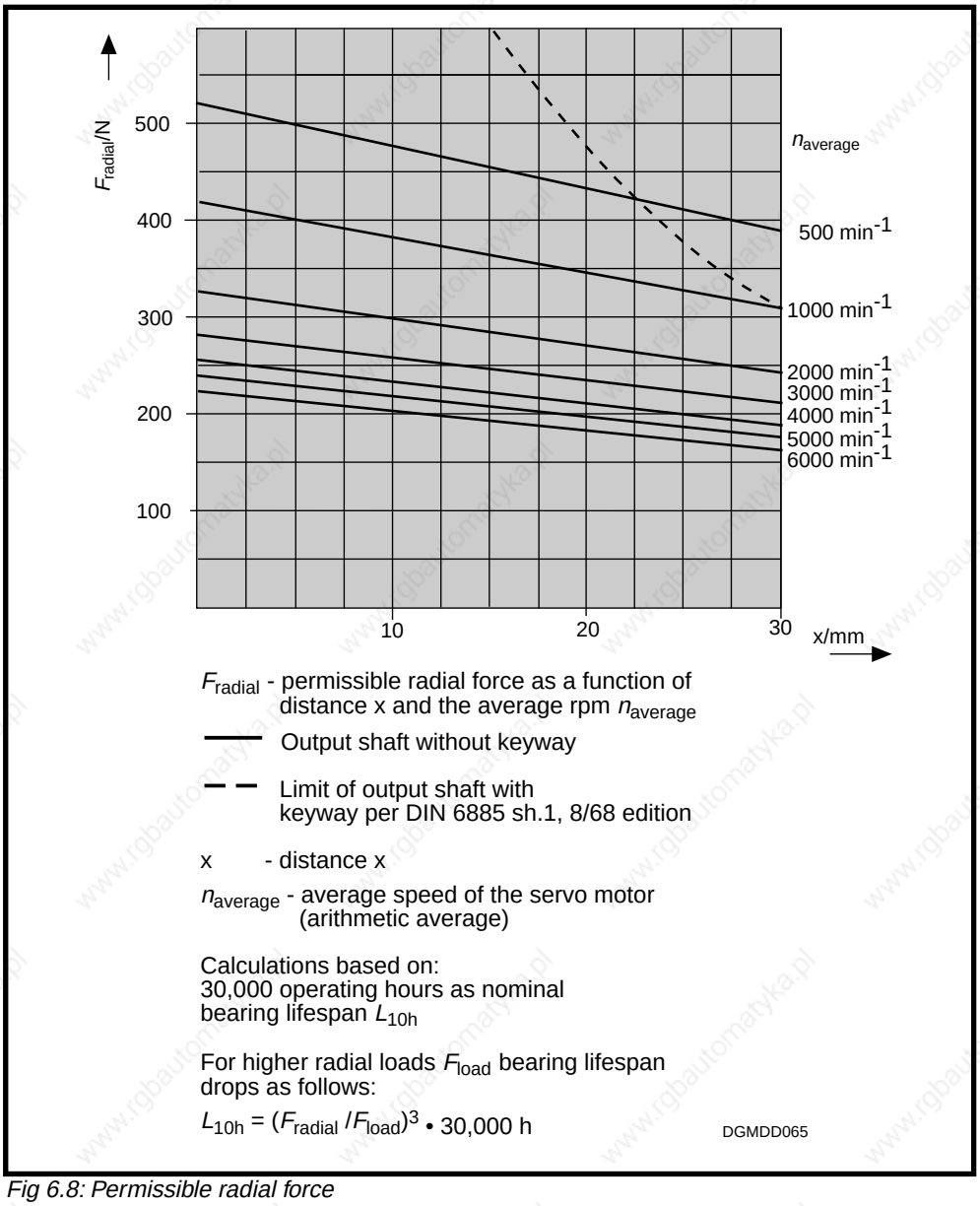


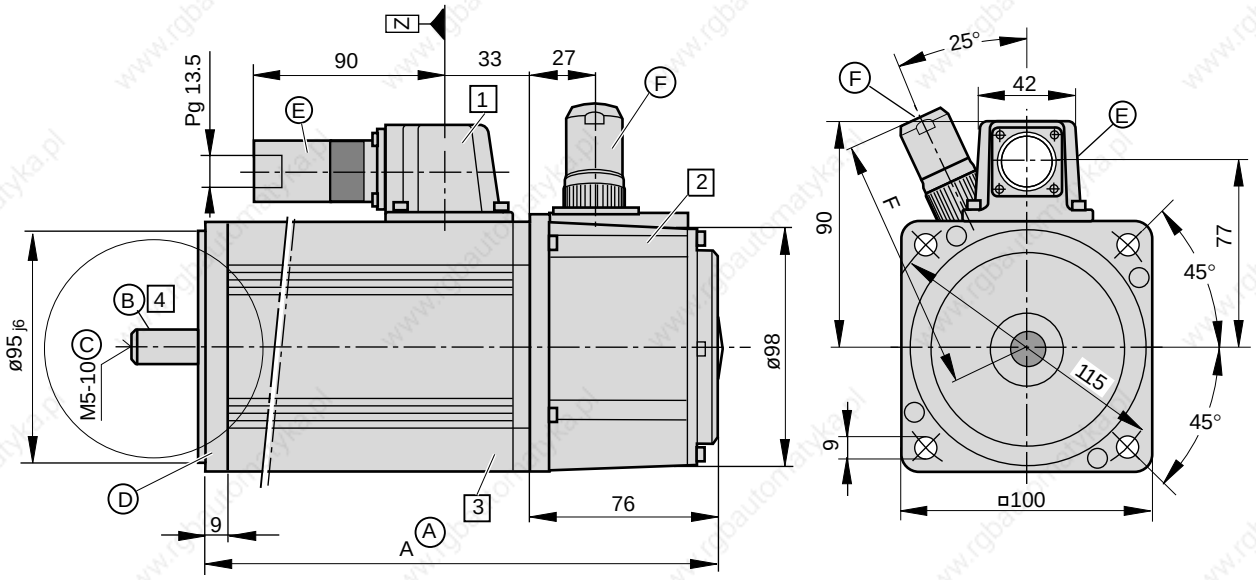
Fig 6.8: Permissible radial force

Permissible axial force F_{axial}

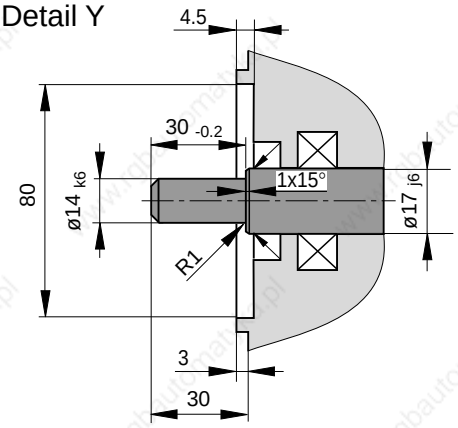
$$\boldsymbol{F_{axial} = 0.57 \cdot F_{radial}}$$

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

6.4. Dimensional Data



Detail Y



Ⓐ **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.

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

Ⓒ
- 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

Ⓓ 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.

Table of dimensions:

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

MBMDD065_1

Fig 6.9: Dimensional data - MDD 065

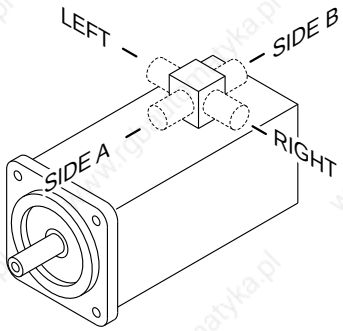
Available Options

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 multiturn absolute encoder

The dimensions are identical.

3 **Blocking brake**

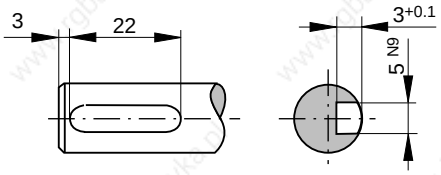
- without blocking brake
- with blocking brake: 3.0 Nm

Dimensional table for motors with blocking brake

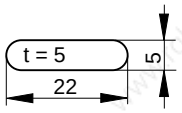
Size	Dim. A
MDD 065 A	187
MDD 065 B	202
MDD 065 C	217
MDD 065 D	232

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

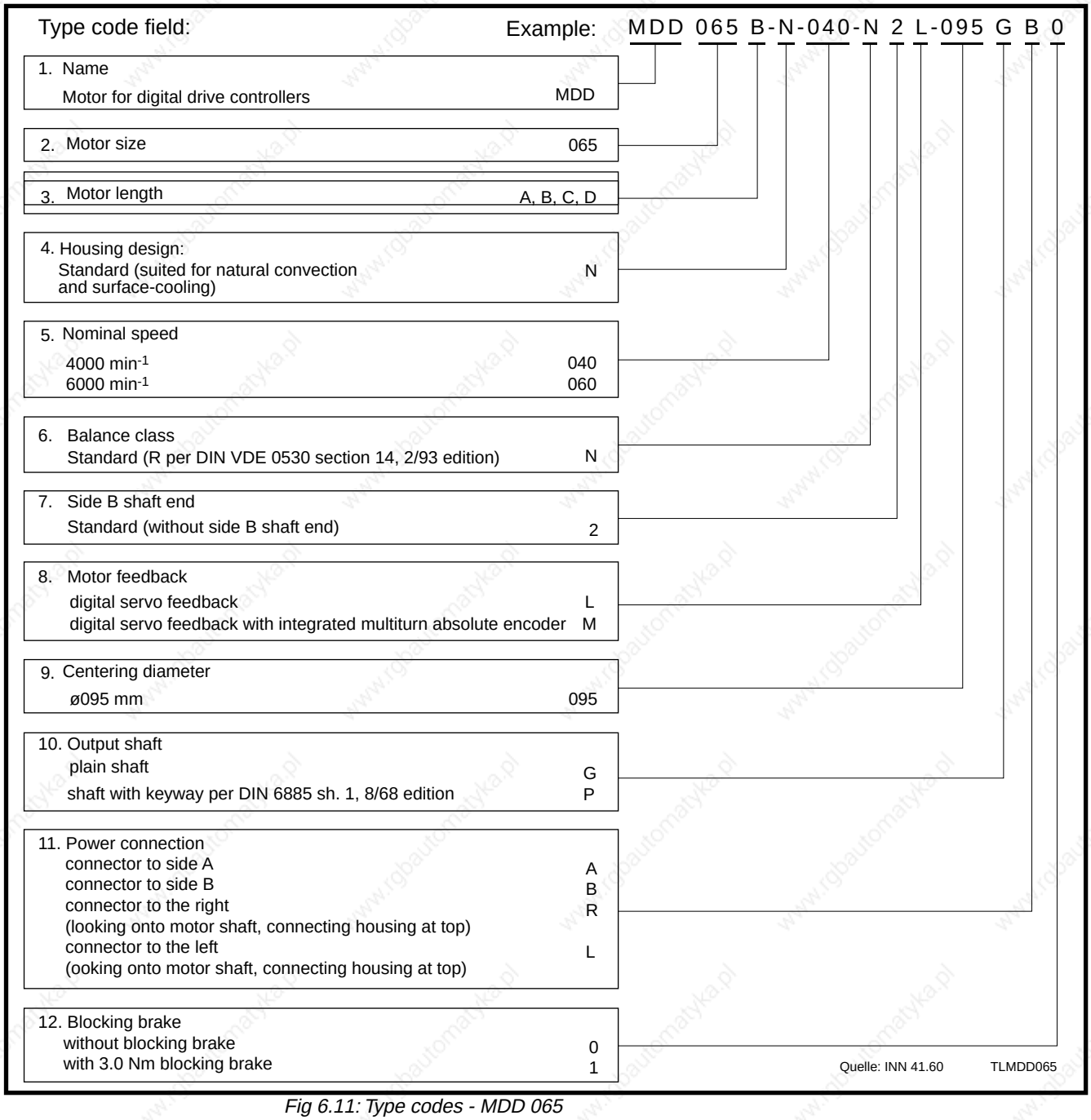


Fig 6.11: Type codes - MDD 065

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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 constante	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 charcteristics 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)

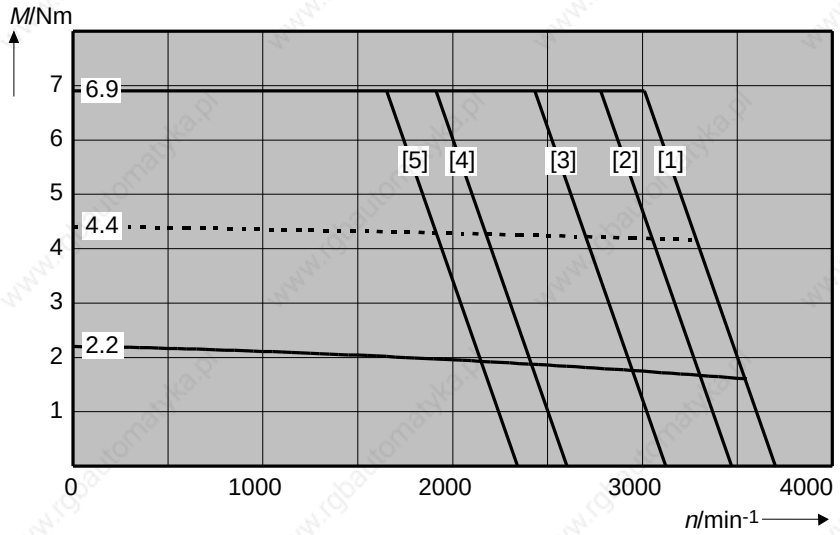
Fig 7.2: General data - MDD 071

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	0.38×10^{-4}	1.06×10^{-4}
Release delay	t_L	ms	30	60
Clamping delay	t_K	ms	15	20
Mass	m_B	kg	0.3	0.5

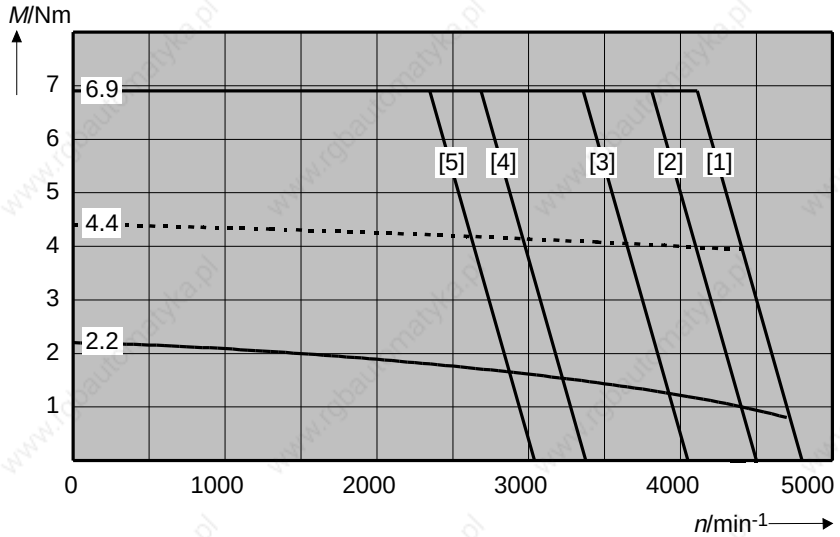
Fig 7.3: Technical data - blocking brake

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

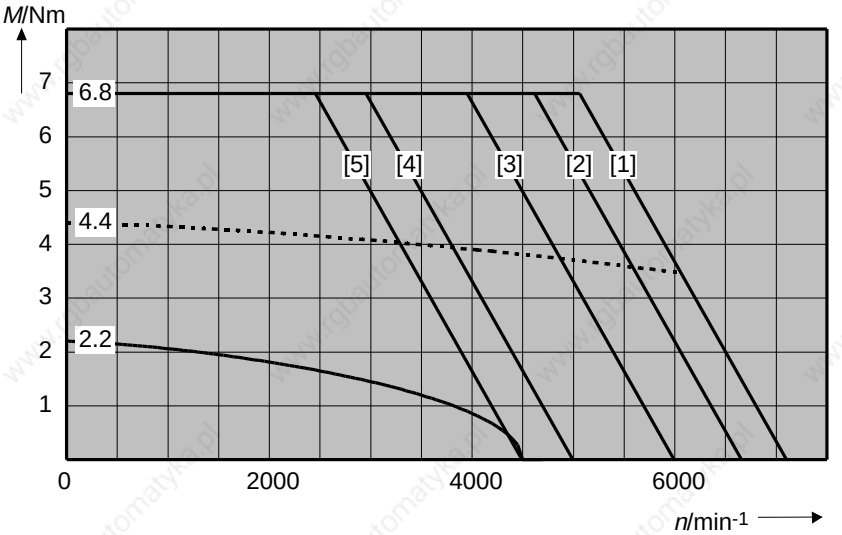
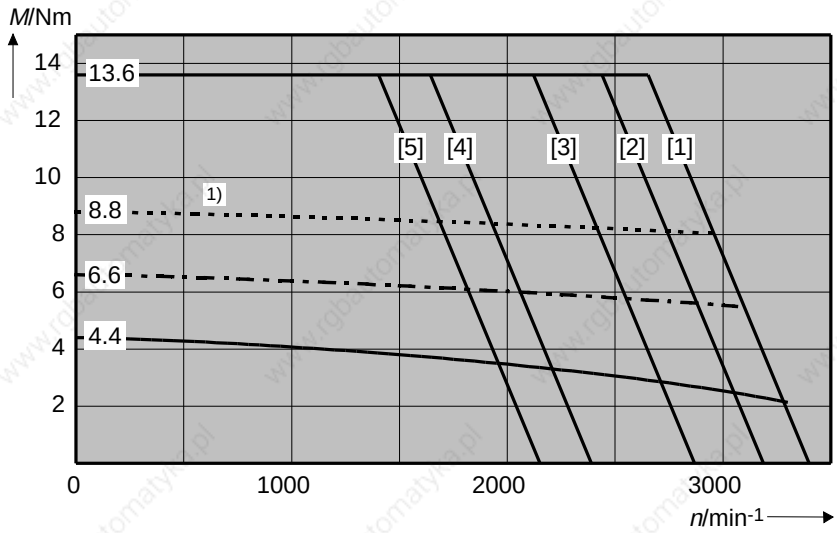
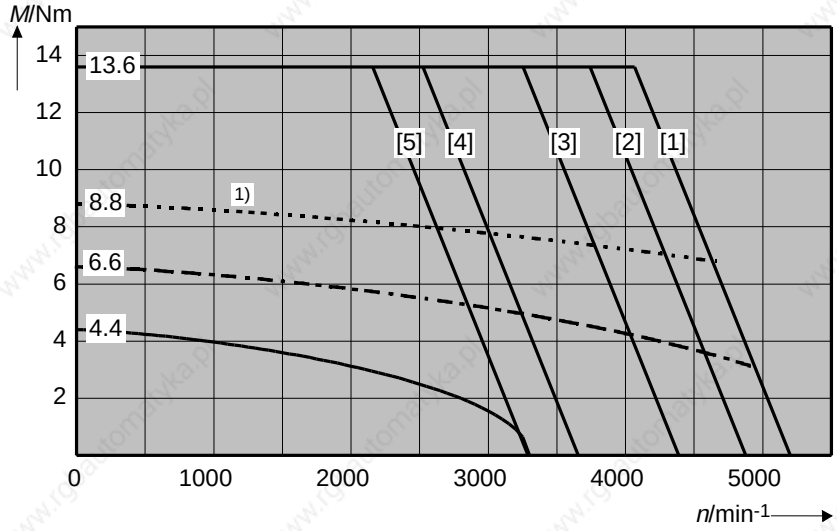


Fig 7.4: Torque-speed characteristics curves - MDD 071

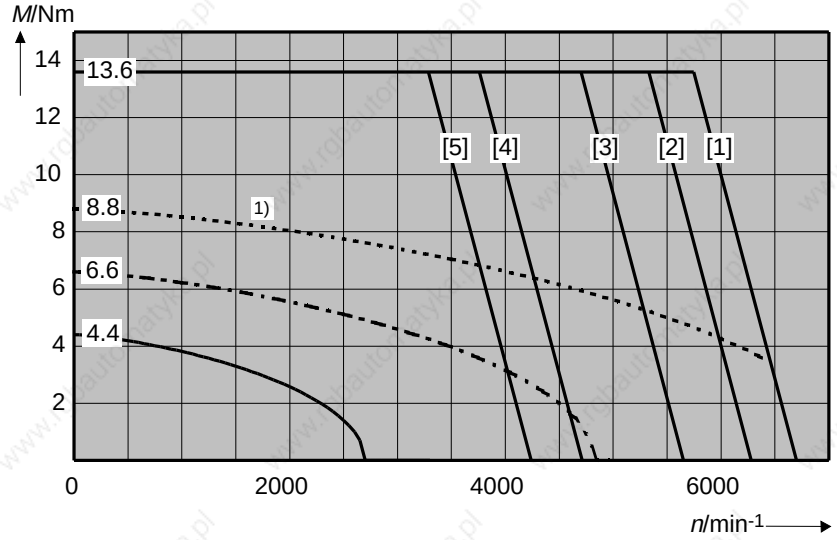
MDD 071 B at 3000 min^{-1}



MDD 071 B at 4000 min^{-1}



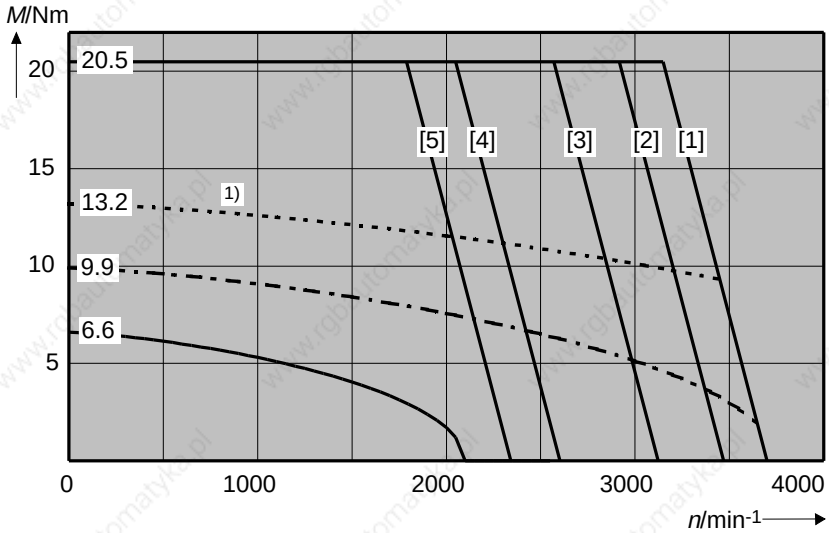
MDD 071 B at 6000 min^{-1}



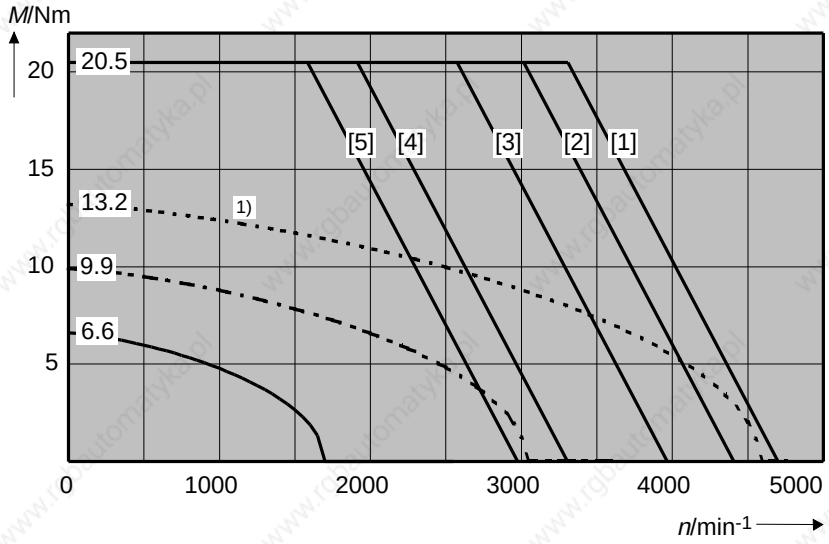
1) Shown: ON time of surface-cooled motor equals 56%.

Fig 7.5: Torque-speed characteristics curves - MDD 071

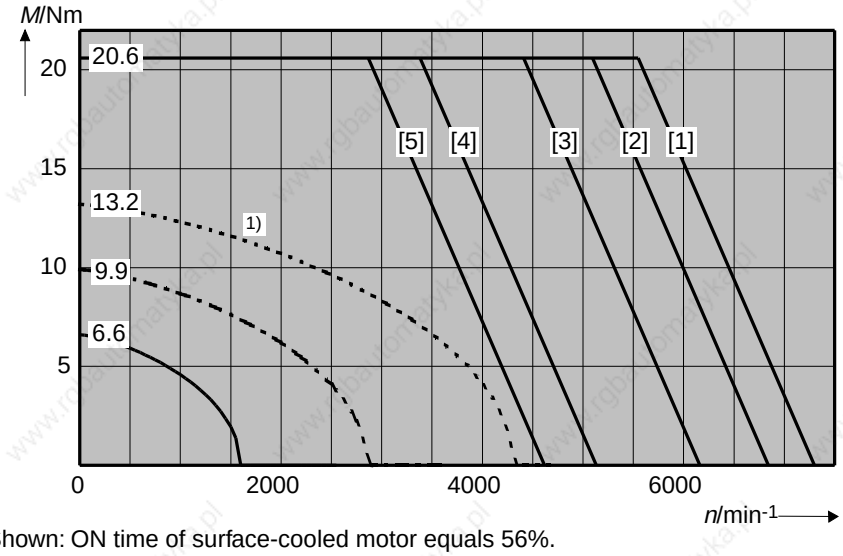
MDD 071 C at 3000 min^{-1}



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

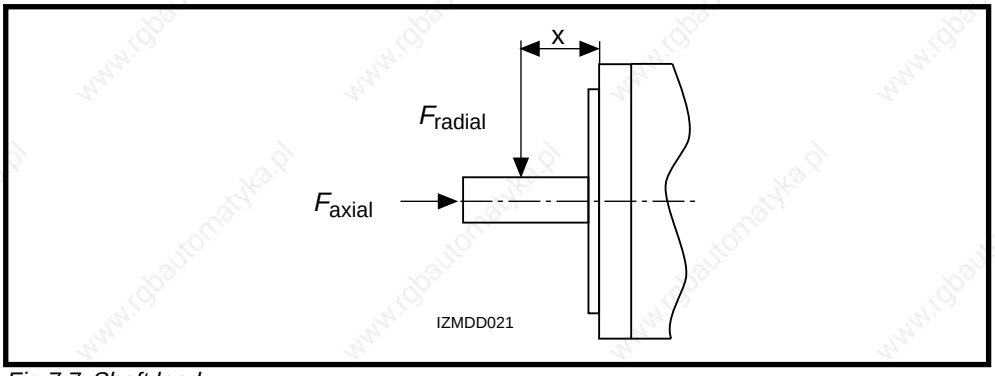


Fig 7.7: Shaft load

Permissible radial force
F_{radial}

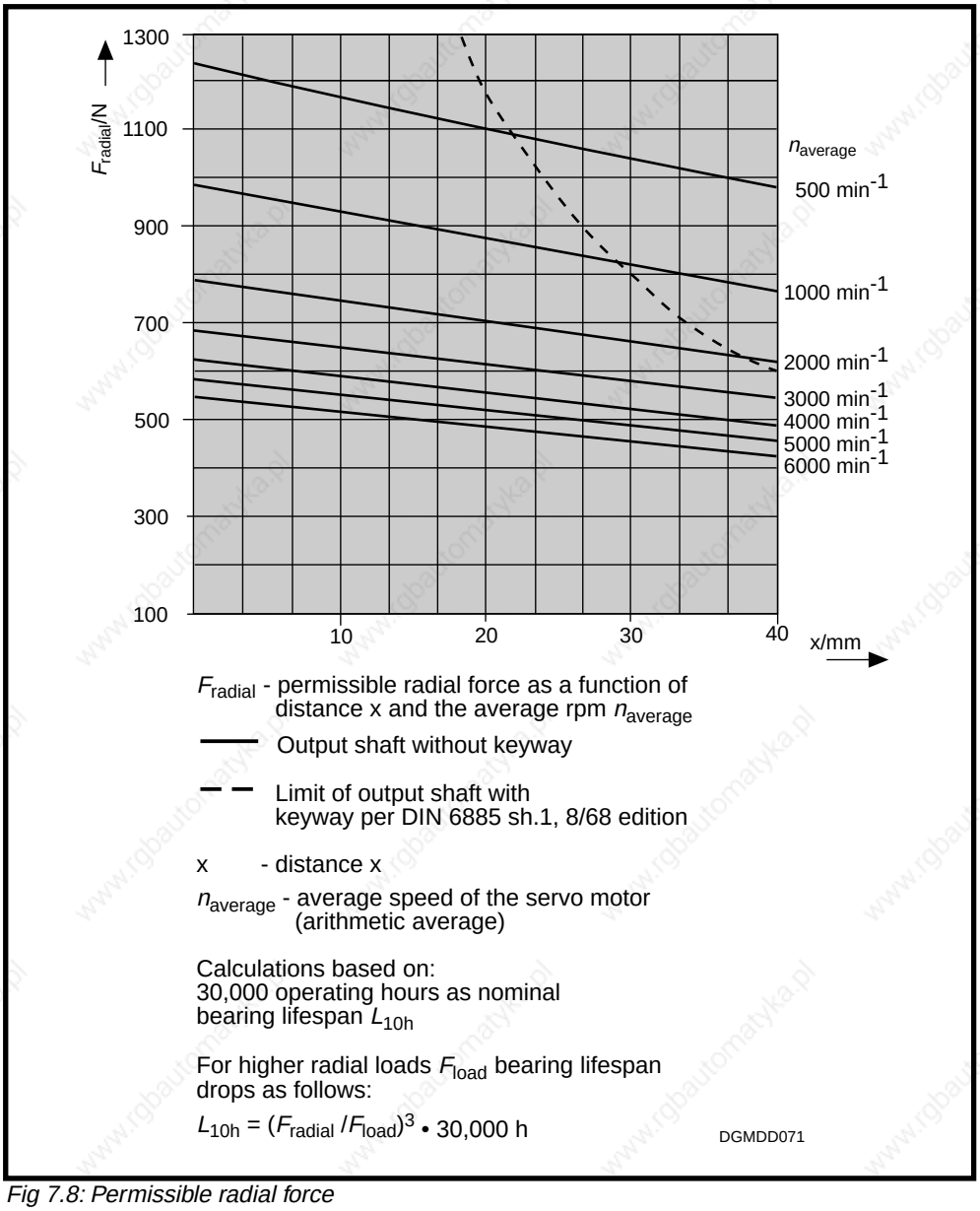


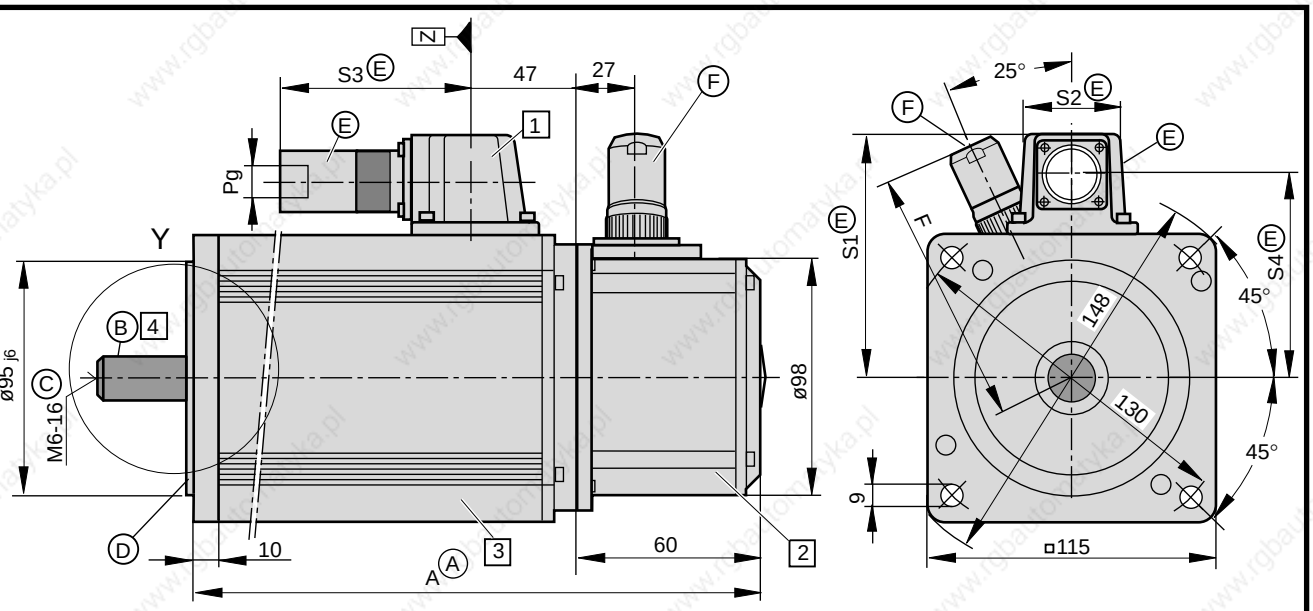
Fig 7.8: Permissible radial force

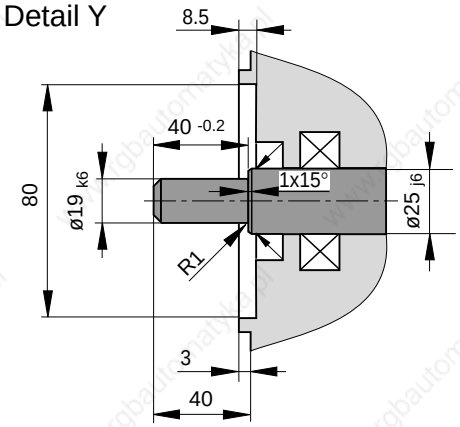
Permissible axial force
F_{axial}

$$\boldsymbol{F_{axial} = 0.50 \bullet F_{radial}}$$

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

7.4. Dimensional Data





Ⓐ **Dimensional table Dim. A**

Size	Dim. A [1]
MDD 071 A	208
MDD 071 B	248
MDD 071 C	288

[1] Bigger with some options. The then applicable dimensions indicated with respective feature.

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

Ⓒ
- 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: 2 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)

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

Table of Dimensions

Type \ Dim	S1	S2	S3	S4	Pg
INS 252 [3]	98	42	130	84	13,5
INS 108 [2]	112	45	110	94	21

[2] with MDD 071 B-N-040, MDD 071 B-N-060, MDD 071 C-N-030, MDD 071 C-N-040, MDD 071 C-N-060

[3] other MDD 071

Ⓕ **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 INS 512	110 112
angle conn.	INS 511 INS 510	108

MBMDD071_1

Fig 7.9: Dimensional data - MDD 071

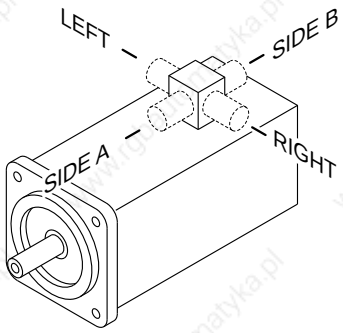
Available Options

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

} The dimensions are identical.

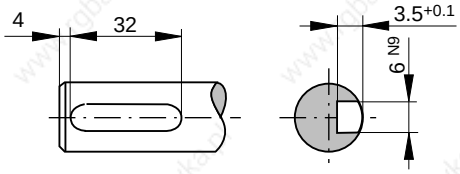
- with blocking brake: 6.5 Nm

Dimensional table for motor with blocking brake: 6.5 Nm

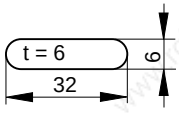
Size	Dim. A
MDD 071 A	236
MDD 071 B	276
MDD 071 C	316

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

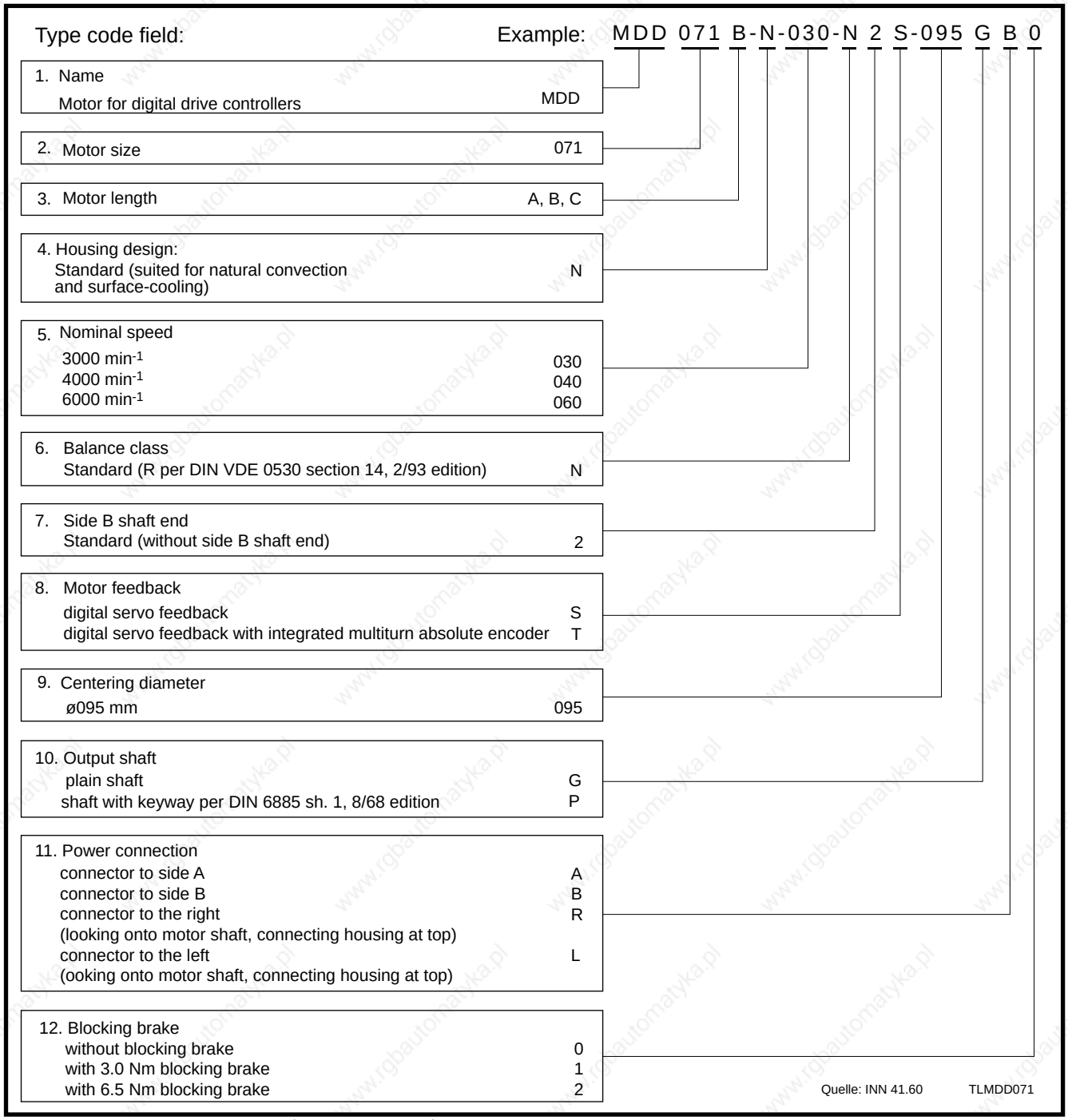


Fig 7.11: Type codes - MDD 071

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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	20×10^{-4}	36×10^{-4}	53×10^{-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	20×10^{-4}	36×10^{-4}	53×10^{-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	20×10^{-4}	36×10^{-4}	53×10^{-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

[11] 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 charcteristics 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)

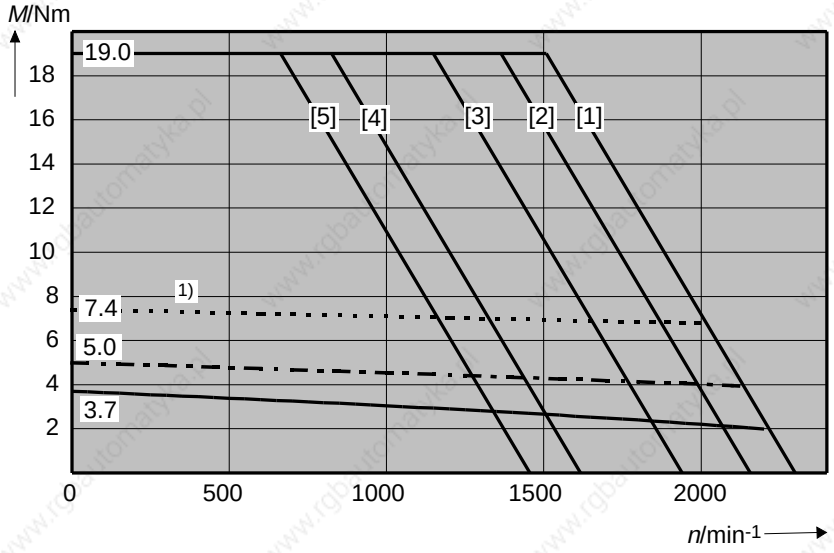
Fig 8.2: General data MDD 090

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	1.06×10^{-4}	1.06×10^{-4}
Release delay	t_L	ms	60	60
Clamping delay	t_K	ms	20	20
Mass	m_B	kg	0.5	0.5

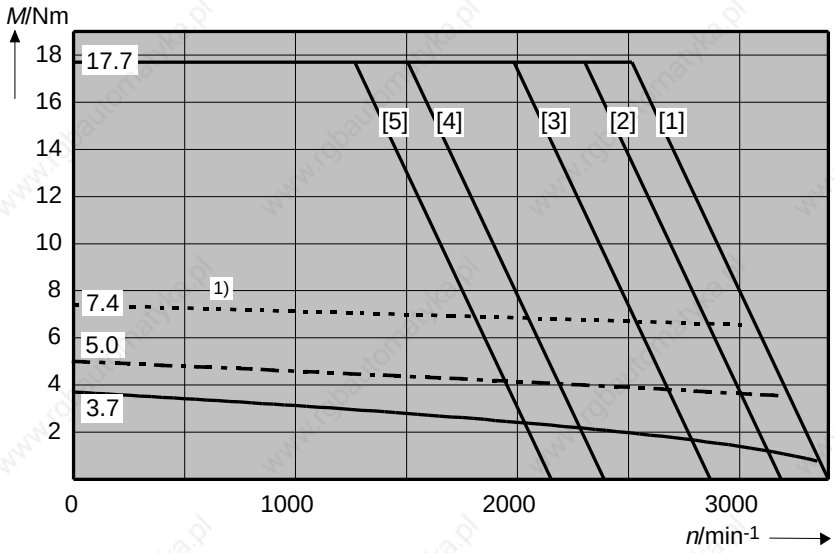
Fig 8.3: Technical data - blocking brake

8.2. Torque-Speed Characteristics

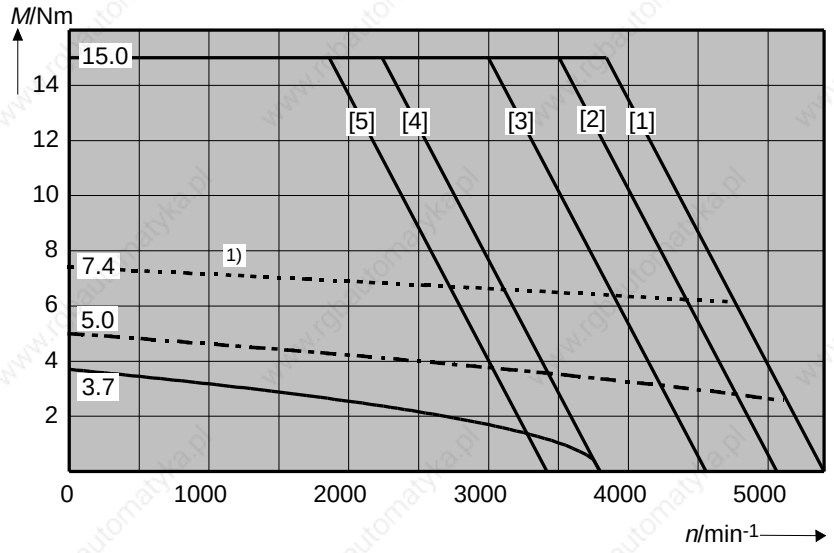
MDD 090 A at 2000 min-1



MDD 090 A at 3000 min-1



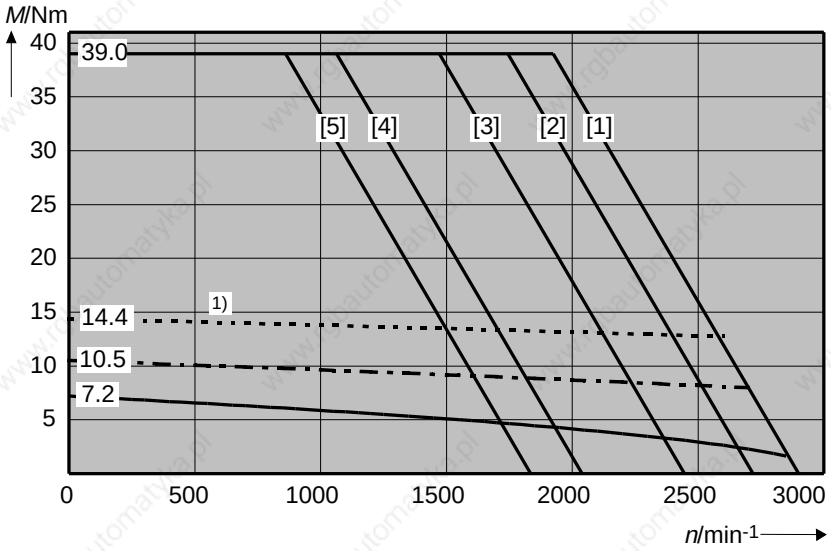
MDD 090 A at 4000 min-1



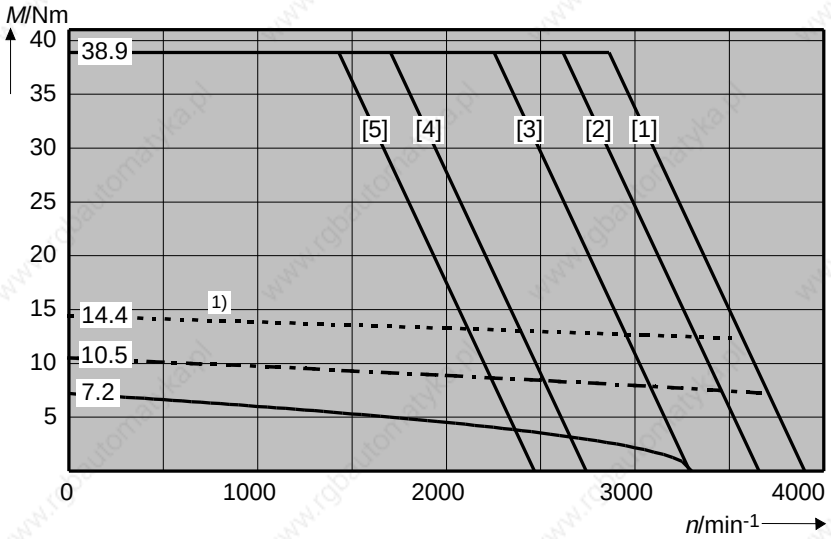
1) Shown: ON time of surface-cooled motor equals 45%.

Fig 8.4: Torque-speed characteristics curves - MDD 090

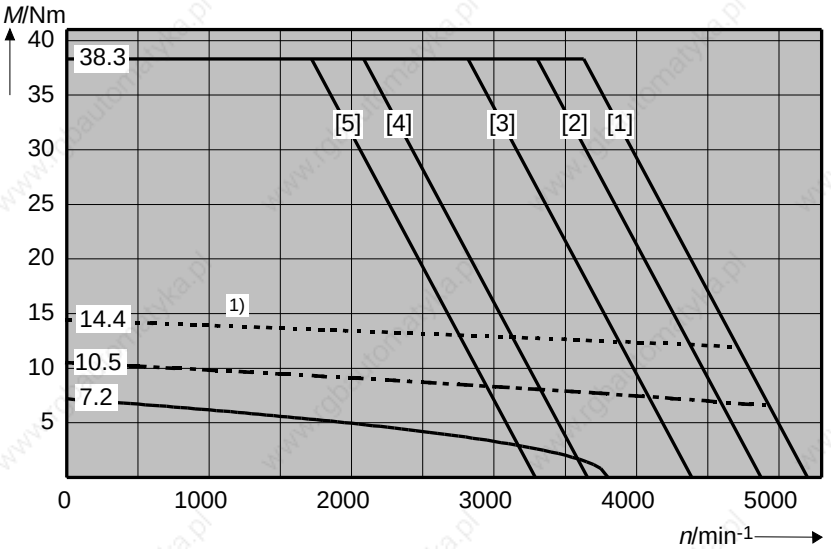
MDD 090 B at 2000 min^{-1}



MDD 090 B at 3000 min^{-1}



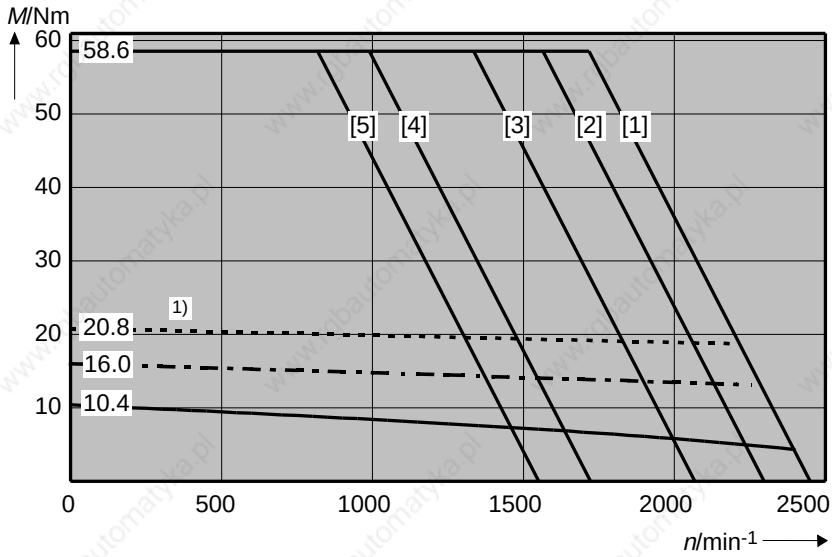
MDD 090 B at 4000 min^{-1}



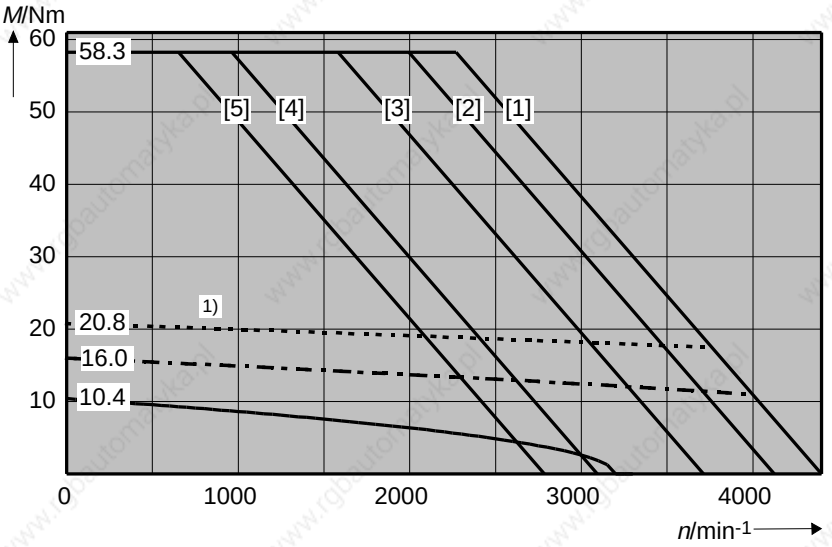
1) Shown: ON time of surface-cooled motor equals 53%.

Fig 8.5: Torque-speed characteristics curves - MDD 090

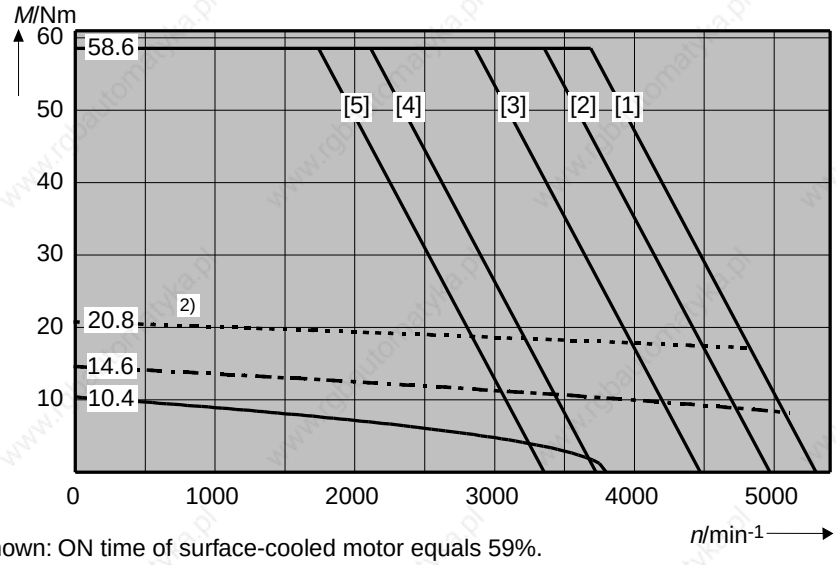
MDD 090 C at 2000 min^{-1}



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

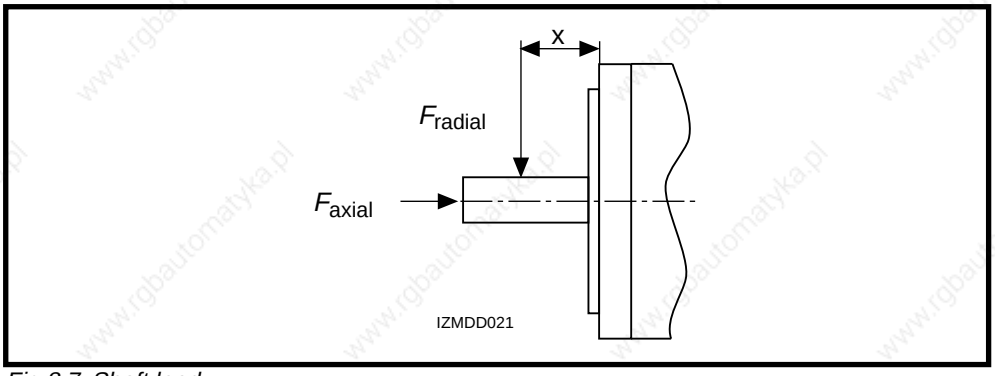


Fig 8.7: Shaft load

Permissible radial force F_{radial}

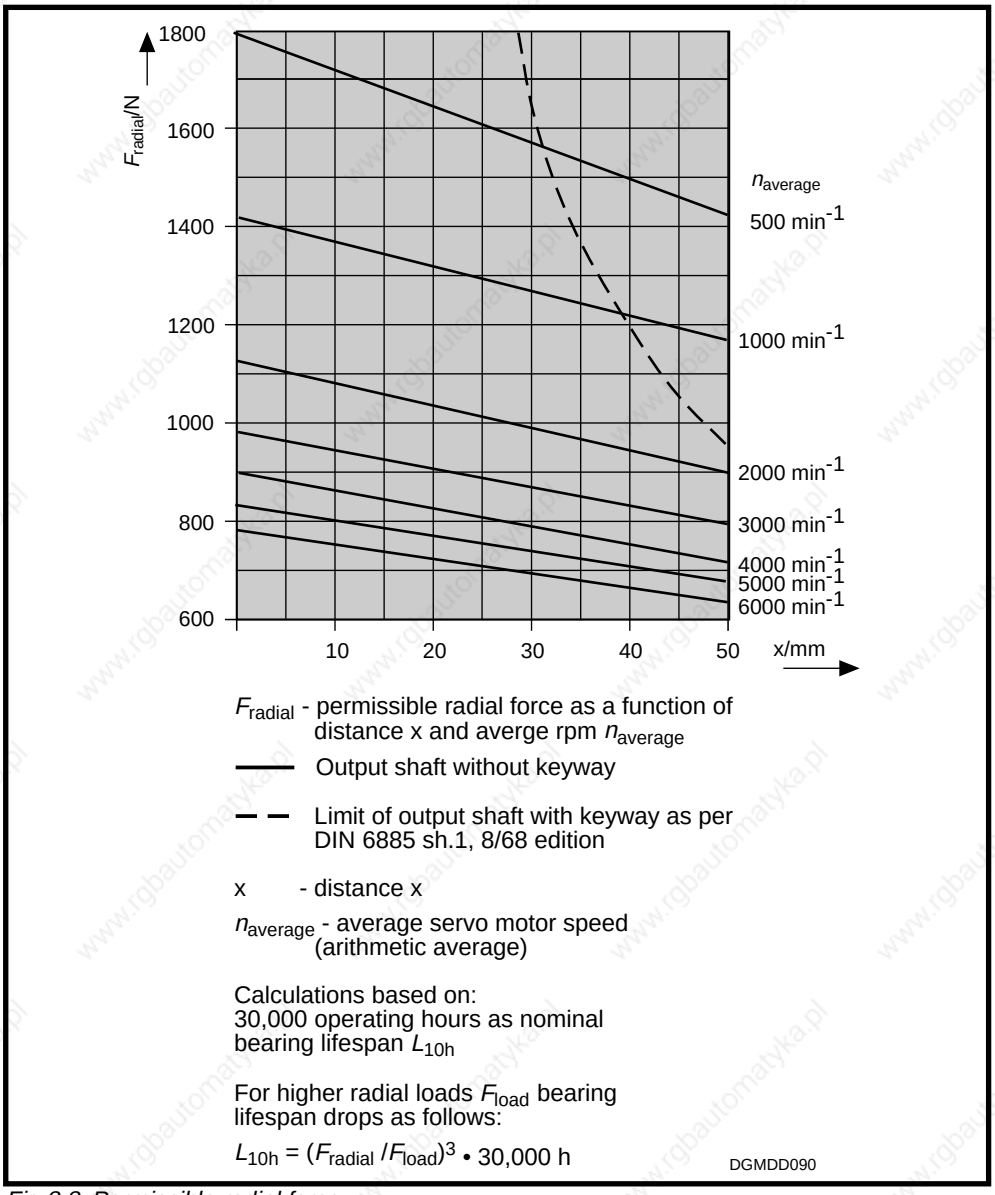


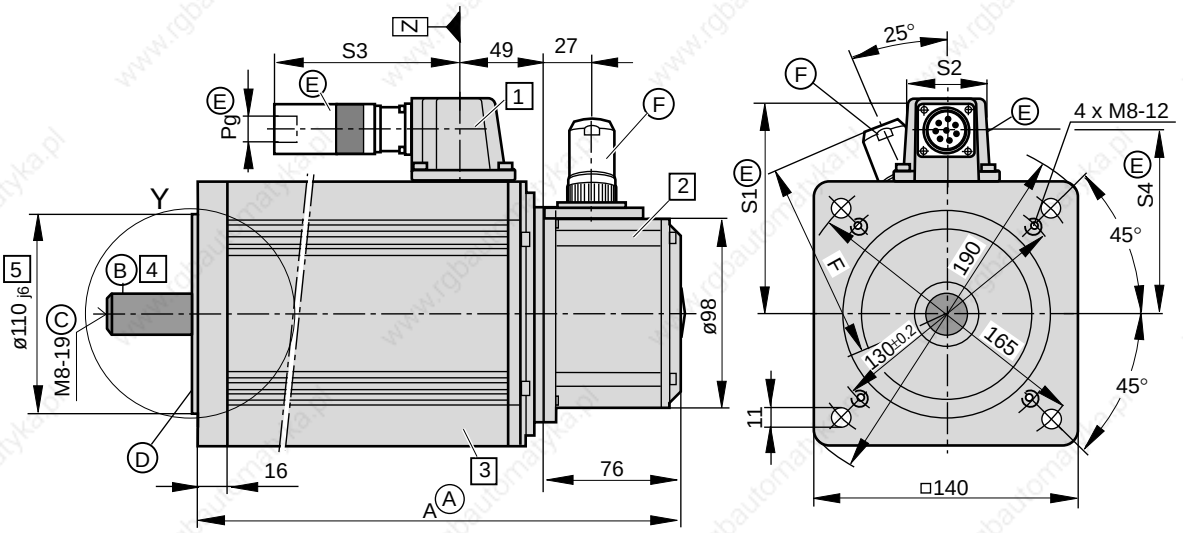
Fig 8.8: Permissible radial force

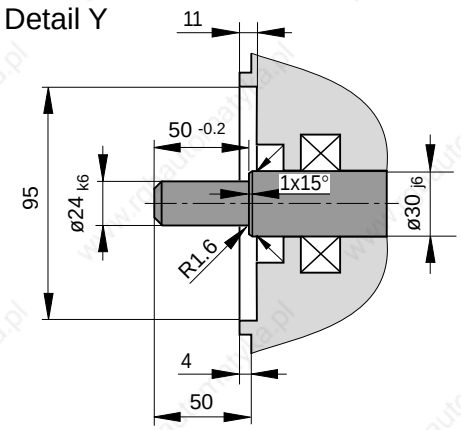
Permissible axial force F_{axial}

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

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

8.4. Dimensional Data





Ⓒ
- 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.

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

Ⓐ **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 respetive feature.

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

Ⓕ **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

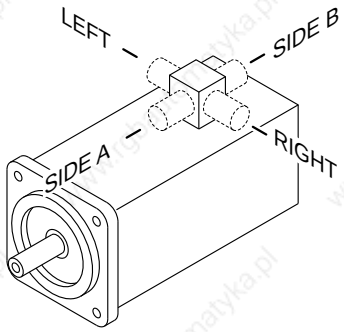
Available Options

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 vitually 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.

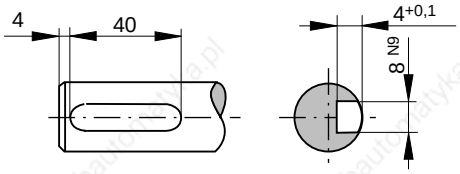
3 **Blocking brake**

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

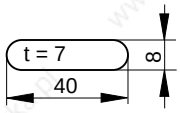
The dimensions are identical.

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**

- ø130 j6

MBMDD090_2

Fig 8.10: Dimensional data - MDD 090 -available options

8.5. Available Versions

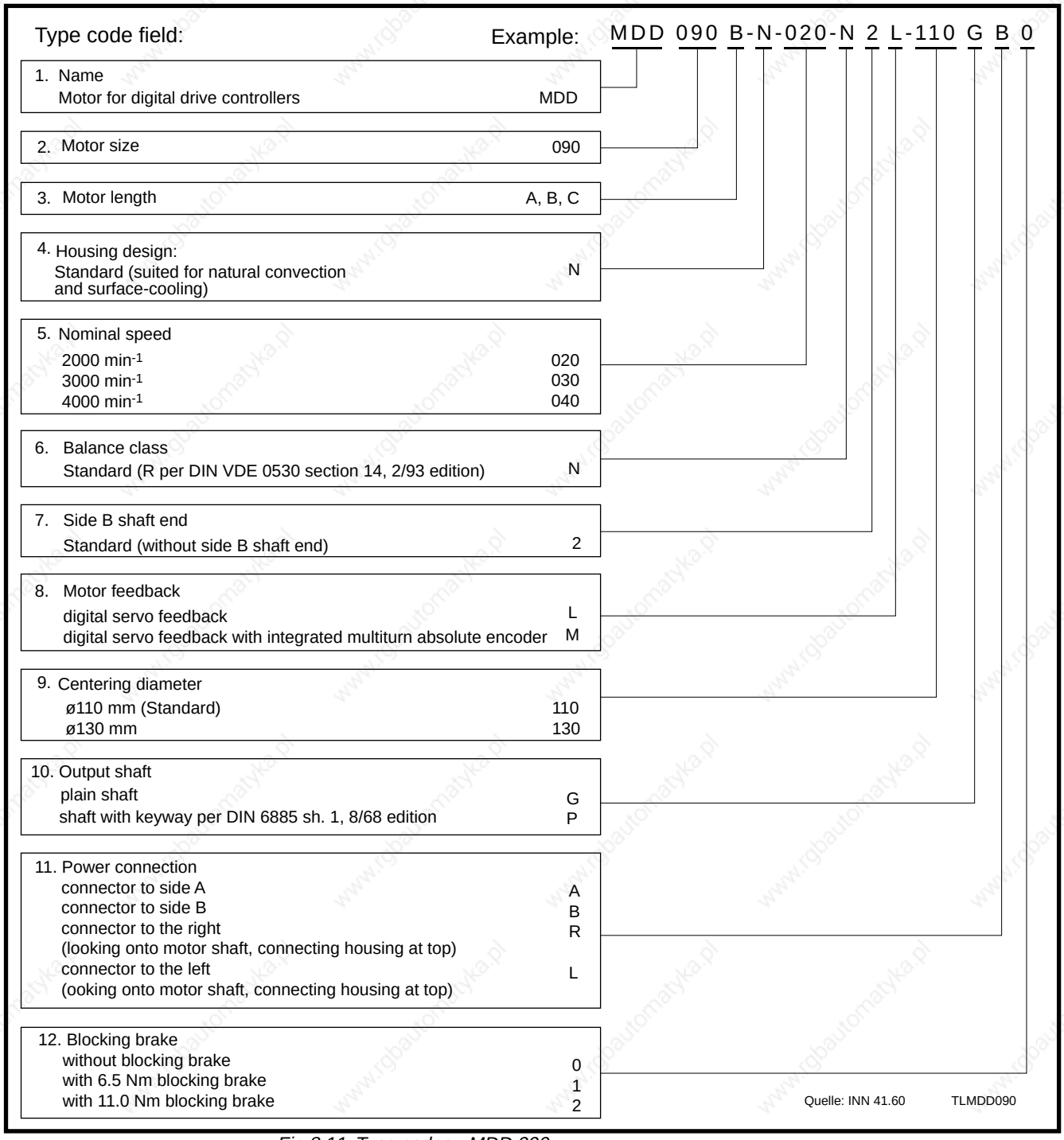


Fig 8.11: Type codes - MDD 090

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 charcteristics 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 charcteristics 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)

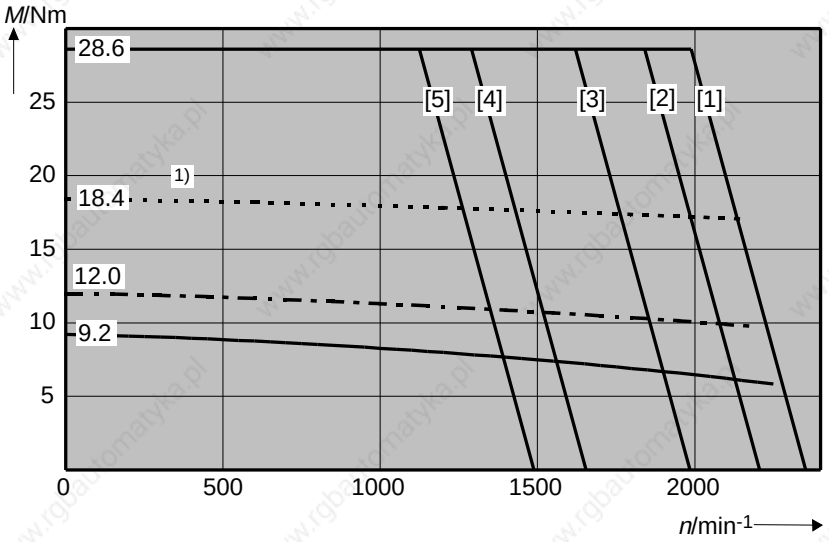
Fig 9.2: General data - MDD 093

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

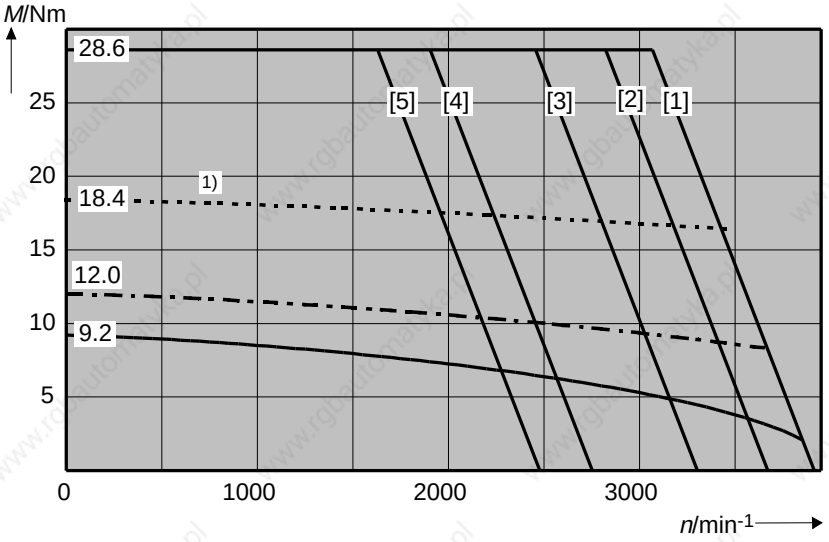
Fig 9.3: Technical data - blocking brake

9.2. Torque-Speed Characteristics

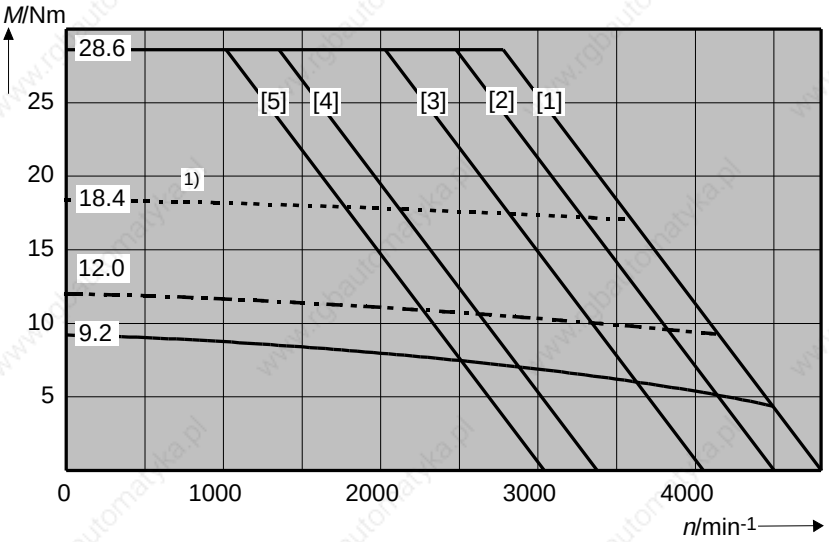
MDD 093 A-N at 2000 min^{-1}



MDD 093 A-N at 3000 min^{-1}



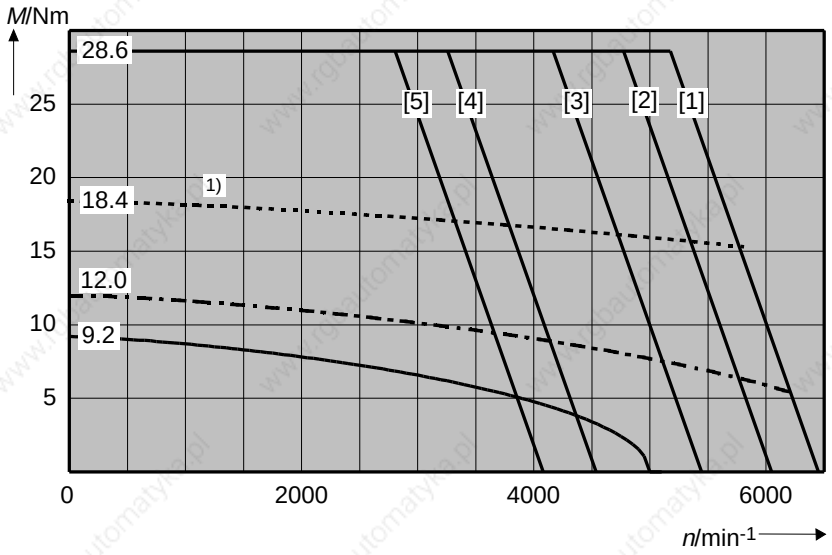
MDD 093 A-N at 4000 min^{-1}



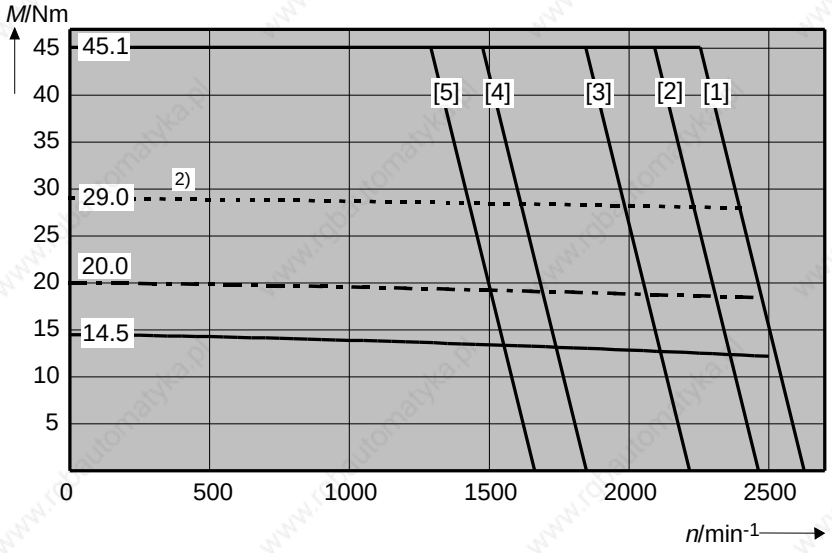
1) Shown: ON time of surface-cooled motor equals 42%

Fig 9.4: Torque-speed characteristics curve - surfaceMDD 093

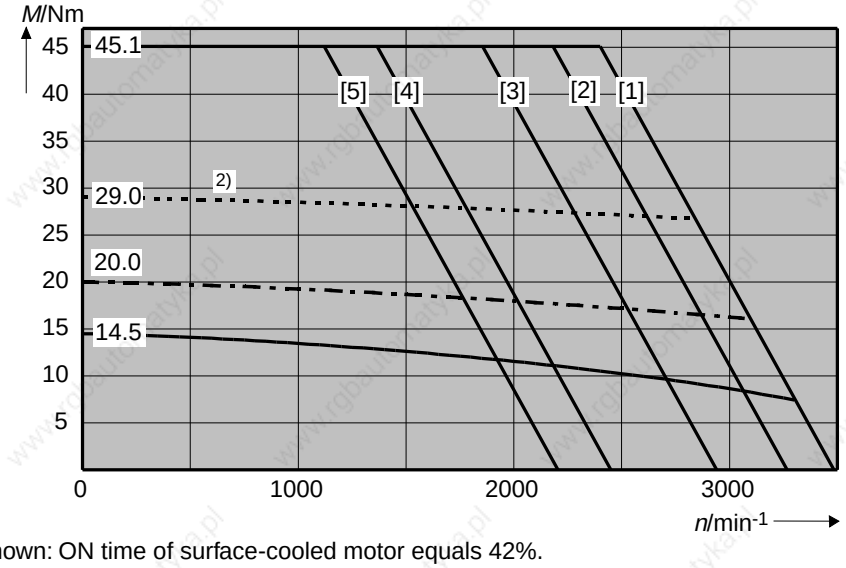
MDD 093 A-N at 6000 min^{-1}



MDD 093 B-N at 2000 min^{-1}



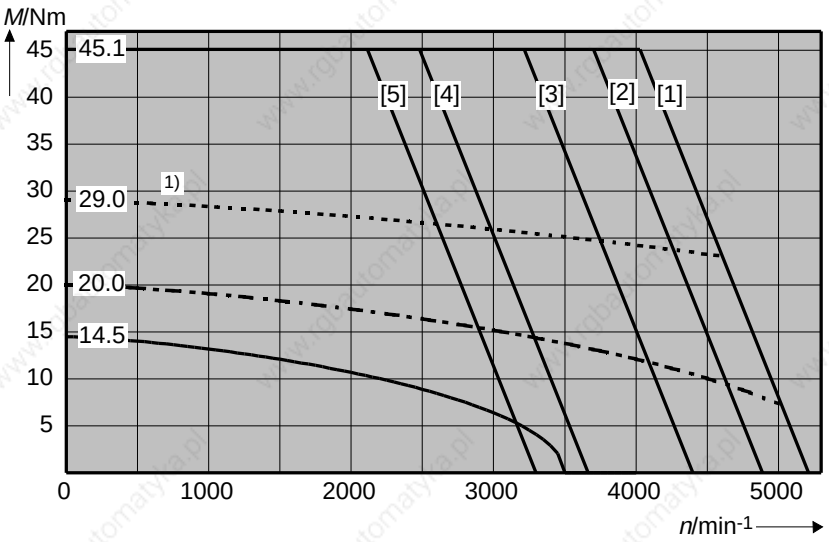
MDD 093 B-N at 3000 min^{-1}



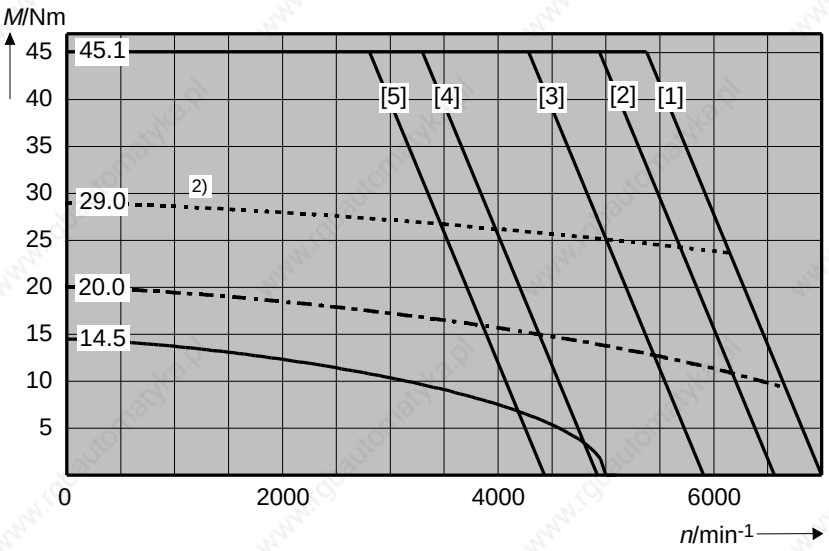
1) Shown: ON time of surface-cooled motor equals 42%.
2) Shown: ON time of surface-cooled motor equals 48%.

Fig 9.5: Torque-speed characteristics curve - MDD 093

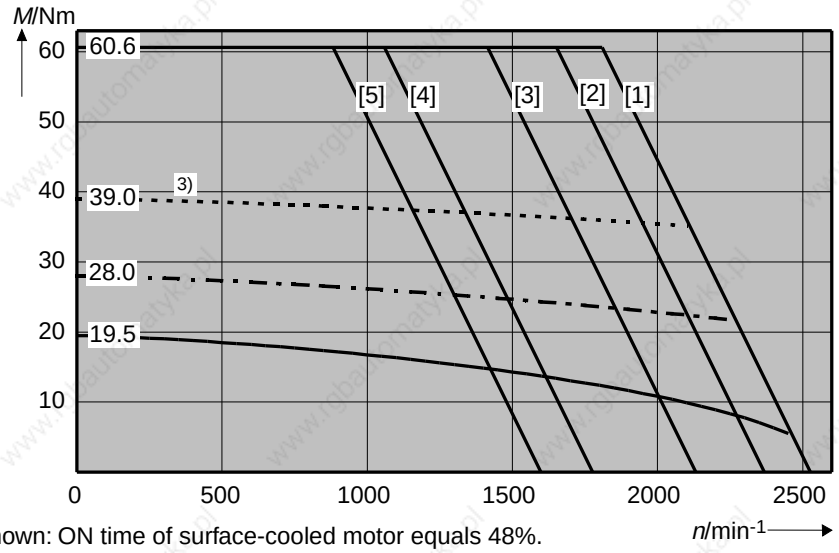
MDD 093 B-N at 4000 min^{-1}



MDD 093 B-N at 6000 min^{-1}



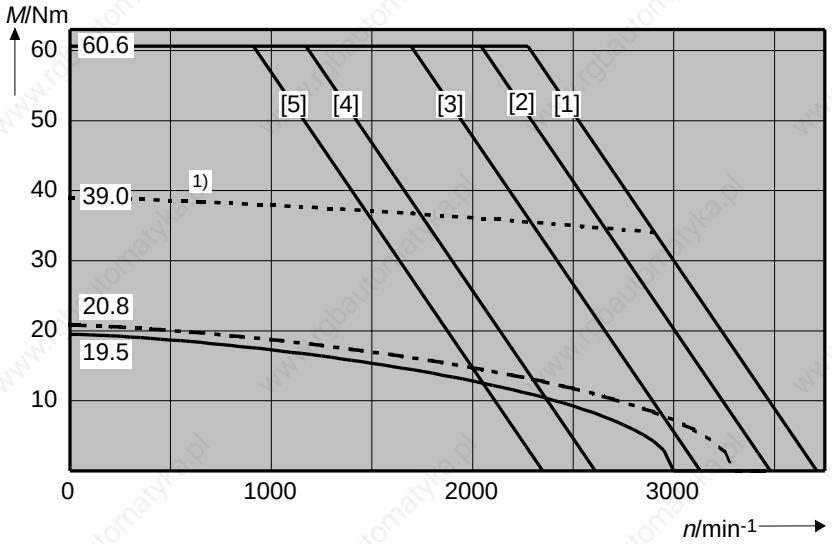
MDD 093 C-N at 2000 min^{-1}



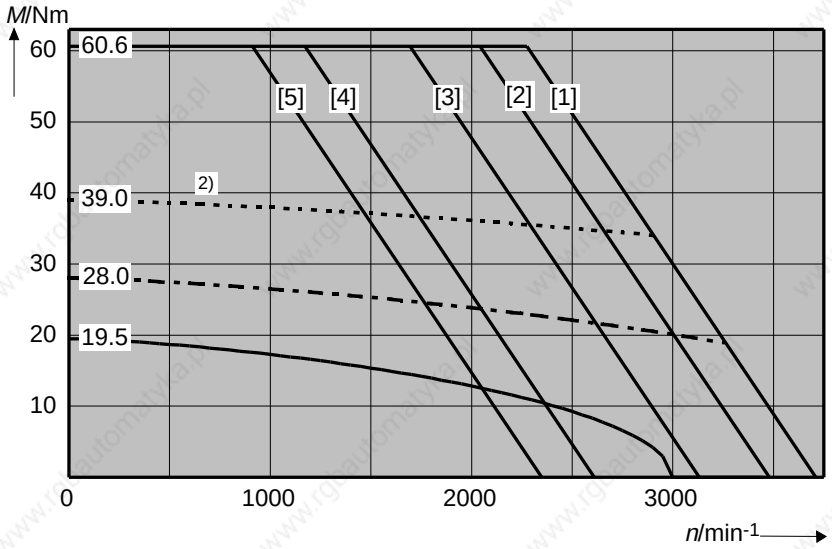
1) Shown: ON time of surface-cooled motor equals 48%.
2) Shown: ON time of surface-cooled motor equals 46%.
3) Shown: ON time of surface-cooled motor equals 52%.

Fig 9.6: Torque-speed characteristics curve - MDD 093

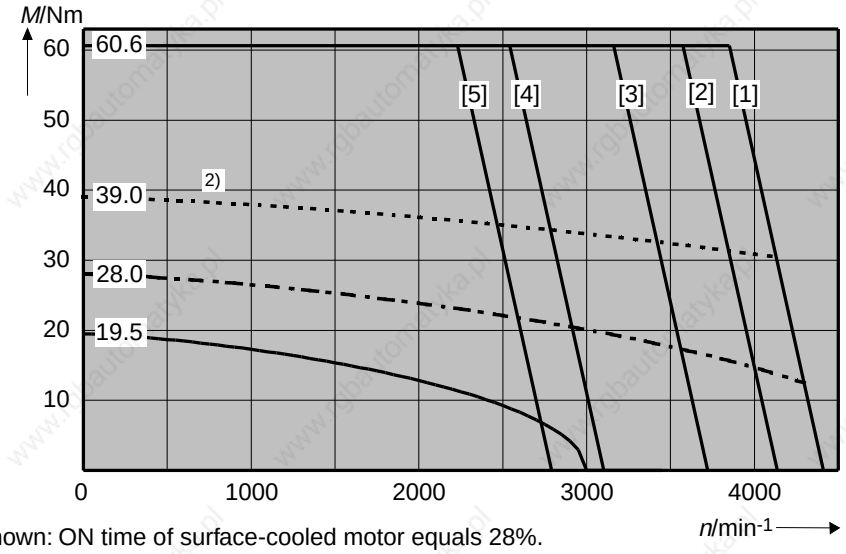
MDD 093 C-N at 3000 min^{-1}



MDD 093 C-L at 3000 min^{-1}



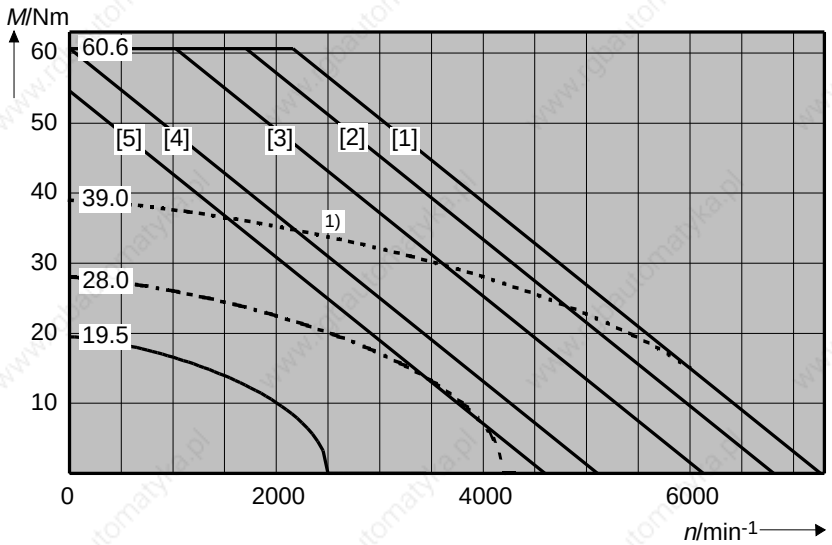
MDD 093 C-N at 4000 min^{-1}



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

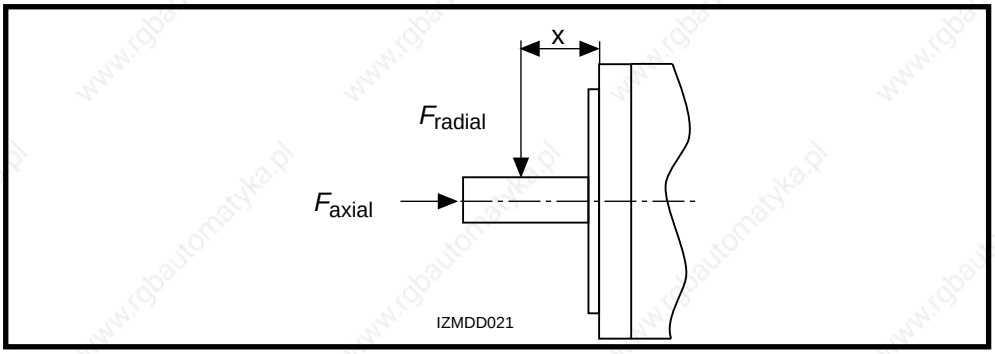


Fig 9.10: Shaft load

Permissible radial force F_{radial}

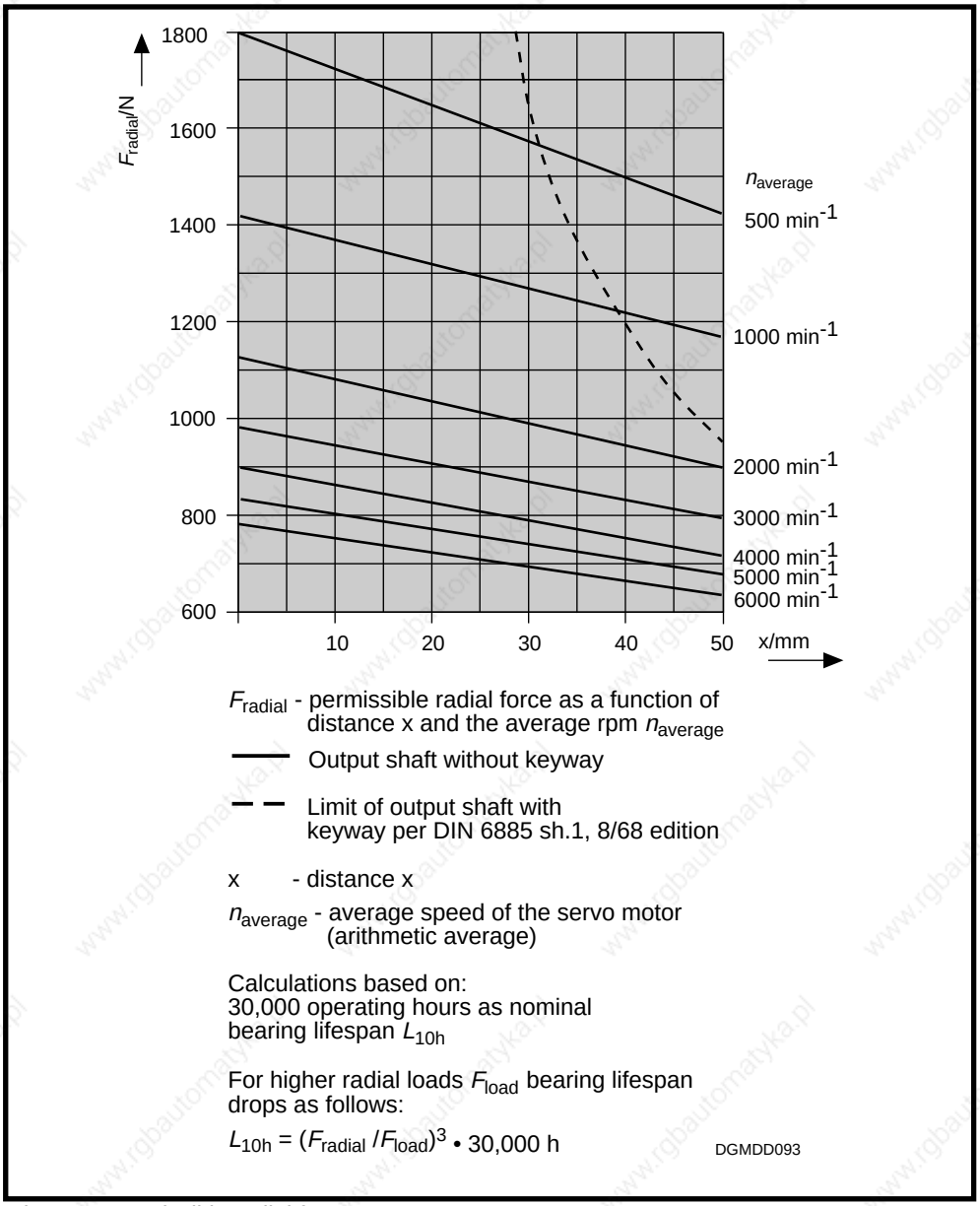


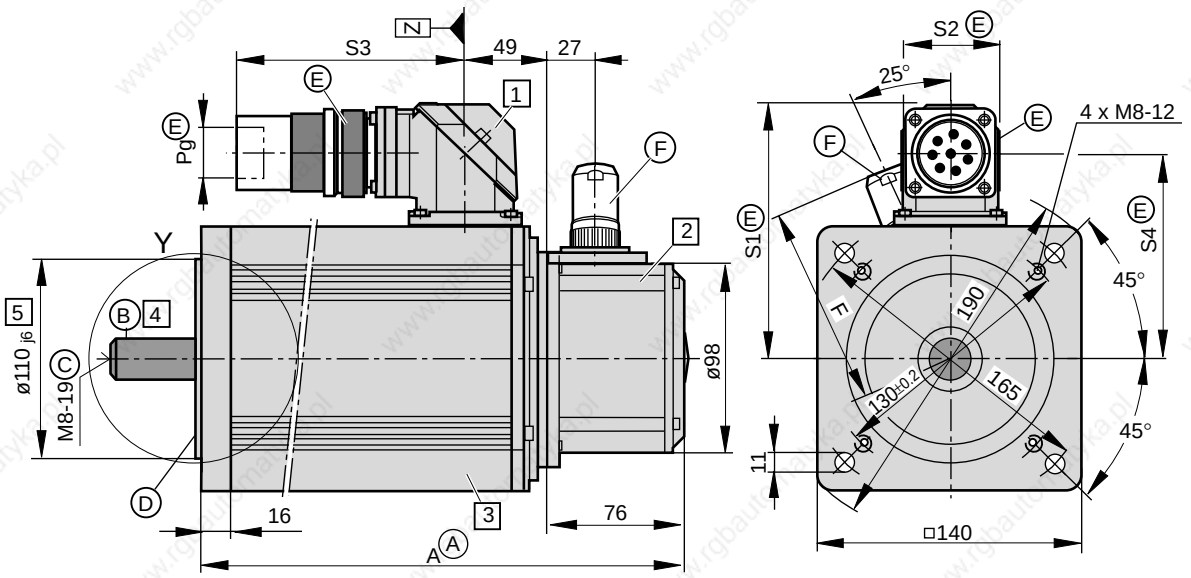
Fig 9.11: Permissible radial force

Permissible axial force F_{axial}

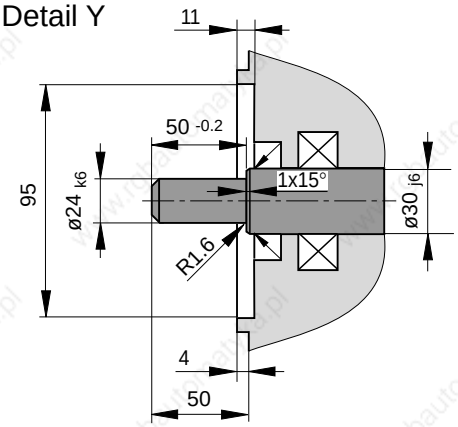
$$F_{axial} = 0.34 \cdot F_{radial}$$

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

9.4. Dimensional Data



Detail Y



Ⓐ **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.

Ⓒ
- 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.

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	108
	INS 510	

MBMDD093_1

Fig 9.12: Dimensional data MDD 093

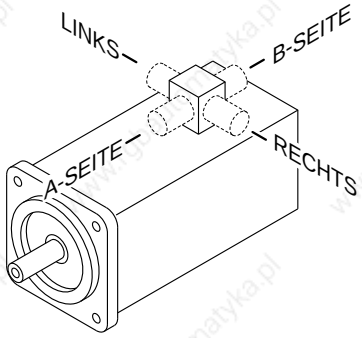
Available Options

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
- with blocking brake: 22 Nm

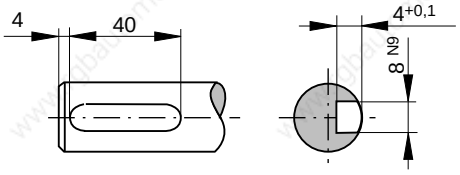
} The dimensions are identical.

Dimensional table for motors with blocking brake: 22 Nm

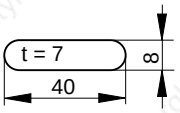
Size	Dim. A
MDD 093 A	316
MDD 093 B	357
MDD 093 C	416
MDD 093 D	466

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**

- ø130 j6

MBMDD093_2

Fig 9.13: Dimensional data MDD 093 - available options

9.5. Available Versions

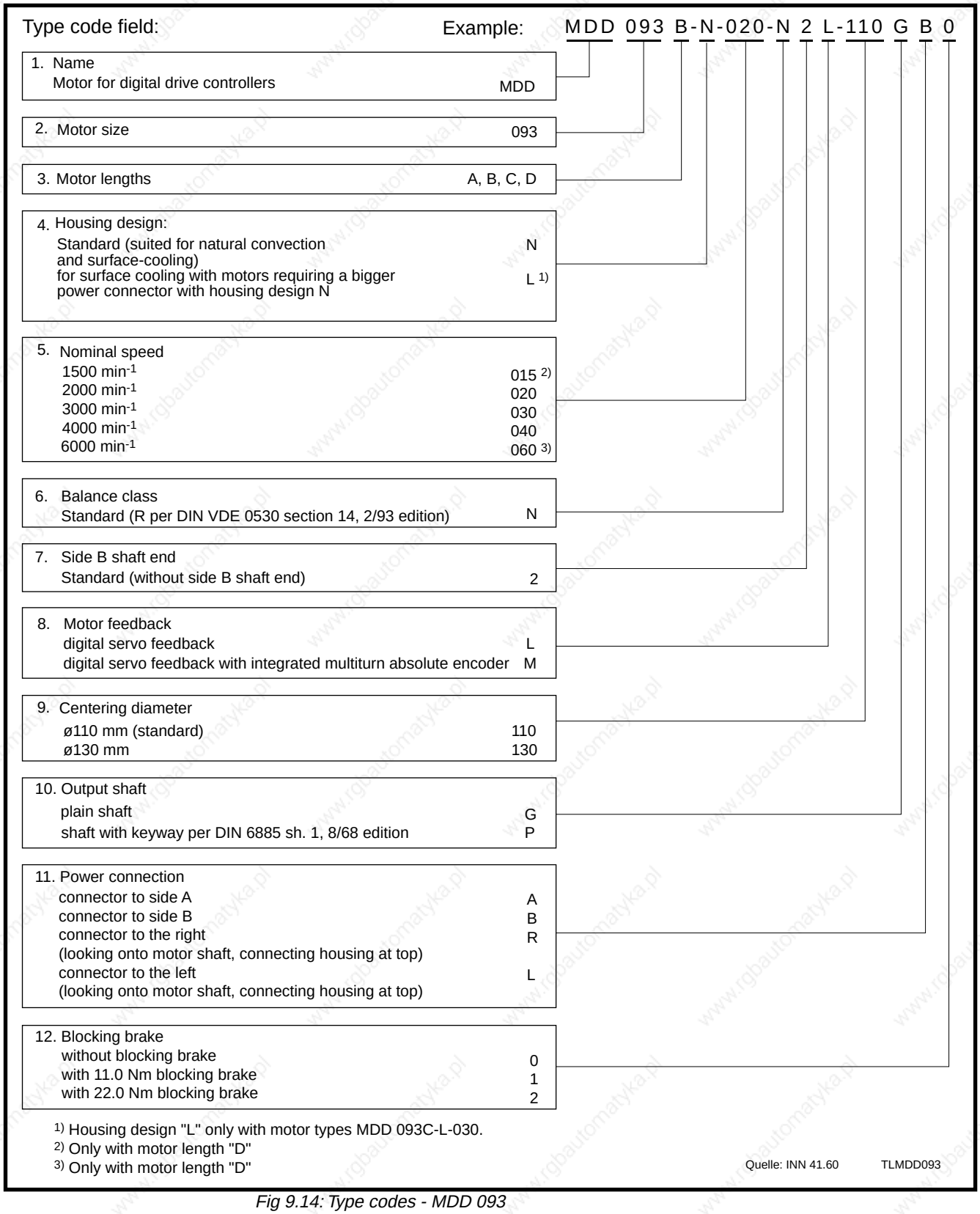


Fig 9.14: Type codes - MDD 093

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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 charcteristics 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 charcteristics 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 temperture	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)

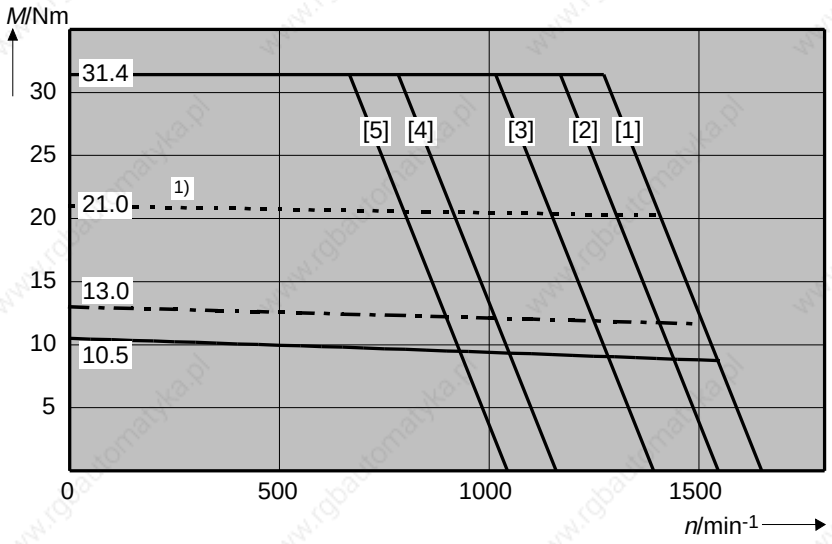
Fig 10.2: General data - MDD 112

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

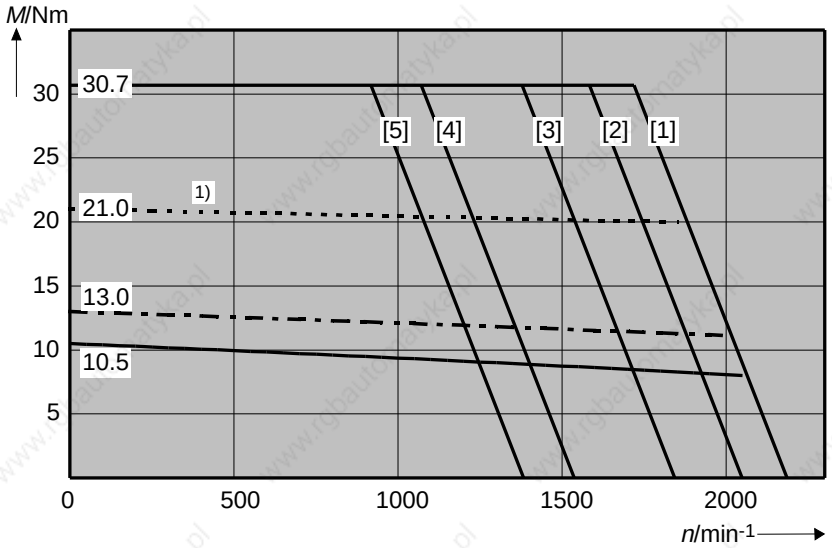
Fig 10.3: Technical data - blocking brake

10.2. Torque-Speed Characteristics

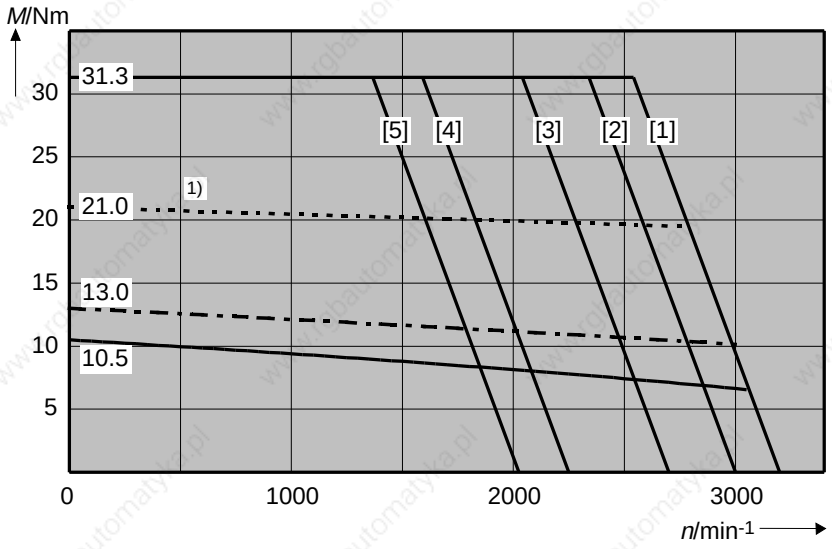
MDD 112 A-N at 1500 min^{-1}



MDD 112 A-N at 2000 min^{-1}



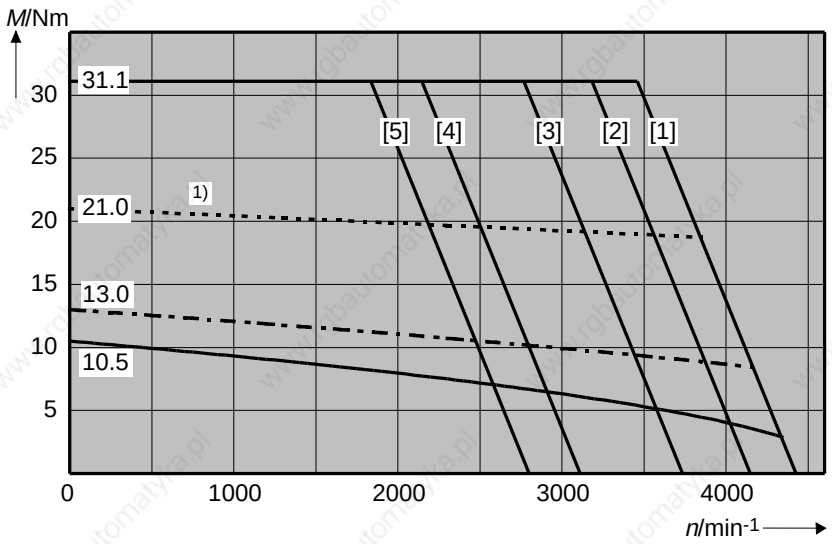
MDD 112 A-N at 3000 min^{-1}



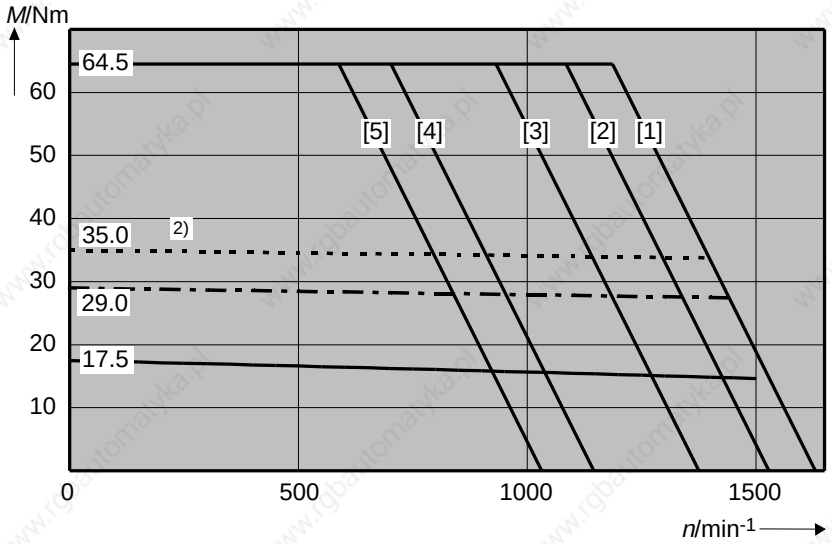
1) Shown: ON time of surface-cooled motor equals 38%.

Fig 10.4: Torque-speed characteristics curve MDD 112

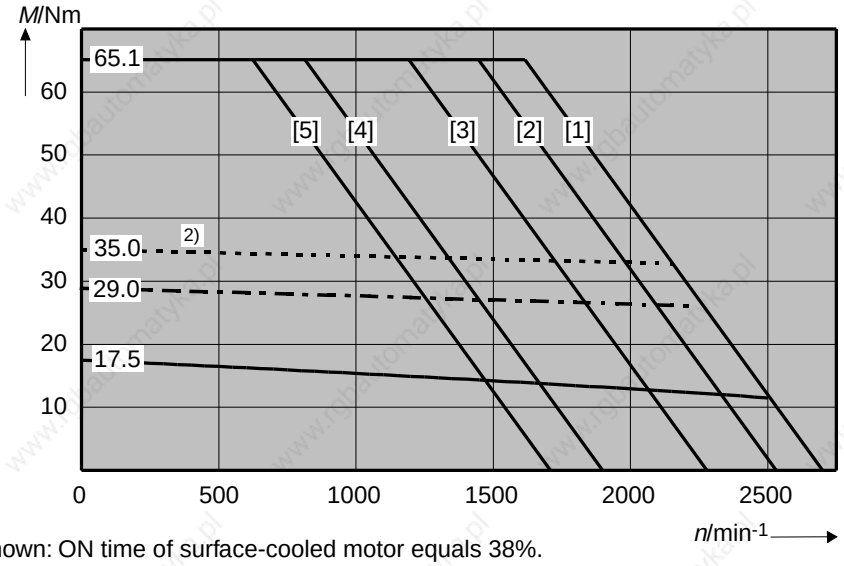
MDD 112 A-N at 4000 min^{-1}



MDD 112 B-N at 1500 min^{-1}



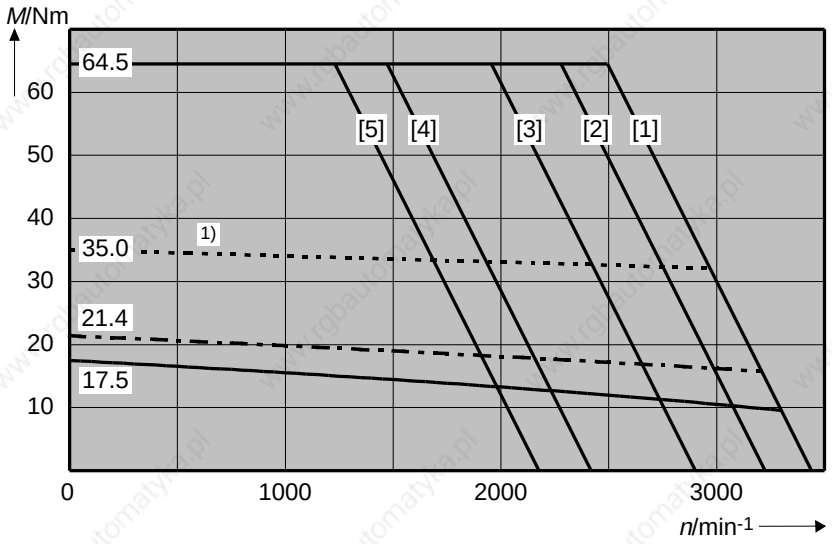
MDD 112 B-N at 2000 min^{-1}



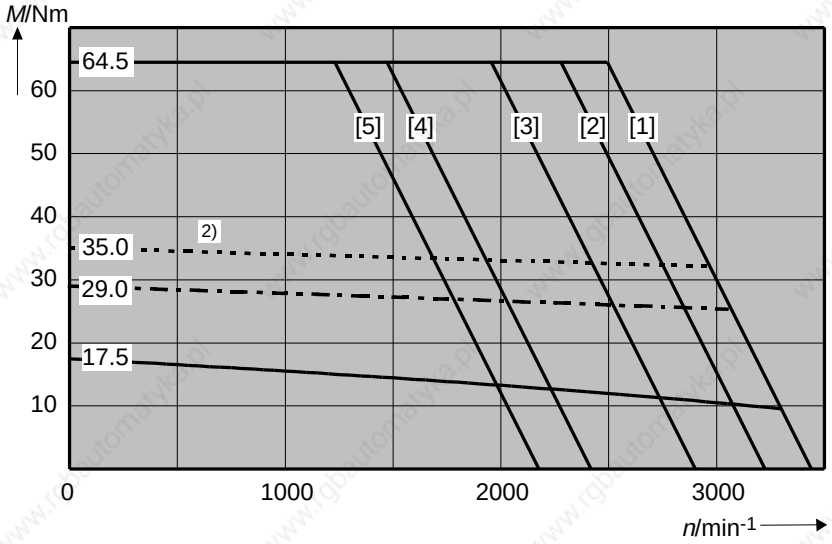
1) Shown: ON time of surface-cooled motor equals 38%.
2) Shown: ON time of surface-cooled motor equals 68%.

Fig 10.5: Torque-speed characteristics curve MDD 112

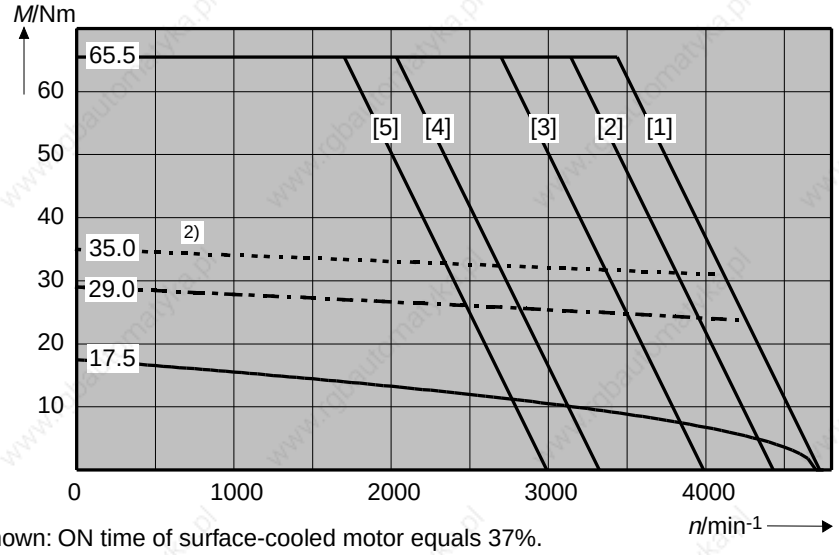
MDD 112 B-N at 3000 min^{-1}



MDD 112 B-L at 3000 min^{-1}



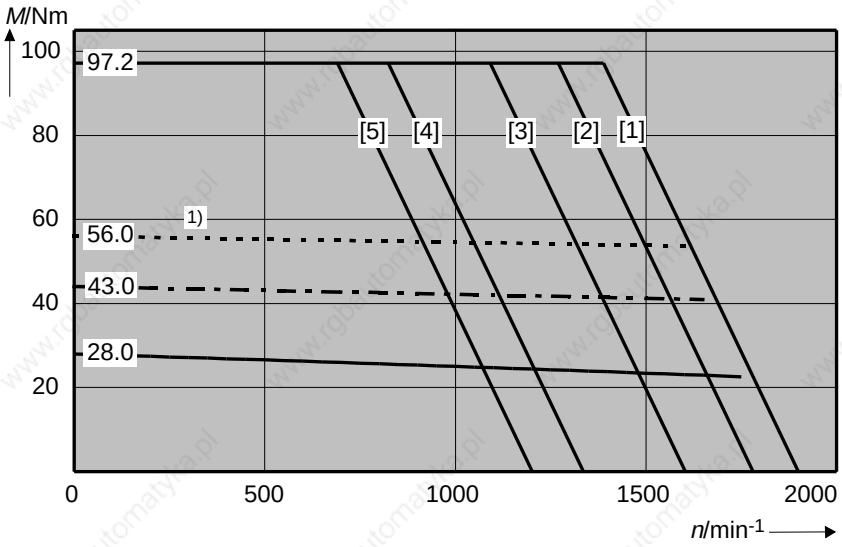
MDD 112 B-N at 4000 min^{-1}



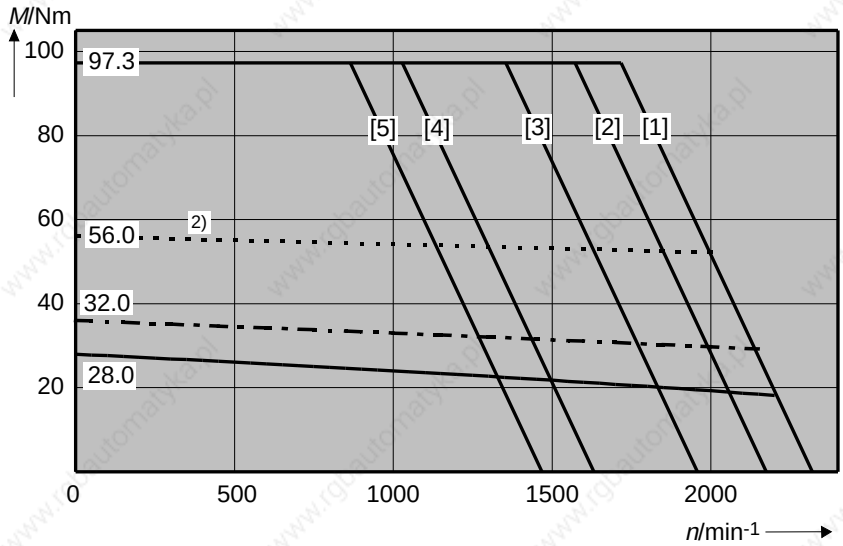
1) Shown: ON time of surface-cooled motor equals 37%.
2) Shown: ON time of surface-cooled motor equals 69%.

Fig 10.6: Torque-speed characteristics curve MDD 112

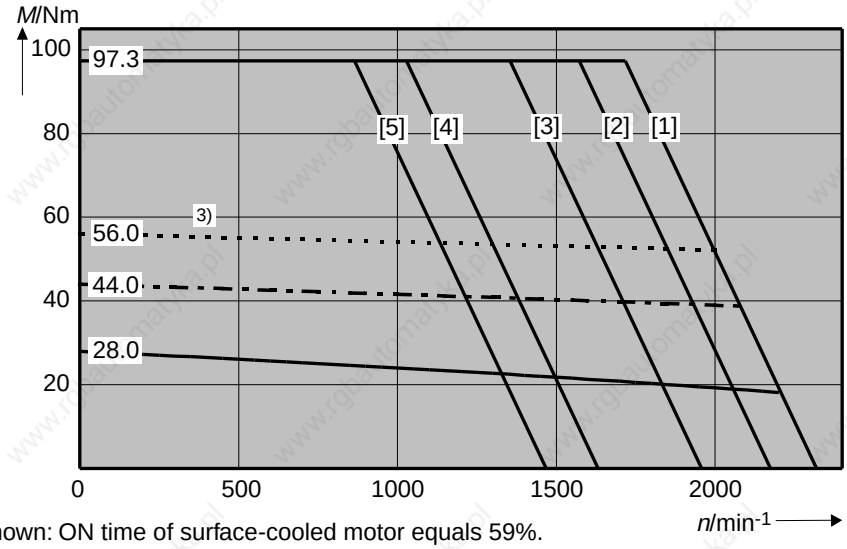
MDD 112 C-N at 1500 min^{-1}



MDD 112 C-N at 2000 min^{-1}



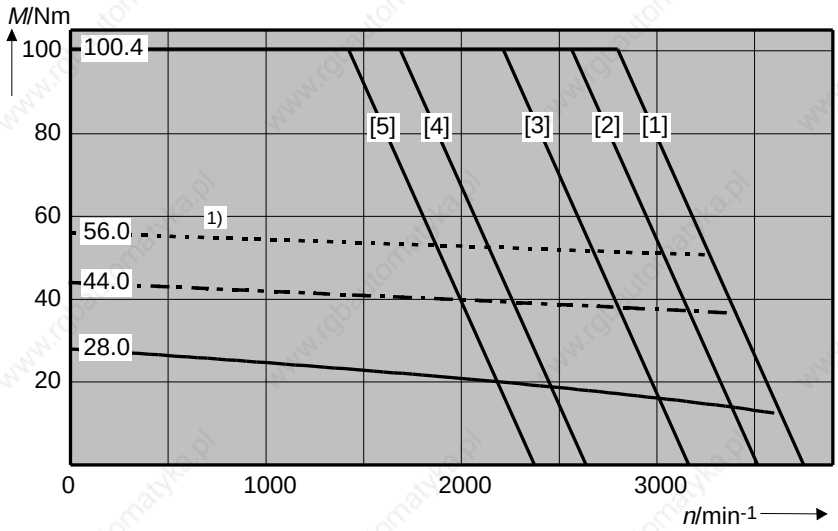
MDD 112 C-L at 2000 min^{-1}



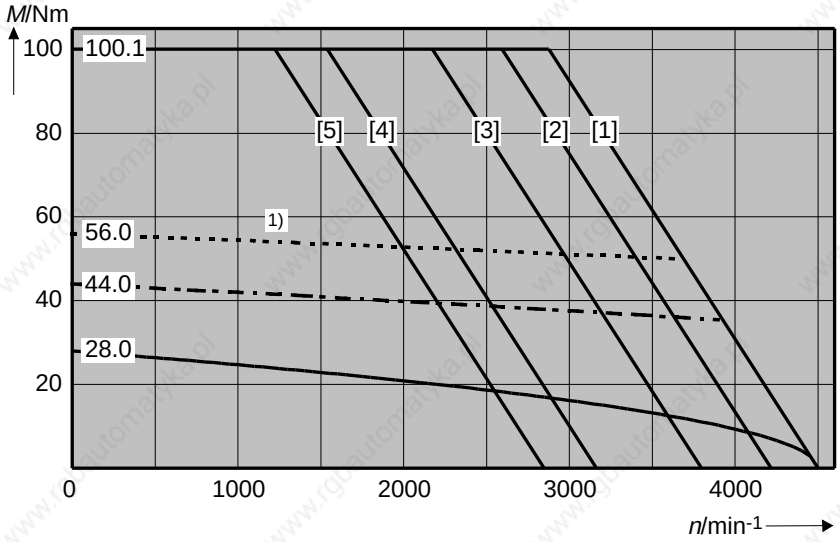
1) Shown: ON time of surface-cooled motor equals 59%.
2) Shown: ON time of surface-cooled motor equals 33%.
3) Shown: ON time of surface-cooled motor equals 62%.

Fig 10.7: Torque-speed characteristics curve MDD 112

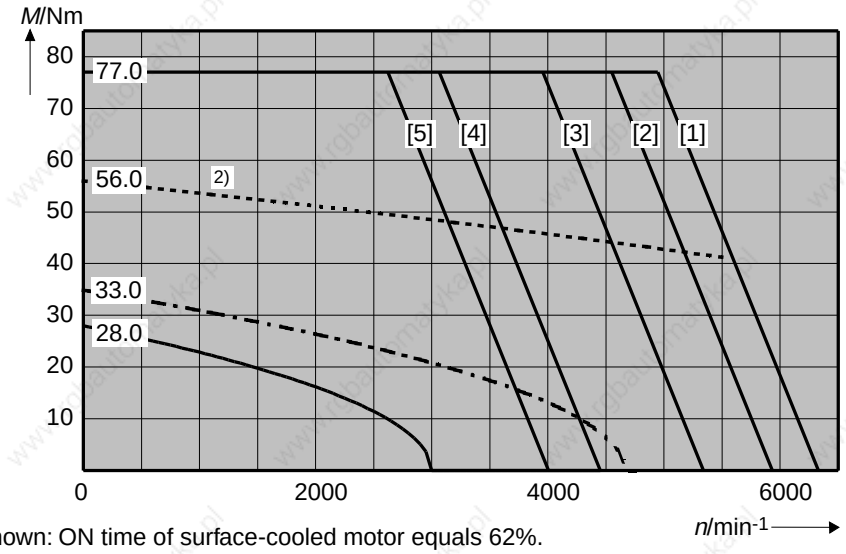
MDD 112 C-N at 3000 min^{-1}



MDD 112 C-N at 4000 min^{-1}



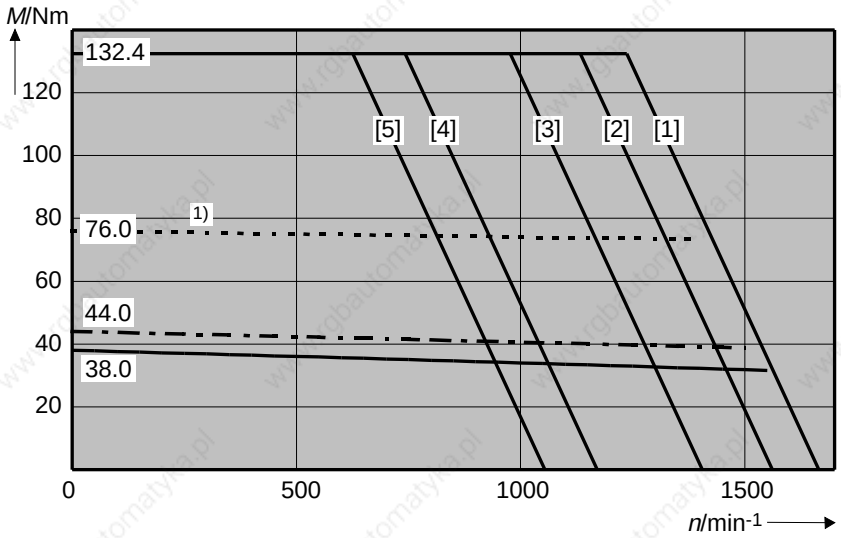
MDD 112 C-N at 6000 min^{-1}



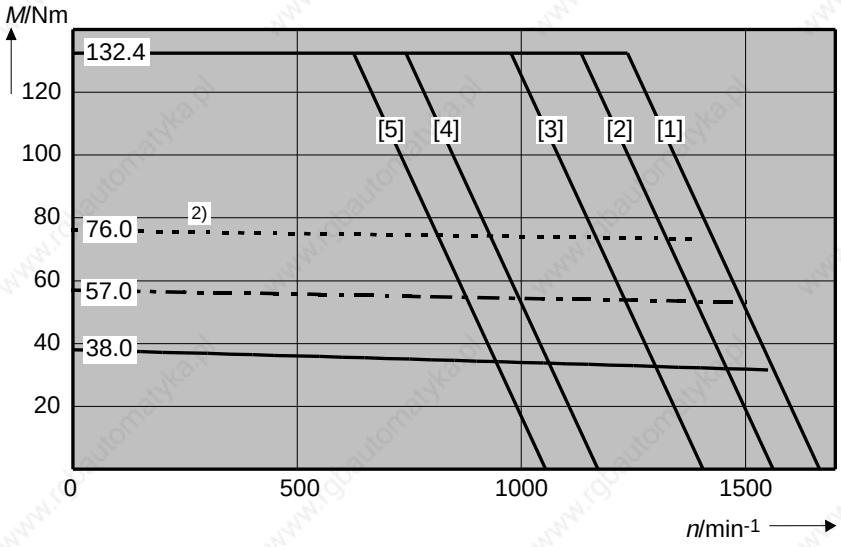
1) Shown: ON time of surface-cooled motor equals 62%.
2) Shown: ON time of surface-cooled motor equals 35%.

Fig 10.8: Torque-speed characteristics curve MDD 112

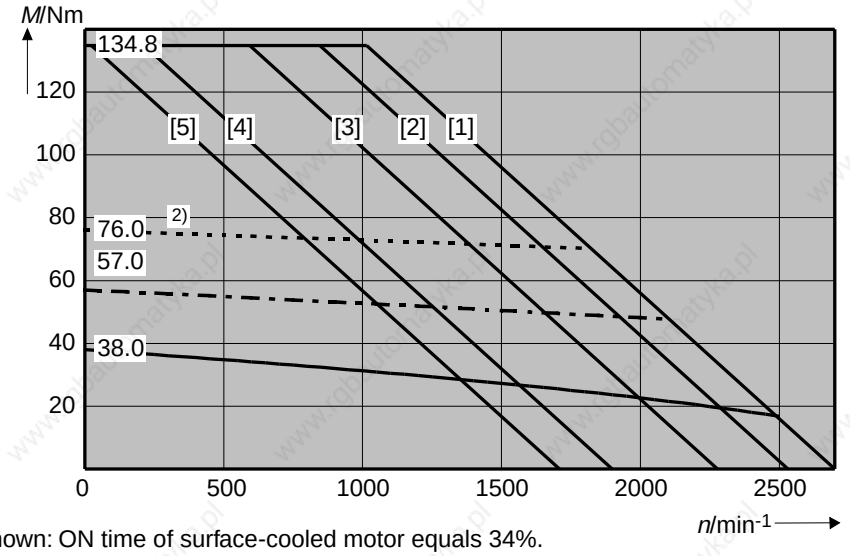
MDD 112 D-N at 1500 min^{-1}



MDD 112 D-L at 1500 min^{-1}



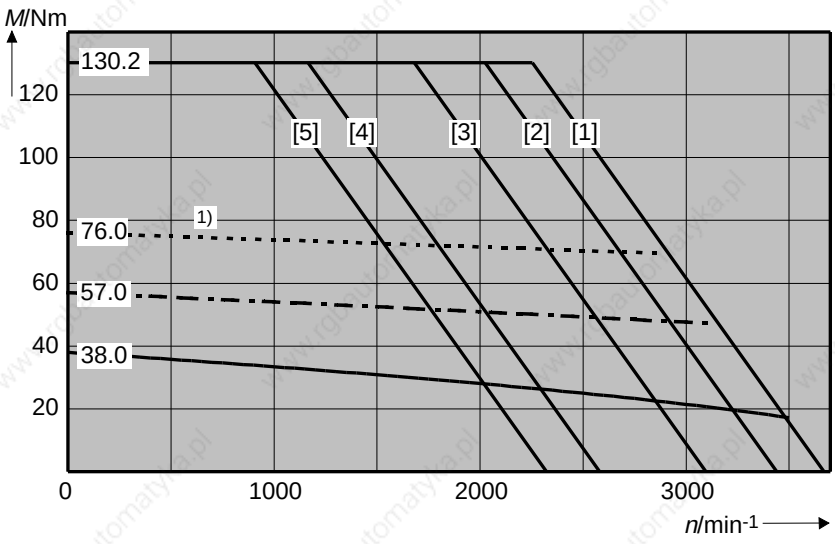
MDD 112 D-N at 2000 min^{-1}



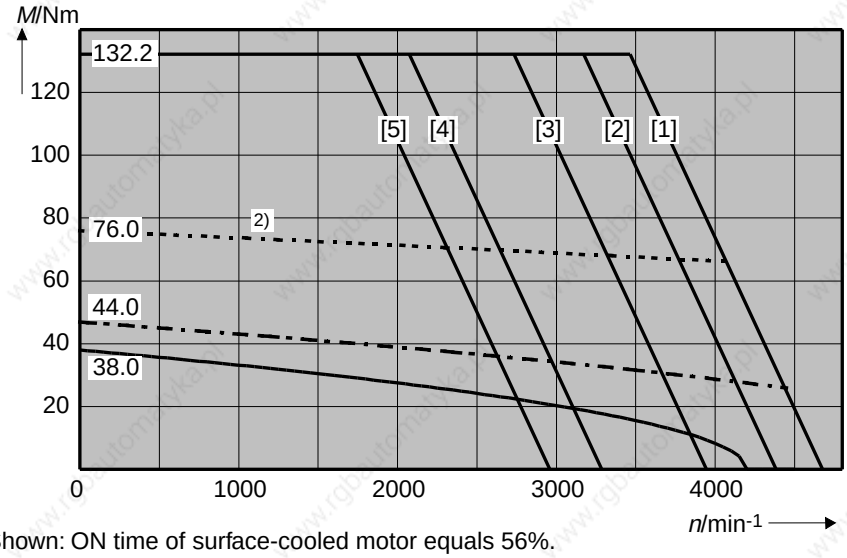
1) Shown: ON time of surface-cooled motor equals 34%.
2) Shown: ON time of surface-cooled motor equals 56%.

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

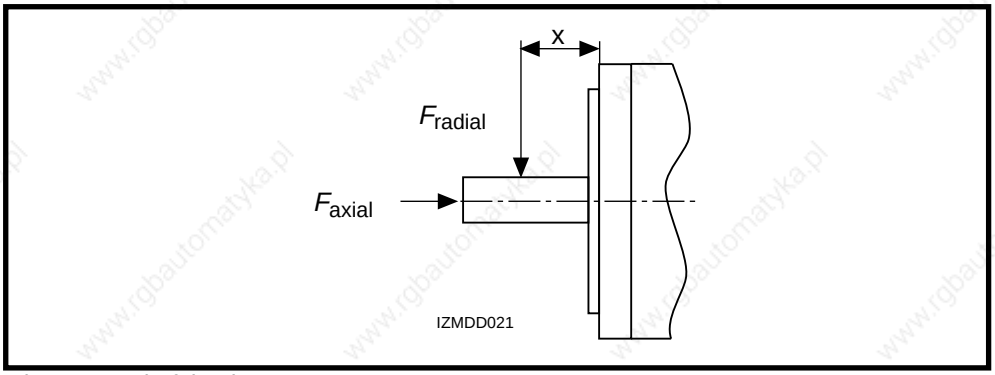


Fig 10.11: Shaft load

Permissible radial force F_{radial}

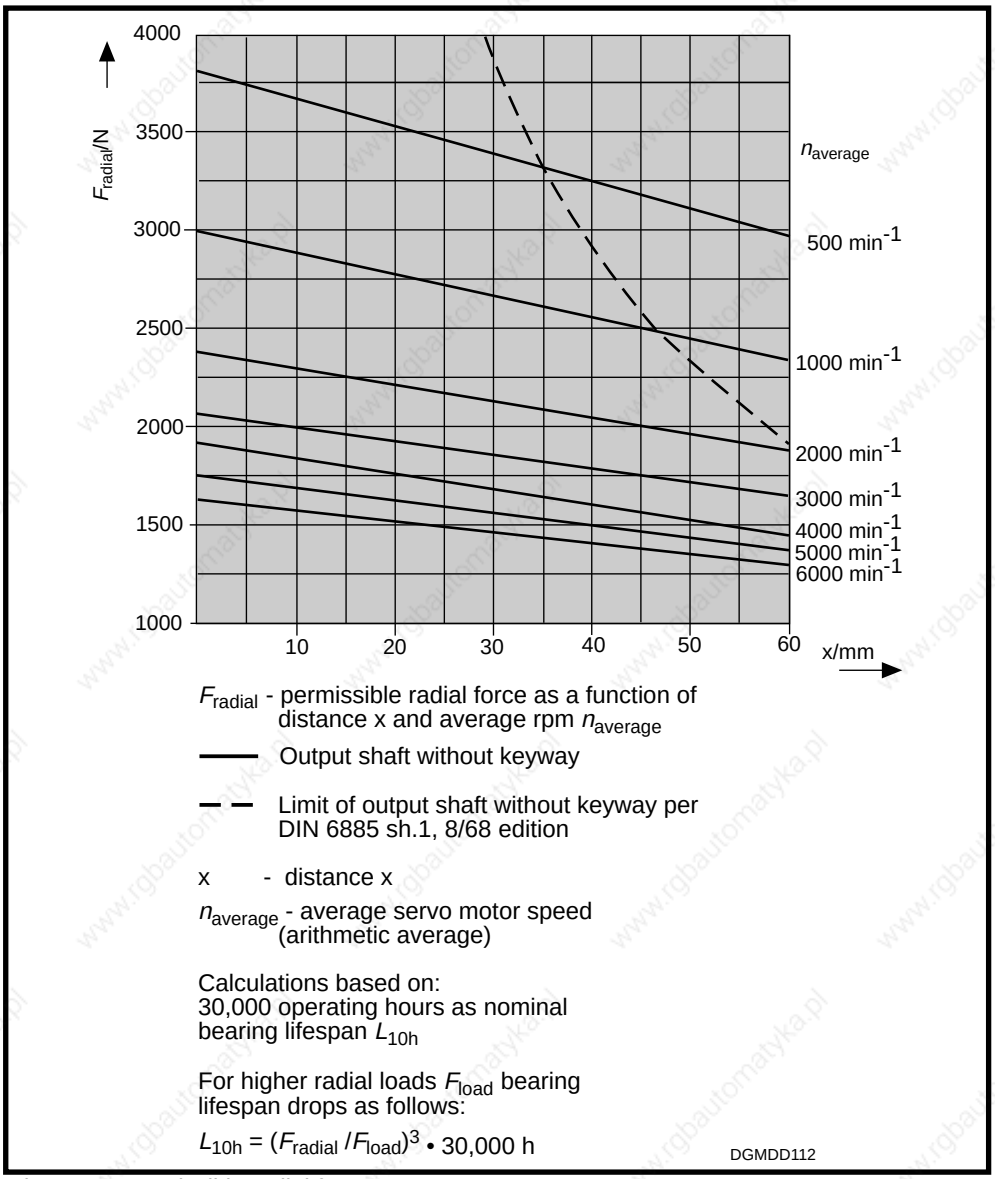


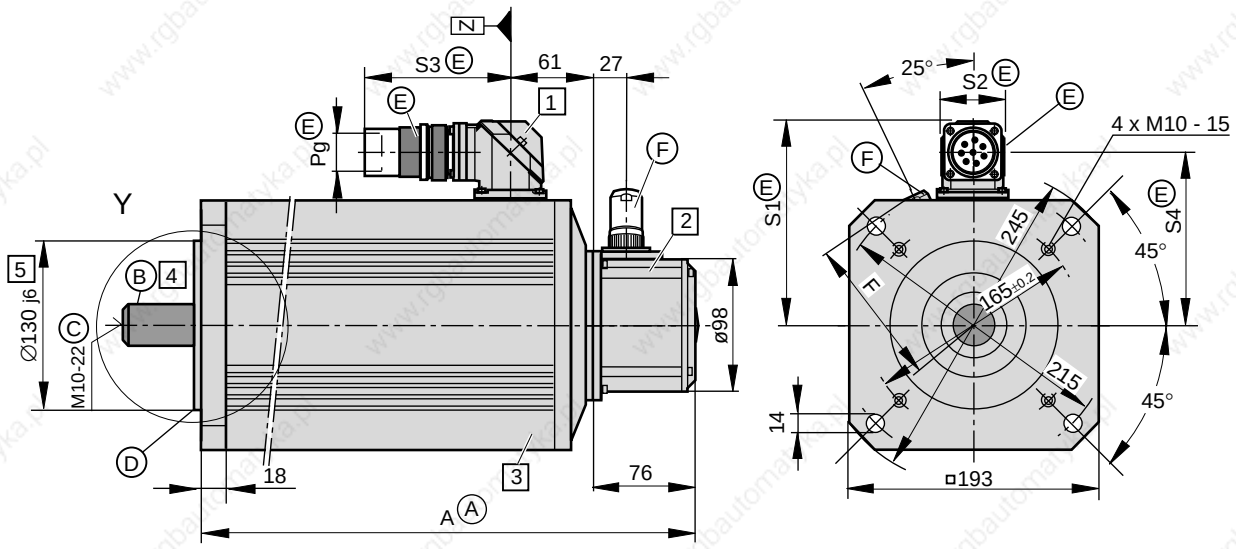
Fig 10.12: Permissible radial force

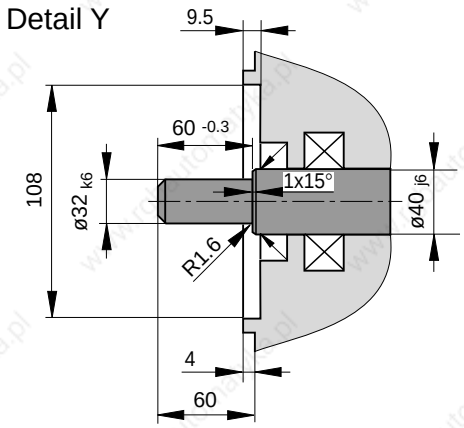
Permissible axial force F_{axial}

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

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.

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) withMDD 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

Ⓐ **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.

Ⓕ **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

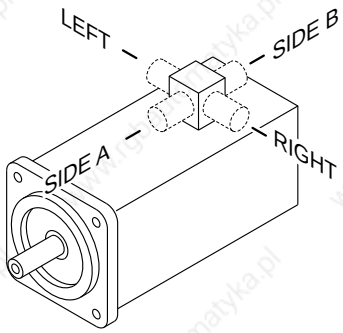
Available Options

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.

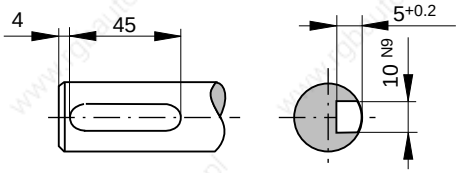
- with blocking brake: 40 Nm (not available with MDD 112 A)
- with blocking brake: 60 Nm (not available with MDD 112)

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

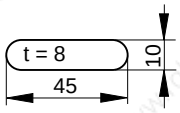
Size	Dim. A
MDD 112 B	437
MDD 112 C	512
MDD 112 D	587

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**

- ø180 $_{j6}$

MBMDD112_2

Fig 10.14: Dimensional data MDD 112 - available options

10.5. Available Versions

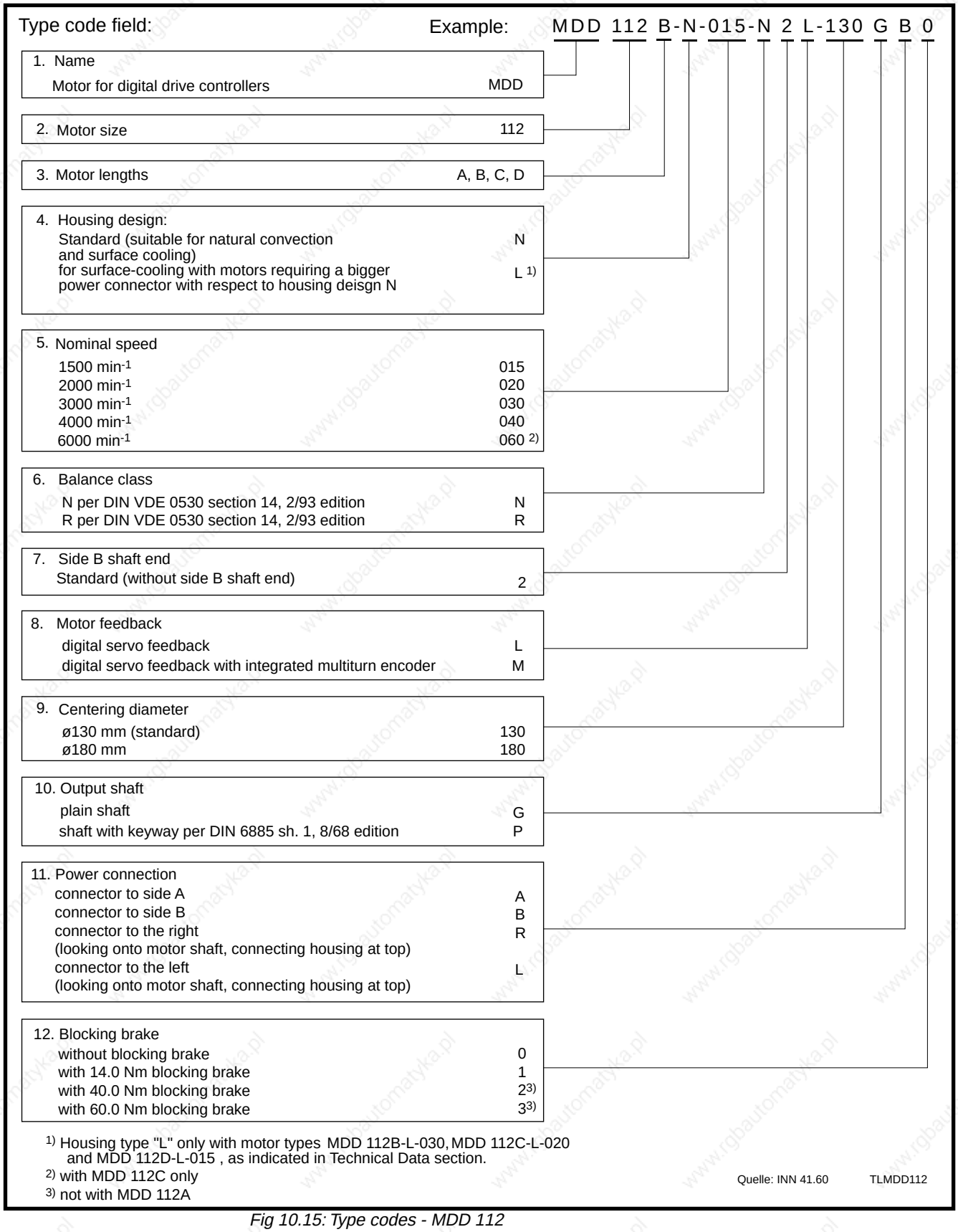


Fig 10.15: Type codes - MDD 112

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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 charcteristics 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	123×10^{-4}	172×10^{-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 charcteristics 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)

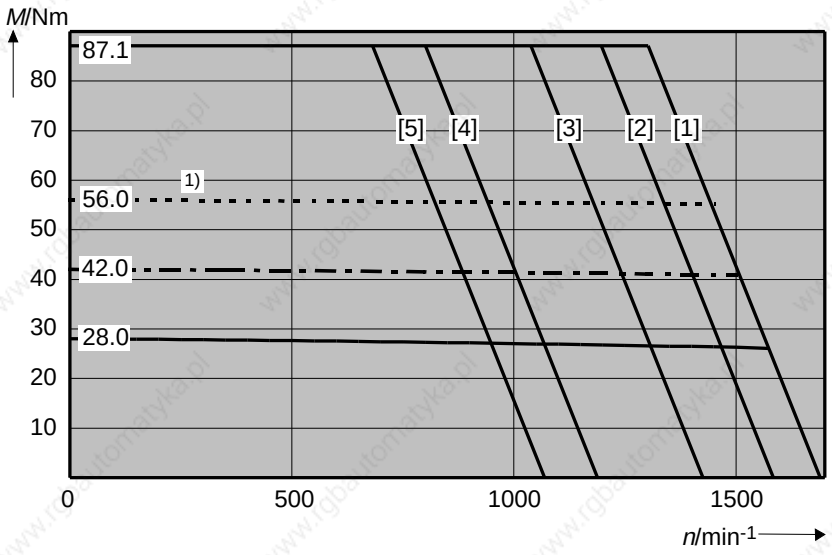
Fig 11.2: General data - MDD 115

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	9.5×10^{-4}	32×10^{-4}
Release delay	t_L	ms	55	150
Clamping delay	t_K	ms	18	30
Mass	m_B	kg	1.9	3.5

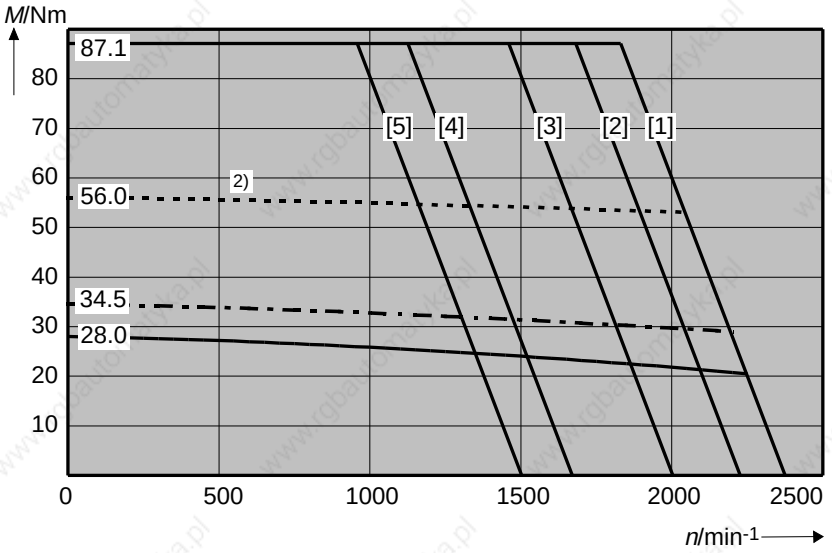
Fig 11.3: Technical data - blocking brake

11.2. Torque-Speed Characteritics

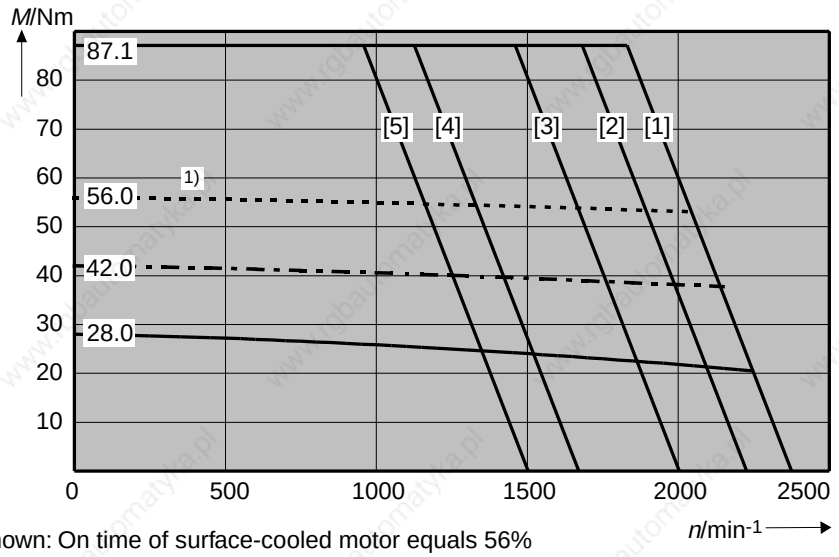
MDD 115 A-N at 1500 min^{-1}



MDD 115 A-N at 2000 min^{-1}



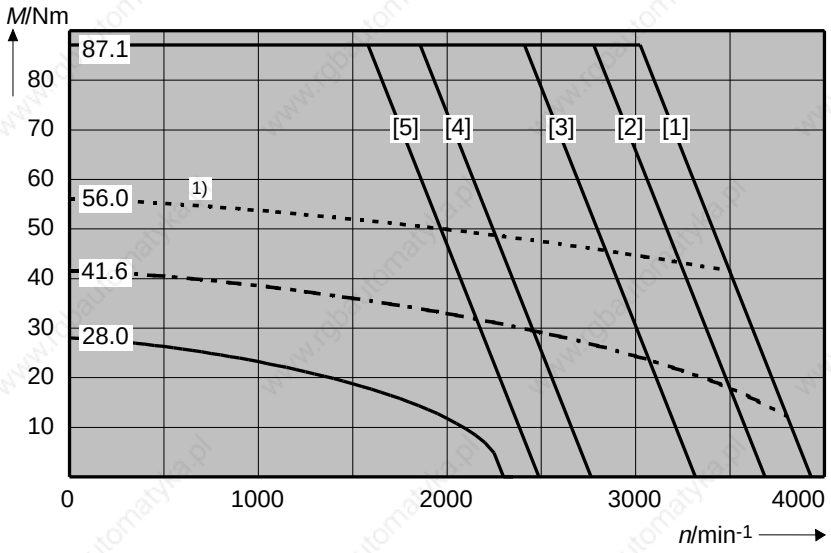
MDD 115 A-L at 2000 min^{-1}



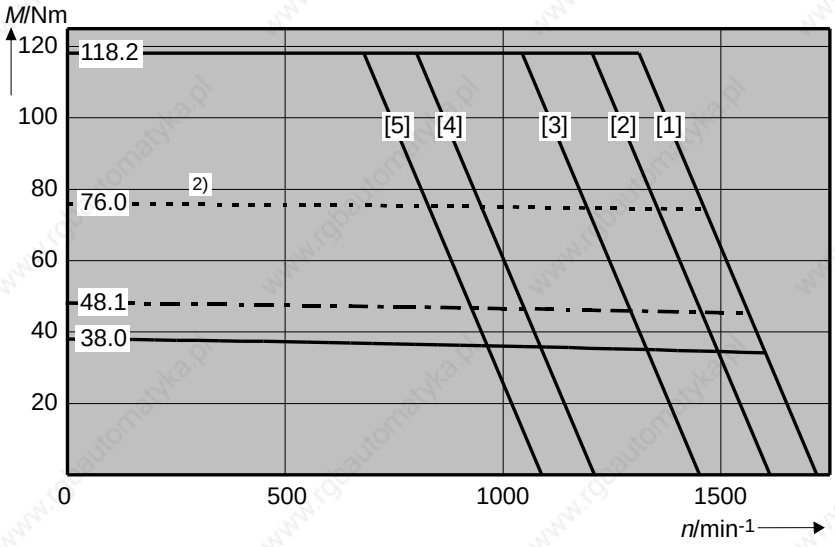
1) Shown: On time of surface-cooled motor equals 56%
2) Shown: On time of surface-cooled motor equals 38%

Fig 11.4: Torque-speed characteristics curve -MDD 115

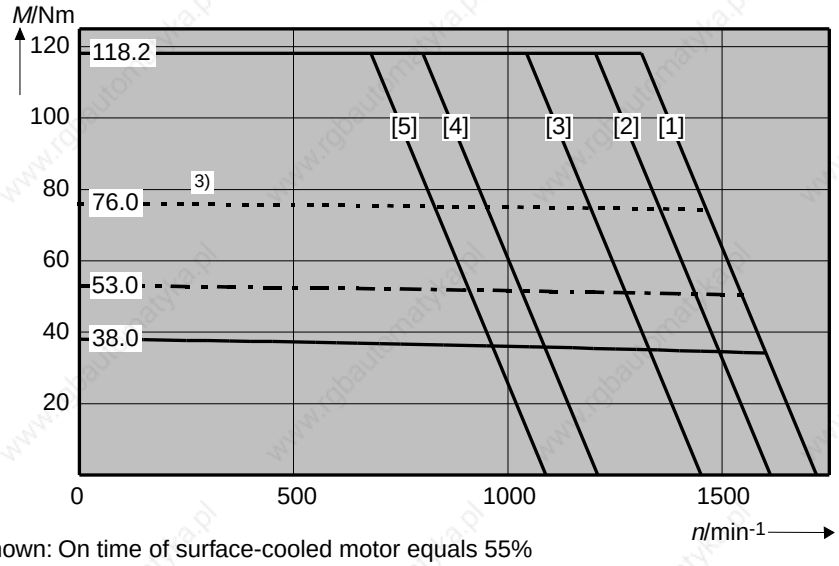
MDD 115 A-N at 3000 min^{-1}



MDD 115 B-N at 1500 min^{-1}



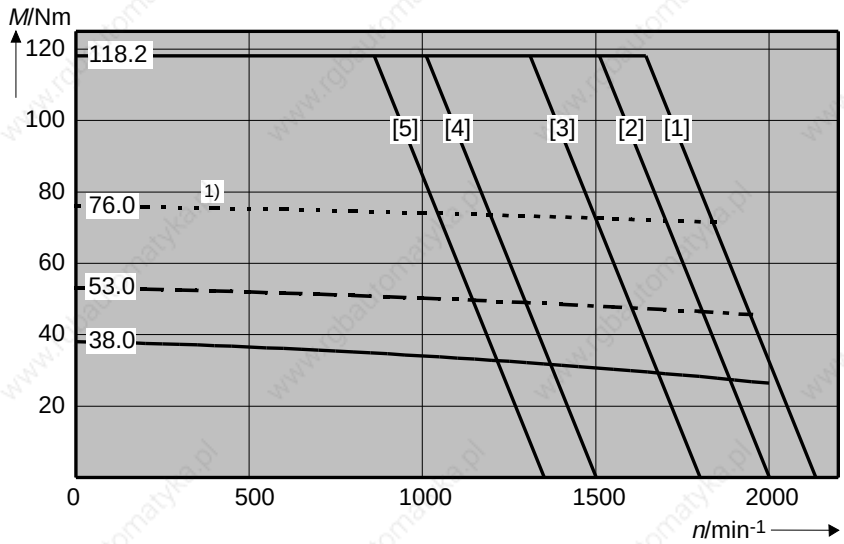
MDD 115 B-L at 1500 min^{-1}



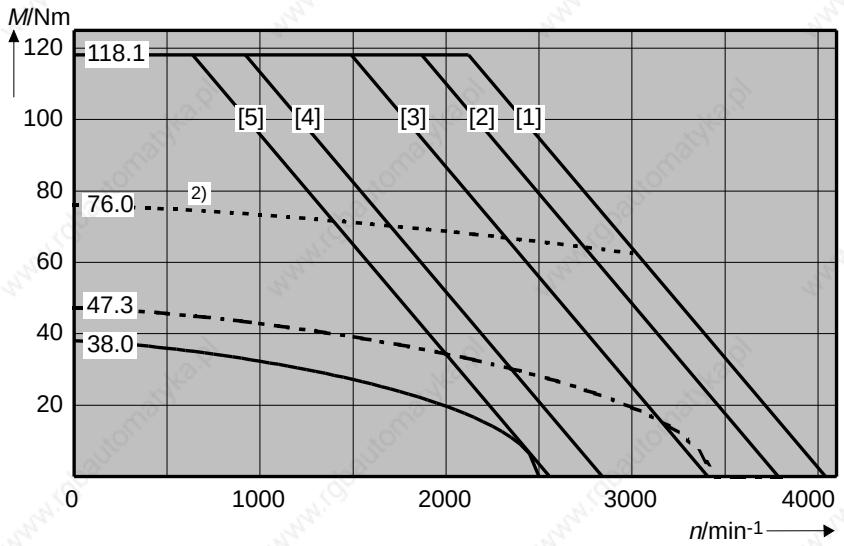
1) Shown: On time of surface-cooled motor equals 55%
2) Shown: On time of surface-cooled motor equals 40%
3) Shown: On time of surface-cooled motor equals 49%

Fig 11.5: Torque-speed characteristics curve - MDD 115

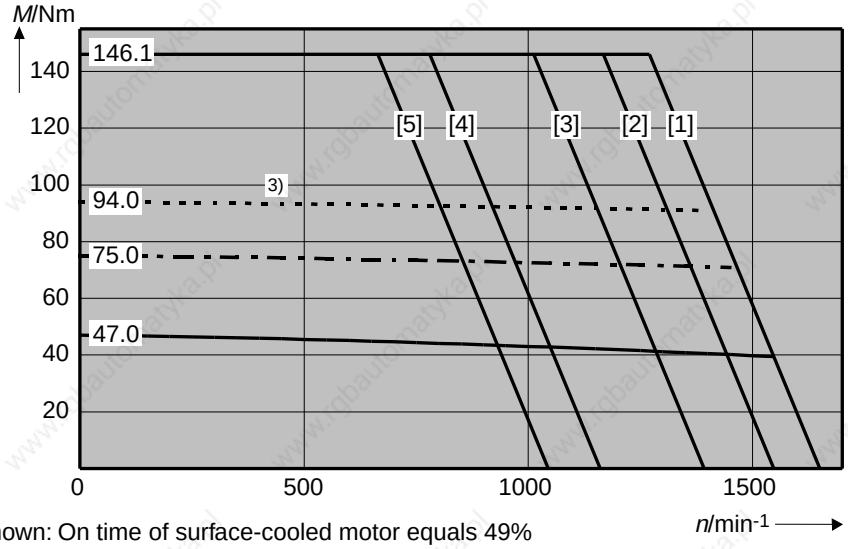
MDD 115 B-N at 2000 min^{-1}



MDD 115 B-N at 3000 min^{-1}



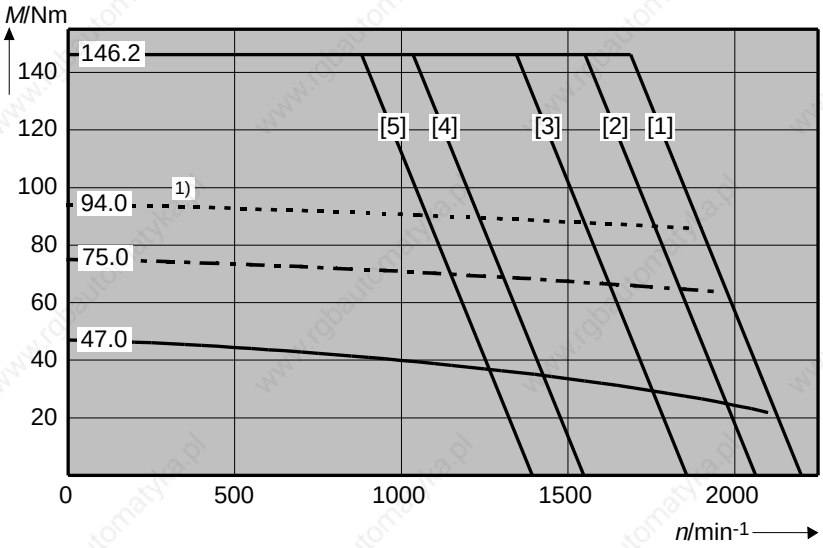
MDD 115 C-N at 1500 min^{-1}



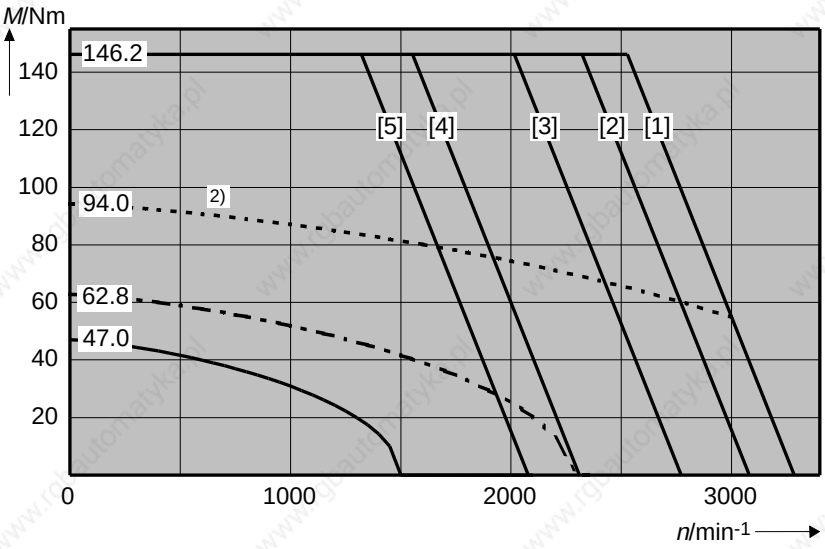
1) Shown: On time of surface-cooled motor equals 49%
2) Shown: On time of surface-cooled motor equals 39%
3) Shown: On time of surface-cooled motor equals 64%

Fig 11.6: Torque-speed characteristics curve - MDD 115

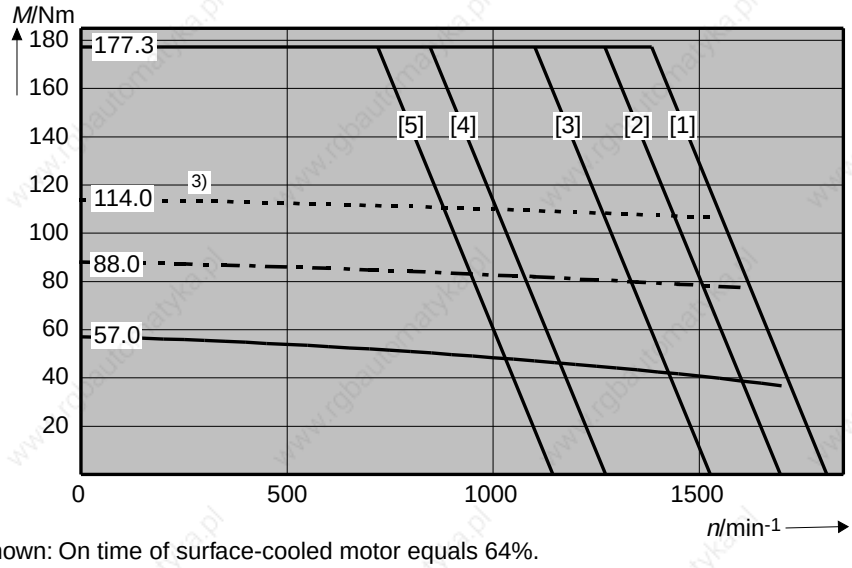
MDD 115 C-N at 2000 min^{-1}



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 characteritics curve - MDD 115

MDD 115 D-N at 2000 min^{-1}

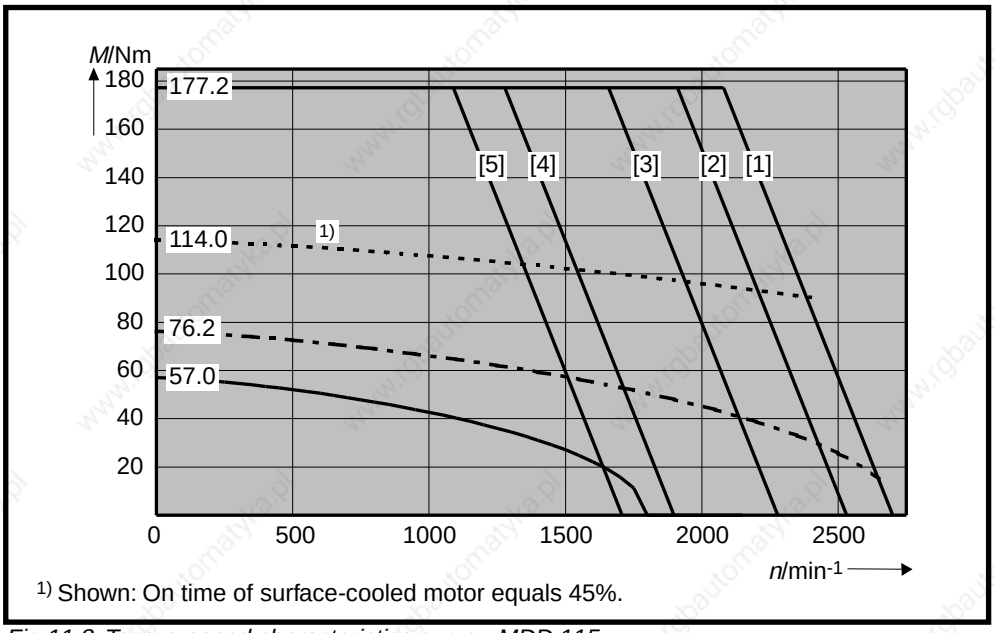


Fig 11.8: Torque-speed characteristics curve - MDD 115

11.3. Shaft Load Capacity

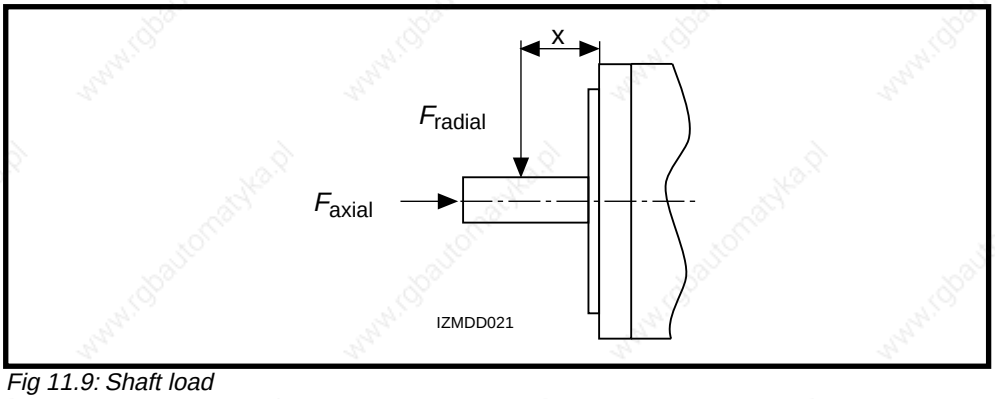


Fig 11.9: Shaft load

Permissible radial force
F_{radial}

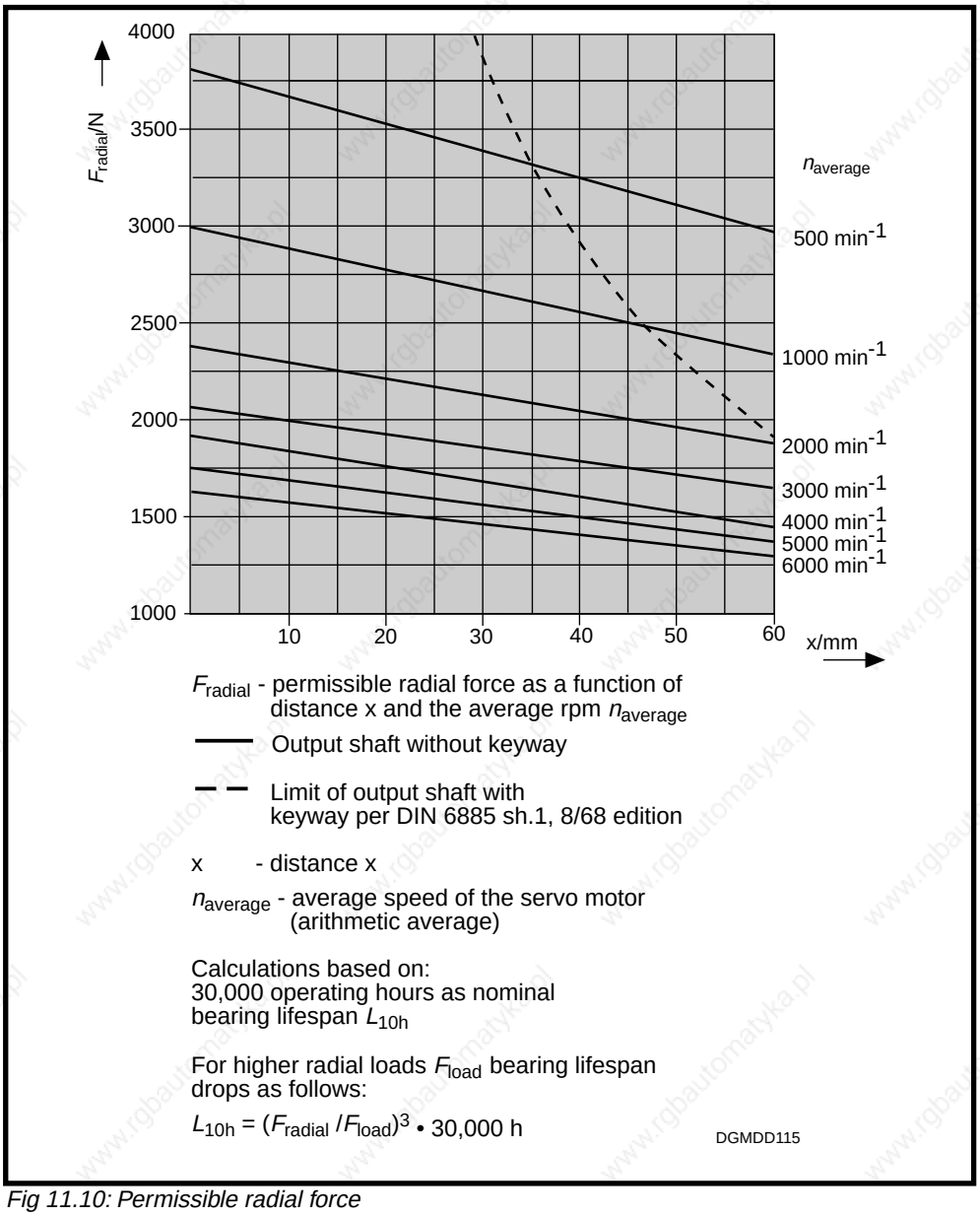


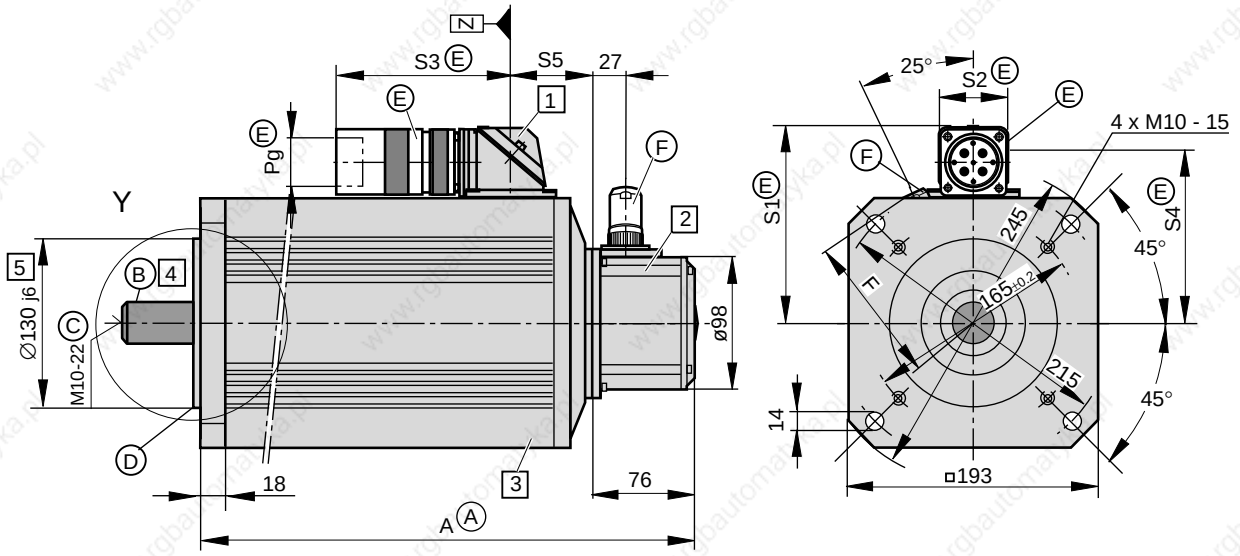
Fig 11.10: Permissible radial force

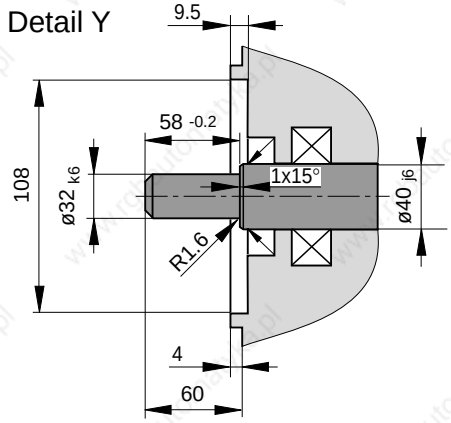
Permissible axial force
F_{axial}

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

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

11.4. Dimensional Data





Ⓐ **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.

Ⓒ
- 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.

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	108
	INS 510	

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

MBMDD115_1

Fig 11.11: Dimensional data - MDD 115

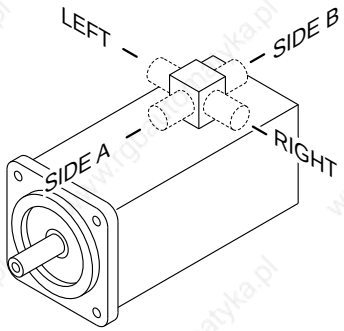
Available Options

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**

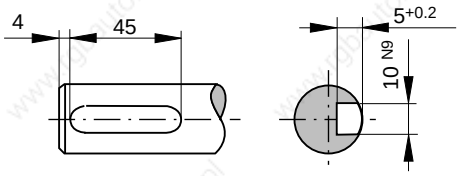
- without blocking brake
- with blocking brake: 45 Nm
- with blocking brake: 60 Nm

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

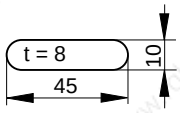
Size	Dim. A	Dim. S5	
		INS 108	INS 172
MDD 115 A	418	104	116
MDD 115 B	468		
MDD 115 C	518		
MDD 115 D	568		

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**

- ø180 j6

MBMDD115_2

Fig 11.12: Dimensional data MDD 115 - available options

11.5. Available Versions

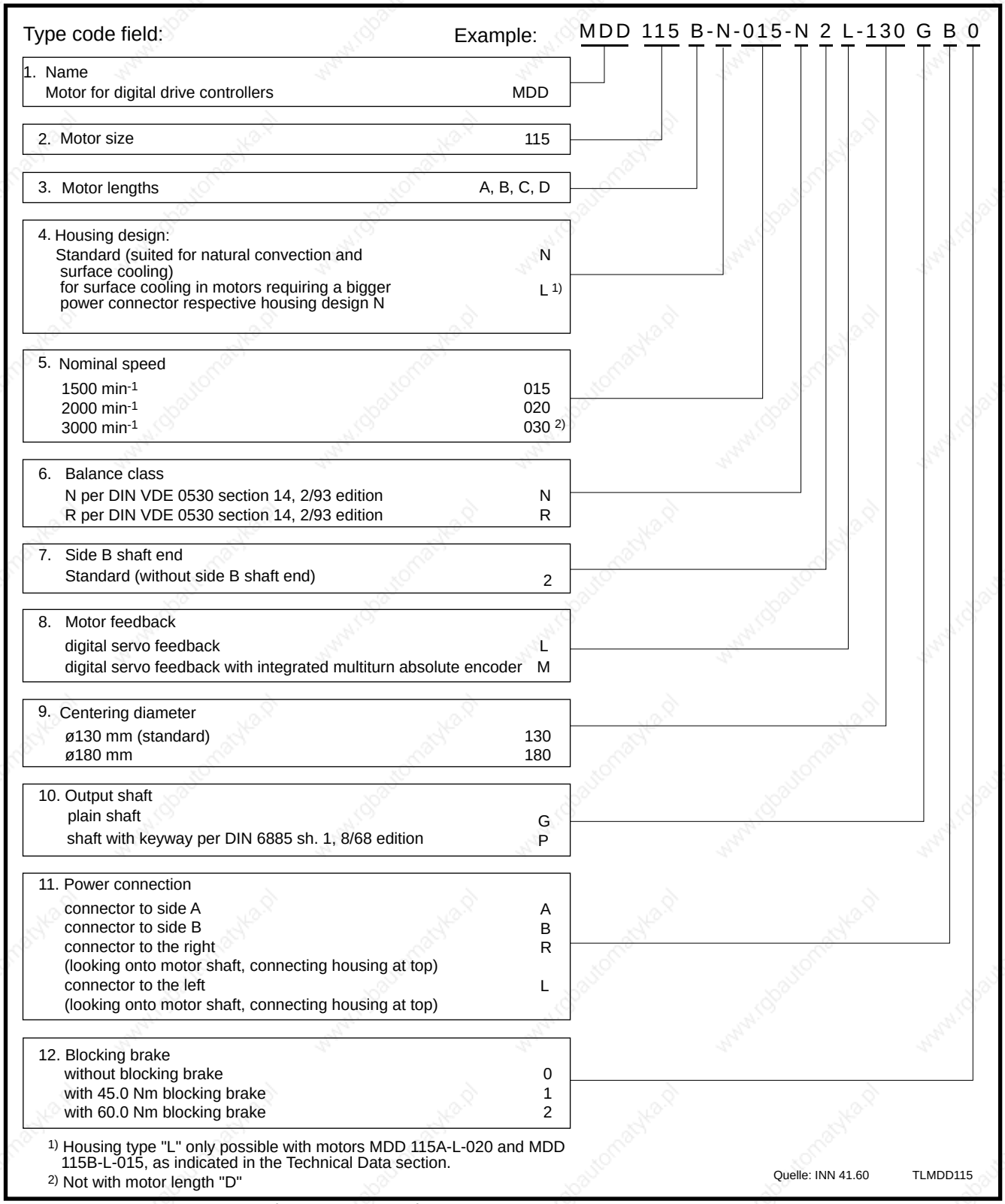
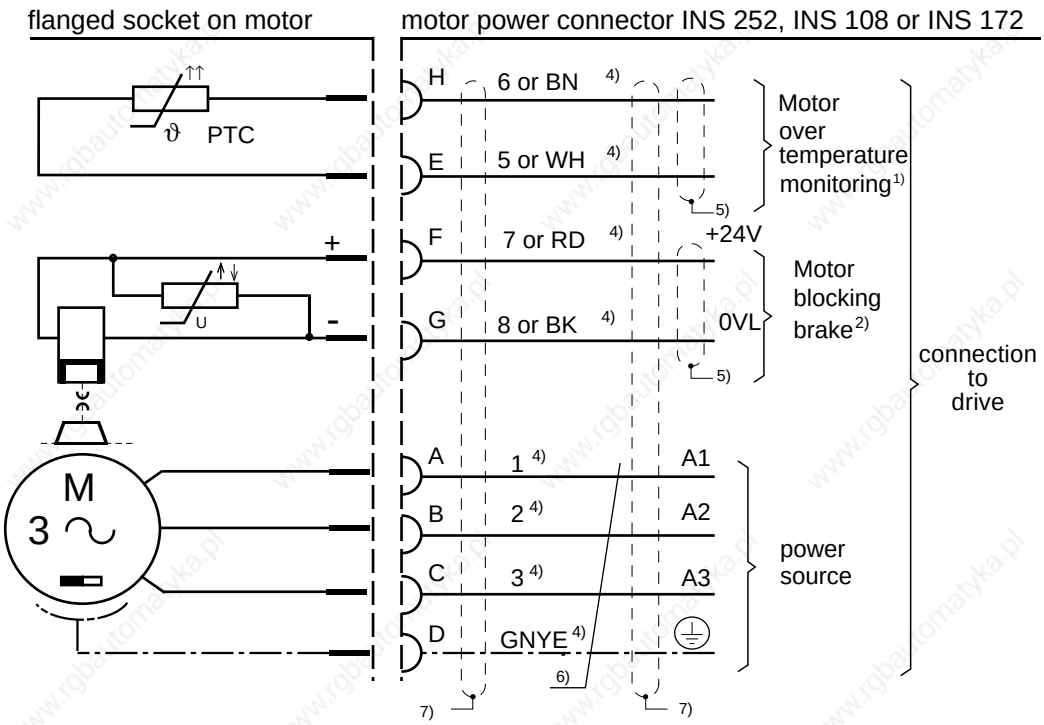


Fig 11.13: Type codes - MDD 115

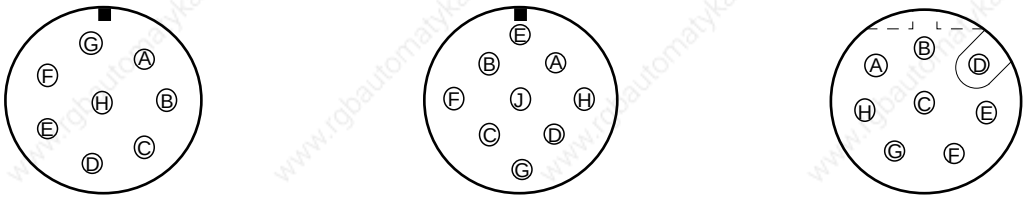
12. Electrical Power Connection

12.1. Terminal Diagram



Motor power connector 3)

(looking towards soldering or crimping side of connector)



INS 108 **INS 172** **INS 252**

1) Recommended cable diameter at least 0.75 mm^2 or AWG 18

2) If motor with blocking brake selected:
- voltage at blocking brake at motor: DC +24 V, ±10 %;
- recommended cable diameter at least 0.75 mm^2 or AWG 18

3) Finishing guidelines for motor power connector:
see cable documentation number 209-0050-4399-XX

4) Core identification of INDRAMAT cable:
Color coding with cable INK 253; all others have number i.d.

5) Mount any shielding in motor power cable to drive controller.

6) See table in Figure 12.2 for diameters.

7) When operating the machine or unit within residential or light industrial areas, it may be necessary to totally shield the power source routing to maintain the limit values for emission of interference (rf interference suppression).
Motor power connector grounded via PG threaded joints.

APALLG

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			
							without total shield		with total shield	Cross section
					Crimping type [3]	Soldering type [3]	standard	highly flex.		
		A	mm²	AWG [2]						mm²
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			
							without total shield		with total shield	Cross section
					Crimping type [3]	Soldering type [3]	standard	highly flex.		
		A	mm^2	AWG [2]						mm^2
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	1.0
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 mm^2 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			
							without total shield		with total shield	Cross section
					Crimping type [3]	Soldering type [3]	standard	highly flex.		
		A	mm^2	AWG [2]						mm^2
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 mm^2 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			
							without total shield		with total shield	Cross section
					Crimping type [3]	Soldering type [3]	standard	highly flex.		
		A	mm^2	AWG [2]						mm^2
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

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 mm^2 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			
							without total shield		with total shield	Cross section
					Crimping type [3]	Soldering type [3]	standard	highly flex.		
		A	mm^2	AWG [2]						mm^2
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 mm^2 or AWG 18. Cables as per UL 508 can only be soldered not crimped to motor power connector.

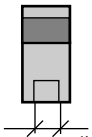
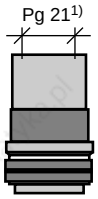
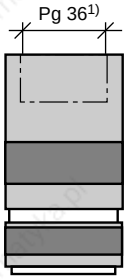
[3] The data following the slash define the type of bushing contact of the connector for either crimping or soldering.

[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.
INS 252  Pg 13,5[1]	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	0.75 mm^2	253 250 653 650	257 379 257 379 257 379 257 379
							AWG 18-16	AWG 18		
INS 108  Pg 21[1]	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	253 250 202 203 204 402 403 404	260 097 225 404 219 857 218 767 218 767 227 526 219 857 218 767
	INS 108/03	2.5	1.5	202 602	219 857 227 526					
	INS 108/04	4.0	1.5	203 402 603	218 767 227 526 218 767		AWG 18-10	AWG 16	653 650 602 603 604	258 787 [4] 258 787 [4] 227 526 218 767 218 767
INS 172  Pg 36[1]	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]					
	INS 172/16	16.0	1.5	206 406 606	220 472 [3] 220 472 [3] 220 473		AWG 10-3	AWG 16	403 404 405 406 407 603 604 605 606 607	228 864 [3] 220 874 [3] 221 554 [3] 220 472 [3] 220 472 [3] 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 mm²	Control core [1] cross section mm²	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.

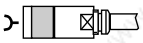
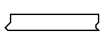
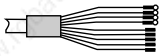
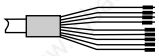
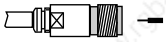
Fig 12.4: Type-dependent data of the motor power cable

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 mm² 	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	—	—	—

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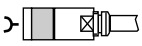
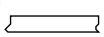
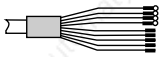
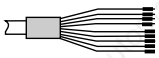
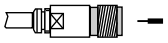
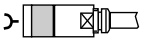
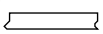
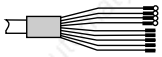
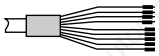
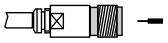
1) For coupling connector mate: motor power connector

Servo motor MDD …	Cooling mode	Motor power connector 	Motor power cable mm² 	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

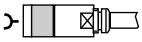
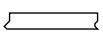
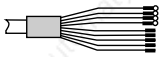
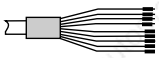
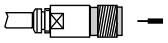
Continued on next page

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)
			mm² 			
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

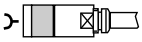
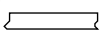
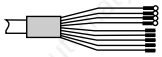
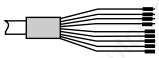
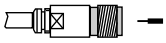
Continued on next page

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)
			mm² 			
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

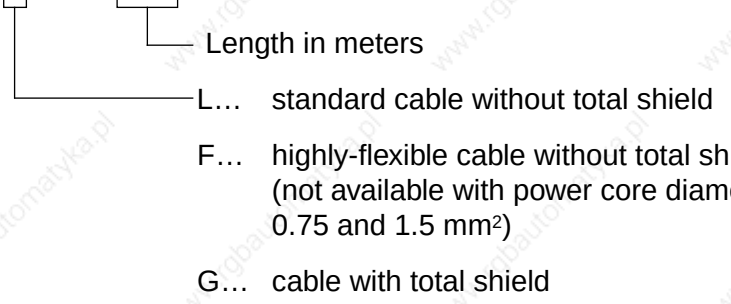
Servo motor MDD …	Cooling mode	Motor power connector	Motor power cable	Cable end for …		
				Connection to drive using a terminal bolt (e.g.. DDS 2)	Intermediate clamp on terminal strip or connection to drive using terminal clamp (e.g.. DKS. DDS 3. DKC)	Intermediate connection using coupling 1)
			mm² 			
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



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…

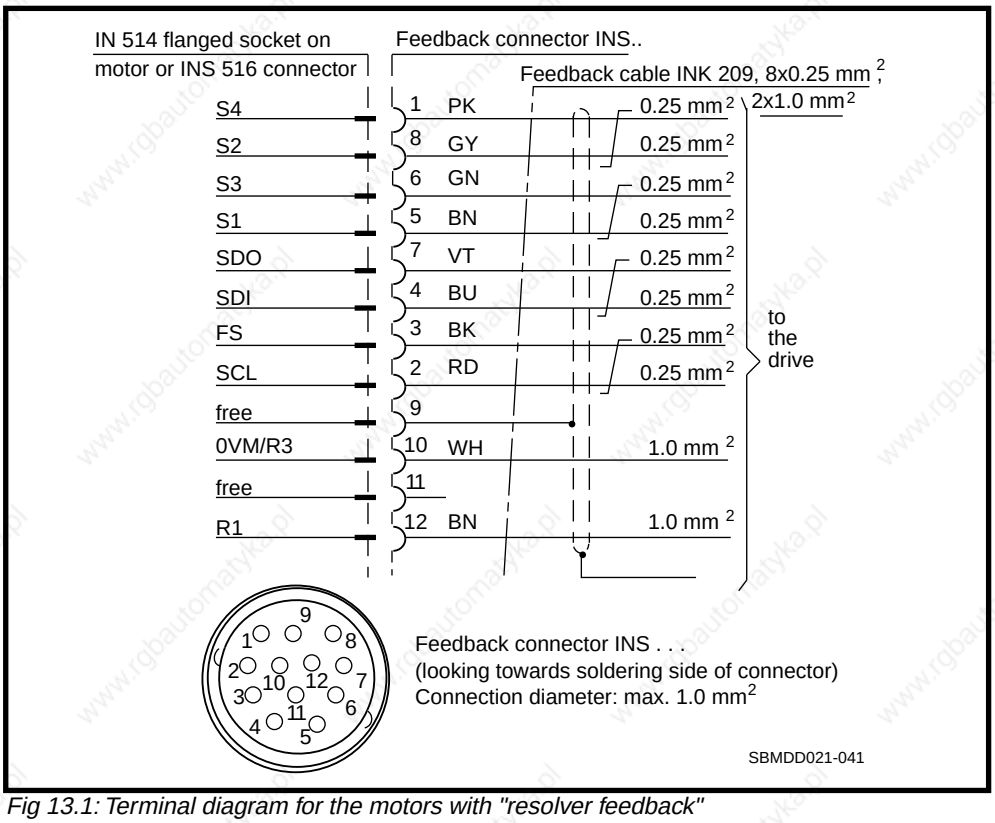


Fig 13.1: Terminal diagram for the motors with "resolver feedback"

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

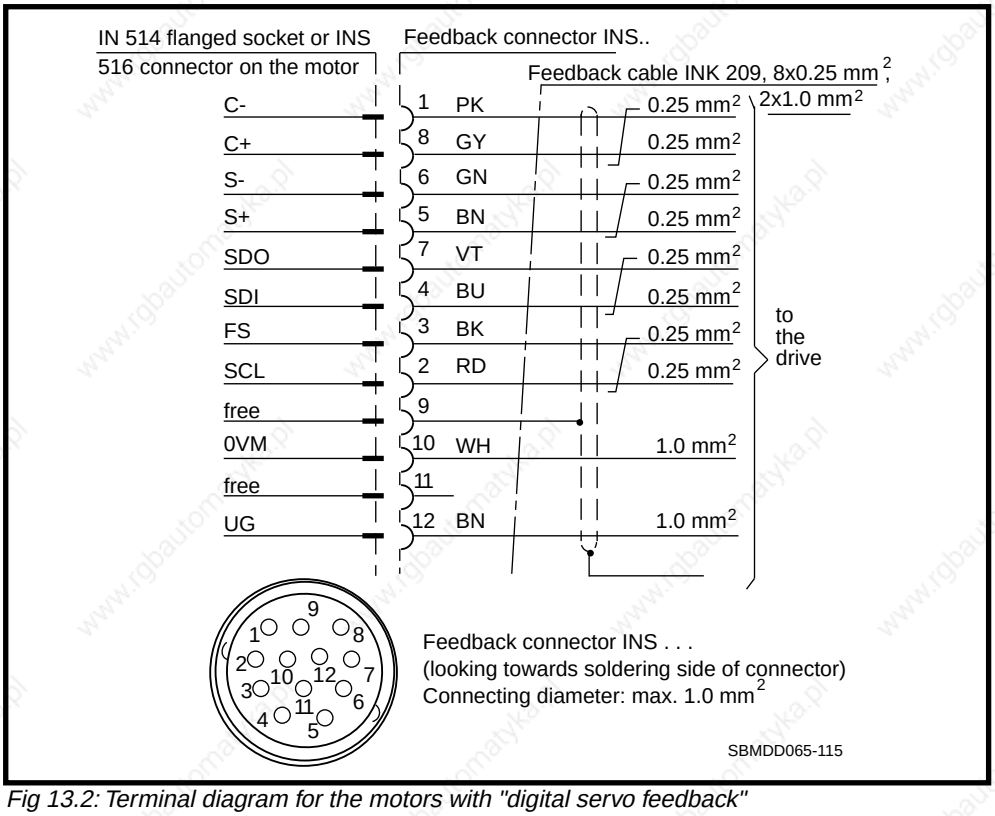
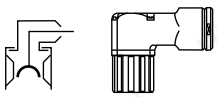
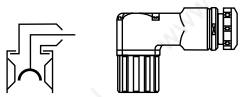


Fig 13.2: Terminal diagram for the motors with "digital servo feedback"

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

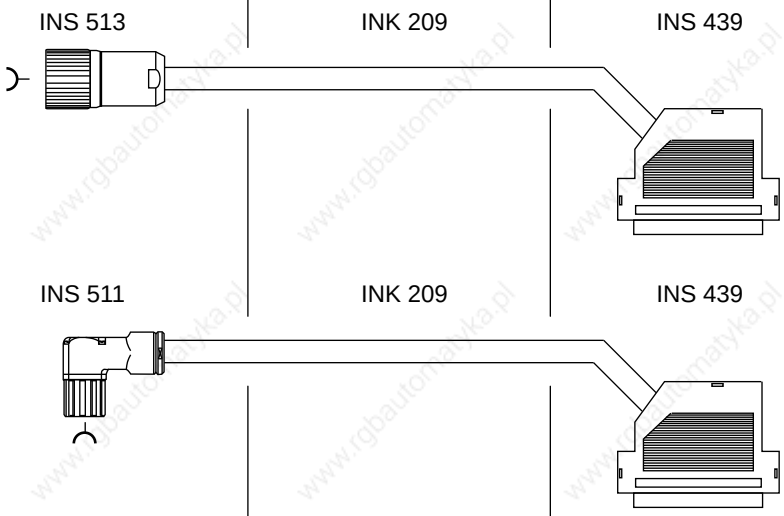
13.3.1. Technical Data

Type designation	INK 209
Cable to connector transision 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	
IKS 379 [2]	INS 511	INK 209	



[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

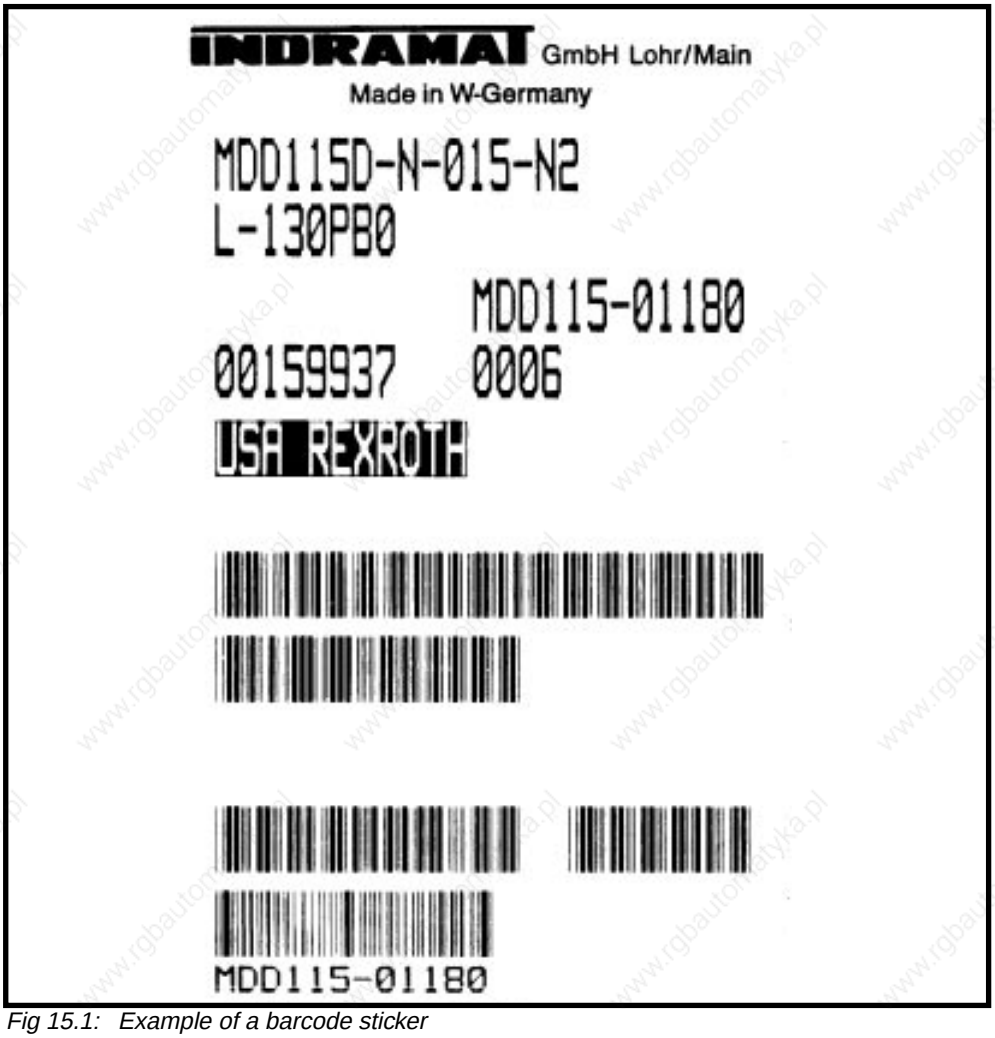


Fig 15.1: Example of a barcode sticker

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.

.

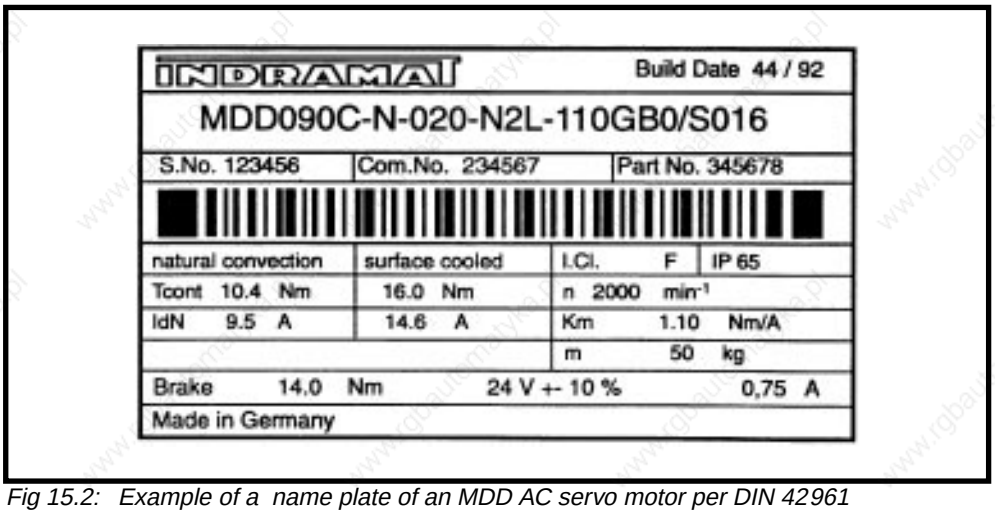


Fig 15.2: Example of a name plate of an MDD AC servo motor per DIN 42961

16. Storage, Transport and Handling

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

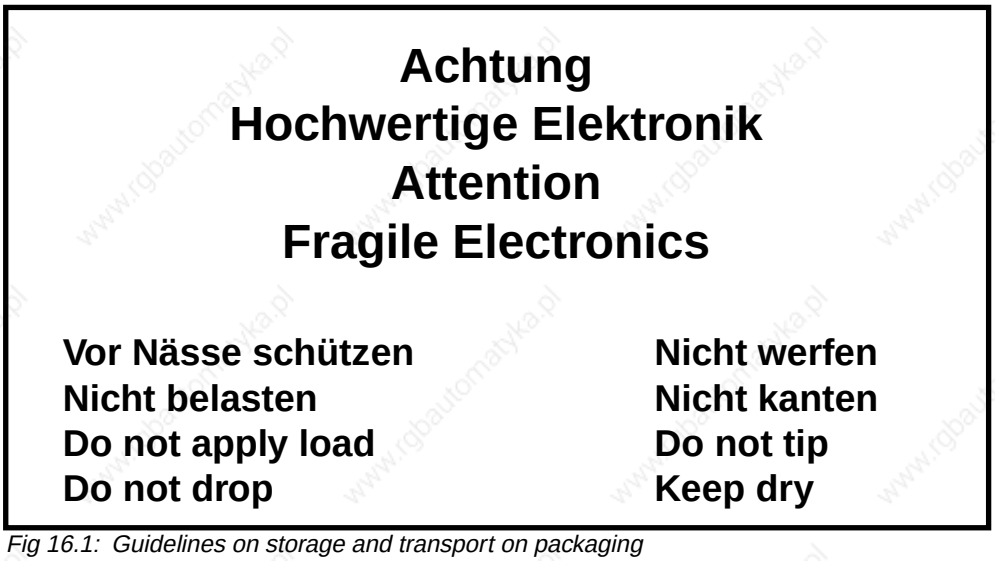


Fig 16.1: Guidelines on storage and transport on packaging

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!

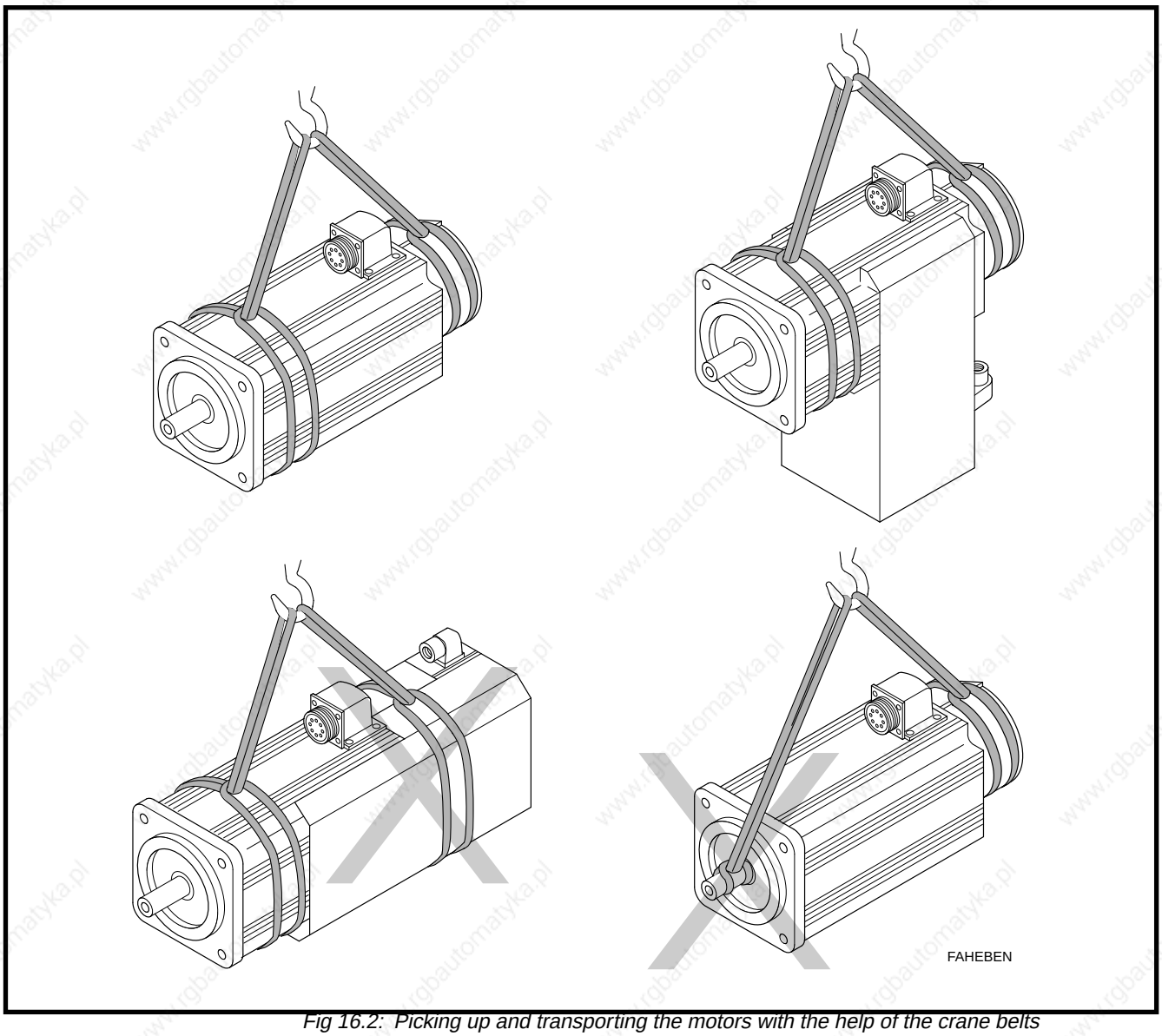


Fig 16.2: Picking up and transporting the motors with the help of the crane belts

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.

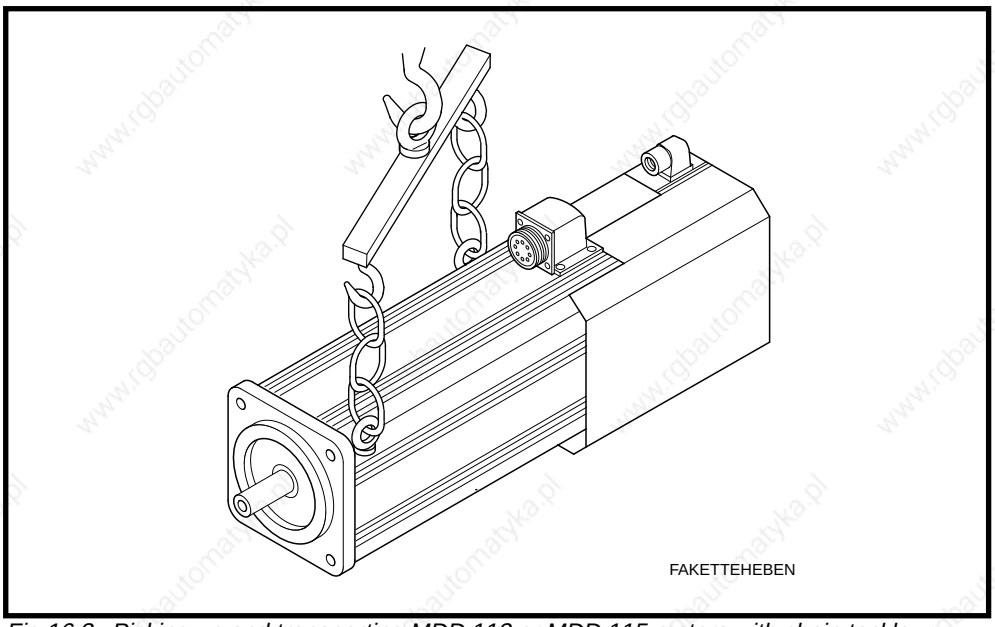


Fig 16.3: Picking up and transporting MDD 112 or MDD 115 motors with chain tackle

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:	☐ horizontal ☐ vertical ☐	Operating time:	Date fault occurred:

Fault:

Fault _____

_____

☐ constantly present
☐ occurs sporadically
☐ occurs after _____ hrs.
☐ occurs with shocks
☐ depends on temperature
☐ other

_____
_____
_____

Additional data:
(e.g., LED diagnosis, error in display)

_____
_____
_____
_____
_____
_____
_____
_____

Cause of fault:

☐ unknown
☐ connection fault
☐ external short circuit
☐ mechanical damage
☐ loose cable(s)
☐ other

_____
_____
_____

Additional Data

General data:

☐ no function
☐ drive not running smooth
☐ uncontrolled drive motions
☐ error in one direction only
☐ supply unit short-circuit fault
☐ other

Concommitant phenomena:

☐ Problems in mechanical sys.
☐ Mains failure
☐ Control failure
☐ Motor failure
☐ Break in cable
☐ other

Drive, supply unit, amplifier, power section

☐ control voltage faulty
☐ power sect. circuit breaker F ___
☐ blower defective
☐ bleeder resistor defective
☐ power voltage faulty
☐ connecting bolt broke
☐ other

Control:

☐ no function
☐ display failed
☐ no command value output
☐ diagnosis
☐ dim. offset in _____ direction
☐ E-stop loop interrupted
☐ position control loop won't close
☐ program sequence fault
☐ interior auxiliary function faulty (outputs)
☐ acknowledgements not accepted (inputs)
☐ other

_____
_____

Motor:

☐ temperature monitoring defective
☐ brake defective
☐ blower defective
☐ feedback defective
☐ tachometer signal faulty
☐ BLC-signal faulty
☐ short-circuit to ground
☐ thermal overload
☐ other

_____
_____
_____
_____

Comments:

_____
_____
_____
_____
_____
_____
_____

PlRepBegl

Fig 18.1: Repair Card

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