# SINAMICS S120

## SIMOTICS T-1FW3 complete torque motors

Configuration Manual · 04/2012

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Configuration Manual




(PKTS), 04/2012

6SN1197-0AD70-0BP6

## Legal information

### Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

**⚠ DANGER**

indicates that death or severe personal injury **will** result if proper precautions are not taken.

**⚠ WARNING**

indicates that death or severe personal injury **may** result if proper precautions are not taken.

**⚠ CAUTION**

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

**CAUTION**

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

**NOTICE**

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

### Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

### Proper use of Siemens products

Note the following:

**⚠ WARNING**

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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### Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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# Preface

## Motor documentation

The motor documentation is organized in the following categories:

- General documentation e.g. catalogs
- Manufacturer/service documentation e.g. Operating Instructions and Configuration Manuals

## More information

Information on the following topics is available under the link:

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

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Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following e-mail address:

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## My Documentation Manager

The following link provides information on how to create your own individual documentation based on Siemens content, and adapt it for your own machine documentation:

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## Training

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http://siemens.com/sitrain

## Technical Support

For technical support telephone numbers for different countries, go to:

http://www.siemens.com/automation/service&support

## Internet addresses for drive technology

Internet address for motors: http://www.siemens.com/motors

Internet address for products: http://www.siemens.com/motioncontrol

Internet address for SINAMICS: http://www.siemens.com/sinamics

## Target group

This documentation addresses project planners and project engineers as well as machine manufacturers and commissioning engineers.

## Benefits

The Configuration Manual supports you when selecting motors, calculating the drive components, selecting the required accessories as well as when selecting line and motor-side power options.

## Standard scope

The scope of the functionality described in this document can differ from the scope of the functionality of the drive that is actually supplied.

- Other functions not described in this documentation might be able to be executed in the drive. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.
- The documentation can also contain descriptions of functions that are not available in a particular product version of the drive. The functionalities of the supplied drive should only be taken from the ordering documentation.
- Extensions or changes made by the machine manufacturer are documented by the machine manufacturer.

For reasons of clarity, this documentation does not contain all of the detailed information on all of the product types. This documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

## EC Declarations of Conformity

The EC Declaration of Conformity for the EMC Directive can be found on the Internet at

http://support.automation.siemens.com

There – as a search term – enter the number **15257461** or contact your local Siemens office.

## Danger and warning information

**⚠ DANGER**

Commissioning is absolutely prohibited until it has been completely ensured that the machine, in which the components described here are to be installed, is in full compliance with the provisions of the EC Machinery Directive.

Only appropriately qualified personnel may commission the SINAMICS units and the motors.

This personnel must carefully observe the technical customer documentation associated with this product and be knowledgeable about and carefully observe the danger and warnings.

Operation of electrical equipment and motors inevitably involves electrical circuits with dangerous voltages. All of the work carried out on the electrical machine or system must be carried out while it is in a no-voltage condition.

When the machine or system is operated, hazardous axis movements can occur.

Notes regarding operation with residual current protective devices (FI, RCD) see the "Manual" of the converter that is being used.

In combination with the drive system, the motors are generally approved for operation on TN and TT line supply systems with **grounded neutral** and on IT line supply systems.

When connected to IT line supply systems, when a first fault occurs between an active part and ground, this must be signaled using appropriate monitoring equipment. In accordance with IEC 60364-4-41, it is recommended that the first fault is removed as quickly as is practically possible.

In systems with a **grounded external conductor**, an isolating transformer with grounded neutral (secondary side) must be connected between the line supply and the drive system to protect the motor insulation from excessive stress.

**⚠ DANGER**

**There is a risk of shock due to the residual voltages at the motor terminals!**

When the power supply voltage is switched-off, active parts of the motor can have a charge of more than 60 µC. In addition, at open-circuit cable ends – e.g. when a connector is withdrawn – even after the power has been disconnected, a voltage of more than 60 V is present for 1 s. This is the reason that you must apply the appropriate measures to provide protection against residual voltages!

**⚠ WARNING**

For 1FW3 motors, voltages are present at the motor terminals when the rotor is rotating (as a result of the permanent magnets). The voltage can be as high as 1000 V depending on the type of motor.

The equipment and motors must be transported, stored, installed, mounted, operated, serviced, and maintained properly in order to ensure that they function correctly and safely.

In the case of special versions of the drive units and motors, the information and data provided in the catalogs and quotations also apply.

In addition to the danger and warning information/instructions in the technical customer documentation supplied, the applicable domestic, local and plant-specific regulations and requirements must be carefully taken into account.

**⚠ CAUTION**

The motors can have surface temperatures of over +100 °C.

For this reason, temperature-sensitive components (e.g. cables or electronic components) must not come into contact with or be attached to the motor.

When connecting the cables, ensure that they
– are not damaged
– are not subject to tensile stress
– cannot be touched by rotating components.

**CAUTION**

Motors should be connected in accordance with the operating instructions. They must not be connected directly to the three-phase supply because this will damage them.

SINAMICS units and synchronous motors are subject to a voltage test during routine testing. While the electrical equipment of industrial machines is being subjected to a voltage test in accordance with EN 60204-1, Section 19.4, all SINAMICS drive unit connections must be disconnected/withdrawn in order to avoid damaging the SINAMICS drive units.

**CAUTION**

Motors with DRIVE-CLiQ interface have an electronic rating plate which contains motor and encoder-specific data. This is the reason that encoder modules with DRIVE-CLiQ interface or mounted Sensor Module may only be operated on the original motor - and may not be mounted onto other motors or replaced by a Sensor Module from other motors.

The DRIVE-CLiQ interface has direct contact to components that can be damaged/ destroyed by electrostatic discharge (ESDS). Neither hands nor tools that could be electrostatically charged should come into contact with the connections.

**Note**

When operational and in dry operating rooms, SINAMICS units with synchronous motors fulfill the Low-Voltage Directive.

In the configurations specified in the associated EC Declaration of Conformity, SINAMICS units with synchronous motors fulfill the EMC Directive.

## ESDS instructions and electromagnetic fields

**⚠ CAUTION**

An **e**lectrostatic-**s**ensitive **d**evice (ESDS) is an individual component, integrated circuit, or module that can be damaged by electrostatic fields or discharges.

ESDS regulations for handling boards and equipment:

When handling components that can be destroyed by electrostatic discharge, it must be ensured that personnel, the workstation and packaging are well grounded!

Personnel in ESD zones with conductive floors may only touch electronic components if they are
– grounded through an ESDS bracelet and
– wearing ESDS shoes or ESDS shoe grounding strips.

Electronic boards may only be touched when absolutely necessary.

Electronic boards may not be brought into contact with plastics and articles of clothing manufactured from man-made fibers.

Electronic boards may only be placed on conductive surfaces (table with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).

Electronic boards may not be brought close to data terminals, monitors or television sets. Minimum clearance to screens > 10 cm).

Measurements may only be carried-out on electronic boards and modules if
– the measuring instrument is grounded (e.g. via a protective conductor) or
– before making measurements with a potential-free measuring device, the measuring head is briefly discharged (e.g. by touching an unpainted blank piece of metal on the control cabinet).

**⚠ DANGER**

It may be dangerous for people to remain in the immediate proximity of the product – especially for those with pacemakers, implants or similar – due to electric, magnetic and electromagnetic fields (EMF) occurring as a consequence of operation.

The machine/system operator and the people present near the product must observe the relevant guidelines and standards! These are, for example, in the European Economic Area (EEA) the Electromagnetic Fields Directive 2004/40/EC and the standards EN 12198-1 to 12198-3 and in the Federal Republic of Germany the Employer's Liability Insurance Association Regulations for the Prevention of Industrial Accidents BGV 11, with the relevant rule BGR 11 "Electromagnetic Fields".

Then a risk assessment must be carried out for every workplace, activities for reducing dangers and exposure for people decided upon and implemented, as well as determining and observing exposure and danger areas.

## Information regarding third-party products

**NOTICE**

This document contains recommendations relating to third-party products. This involves third-party products whose fundamental suitability is familiar to us. It goes without saying that equivalent products from other manufacturers may be used. Our recommendations are to be seen as helpful information, not as requirements or regulations. We cannot accept any liability for the quality and properties/features of third-party products.

## Environmental compatibility

- Environmental aspects during development

  When selecting supplier parts, environmental compatibility was an essential criteria.

  Special emphasis was placed on reducing the envelope dimensions, mass and type variety of metal and plastic parts.

  Effects of paint-wetting impairment substances can be excluded (PWIS test)

- Environmental aspects during production

  Supplier parts and the products are predominantly transported in re-usable packing. Transport for hazardous materials is not required.

  The packing materials themselves essentially comprises paperboard containers that are in compliance with the Packaging Directive 94/62/EC.

  Energy consumption during production was optimized.

  Production has low emission levels.

- Environmental aspects for disposal

  Motors must be disposed of carefully taking into account domestic and local regulations in the normal recycling process or by returning to the manufacturer.

  The following must be taken into account when disposing of the motor:

  Oil according to the regulations for disposing of old oil (e.g. gear oil when a gearbox is mounted)

  Not mixed with solvents, cold cleaning agents of remains of paint

  Components that are to be recycled should be separated according to:

  – Electronics scrap (e.g. encoder electronics, sensor modules)
  – Iron to be recycled
  – Aluminum
  – Non-ferrous metal (gearwheels, motor windings)

## Residual risks of power drive systems

When carrying out a risk assessment of the machine in accordance with the EU Machinery Directive, the machine manufacturer must as a minimum consider the following residual risks associated with the control and drive components of a power drive system (PDS).

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions not within the scope of the specification
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage
2. Exceptional temperatures as well as emissions of light, noise, particles, or gas caused by, for example:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions not within the scope of the specification
   - External influences / damage
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions not within the scope of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

More extensive information concerning the residual risks associated with the PDS is provided in the relevant chapters of the technical user documentation.

# Table of contents

# Motor description

# 1

## 1.1 Properties

### Overview

The 1FW3 series was developed as direct drive. This direct drive is a compact drive unit where the mechanical motor power is transferred directly to the driven machine without any mechanical transmission elements. 1FW3 complete torque motors are water-cooled, high-pole (slow running) permanent-magnet-excited synchronous motors. The operating characteristics are comparable to those of regular synchronous motors.

The range includes 3 outer diameters with various shaft lengths. For shaft heights 150 and 200, the stator and rotor have a flange with centering edges and tapped holes at the DE that allow them to be integrated into a machine.

The complete torque motor 1FW3 can be ordered with various shaft versions:

- Hollow shaft
- Plug-on shaft with integrated shaft centering
- Solid shaft

These allow highly flexible design and maintenance concepts to be implemented. 1FW3 torque motors can be combined with the SINAMICS S120 drive system to create a powerful, high-performance system. The integrated encoder systems for speed and position control can be selected according to the application.

Table 1- 1 Shaft versions

| Versions | Hollow shaft | Plug-on shaft | Solid shaft |
|---|---|---|---|
| Photo-graph |  |  |  |
| Advan-tages | • continuously hollow shafts can be used for feeding coolant/heating media, measuring cables, etc.<br>• motors with various lengths can be connected to the machine shaft | • simple and quick installation as a result of the integrated shaft adapter with centering<br>• simpler clamping element<br>• simple encoder replacement | • "classic" motor installation<br>• simplest overall solution<br>• simple replacement of a geared motor without having to change the connection to the machine<br>• simple encoder replacement |

## Use and highlights

- High torque for a compact design and low envelope dimensions
- Optimized mechatronic solution
  - High degree of stiffness
  - High speeds possible
  - Innovative machine concepts are possible
  - Increased productivity and quality
- The optimum version for any application
  - Wide power range from 3 to 380 kW
  - Rated torques from 100 to 7000 Nm
  - Rated speeds from 150 to 1200 rpm
  - Hollow shaft, plug-on shaft or solid shaft
  - Different encoder types for speed control and precision positioning
- Outstanding performance characteristics
  - Maximum speeds of up to 1800 rpm
  - Excellent rotational accuracy
  - High dynamic response (short acceleration times)

- The ideal motor for energy-saving solutions
- Simple encoder replacement without requiring any readjustment for plug-on and solid shafts

## Field of applications

- Main extruder drives
- Worm drives for injection molding machines
- Roll drive
- Winder
- Cross lapper
- Pull-roll drives for foil drawing machines
- Stretch, calender, casting and cooling rolls
- Dynamic positioning tasks, e.g. rotary tables, clocked conveyor belts
- Replacing hydraulic motors
- Roll drives in paper machines
- Cross-cutter drives for continuous material webs, e.g. paper, textiles, metal sheet
- Wire-drawing machines
- Chippers

## Overview of the special Heavy Duty version

In many machining processes in the industrial environment, the tools and machining equipment are subjected to extreme mechanical stresses. This is the case in metal forming for example, but also in machining processes in which extremely high forces must be applied.

Also the trend towards greater productivity and more refined products requiring the use of more complex machining techniques demands the use of state-of-the-art but also extremely rugged drive systems and automation technology.

Figure 1-1 Complete 1FW3 Heavy Duty torque motor

Siemens is offering, with the complete 1FW3 Heavy Duty torque motor, a direct drive that addresses the following requirements.

The powerful, permanent-magnet synchronous motor is characterized on the one hand by its high dynamic response and precision. On the other hand, the motor has a mechanically rugged design, enabling it to resist shocks in the range of up to 10 g without any difficulty.

The 1FW3 Heavy Duty torque motor is ideally suited to following the motion profiles with high demands on the dynamic performance of higher-level motion controllers even under harsh operating conditions.

In contrast to motor/gearbox combinations, the complete 1FW3 Heavy Duty torque motor is characterized not only by its enhanced ruggedness, but also by its compactness. These characteristics make it particularly suitable as a main drive in servo presses.

The Heavy Duty version is defined by specifying option +L03. At the present time, only shaft height 280 is available. For an additional mechanical description, refer to the Chapter "Heavy Duty" in the Installation chapter.

### Complete 1FW3 Heavy Duty torque motor – brief overview of its strengths

- High precision true running characteristics and outstanding dynamic performance
- 200% overload capability

### Easy to integrate

- in the mechanical system
- in the SINAMICS S120 drive system (DRIVE-CLiQ interface)

### Complete 1FW3 Heavy Duty torque motor – brief overview of the technology

| | |
|---|---|
| Rated speed:* | up to 600 rpm (maximum speed up to 1,000 rpm) |
| Rated torque:* | up to 6600 Nm (maximum torque up to 11,400 Nm) |

* depending on the version and type

### Complete 1FW3 Heavy Duty torque motor – typical applications

Especially rugged direct drive for use in harsh environments, e.g. in servo presses

# 1.2 Torque overview

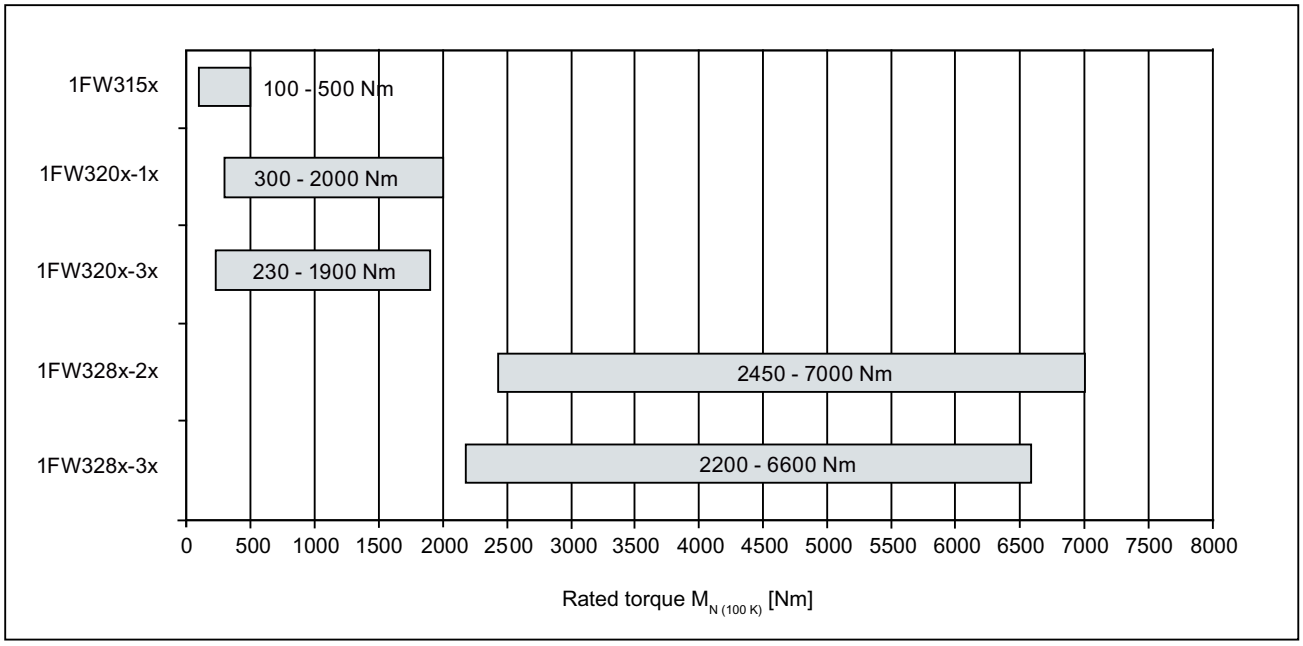



Figure 1-2 Torque overview, 1FW3

# 1.3 Technical features

Table 1- 2 Technical features

| | |
|---|---|
| Motor type | Permanent-magnet synchronous motor |
| Magnet material | Rare-earth magnetic material |
| Stator winding insulation<br>(acc. to EN 60034-1; IEC 60034-1) | Temperature class 155 (F) for a winding temperature rise of $\Delta T$ = 100 K for a cooling water intake temperature of +30 °C. |
| Installation altitude (to IEC 60034-1) | For an installation altitude > 1000 m above sea level, the relevant data in the drive converter documentation must be carefully observed (secondary conditions/limitations). |
| Type of construction (acc. to EN 60034-7; IEC 60034-7) | Shaft height 150: IM B14, IM V18, IM V19<br>shaft height 200: IM B14, IM V18, IM V19<br>shaft height 280: IM B35, IM B5, IM V1, IM V3, IM V15, IM V35 |
| Degree of protection (acc. to EN 60034-5; IEC 60034-5) | Hollow shaft: IP54<br>plug-on shaft: IP55, SH 280 IP54<br>solid shaft: IP55 |
| Cooling (acc. to EN 60034-6; IEC 60034-6) | Water cooling |
| Thermal motor protection<br>(acc. to EN 60034–11; IEC 60034-11) | KTY 84 temperature sensor in stator winding |
| Paint finish | Anthracite (RAL 7016) |
| 2nd Rating plate | Enclosed separately |
| Shaft version<br>(acc. to DIN 748-3; IEC 60072-1) | Hollow shaft, plug-on shaft, solid shaft<br>Details see Chapter "Shaft version" and Chapter "Dimension drawings" |
| Shaft and flange accuracy<br>(acc. to DIN 42955; IEC 60072-1) | Tolerance class N (at normal running temperature) |
| Vibration severity (acc. to EN 60034-14; IEC 60034-14) | Grade A is observed up to rated speed. |
| Sound pressure level<br>(acc. to DIN EN ISO 1680) | Max. 73 dB(A) at 4 kHz rated pulse frequency at the nominal operating point |
| Bearing version | Roller bearings with permanent grease lubrication (bearing change interval = 20000h) |
| Built-in encoder systems for motors without DRIVE-CLiQ interface | • Incremental encoder, sin/cos 1 $V_{pp}$, 2048 S/R[1)] with C and D tracks, encoder IC2048S/R[1)]), belt-mounted<br>• Absolute encoder 2048 S/R[1)] singleturn, 4096 revolutions multiturn, with EnDat interface, encoder AM2048S/R[1)]), belt-mounted or coaxially mounted at NDE<br>• Multi-pole resolver, belt mounted |
| Built-in encoder systems for motors with DRIVE-CLiQ interface<br>Belt-mounted | • Incremental encoder, 22-bit (resolution 4194304, internal encoder 2048 S/R [1)]) + commutation position, 11-bit, encoder IC22DQ<br>• Absolute encoder 22 bit singleturn (resolution 4194304, in the encoder 2048 S/R [1)]) + 12 bit multiturn (traversing range 4096 revolutions), encoder AM22DQ<br>• Resolver 15 bit (resolution 32768, internal, multi-pole), encoder R15DQ |
| Built-in encoder systems for motors with DRIVE-CLiQ interface<br>Coaxially mounted at NDE | • Absolute encoder 24 bit singleturn (resolution 16777216), encoder AS24DQI<br>• Absolute encoder 24 bit singleturn (resolution 16777216), + 12 bit multiturn (traversing range 4096 revolutions), encoder AM24DQI |

| | |
|---|---|
| Connection | Terminal box for power cable<br>Connector for encoder signals and KTY 84 |
| Options | • PTC thermistor motor protection using 3 integrated temperature sensors for shutdown<br>• Version with/without encoder<br>• Shaft cover at NDE for the hollow shaft version<br>• Regreasing system<br>• Special paint finish<br>• Non-standard rated speeds (an inquiry is required)<br>• Natural cooling on request<br>• Special grease lubrication for low speeds<br>• Heavy-Duty version in shaft height 280 |

1) S/R = Signals/Revolution

## 1.4 Technical specifications

The data in the following tables refer to operation with an ALM (Active Line Module) and a 600 V DC link voltage. The specified efficiency η is a typical value, theoretically determined and which has its optimum in the continuous operation range.

Table 1- 3 Technical data, 1FW315□

| Motor type | $n_N$ | $M_N$ | $I_N$ | $P_N$ | η | $M_{max}$ | $I_{max}$ | $n_{max\ mech.}$ |
|---|---|---|---|---|---|---|---|---|
| | [rpm] | [Nm] | [A] | [kW] | [%] | [Nm] | [A] | [rpm] |
| 1FW3150-1□H | 300 | 100 | 8.0 | 3.1 | 89 | 200 | 17 | 1700 |
| 1FW3150-1□L | 500 | 100 | 12 | 5.2 | 90 | 200 | 26 | 1700 |
| 1FW3150-1□P | 750 | 100 | 18 | 7.9 | 90 | 200 | 41 | 1700 |
| 1FW3152-1□H | 300 | 200 | 14 | 6.3 | 92 | 400 | 35 | 1700 |
| 1FW3152-1□L | 500 | 200 | 22 | 10.5 | 92 | 400 | 53 | 1700 |
| 1FW3152-1□P | 750 | 200 | 32.5 | 15.7 | 93 | 400 | 79 | 1700 |
| 1FW3154-1□H | 300 | 300 | 20.5 | 9.4 | 93 | 600 | 49 | 1700 |
| 1FW3154-1□L | 500 | 300 | 32 | 15.7 | 93 | 600 | 75 | 1700 |
| 1FW3154-1□P | 750 | 300 | 47.5 | 23.6 | 93 | 600 | 113 | 1700 |
| 1FW3155-1□H | 300 | 400 | 28 | 12.6 | 94 | 800 | 67 | 1700 |
| 1FW3155-1□L | 500 | 400 | 43 | 20.9 | 94 | 800 | 103 | 1700 |
| 1FW3155-1□P | 750 | 400 | 64 | 31.4 | 94 | 800 | 153 | 1700 |
| 1FW3156-1□H | 300 | 500 | 34 | 15.7 | 94 | 1000 | 81 | 1700 |
| 1FW3156-1□L | 500 | 500 | 53 | 26.2 | 94 | 1000 | 126 | 1700 |
| 1FW3156-1□P | 750 | 500 | 76 | 39.3 | 94 | 1000 | 183 | 1700 |

Table 1- 4 Technical data, 1FW320□ Standard

| Motor type | $n_N$ | $M_N$ | $I_N$ | $P_N$ | η | $M_{max}$ | $I_{max}$ | $n_{max\ mech.}$ |
|---|---|---|---|---|---|---|---|---|
| | [rpm] | [Nm] | [A] | [kW] | [%] | [Nm] | [A] | [rpm] |
| 1FW3201-1□E | 150 | 300 | 13 | 4.7 | 91 | 555 | 28 | 1000 |
| 1FW3201-1□H | 300 | 300 | 23 | 9.4 | 92 | 555 | 50 | 1000 |
| 1FW3201-1□L | 500 | 300 | 37 | 15.7 | 92 | 555 | 82 | 1000 |
| 1FW3202-1□E | 150 | 500 | 21 | 7.9 | 93 | 925 | 47 | 1000 |
| 1FW3202-1□H | 300 | 500 | 37 | 15.7 | 94 | 925 | 81 | 1000 |
| 1FW3202-1□L | 500 | 500 | 59 | 26.2 | 94 | 925 | 131 | 1000 |
| 1FW3203-1□E | 150 | 750 | 30 | 11.8 | 94 | 1390 | 69 | 1000 |
| 1FW3203-1□H | 300 | 750 | 59 | 23.6 | 95 | 1390 | 132 | 1000 |
| 1FW3203-1□L | 500 | 750 | 92 | 39.3 | 95 | 1390 | 204 | 1000 |
| 1FW3204-1□E | 150 | 1000 | 40 | 15.7 | 94 | 1850 | 90 | 1000 |
| 1FW3204-1□H | 300 | 1000 | 74 | 31.4 | 95 | 1850 | 163 | 1000 |
| 1FW3204-1□L | 500 | 1000 | 118 | 52.3 | 95 | 1850 | 260 | 1000 |
| 1FW3206-1□E | 150 | 1500 | 65 | 23.6 | 94 | 2775 | 145 | 1000 |
| 1FW3206-1□H | 300 | 1500 | 118 | 47.1 | 95 | 2775 | 256 | 1000 |
| 1FW3206-1□L | 500 | 1400 | 169 | 73.3 | 95 | 2775 | 399 | 1000 |
| 1FW3208-1□E | 150 | 2000 | 84 | 31.4 | 94 | 3700 | 187 | 1000 |
| 1FW3208-1□H | 300 | 2000 | 153 | 62.8 | 94 | 3700 | 340 | 1000 |
| 1FW3208-1□L | 500 | 1850 | 226 | 96.8 | 94 | 3700 | 533 | 1000 |

Table 1- 5 Technical data, 1FW320□ High Speed

| Motor type | $n_N$ | $M_N$ | $I_N$ | $P_N$ | η | $M_{max}$ | $I_{max}$ | $n_{max\ mech.}$ |
|---|---|---|---|---|---|---|---|---|
| | [rpm] | [Nm] | [A] | [kW] | [%] | [Nm] | [A] | [rpm] |
| 1FW3201-3□P | 800 | 245 | 37 | 20.5 | 91 | 500 | 80 | 1800 |
| 1FW3201-3□S | 1200 | 230 | 50 | 29.0 | 91 | 500 | 114 | 1800 |
| 1FW3202-3□P | 800 | 470 | 69 | 39.5 | 93 | 860 | 133 | 1800 |
| 1FW3202-3□S | 1200 | 440 | 92 | 55 | 93 | 860 | 190 | 1800 |
| 1FW3203-3□P | 800 | 680 | 96 | 57 | 94 | 1210 | 182 | 1800 |
| 1FW3203-3□S | 1200 | 630 | 131 | 79 | 94 | 1210 | 265 | 1800 |
| 1FW3204-3□P | 800 | 930 | 137 | 78 | 95 | 1700 | 265 | 1800 |
| 1FW3204-3□S | 1200 | 860 | 191 | 108 | 95 | 1700 | 400 | 1800 |
| 1FW3206-3□P | 800 | 1360 | 192 | 114 | 95 | 2400 | 365 | 1800 |
| 1FW3206-3□S | 1200 | 1210 | 270 | 152 | 95 | 2400 | 570 | 1800 |
| 1FW3208-3□P | 800 | 1900 | 270 | 159 | 95 | 3300 | 500 | 1800 |
| 1FW3208-3□S | 1200 | 1700 | 385 | 215 | 95 | 3300 | 800 | 1800 |

Table 1- 6 Technical data 1FW328□ Standard

| Motor type | $n_N$ | $M_N$ | $I_N$ | $P_N$ | η | $M_{max}$ | $I_{max}$ | $n_{max\ mech.}$ |
|---|---|---|---|---|---|---|---|---|
| | [rpm] | [Nm] | [A] | [kW] | [%] | [Nm] | [A] | [rpm] |
| 1FW3281-2□E | 150 | 2500 | 82 | 39.0 | 94 | 4050 | 145 | 1000 |
| 1FW3281-2□G | 250 | 2450 | 126 | 64.0 | 95 | 4050 | 226 | 1000 |
| 1FW3283-2□E | 150 | 3500 | 115 | 55.0 | 95 | 5700 | 203 | 1000 |
| 1FW3283-2□G | 250 | 3450 | 176 | 90.0 | 96 | 5700 | 316 | 1000 |
| 1FW3285-2□E | 150 | 5000 | 160 | 79.0 | 95 | 8150 | 284 | 1000 |
| 1FW3285-2□G | 250 | 4950 | 244 | 130.0 | 96 | 8150 | 436 | 1000 |
| 1FW3287-2□E | 150 | 7000 | 230 | 110.0 | 96 | 11400 | 406 | 1000 |
| 1FW3287-2□G | 250 | 6900 | 352 | 181.0 | 96 | 11400 | 632 | 1000 |

Table 1- 7 Technical data 1FW328□ High Speed

| Motor type | $n_N$ | $M_N$ | $I_N$ | $P_N$ | η | $M_{max}$ | $I_{max}$ | $n_{max\ mech.}$ |
|---|---|---|---|---|---|---|---|---|
| | [rpm] | [Nm] | [A] | [kW] | [%] | [Nm] | [A] | [rpm] |
| 1FW3281-3□J | 400 | 2350 | 188 | 98.0 | 96 | 4050 | 352 | 1000 |
| 1FW3281-3□M | 600 | 2200 | 256 | 138.0 | 96 | 4050 | 512 | 1000 |
| 1FW3283-3□J | 400 | 3300 | 275 | 138.0 | 96 | 5700 | 516 | 1000 |
| 1FW3283-3□M | 600 | 3100 | 357 | 195.0 | 96 | 5700 | 712 | 1000 |
| 1FW3285-3□J | 400 | 4700 | 376 | 197.0 | 96 | 8150 | 709 | 1000 |
| 1FW3285-3□M | 600 | 4400 | 469 | 276.0 | 97 | 8150 | 942 | 1000 |
| 1FW3287-3□J | 400 | 6600 | 504 | 276.0 | 97 | 11400 | 946 | 1000 |
| 1FW3287-3□M | 600 | 6050 | 696 | 380.0 | 97 | 11400 | 1424 | 1000 |

## Motor Module

The rated motor current ($I_N$) is used as a basis to dimension the appropriate Motor Modules for the 1FW3 motors. If the full motor stall torque is required, the Motor Modules must be dimensioned according to the motor stall current ($I_0$).

If the motor is temporarily operated at operating points above the S1 characteristic, the current drawn by the motors at these points must be taken into account and the appropriate Motor Module configured.

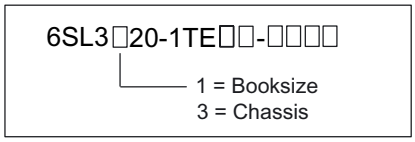
**Note**

**Configuration tool**

The SIZER for SIEMENS Drives engineering tool supports you when dimensioning and configuring the drive system (see the Chapter "Engineering").

The engineering tool supports you here (see Chapter "Engineering").

## Format of the MLFB for Motor Modules




## Suitable Motor Module

Table 1- 8 Assignment: Motor type - Motor Module

| Motor type | Rated current / stall current $I_N$ [A] / $I_0$ [A] | Order designation (MLFB) SINAMICS S120 Motor Modules | Rated current Motor Module $I_N$ [A] |
|---|---|---|---|
| Line supply voltage of 400 V 3 AC, Active Line Module ($V_{mot}$ = 425 V) *) | | | |
| 1FW315□ | | | |
| 1FW3150-1□H | 7.2 / 7.3 | 6SL312□-□TE21-0AA3 | 9 |
| 1FW3150-1□L | 11 / 11.5 | 6SL312□-□TE21-8AA3 | 18 |
| 1FW3150-1□P | 17 / 17.5 | 6SL312□-□TE21-8AA3 | 18 |
| 1FW3152-1□H | 14 / 15 | 6SL312□-□TE21-8AA3 | 18 |
| 1FW3152-1□L | 22 / 22.5 | 6SL312□-1TE23-0AA3 | 30 |
| 1FW3152-1□P | 32.5 / 33.5 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3154-1□H | 20.5 / 21.5 | 6SL312□-1TE23-0AA3 | 30 |
| 1FW3154-1□L | 32 / 33 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3154-1□P | 47.5 / 49 | 6SL312□-1TE26-0AA3 | 60 |
| 1FW3155-1□H | 28 / 29 | 6SL312□-1TE23-0AA3 | 30 |
| 1FW3155-1□L | 43 / 45 | 6SL312□-1TE26-0AA3 | 60 |
| 1FW3155-1□P | 64 / 67 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW3156-1□H | 34 / 35 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3156-1□L | 53 / 55 | 6SL312□-1TE26-0AA3 | 60 |
| 1FW3156-1□P | 76 / 80 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW320□ Standard | | | |
| 1FW3201-1□E | 13 / 13 | 6SL312□-□TE21-8AA3 | 18 |
| 1FW3201-1□H | 23 / 24 | 6SL312□-1TE23-0AA3 | 30 |
| 1FW3201-1□L | 37 / 38 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3202-1□E | 21 / 22 | 6SL312□-1TE23-0AA3 | 30 |
| 1FW3202-1□H | 37 / 39 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3202-1□L | 59 / 62 | 6SL312□-1TE26-0AA3 | 60 |
| 1FW3203-1□E | 30 / 32 | 6SL312□-1TE23-0AA3 | 30 |
| 1FW3203-1□H | 59 / 62 | 6SL312□-1TE26-0AA3 | 60 |
| 1FW3203-1□L | 92 / 100 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3204-1□E | 40 / 42 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3204-1□H | 74 / 77 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW3204-1□L | 118 / 129 | 6SL312□-1TE31-3AA3 | 132 |

| Motor type | Rated current / stall current $I_N$ [A] / $I_0$ [A] | Order designation (MLFB) SINAMICS S120 Motor Modules | Rated current Motor Module $I_N$ [A] |
|---|---|---|---|
| Line supply voltage of 400 V 3 AC, Active Line Module ($V_{mot}$ = 425 V) *) | | | |
| 1FW3206-1□E | 65 / 68 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW3206-1□H | 118 / 121 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3206-1□L | 169 / 189 | 6SL312□-1TE32-0AA3 | 200 |
| 1FW3208-1□E | 84 / 88 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW3208-1□H | 153 / 160 | 6SL312□-1TE32-0AA3 | 200 |
| 1FW3208-1□L | 226 / 256 | 6SL3320-1TE32-6AA3 | 260 |
| 1FW320□ High Speed | | | |
| 1FW3201-3□P | 37 / 38 | 6SL312□-1TE24-5AA3 | 45 |
| 1FW3201-3□S | 50 / 54 | 6SL312□-1TE26-0AA3 | 60 |
| 1FW3202-3□P | 69 / 72 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW3202-3□S | 92 / 102 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3203-3□P | 96 / 102 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3203-3□S | 131 / 149 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3204-3□P | 137 / 145 | 6SL312□-1TE32-0AA4 | 200 |
| 1FW3204-3□S | 191 / 220 | 6SL312□-1TE32-0AA4 | 200 |
| 1FW3206-3□P | 192 / 210 | 6SL312□-1TE32-0AA4 | 200 |
| 1FW3206-3□S | 270 / 330 | 6SL3320-1TE33-1AA3 | 310 |
| 1FW3208-3□P | 270 / 295 | 6SL3320-1TE33-1AA3 | 310 |
| 1FW3208-3□S | 385 /470 | 6SL3320-1TE35-0AA3 | 490 |
| 1FW328□ Standard | | | |
| 1FW3281-2□E | 82 / 84 | 6SL312□-1TE28-5AA3 | 85 |
| 1FW3281-2□G | 126 / 131 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3283-2□E | 115 / 116 | 6SL312□-1TE31-3AA3 | 132 |
| 1FW3283-2□G | 176 / 181 | 6SL312□-1TE32-0AA3 | 200 |
| 1FW3285-2□E | 160 / 163 | 6SL312□-1TE32-0AA3 | 200 |
| 1FW3285-2□G | 244 / 251 | 6SL3320-1TE32-6AA0 | 260 |
| 1FW3287-2□E | 230 / 234 | 6SL3320-1TE32-6AA0 | 260 |
| 1FW3287-2□G | 352 / 365 | 6SL3320-1TE33-8AA0 | 380 |
| 1FW328□ High Speed | | | |
| 1FW3281-3□J | 188 / 200 | 6SL312□-1TE32-0AA3 | 200 |
| 1FW3281-3□M | 256 / 291 | 6SL3320-1TE33-1AA0 | 310 |
| 1FW3283-3□J | 275 / 292 | 6SL3320-1TE33-1AA0 | 310 |
| 1FW3283-3□M | 357 / 402 | 6SL3320-1TE33-8AA0 | 380 |
| 1FW3285-3□J | 376 / 400 | 6SL3320-1TE33-8AA0 | 380 |
| 1FW3285-3□M | 469 / 532 | 6SL3320-1TE35-0AA0 | 490 |
| 1FW3287-3□J | 504 / 534 | 6SL3320-1TE36-1AA0 | 605 |
| 1FW3287-3□M | 696 / 787 | 6SL3320-1TE37-5AA0 | 745 |

*) Other supply voltages can also be configured in SIZER.

**Note**

**Sound pressure level when reducing the pulse frequency**

When the pulse frequency is reduced, a significantly higher sound pressure level can occur.

# 1.5 Rating plate data

The rating plate refers to the technical data of the motor.

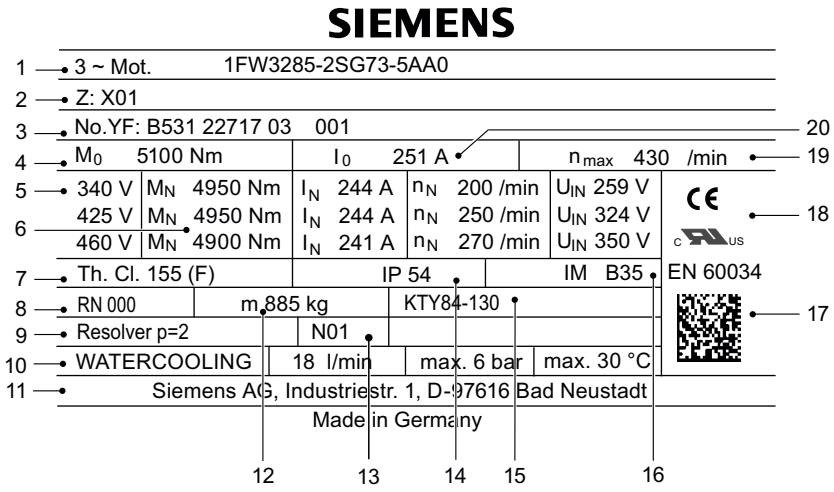
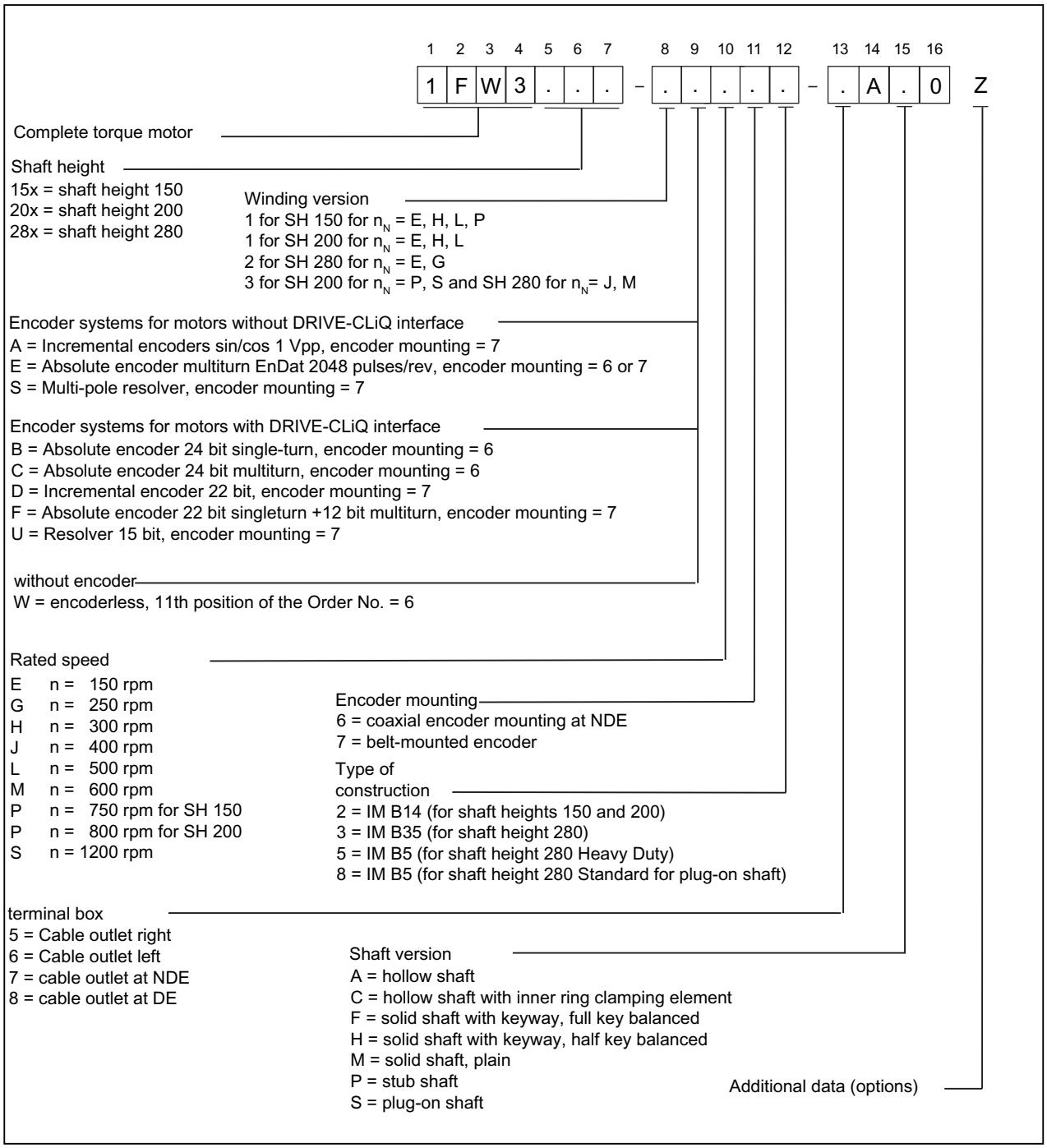



Figure 1-3 Schematic layout of the rating plate

Table 1- 9 Description of the rating plate data

| Position | Description / Technical specifications |
|---|---|
| 1 | Motor type: Synchronous motor, complete torque motor, order number |
| 2 | Additional information |
| 3 | Ident. No., production number |
| 4 | Static torque [Nm] |
| 5 | Output voltages [V] |
| 6 | Motor technical data |
| 7 | Temperature class |
| 8 | Motor version |
| 9 | Code, encoder type |
| 10 | Technical data of the cooling |
| 11 | Production address |
| 12 | Motor weight [kg] |
| 13 | Supplement to item 9 (encoder type) |
| 14 | Degree of protection |
| 15 | ID, temperature sensor |
| 16 | Type of construction |
| 17 | 2D code |
| 18 | Standards and regulations, approximations |
| 19 | Max. permissible speed (inverter) [rpm] |
| 20 | Stall current [A] |

# 1.6 Order number



## Order codes

When ordering a complete torque motor with options, **-Z** should be added to the order number. The order code should also be specified for each additional required option.

Order codes must not be repeated in plain text in the order.

Table 1- 10 List of order codes

| Order code | Designation |
|---|---|
| A11 | Motor protection using PTC thermistors |
| K40 | Regreasing system |
| L03 | Heavy-duty version |
| Q30 | Clamping elements |
| T20 | Shaft cover at NDE |
| T32 | Siemens torque arm |
| V07 | Special grease for low speeds |
| X01 | Paint finish, matt black RAL9005 paint finish |
| X02 | Paint finish, cream white RAL9001 |
| X03 | Paint finish, reseda green RAL 6011 |
| X04 | Paint finish, pebble gray RAL 7032 |
| X05 | Paint finish, sky blue RAL 5015 |
| X06 | Paint finish, light ivory RAL 1015 |
| X08 | Paint finish, white aluminum, RAL 9006 |
| X13 | Paint finish, pastel blue RAL 5024 |
| X18 | Paint finish, papyrus white RAL 9018 |
| X22 | Paint finish, gray white RAL 9002 |
| X28 | Paint finish, azure blue RAL 9009 |
| X29 | Paint finish, mouse gray RAL 7005 |
| X30 | Paint finish, ivory RAL 1014 |
| X31 | Paint finish, brilliant blue RAL 5007 |
| X32 | Paint finish, pale green RAL 6021 |
| X36 | Paint finish, traffic white RAL 9016 |
| X53 | Paint finish, light gray RAL 7035 |

**Note**

Note that not every theoretical combination is possible in practice.

# Configuration 2

## 2.1 Configuration software

### 2.1.1 Configuration tool SIZER for SIEMENS Drives

#### Overview

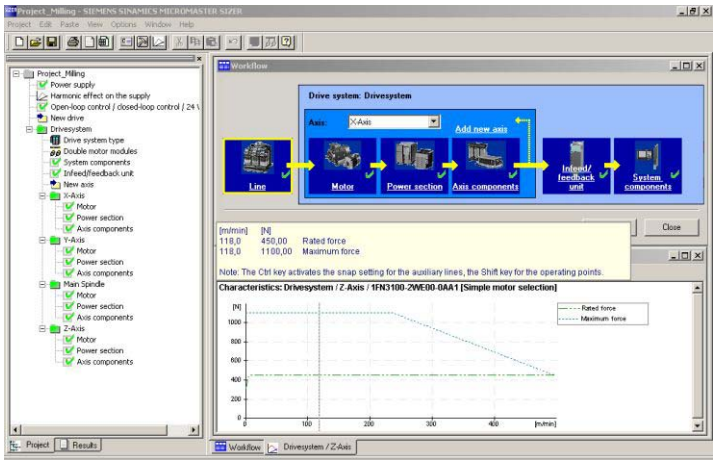



Figure 2-1 SIZER for SIEMENS Drives

The user-friendly configuration of the SINAMICS drive family is carried out using the configuration tool SIZER for SIEMENS Drives. It provides support for the technical planning of the hardware and firmware components required for a drive task. SIZER for SIEMENS Drives covers the full range of operations required to configure a complete drive system, from simple single drives to complex multi-axis applications.

SIZER for SIEMENS Drives supports all the configuration steps in a single workflow:

- Configuring the power supply
- Designing the motor and gearbox, including calculation of mechanical transmission elements
- Configuring the drive components
- Compiling the required accessories
- Selection of the line-side and motor-side power options

When SIZER for SIEMENS Drives was being designed, particular importance was placed on a high degree of usability and a holistic, function-based approach to the drive application. The extensive user navigation makes it easy to use the tool. Status information keeps you continually informed about how engineering is progressing.

The SIZER for SIEMENS Drives user interface is available in German and English. The drive configuration is saved in a project. In the project, the components and functions used are displayed in a hierarchical tree structure. The project view permits the configuration of drive systems and the copying/inserting/modifying of drives already configured.

The configuration process produces the following results:

- Parts list of components required (Export to Excel)
- Technical specifications of the system
- Characteristics
- Comments on system reactions
- Location diagram of drive and control components and dimension drawings

These results are displayed in a results tree and can be reused for documentation purposes. User support is provided by technological online help, which provides the following information:

- Detailed technical data
- Information about the drive systems and their components
- Decision-making criteria for the selection of components.

Table 2- 1 Order number for SIZER for SIEMENS Drives

| Configuration tool | Order number (MLFB) of the DVD |
|---|---|
| SIZER for SIEMENS Drives<br>German/English | 6SL3070-0AA00-0AG0 |

## Minimum system requirements

- PC or PG with Pentium™ III 800 MHz (recommended > 1 GHz)
- 512 MB RAM (1 GB recommended)
- At least 4.1 GB free hard disk space
- In addition, 100 MB free hard disk space on the Windows system drive
- Screen resolution 1024 × 768 pixels (1280 x 1024 pixels recommended)
- Windows™ 7 Professional (32 bit), 7 Ultimate (32 bit), XP Prof SP2, XP Home SP2, XP 64 bit SP2, Vista Business
- Microsoft Internet Explorer 5.5 SP2

## 2.1.2 STARTER drive/commissioning software

The STARTER commissioning tool provides

- Commissioning
- Optimization
- Diagnostics

Table 2- 2 Order number for STARTER

| Commissioning tool | Order number (MLFB) of the DVD |
|---|---|
| STARTER<br>German, English, French, Italian, Spanish | 6SL3072-0AA00-0AG0 |

### Minimum system requirements

- Hardware
  - PG or PC with Pentium III min. 800 MHz (recommended > 1 GHz)
  - 512 MB RAM (1 GB recommended)
  - Screen resolution 1024 × 768 pixels, 16-bit color depth
  - Free hard disk memory: min. 2 GB;
- Software
  - Microsoft Windows 2000 SP4
  - Microsoft Windows Server 2003 SP1 and SP2 (PCS7)
  - Microsoft Windows XP Professional SP2 and SP3
  - Microsoft Windows VISTA Business SP1 *)
  - Microsoft Windows VISTA Ultimate SP1 *)
  - Microsoft Internet Explorer V6.0 or higher

*) DCC cannot be used.
STARTER can be used on these operating systems only if it does not include the DCC option.

# 2.2 Procedure when engineering

## Motion Control

Servo drives are optimized for motion control applications. They execute linear or rotary movements within a defined movement cycle. All movements should be optimized in terms of time.

As a result of these considerations, servo drives must meet the following requirements:

- High dynamic response, i.e., short rise times
- Capable of overload, i.e. a high reserve for accelerating
- Wide control range, i.e. high resolution for precise positioning

## General procedure when engineering

The function description of the machine provides the basis when engineering the drive application. The definition of the components is based on physical interdependencies and is usually carried-out as follows:

| | Step | Description of the engineering activity |
|---|---|---|
| See following sections | 1. | The type of drive/infeed type is clarified |
| | 2. | Definition of supplementary conditions and integration into an automation system |
| | 3. | The load is defined, the max. load torque is calculated, the motor selected |
| See Catalog | 4. | The SINAMICS Motor Module is selected |
| | 5. | Steps 3 and 4 are repeated for additional axes |
| | 6. | The required DC link power is calculated and the SINAMICS Line Module is selected |
| | 7. | The line-side options (main switch, fuses, line filters, etc.) are selected |
| | 8. | Specification of the required control performance and selection of the Control Unit, definition of component cabling |
| | 9. | Additional system components are defined and selected |
| | 10. | The current demand of the 24 V DC supply for the components is calculated and the power supplies (SITOP devices, control supply modules) specified |
| | 11. | The components for the connection system are selected |
| | 12. | Design of the components of the drive line-up |

### 2.2.1 1. Clarification of the type of drive

The motor is selected on the basis of the required torque, which is defined by the application, e.g. traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives or main spindle drives. Gear units to convert motion or to adapt the motor speed and motor torque to the load conditions must also be considered.

As well as the load torque, which is determined by the application, the following mechanical data are among those required to calculate the torque to be provided by the motor:

- Masses moved
- Diameter of the drive wheel/diameter
- Leadscrew pitch, gear ratios
- Frictional resistance
- Mechanical efficiency
- Traversing paths
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

You must decide whether synchronous or induction motors are to be used.

Synchronous motors are the best choice if it is important to have low envelope dimensions, low rotor moment of inertia and therefore maximum dynamic response. These motors are operated in control type "servo". For additional applications, the 1FW3 can also be operated in the "Vector" control mode.

The following factors are especially important when engineering a drive application:

- The line system configuration, when using specific types of motor and/or line filters on IT systems (non-grounded systems)
- The ambient temperatures and the installation altitude of the motors and drive components.

The motor-specific limiting characteristics provide the basis for defining the motors.

These define the torque or power characteristic versus the speed and take into account the motor limits based on the DC-link voltage of the power or motor module. The DC-link voltage, in turn, is dependent on the supply voltage and, with multi-motor drives, on the type of the line module.

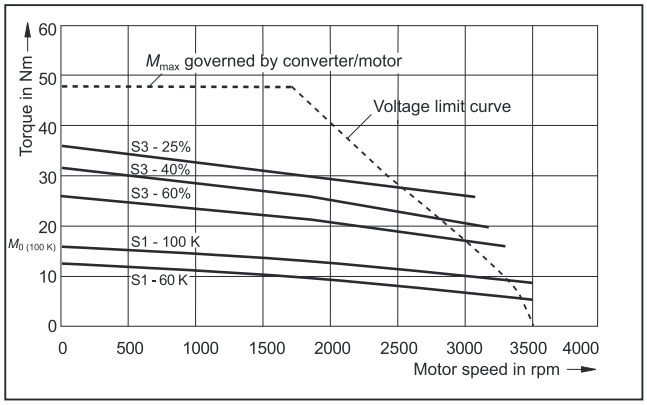



Figure 2-2 Limit curves for synchronous motors

## 2.2.2 2. Definition of supplementary conditions and integration into an automation system

You must decide whether synchronous or induction motors are to be used.

Synchronous motors are the best choice if it is important to have low envelope dimensions, low rotor moment of inertia and therefore maximum dynamic response.

Induction motors can be used to increase maximum speeds in the field weakening range. Induction motors for higher power ratings are also available.

You should also specify whether the drives are to be operated as single-axis drives or in a group as multi-axis drives.

The following factors are especially important when engineering a drive application:

- The type of line supply, when using specific types of motor and/or line filters on IT line supply systems (non-grounded systems)
- The utilization of the motor in accordance with rated values for winding temperatures of 60 K or 100 K
- The ambient temperatures and the installation altitude of the motors and drive components.

Other supplementary conditions apply when integrating the drives into an automation environment such as SIMATIC or SIMOTION.

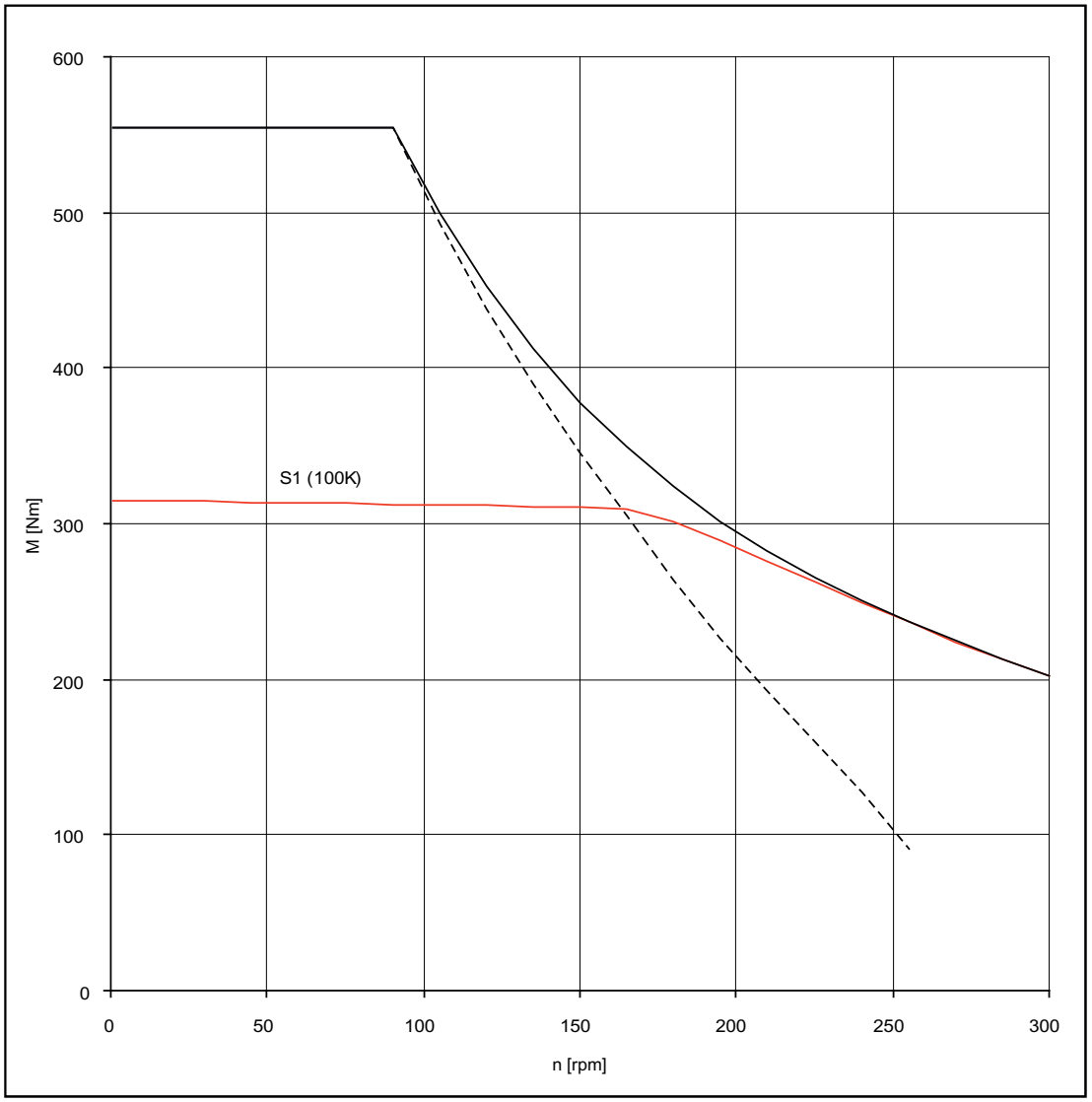
For motion control and technology functions (e.g. positioning), as well as for synchronous functions, the corresponding automation system, e.g. SIMOTION D, is used.

The drives are interfaced to the higher-level automation system via PROFIBUS.

## 2.2.3 3. Definition of load cycle, calculation of max. load torque, definition of motor

The motor-specific limiting curves are used as basis when selecting a motor.

These define the torque characteristic with respect to speed and take into account the motor limits based on the line supply voltage and the function of the infeed.




SINAMICS ALM 400 V line supply (600 V DC link voltage)

Figure 2-3 Limiting characteristics for synchronous motors 1FW3201-1□E□

The motor is selected on the basis of the load specified by the application. Different characteristics must be used for different loads.
The following operating scenarios have been defined:

- Load duty cycles with constant on period
- Load duty cycles with varying on period
- Duty cycle, variable

The objective is to identify characteristic torque and speed operating points, which can be used as a basis for selecting the motor depending on the load.

Once the operating scenario has been defined and specified, the maximum motor torque is calculated. Generally, the maximum motor torque is required when accelerating. The load torque and the torque required to accelerate the motor are added.

The maximum motor torque is then verified using the motor limiting curves.

The following criteria must be taken into account when the motor is selected:

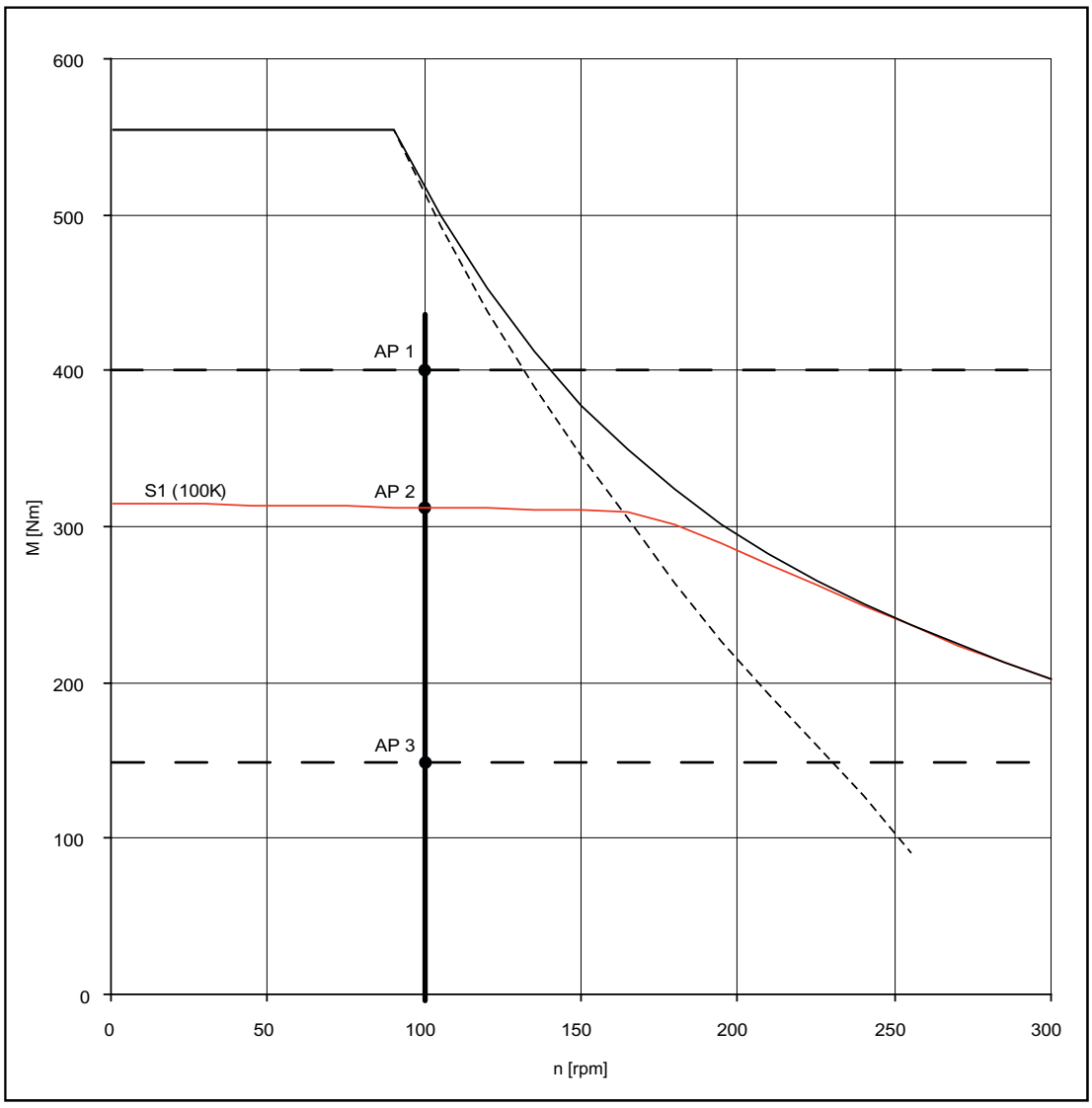
- The dynamic limits must be observed, that is, all speed-torque points of the load must lie below the relevant limiting curve.
- The thermal limits must be observed, that is, in the case of synchronous motors, the RMS motor torque at the average motor speed resulting from the load duty cycle must lie below the S1 curve (continuous duty).
- In the case of synchronous motors, note that the maximum permissible motor torque is reduced at higher speeds as a result of the voltage limiting curve. A clearance of 10% from the voltage limiting characteristic should also be observed to safeguard against voltage fluctuations.

### Load duty cycles with constant on period

For load duty cycles with constant on time, specific requirements are placed on the torque characteristic as a function of the speed
e.g. M = constant, M ~ $n^2$, M ~ n or P = constant.

These drives typically operate at a specific operating point. and are dimensioned for a base load. The base load torque must lie on or below the S1 curve.

In the event of transient overloads (e.g. during acceleration), an overload must be taken into account. For synchronous motors, the peak torque must lie below the voltage limiting characteristic.




SINAMICS ALM 400 V line supply (600 V DC link voltage)

AP 1 Operate for e.g. 1 min

AP 2 Continuous operation (S1) for x h (with water cooling)

AP 3 Continuous operation (S1) for x h (without water cooling)

Figure 2-4 Selecting motors for load examples with constant on time 1FW3201-□E□

**Note**

Free convection must be possible for operation without water cooling.

## Load duty cycles with varying on period

As well as continuous duty (S1), standard intermittent duty types (S3) are also defined for load duty cycles with varying on periods. This involves operation that comprises a sequence of similar load cycles, each of which comprises a time with constant load and an off period.

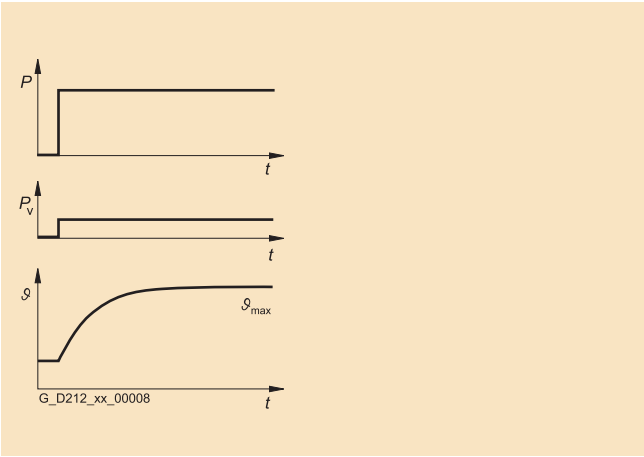



Figure 2-5 S1 duty (continuous operation)

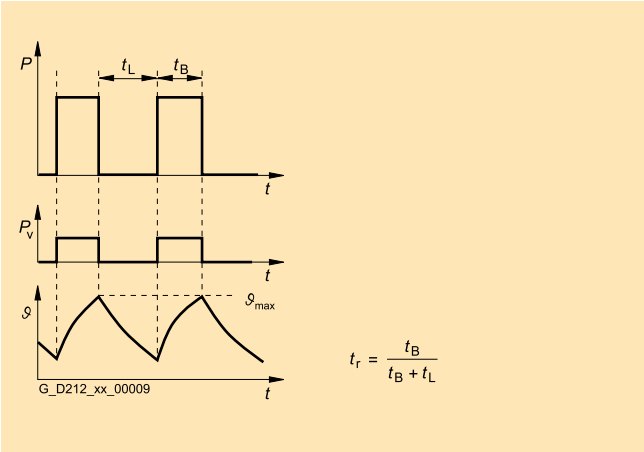



Figure 2-6 S3 duty (intermittent operation without influencing starting)

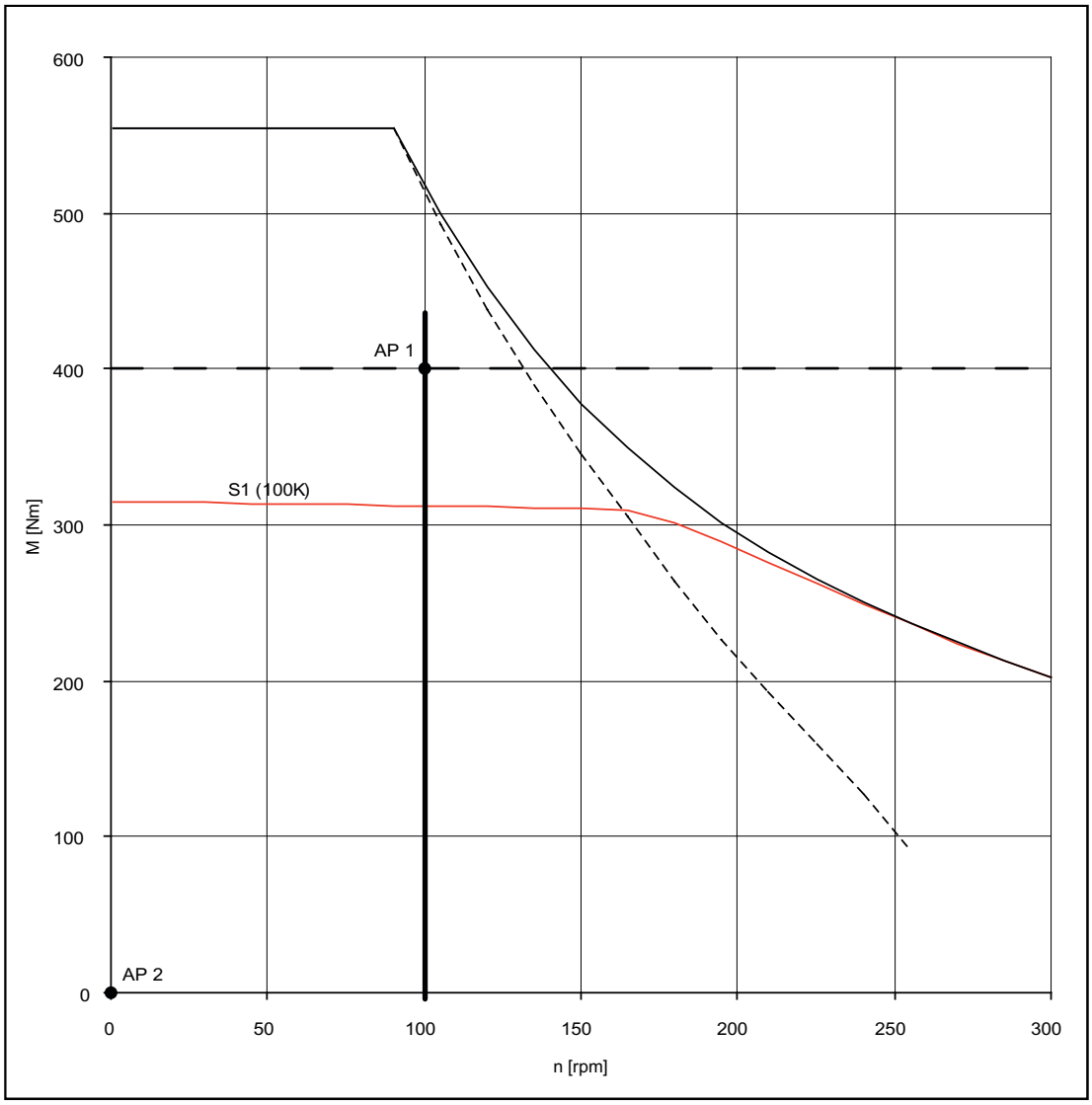
The load torque must lie below the corresponding thermal limiting characteristic of the motor. An overload must be taken into consideration for load duty cycles with varying on times.

### Note

For duty cycles in the field weakening range, the SIZER for SIEMENS Drives engineering tool must be used. The following formulas can be used for duty cycles outside the field weakening range.

$$M_{Mot,\,eff} = \sqrt{\frac{\sum M_{Mot,\,i}^2 \bullet \Delta t_i}{T}}$$

$$n_{Mot,\,medium} = \frac{\sum \frac{n_{Mot,\,k,\,A} + n_{Mot,\,k,\,E}}{2} \bullet \Delta t_i}{T}$$




SINAMICS ALM 400 V line supply (600 V DC link voltage)

AP 1 = 400 Nm at 100 rpm

AP 2 = 0 Nm at 0 rpm

Figure 2-7 Selecting motors for load duty cycles with different on time 1FW3201-□E□

**Note**

A holding torque may be required when the motor is stationary. This holding torque must be taken into consideration for $M_{rms}$. The reason could be that self-locking gearboxes are not used.

## Duty cycle, variable

A load duty cycle defines the characteristics of the motor speed and the torque with respect to time.

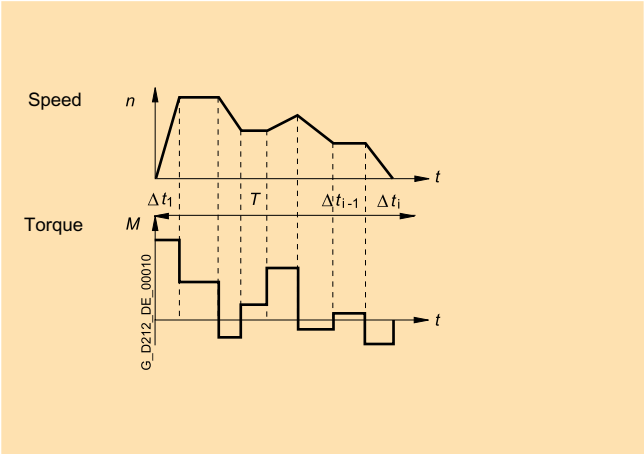



Figure 2-8 Example of a load duty cycle

A load torque is specified for each time period. In addition to the load torque, the average load moment of inertia and motor moment of inertia must be taken into account for acceleration. It may be necessary to take into account a frictional torque that opposes the direction of motion.

The gear ratio and gear efficiency must be taken into account when calculating the load and/or accelerating torque to be provided by the motor.

**Note**

For duty cycles in the field weakening range, the SIZER for SIEMENS Drives engineering tool must be used. The following formulas can be used for duty cycles outside the field weakening range.

For the motor torque in a time slice $\Delta t_i$ the following applies:

$$M_{Mot,\,rms} = (J_M + J_G) \bullet \frac{2\,\pi}{60} \bullet \frac{\Delta\, n_{load,\,i}}{\Delta\, t_i} \bullet i + (J_{load} \bullet \frac{2\,\pi}{60} \bullet \frac{\Delta\, n_{Last,\,i}}{\Delta\, t_i} + (M_{load,\,i} + M_R) \bullet \frac{1}{i \bullet \eta_G}$$

Calculation of the motor speed

$$n_{mot,\,i} = n_{load,\,i} \bullet i$$

Calculating the rms torque

$$M_{mot,\,rms} = \sqrt{\frac{\sum M_{mot,\,i}^2 \bullet \Delta t_i}{T}}$$

Calculating the average motor speed

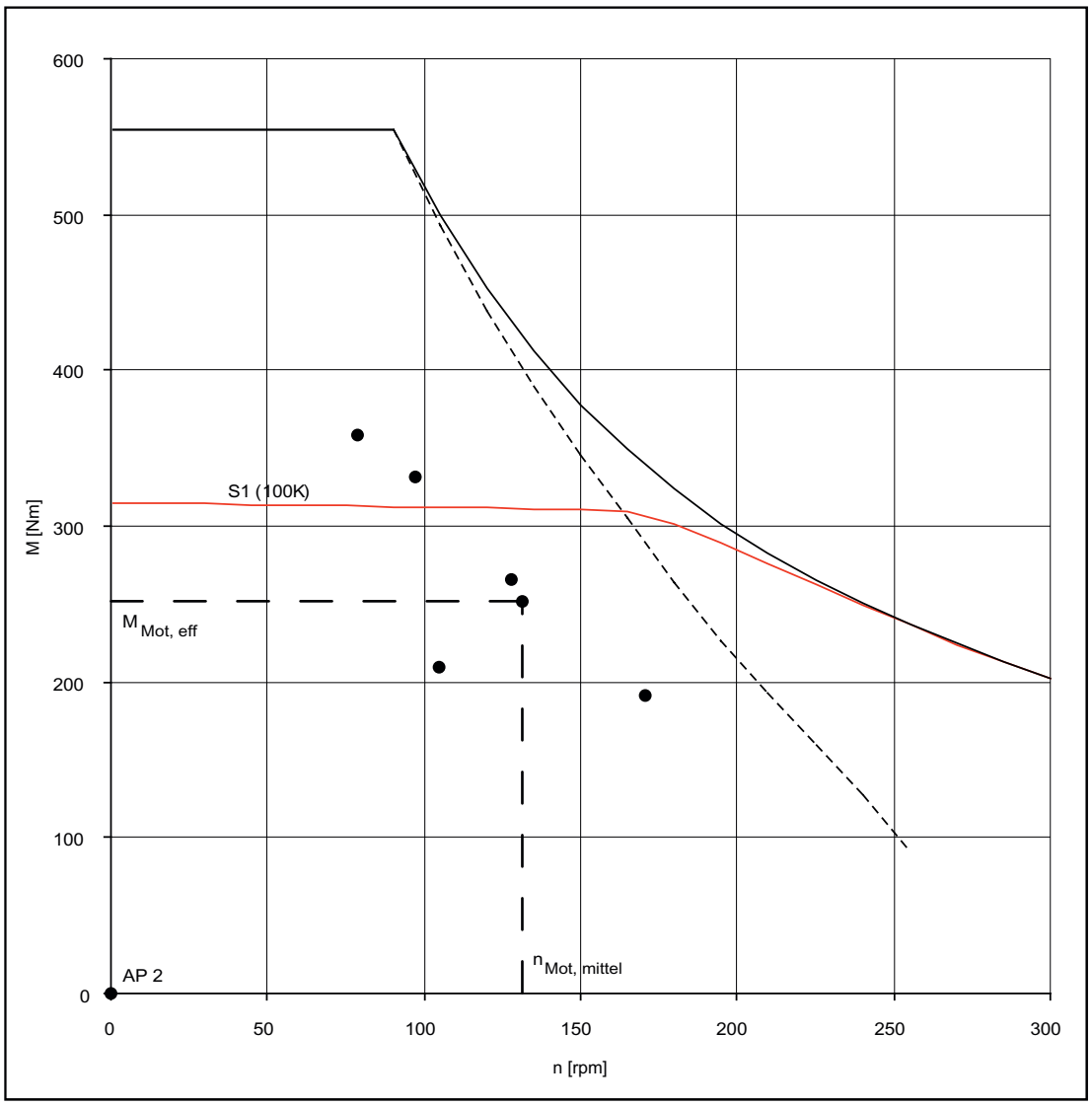
$$n_{Mot,\,medium} = \frac{\sum \frac{n_{Mot,\,k,\,A} + n_{Mot,\,k,\,E}}{2} \bullet \Delta t_i}{T}$$

| | |
|---|---|
| $J_M$ | Motor moment of inertia |
| $J_G$ | Gearbox moment of inertia |
| $J_{load}$ | Load moment of inertia |
| $n_{Load}$ | Load speed |
| i | Gear ratio |
| $\eta_G$ | Gearbox efficiency |
| $M_{load}$ | Load torque |
| $M_R$ | Frictional torque |
| T | Cycle time, clock cycle time |
| A;E | Initial value, final value in time slice $\Delta t_i$ |
| $t_e$ | On period |
| $\Delta t_i$ | Time interval |

The rms torque $M_{mot,\,rms}$ must, for $n_{mot,\,average}$, lie below the S1 curve.

The maximum torque $M_{max}$ is required when the drive is accelerating and for synchronous motors must lie below the voltage limiting curve/$M_{max}$ characteristic.

In summary, the motor is selected as follows:




SINAMICS ALM 400 V line supply (600 V DC link voltage)

Figure 2-9 Selecting motors according to the load duty cycle for motor 1FW3201-□E□

## Motor selection

By making the appropriate iterations, a motor can now be selected that precisely fulfills the operating conditions and application

In a second step, a check is made as to whether the thermal limits are maintained. To do this, the motor current at the base load must be calculated. When engineering a drive according to the load duty cycle with a constant on period with overload, the overload current based on the required overload torque must be calculated. The calculation rules for this purpose depend on the type of motor used (synchronous motor, induction motor) and the operating scenario (duty cycles with constant or with different switch-on duration).

Finally, the other motor features must be defined This is realized by appropriately configuring the motor options.

# Mechanical properties of the motors

# 3

## 3.1 Cooling

| ⚠ WARNING |
| --- |
| The equipment must be safely disconnected from the supply before any installation or service work is carried out on cooling water circuit components.<br>Only qualified personnel may design, install and commission the cooling circuit. |

### 3.1.1 Cooling circuit

The electrochemical processes that take place in a cooling system must be minimized by choosing the right materials. For this reason, mixed installations, i.e. a combination of different materials, such as copper, brass, iron, or halogenated plastic (PVC hoses and seals), should not be used or limited to the absolutely essential minimum.

A differentiation is made between 3 different cooling circuits:

- Closed cooling circuit
- Semi-open cooling circuit
- Open cooling circuit

Table 3- 1 Description of the various cooling circuits

| Definition | Description |
| --- | --- |
| Closed cooling circuit | The pressure equalizing tank is closed (oxygen cannot enter the system) and has a pressure relief valve. The cooling water is only routed in the motors and converters as well as the components that have to be cooled. |
| Semi-open cooling circuit | Oxygen can only enter the cooling system through the pressure equalization tank, otherwise the same as "closed cooling circuit". |
| Open cooling circuit (tower system) | The cooling water is cooled in a tower. In this case, there is intensive oxygen contact. |

**Note**

**Cooling circuits**

Only closed and semi-open cooling circuits are permissible for motors. Converter systems must be connected before the motors in the cooling circuit.

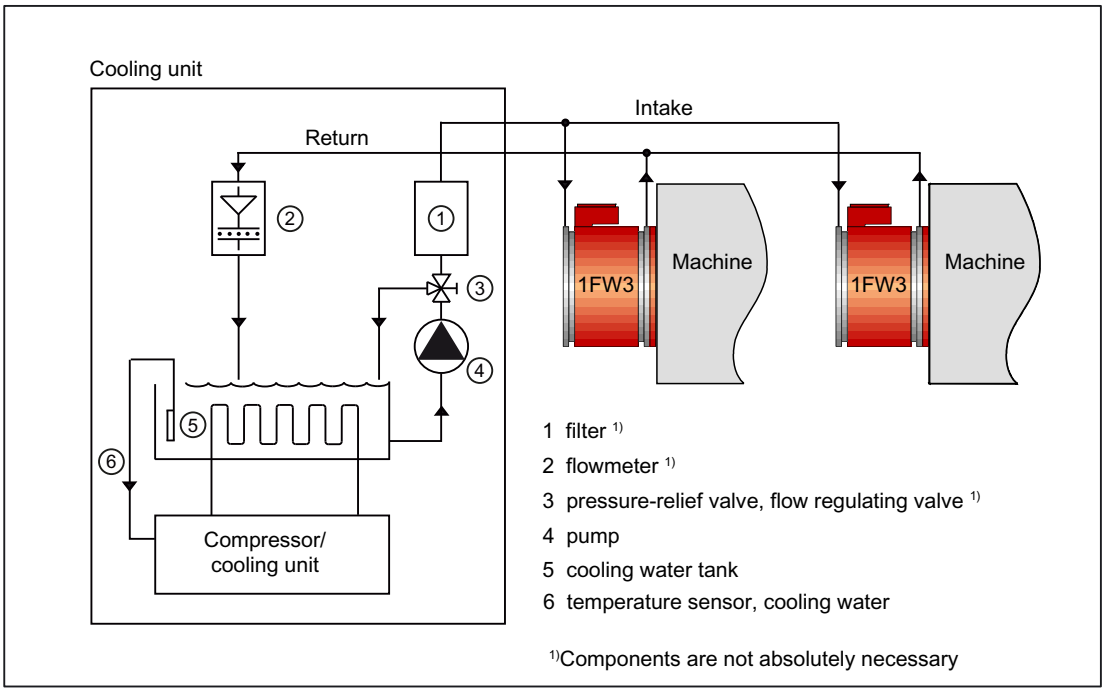



Figure 3-1 Example of a semi-open cooling circuit

## Equipotential bonding

All components in the cooling system (motor, heat exchanger, piping system, pump, pressure equalization tank, etc.) must be connected to an equipotential bonding system. This is implemented using a copper bar or finely stranded copper cable with the appropriate cable cross-sections.

| NOTICE |
| --- |
| Under no circumstances may the cooling water pipes come into contact with live components. There must always be an isolating clearance of > 13 mm! The pipes must be securely mounted and checked for leaks. |

## Materials used in the motor cooling circuit

The materials used in the cooling circuit must be coordinated with the materials in the motor.

Materials used in the motor (cooling jacket material): E355 AR (1.0580), DD11 (1.0332)

## Materials and components in the cooling circuit

The following table lists a wide variety of materials and components which may or may not be used in a cooling circuit.

Table 3- 2 Materials and components of a cooling circuit

| Material | Used as | Description |
|---|---|---|
| Zinc | Pipes, valves and fittings | Use is not permitted. |
| Brass | Pipes, valves and fittings | Can be used in closed circuits with inhibitor. |
| Copper | Pipes, valves and fittings | Can be used only in closed circuits with inhibitors in which the heat sink and copper component are separated (e.g. connection hose on units). |
| Common steel (e.g. St37) | Pipes | Permissible in closed circuits and semi-open circuits with inhibitors or Antifrogen N, check for oxide formation, inspection window recommended. |
| Cast steel, cast iron | Pipes, motors | Closed circuit and use of strainers and flushback filters. Fe separator for stainless heat sink. |
| High-alloy steel, Group 1 (V2A) | Pipes, valves and fittings | Can be used for drinking or municipal water with a chloride content up to < 250 ppm, suitable according to definition in Section "Cooling water definition". |
| High-alloy steel, Group 2 (V4A) | Pipes, valves and fittings | Can be used for drinking or municipal water with a chloride content up to < 500 ppm, suitable according to definition in Section "Cooling water definition". |
| ABS (**A**crylnitrile**B**utadiene**S**tyrene) | Pipes, valves and fittings | Suitable according to the definition in Section "Cooling water definition". Suitable for mixing with inhibitor and/or biocide as well as Antifrogen N. |
| Installation comprising different materials (mixed installation) | Pipes, valves and fittings | Use is not permitted. |
| PVC | Pipes, valves, fittings and hoses | Use is not permitted. |
| Hoses | | Reduce the use of hoses to a minimum (device connection). Must not be used as the main pipe for the whole system. Recommendation: EPDM hoses with an electrical resistance > $10^9$ Ω (e.g. Semperflex FKD supplied from Semperit or DEMITTEL; from PE/EPD, supplied from Telle). |
| Gaskets | Pipes, valves and fittings | Use of FPM (Viton), AFM34, EPDM is recommended. |
| Hose connections | Transition Hose - pipe | Secure with clips conforming to DIN 2817, available e.g. from Telle. |

The following recommendation applies in order to achieve an optimum motor heatsink (enclosure) lifetime:

- Engineer a closed cooling circuit with cooling unit manufactured out of stainless steel that dissipates the heat through a water-water heat exchanger.
- All other components such as cooling circuit cables and fittings manufactured out of ABS, stainless steel or general construction steel.

### Cooling system manufacturers

| | |
|---|---|
| BKW Kälte-Wärme-Versorgungstechnik GmbH | http://www.bkw-kuema.de |
| DELTATHERM Hirmer GmbH | http://www.deltatherm.de |
| Glen Dimplex Deutschland GmbH | http://www.riedel-cooling.com |
| Helmut Schimpke und Team Industriekühlanlagen GmbH + Co. KG | http://www.schimpke.org |
| Hydac System GmbH | http://www.hydac.com |
| Hyfra Industriekühlanlagen GmbH | http://www.hyfra.de |
| KKT Kraus Kälte- und Klimatechnik GmbH | http://www.kkt-kraus.de |
| Pfannenberg GmbH | http://www.pfannenberg.com |
| Rittal GmbH & Co. KG | http://www.rittal.de |

**Note**

It goes without saying that equivalent products from other manufacturers may be used. Our recommendations are to be seen as helpful information, not as requirements or regulations. We cannot accept any liability for the quality and properties/features of third-party products.

## 3.1.2 Engineering the cooling circuit

### Pressure

The operating pressure must be set according to the flow conditions in the supply and return lines of the cooling circuit. The required cooling water flow rate per time unit must be set according to the technical data of the equipment and motors.

The maximum permissible pressure with respect to atmosphere in the heat sink and thus in the cooling circuit must not exceed 0.6 MPa (6 bar) If a pump that can achieve a higher pressure is used, suitable measures must be provided on the system side (e.g. safety valve $p \leq 0.6$ MPa, pressure control etc.) to ensure that the maximum pressure is not exceeded.

The lowest possible differential pressure between the cooling water in the supply and return lines should be selected to allow pumps with a flat characteristic to be used.

An additional flushback filter should be used in the circuit in order to help prevent blockages and corrosion. This allows any material deposits to be flushed out in operation.

### Pressure equalization

If various components are connected up in the cooling circuit, it may be necessary to provide pressure equalization.

**Note**

Reactor elements must be fitted at the cooling water outlet of the motor or the relevant component!

### Avoiding cavitation

During uninterrupted duty, the pressure drop by a converter or motor must not exceed 0.2 MPa (2 bar). Otherwise, the high flow rate results in damage due to cavitation and/or abrasion.

### Connecting motors in series

For the following reasons, connecting motors in series can only be conditionally recommended:

- The required flow rates of the motors must be approximately the same (< a factor of 2)
- An increase in the cooling water temperature can result in having to derate the second or third motor if the maximum cooling water inlet temperature is exceeded.

### Cooling water inlet temperature

**Note**

The cooling water inlet temperature must be selected so that condensation does not form on the surface of the motor: $T_{cooling} > T_{ambient} - 5$ K.

Cooling water temperatures which are lower than the ambient temperature tend to result in increased water condensation. The difference between the cooling water inlet temperature and the ambient temperature should therefore not exceed a maximum of 5 K (Kelvin). Furthermore, the inflow of cooling water must be interrupted when the motor is idle for prolonged periods.

The motors are designed for operation up to a cooling water inlet temperature of +30 °C, as long as all of the specified motor data is maintained. If the cooling water inlet temperature deviates from this, the continuous torque will change (see the table titled "Derating factors").

Table 3- 3 Derating factors

| Cooling water inlet temperature | ≤ 30 °C | 35 °C | 40 °C | 45 °C |
|---|---|---|---|---|
| Derating factor | 1.00 | 0.97 | 0.95 | 0.92 |

## Cooling powers to be dissipated and the cooling flow rate

The values specified in the table "Cooling power to be dissipated" refer to a cooling-water temperature of +30 °C and S1 duty.

The cooling power to be dissipated [kW] specified in the table refers to the highest power loss to be dissipated for the particular shaft height for a maximum temperature difference between cooling water intake/cooling water discharge of 10 K.

Table 3- 4 Cooling power to be dissipated

| Motor type | Cooling power to be dissipated at $n_N$ [kW] | Pressure loss [bar] | Cooling flow rate [l/min] |
|---|---|---|---|
| **SH 150 Standard** | | | |
| 1FW3150-1 | 1.4 | 0.1 | 2.0 |
| 1FW3152-1 | 1.6 | 0.1 | 3.0 |
| 1FW3154-1 | 2.3 | 0.2 | 4.5 |
| 1FW3155-1 | 2.7 | 0.1 | 5.5 |
| 1FW3156-1 | 3.4 | 0.2 | 7.0 |
| **SH 200 Standard** | | | |
| 1FW3201-1 | 1.7 | 0.1 | 3.0 |
| 1FW3202-1 | 2.3 | 0.2 | 4.0 |
| 1FW3203-1 | 3.4 | 0.1 | 5.0 |
| 1FW3204-1 | 3.9 | 0.1 | 6.0 |
| 1FW3206-1 | 5.5 | 0.3 | 8.0 |
| 1FW3208-1 | 8.4 | 0.6 | 10.0 |
| **SH 200 High Speed** | | | |
| 1FW3201-3 | 2.9 | 0.2 | 3.5 |
| 1FW3202-3 | 4.2 | 0.4 | 5.0 |
| 1FW3203-3 | 5.4 | 0.1 | 6.5 |
| 1FW3204-3 | 6.7 | 0.2 | 8.0 |
| 1FW3206-3 | 8.8 | 0.5 | 10.5 |
| 1FW3208-3 | 10.9 | 1.0 | 13.0 |
| **SH 280 Standard** | | | |
| 1FW3281-2 | 7.9 | 0.5 | 11.0 |
| 1FW3283-2 | 9.0 | 0.7 | 13.0 |
| 1FW3285-2 | 12.8 | 0.7 | 16.0 |
| 1FW3287-2 | 15.7 | 0.8 | 20.0 |
| **SH 280 High Speed** | | | |
| 1FW3281-3 | 7.4 | 0.5 | 11.0 |
| 1FW3283-3 | 10.3 | 0.7 | 13.0 |
| 1FW3285-3 | 12.6 | 0.7 | 16.0 |
| 1FW3287-3 | 15.8 | 0.8 | 20.0 |

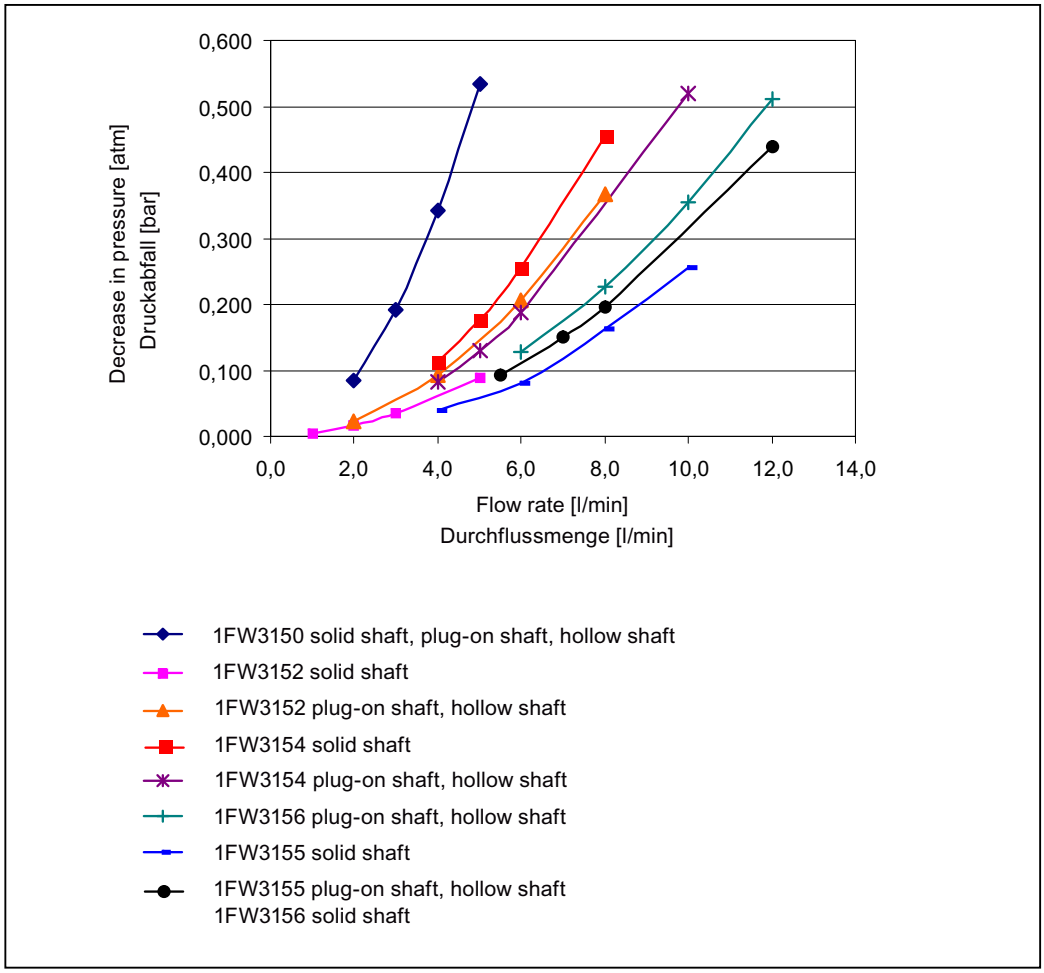



Figure 3-2 Flow rate for SH 150

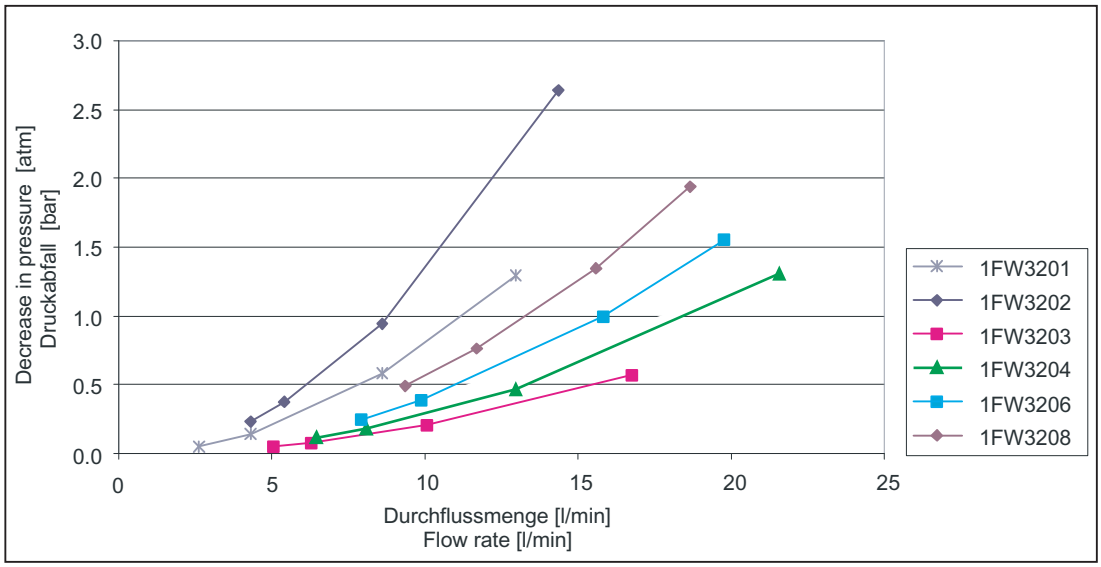



Figure 3-3 Flow rate for SH 200

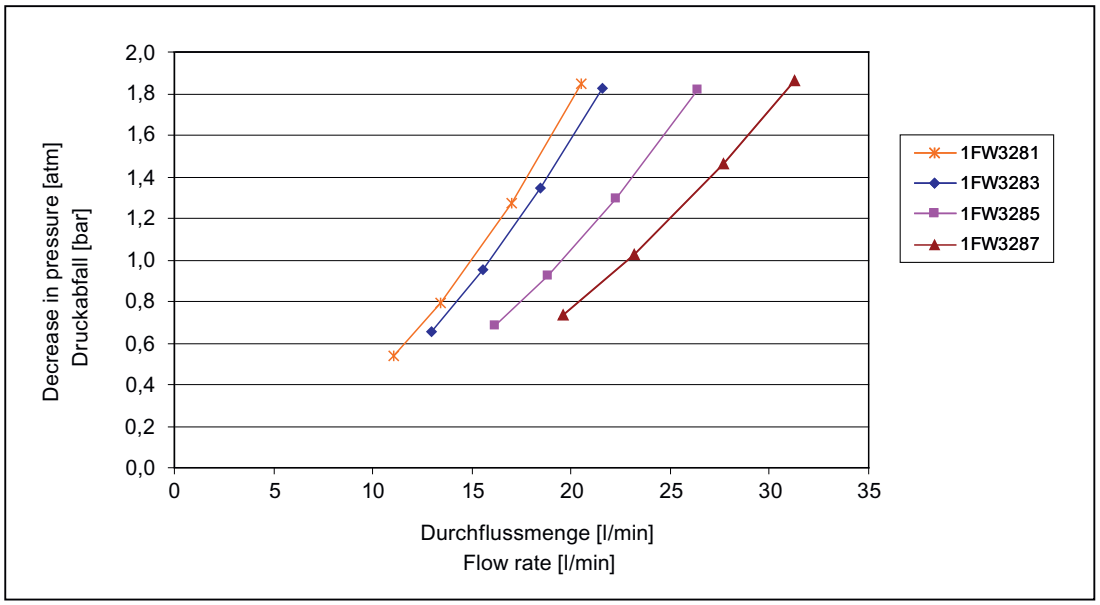



Figure 3-4 Flow rate for SH 280

## 3.1.3 Cooling water

Table 3- 5 Cooling water specification

| | **Quality of the water used as coolant for motors with aluminum, stainless steel tubes + cast iron or steel jacket** |
|---|---|
| Chloride ions | < 40 ppm, can be achieved by adding deionized water. |
| Sulfate ions | < 50 ppm |
| Nitrate ions | < 50 ppm |
| pH value | 6 ... 9 (for aluminum 6 ... 8) |
| Electrical conductivity | < 500 µS/cm |
| Total hardness | < 170 ppm |

**Note**

It is recommended to use deionized water with reduced conductivity (5 ... 10 µS/cm) (if required, ask the water utility for the values). According to 98/83/EC, drinking water may contain up to 2500 ppm of chloride!

Manufacturers of chemical additives can provide support when analyzing the water that is available on the plant side.

Table 3- 6 Cooling water quality

| | Coolant quality |
|---|---|
| Cooling water | According to the table "Specifications for cooling water" |
| Corrosion protection | 0.2 to 0.25 % inhibitor, Nalco TRAC100 (previously 0GE056) [1] |
| Anti-freeze protection | When required, 20 - 30 % Antifrogen N (from the Clariant Company) [2] |
| Dissolved solids | < 340 ppm |
| Size of particles in the coolant | < 100 µm |

1) The inhibitor is not required if it ensured that the concentration of Antifrogen N is > 20%.

2) Derating is not required for an anti-freeze protection concentration < 30%.

## Biocide

Closed cooling circuits with soft water are susceptible to microbes. The risk of corrosion caused by microbes is virtually non-existent in chlorinated drinking water systems.

Antifrogen N has a biocidal effect even at the minimum required concentration of > 20 %. No strain of bacteria can survive if >20 % Antifrogen N is added.

The suitability of a biocide depends on the type of microbe. The following types of microbes are encountered in practice:

- Slime-forming bacteria
- Corrosive bacteria
- Iron-depositing bacteria

At least one water analysis per annum is recommended to determine the number of bacterial colonies. Suitable biocides are available from the manufacturer Nalco for example. The manufacturer's recommendations must be followed regarding the concentration and compatibility with any inhibitor used.

| NOTICE |
|---|
| Biocides and Antifrogen N must not be mixed. |

There are other manufacturers of chemical additives in the market. Equivalent products from other manufacturers may be used. The suitability must be checked by testing.

### Manufacturers of chemical additives

| | |
|---|---|
| Tyforop Chemie GmbH | http://www.tyfo.de |
| Clariant Produkte Deutschland GmbH | http://www.antifrogen.de |
| Cimcool Industrial Products | http://www.cimcool.net |
| FUCHS PETROLUB AG | http://www.fuchs-oil.com |
| Hebro chemie GmbH | http://www.hebro-chemie.de |
| HOUGHTON Deutschland GmbH | http://www.houghton.com |
| Nalco Deutschland GmbH | http://www.nalco.com |
| Schweitzer-Chemie GmbH | http://www.schweitzer-chemie.de |

| NOTICE |
|---|
| It goes without saying that equivalent products from other manufacturers may be used. Our recommendations are to be seen as helpful information, not as requirements or regulations. We cannot accept any liability for the quality and properties/features of third-party products. |

### 3.1.4 Cooling water connection

The motor is connected to the cooling circuit using two female threads. These are located on the side of the motor. The intake and discharge connections can be selected as required. Recommendation: Inlet at NDE

The units should be connected with hoses to provide mechanical decoupling (refer to the table "Materials and components of a cooling circuit").

| Cooling water connection | |
|---|---|
| for 1FW315x and 1FW320x | G 1/2" |
| for 1FW328x | G 1" |

## 3.2 Shaft versions

The complete torque motor 1FW3 can be ordered with 3 different shaft versions:

- Hollow shaft
- Plug-on shaft
- Solid shaft

The DE shaft end is cylindrical in accordance with DIN 748-3 (IEC 60072-1).

Table 3- 7 Hollow shaft

| Frame size | Flange centering edge $d_i$ [mm] |
|---|---|
| 1FW315x | 153 H7 |
| 1FW320x | 153 H7 |
| 1FW328x | 250 H7 |

Table 3- 8 Plug-on shaft

| Frame size | Flange centering edge $d_i$ [mm] | Support $d_i$ [mm] |
|---|---|---|
| 1FW315x | 153 H7 | 70 H6 |
| 1FW320x | 153 H7 | 85 H6 |
| 1FW328x | 250 H7 | 110 H7 and 180 H7 |

Table 3- 9 Solid shaft

| Frame size | Shaft length l [mm] | Shaft diameter d [mm] |
|---|---|---|
| 1FW315x | 140 | 65 m6 |
| 1FW320x | 170 | 90 m6 |

The shaft version "solid shaft" can be ordered with a plain shaft end or with keyway (according to DIN 6885-1).

**Note**

**Shaft cover at NDE for the "hollow shaft" version**

If the hollow through-shaft is not used by the customer and must be sealed at the NDE for touch protection reasons, the motor can be supplied with a shaft cover at the NDE. Ordering options: Order code T20.

See the dimension drawings for further details.

### Direction of rotation

The positive direction of rotation is clockwise when viewing the drive end (flange side).

## 3.3 Degree of protection

The degree of protection designation in accordance with EN 60034-5 (IEC 60034-5) is described using the letters IP and two digits.

IP = International Protection
1st digit = protection against ingress of foreign bodies
2nd digit = protection against harmful ingress of water

Since coolants used for machine tools and transfer machines usually contain oil, are able to creep, and may also be corrosive, protection against water alone is insufficient. The motors must be protected by suitable covers.

Attention must be paid to providing suitable sealing of the motor shaft for the selected degree of protection for the motor.

Table 3- 10 Degree of protection of the 1FW3 complete torque motors

| Motor | Shaft version | | |
|---|---|---|---|
| | Hollow shaft | Plug-on shaft | Solid shaft |
| 1FW315x | IP54 | IP55 | IP55 |
| 1FW320x standard | IP54 | IP55 | IP55 |
| 1FW320x High Speed | - | IP55 | IP55 |
| 1FW328x standard | IP54 | IP54 | - |
| 1FW328x High Speed | IP54 | IP54 | - |

## 3.4 Bearing version

The bearings of the complete torque motors are greased for life and designed for a minimum ambient temperature range in operation of -15 °C.

Table 3- 11 Bearing designation and bearing properties for the normal version with standard bearings

| | SH 150 | SH 200 | SH 280 |
|---|---|---|---|
| Hollow shaft DE (fixed bearing) | 61838 | 61838 | 61864 |
| Hollow shaft NDE (floating bearing) | 61832 | 61832 | 61856 |
| Plug-on shaft DE (fixed bearing) | 61838 | 61838 | 61864 |
| Plug-on shaft NDE (floating bearing) | 6213 | 6020 | 6230 |
| Solid shaft DE (fixed bearing) | 6215 | 6220 | --- |
| Solid shaft NDE (floating bearing) | 6213 | 6020 | --- |
| Possible mounting positions | Horizontal and vertical | Horizontal and vertical | Horizontal and vertical |
| Bearing change interval with permanent grease lubrication, horizontal mounting position | 20000 h at max. 40 °C ambient temperature | 20000 h at max. 40 °C ambient temperature | --- |
| Regreasing | Option +K40<br>See table "Bearings with regreasing system" | Option +K40<br>See table "Bearings with regreasing system" | Regreasing in the standard<br>See table "Bearings with regreasing system" |

### Special versions

Special versions for increased radial and axial forces on request.

Typical applications: General machine construction.

**Note**

**Bearings without regreasing system**

For bearings without regreasing system (SH 150 and SH 200), we recommend that the bearings are replaced after approx. 20000 operating hours for an ambient temperatures up to a maximum of 40 °C, or after 5 years (after delivery) at the latest.

The bearing lifetime is reduced by 50 % when motors are mounted vertically. This is the reason that we recommend that a regreasing system is used when motors are mounted vertically.

## Regreasing system (option for 1FW315x and 1FW320x, standard for 1FW328x)

If required, 1FW3 complete torque motors can be equipped with a re-lubricating device with a lubricating nipple M8 x 1 to DIN 71412-A for the DE and NDE bearings. This increases the bearing change interval in accordance with the table "Bearings with regreasing system" if the regreasing intervals are maintained and the ambient temperature 40 °C is not exceeded.

Ordering options: Order code K40

The re-lubricating device cannot be retrofitted!

Table 3- 12 Bearings with regreasing system (for 1FW315x, 1FW320x and 1FW328x-1, optional)

| Motor | Bearing change interval with regreasing [h] | Regreasing intervals [h] | Quantity of grease for each regreasing [g] [1] | |
|---|---|---|---|---|
| | | | DE | NDE |
| 1FW315x hollow shaft | 40000 | 10000 | 26 - 30 | 16 - 20 |
| 1FW315x plug-on shaft | 60000 | 10000 | 26 - 30 | 14 - 18 |
| 1FW315x solid shaft | 60000 | 10000 | 17 - 21 | 14 - 18 |
| 1FW320x hollow shaft | 40000 | 10000 | 26 - 30 | 16 - 20 |
| 1FW320x plug-on shaft | 60000 | 10000 | 26 - 30 | 19 - 23 |
| 1FW320x solid shaft | 60000 | 10000 | 35 - 39 | 19 - 23 |
| 1FW328x-1 and 1FW328x-2 $n_N$ = 150/200 hollow shaft | 40000 | 10000 | 76 - 80 | 56 - 60 |
| 1FW328x-1 and 1FW328x-3 $n_N$ = 400 hollow shaft | 40000 | 6500 | 76 - 80 | 56 - 60 |
| 1FW328x-3 $n_N$ = 600 hollow shaft | 24000 | 4000 | 76 - 80 | 56 - 60 |
| 1FW328x-2/3 plug-on shaft | 40000 | 8000 | 76 - 80 | 116 - 120 |

[1] ) Bearing grease designation: Klüberquiet BQH 72-102, Klüber Lubrication Munich KG, Internet: www.klueber.com

| NOTICE |
| --- |
| **Vertical mounting position**<br>The regreasing interval is reduced to 50% and therefore the bearing replacement interval when motors are mounted vertically. |

Re-lubricating should be carried out manually using a grease gun (not a hydraulic gun). The grease quantities must be observed. Bearings should be re-lubricated at a low speed if it is not dangerous for persons. The recommended re-lubricating intervals relate to normal loads:

- Operation at speeds in accordance with the rating plate data
- Precision-balanced operation
- Use of the specified roller bearing greases

### Option, special grease for low speeds +V07 (for 1FW315x and 1FW320x)

Hollow shaft version:

For motors with hollow shaft, we recommend for effective speeds up to 25 rpm that the special LGHB2 grease is ordered with option +V07.

Solid shaft version and plug-on shaft:

For motors with solid shaft and plug-shaft, in order to achieve the bearing change interval, we recommend for effective speeds up to 500 rpm that the special LGHB2 grease is ordered with option +V07.

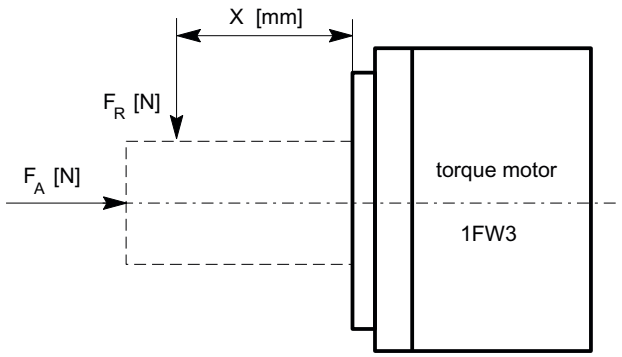
### Special versions

Unfavorable factors (e.g. effects of mounting/installation, speeds, special modes of operation or high mechanical loads) may require special measures. Contact your local Siemens office, specifying the prevailing general conditions.

## 3.5 Radial and axial forces

Point of application of radial forces $F_R$ at the torque motor

- for average operating speeds
- for a nominal bearing change interval of 20000 h




Maß X:
Abstand zwischen dem Angriffspunkt der Kraft $F_R$ und der Wellenschulter des Torquemotors.

Dimension X:
Distance between the point of application of the force $F_R$ and the shaft shoulder of the torque motor.

Figure 3-5 Point of application of radial force $F_R$ and axial force $F_A$

**⚠ CAUTION**

If you use mechanical transmission elements that subject the shaft end to a radial force, you must ensure that the maximum limit values specified in the radial force diagrams are not exceeded.

**NOTICE**

When the axial force diagram is used, the maximum permissible radial force must be noted.

The axial force diagram is valid for x < 100 mm.

When the bearing is designed, the motor operating speed must be rounded-off according to the next-higher speed curve.

## 3.5.1 Hollow shaft

### Radial force diagram for 1FW315❑ hollow shaft

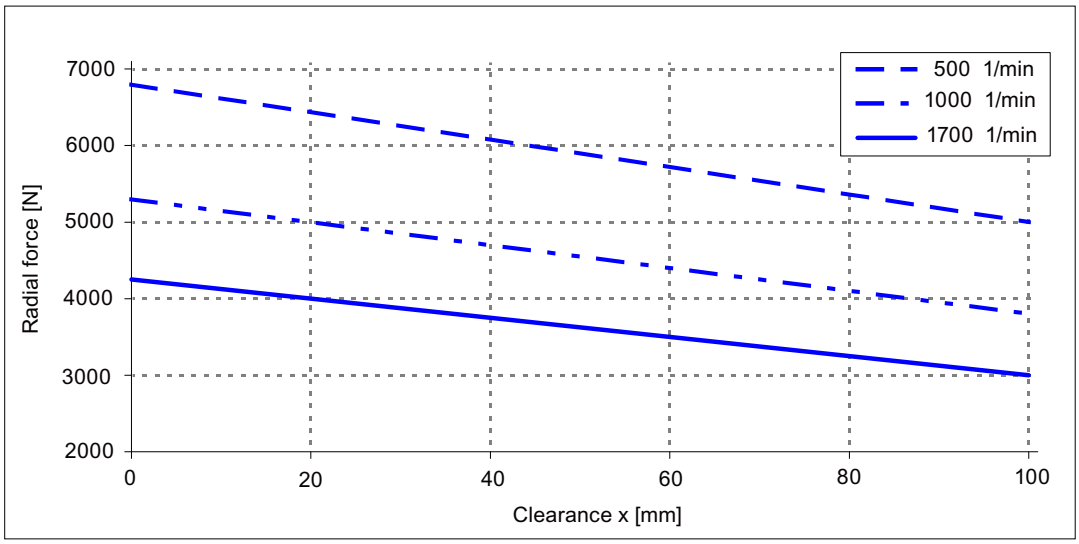



Figure 3-6 Radial force diagram for 1FW315❑, with nominal bearing change interval of 20000 h

### Axial force diagram for 1FW315❑ hollow shaft

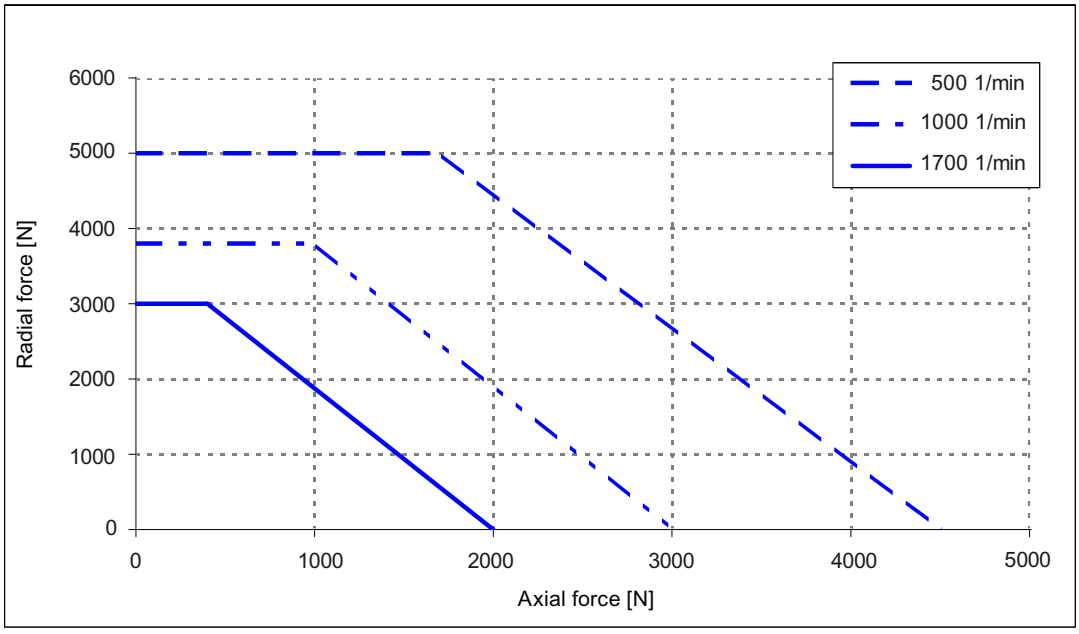



Figure 3-7 Permissible axial force as a function of radial force for 1FW315❑

## Radial force diagram for 1FW320❑ hollow shaft

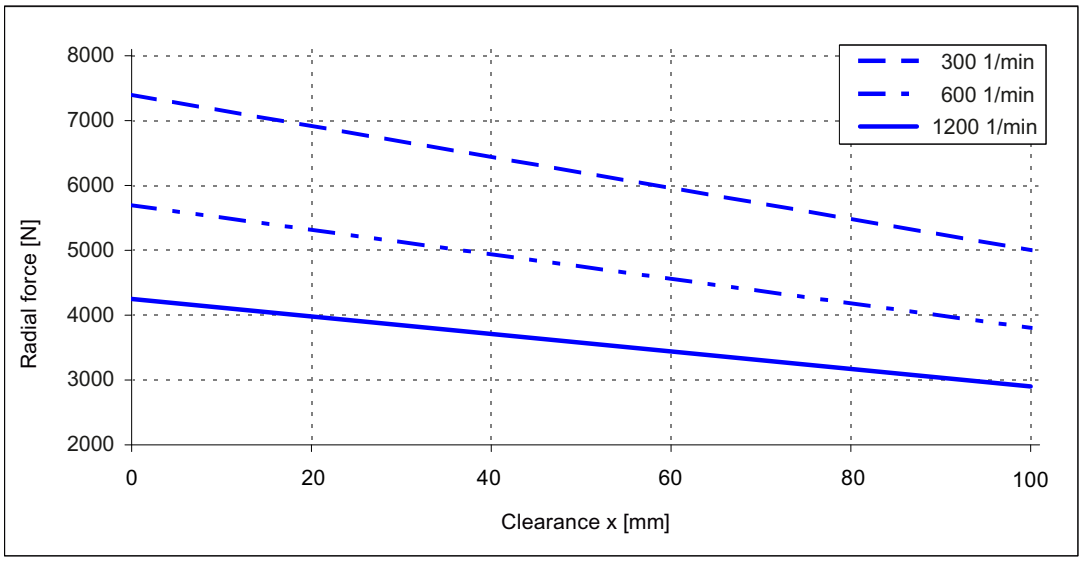



Figure 3-8 Radial force diagram for 1FW320❑, with nominal bearing change interval of 20000 h

## Axial force diagram for 1FW320❑ hollow shaft

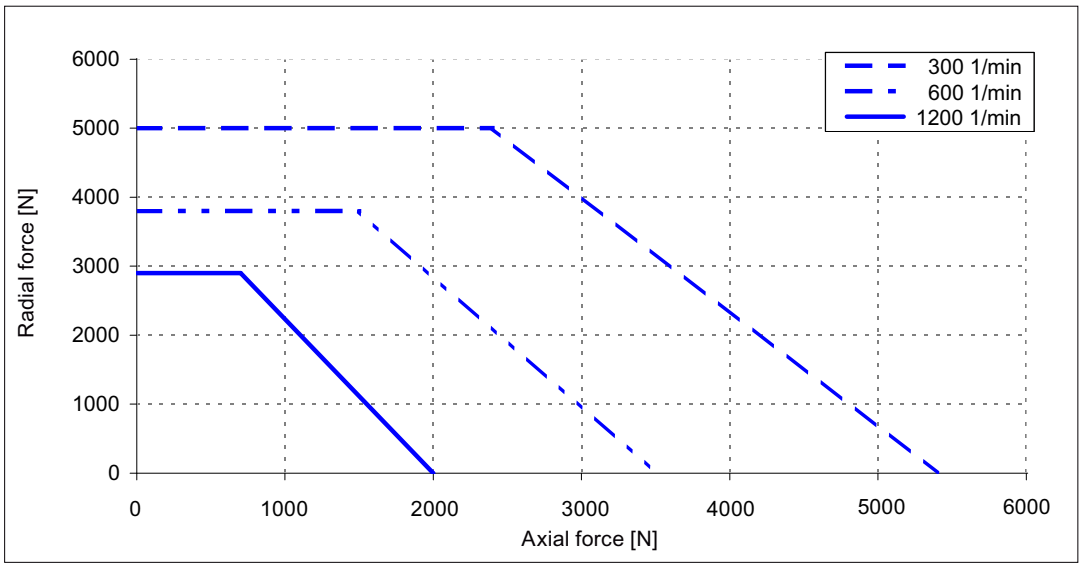



Figure 3-9 Permissible axial force as a function of radial force for 1FW320❑

## Radial force diagram for 1FW328❑ hollow shaft

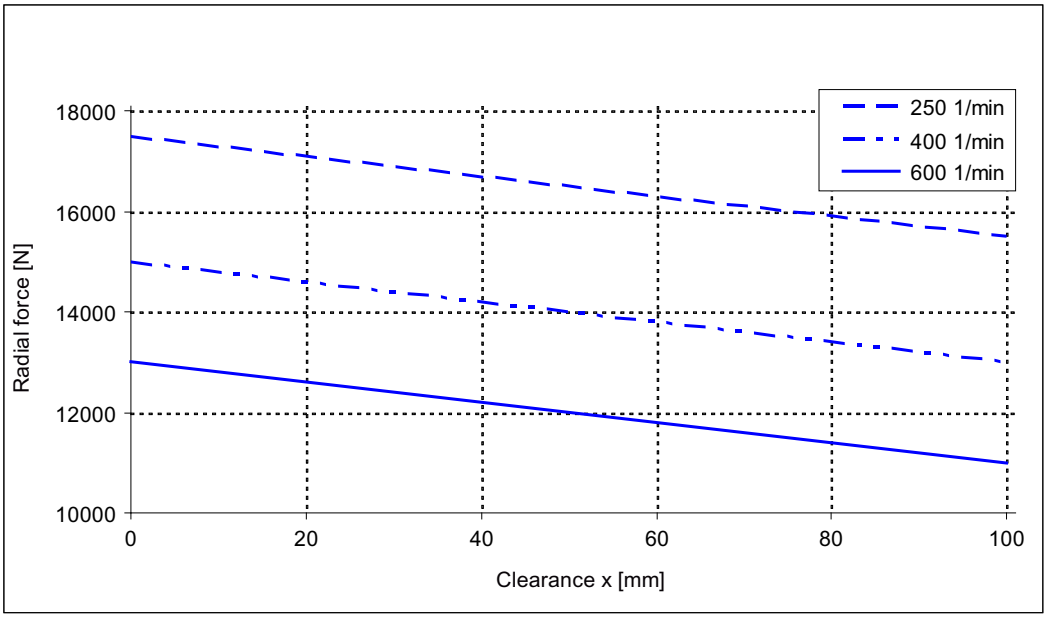



Figure 3-10 Radial force diagram for 1FW328❑, with nominal bearing change interval of 20000 h

## Axial force diagram for 1FW328❑ hollow shaft

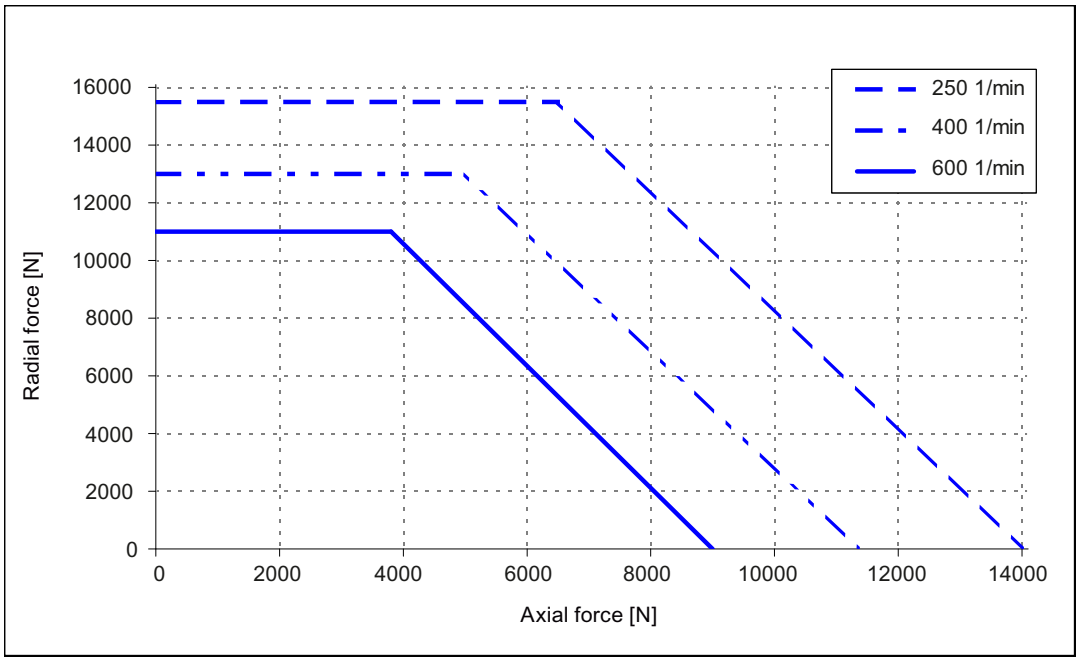



Figure 3-11 Permissible axial force as a function of radial force for 1FW328❑

## 3.5.2 Plug-on shaft

### Radial force diagram, 1FW315❑ plug-on shaft

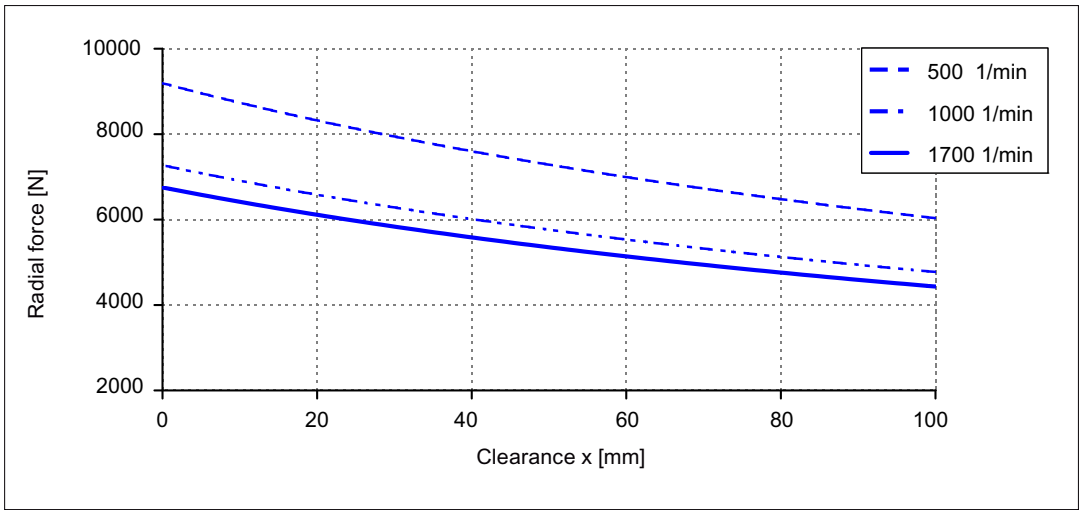



Figure 3-12 Radial force diagram for 1FW315❑, with nominal bearing change interval of 20000 h

### Axial force diagram 1FW315❑ plug-on shaft

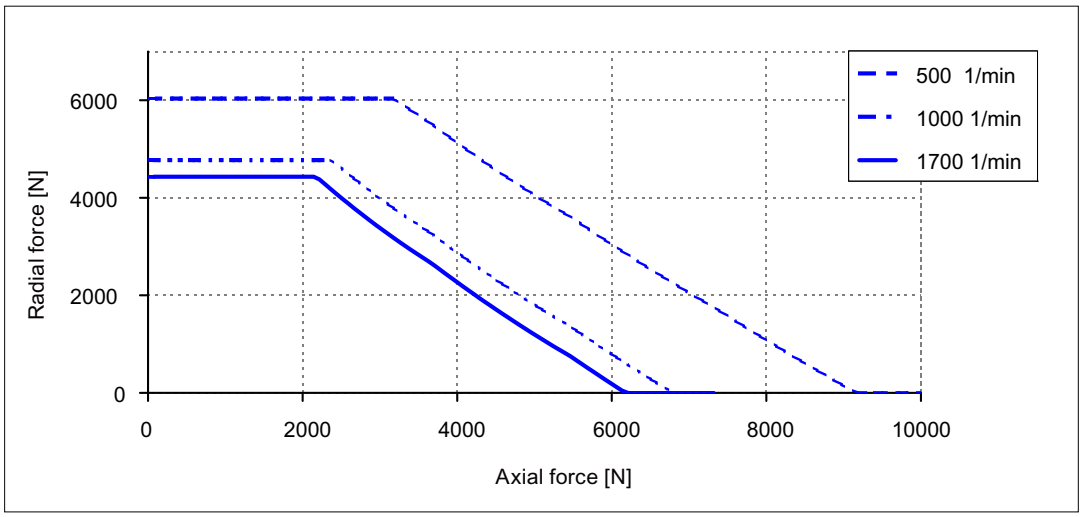



Figure 3-13 Permissible axial force as a function of radial force for 1FW315❑ (20000 h)

## Radial force diagram, 1FW315❑ plug-on shaft

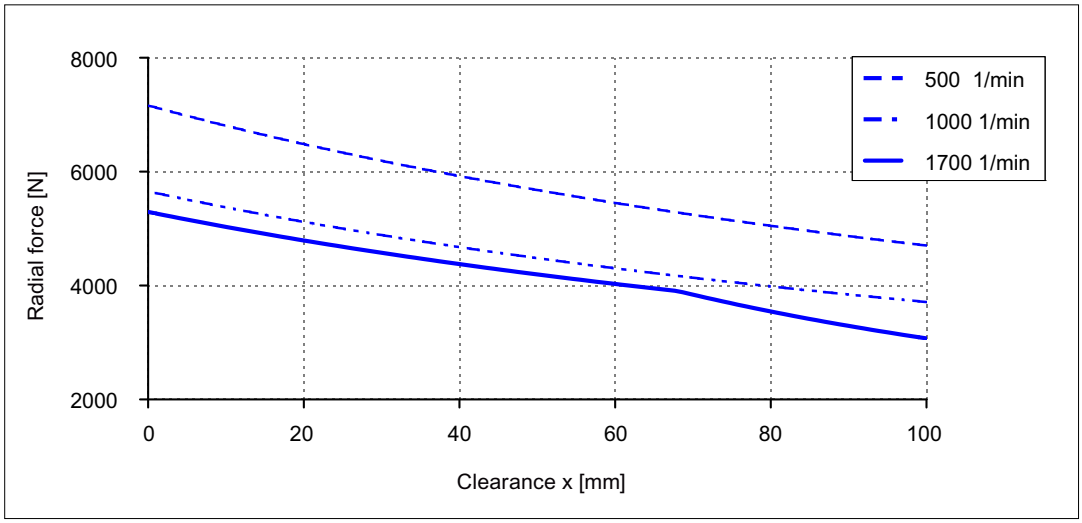



Figure 3-14 Radial force diagram for 1FW315❑, with nominal bearing change interval of 60000 h

## Axial force diagram 1FW315❑ plug-on shaft

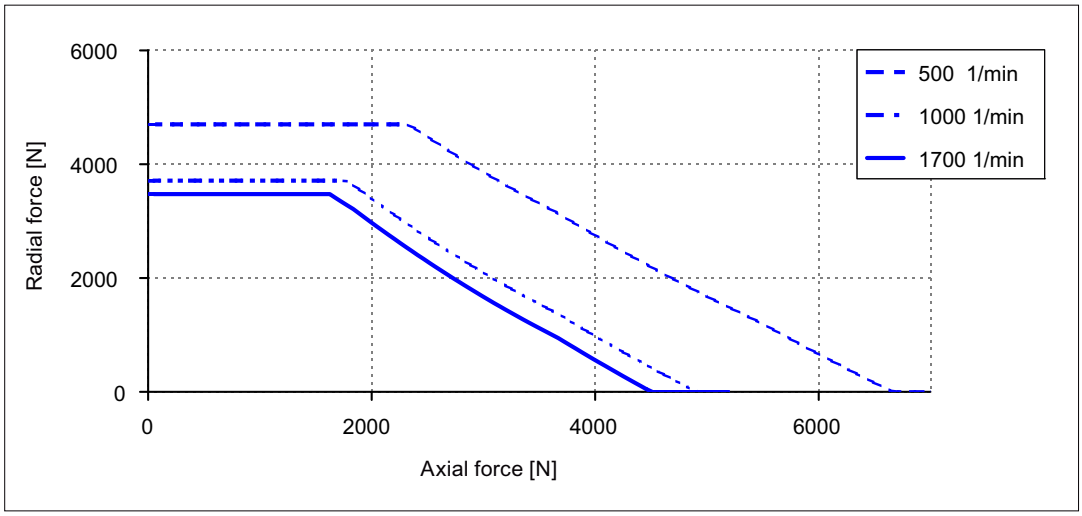



Figure 3-15 Permissible axial force as a function of radial force for 1FW315❑ (60000 h)

## Radial force diagram 1FW320❑ plug-on shaft

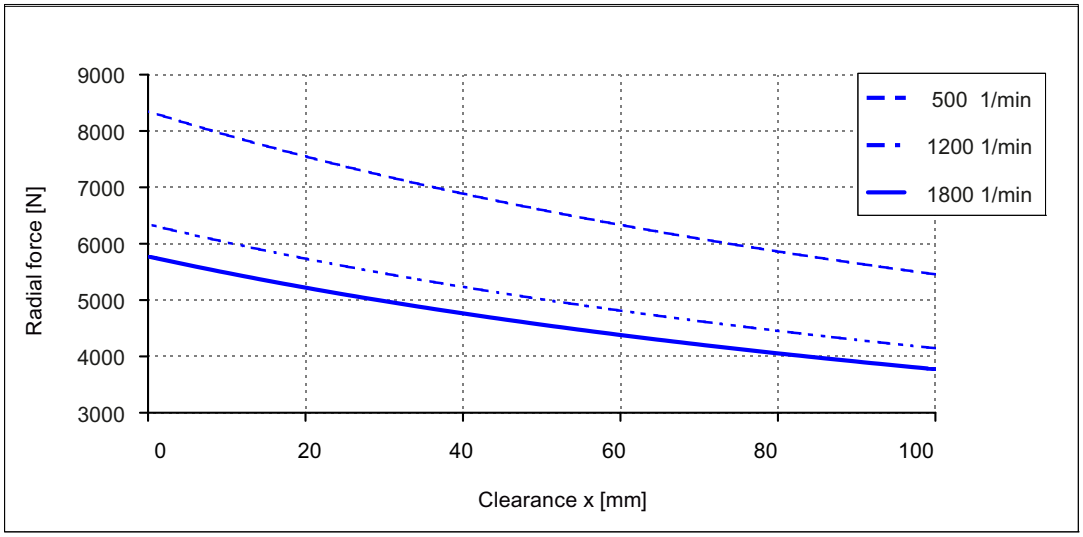



Figure 3-16 Radial force diagram for 1FW320❑, with nominal bearing change interval of 20000 h

## Axial force diagram 1FW320❑ plug-on shaft

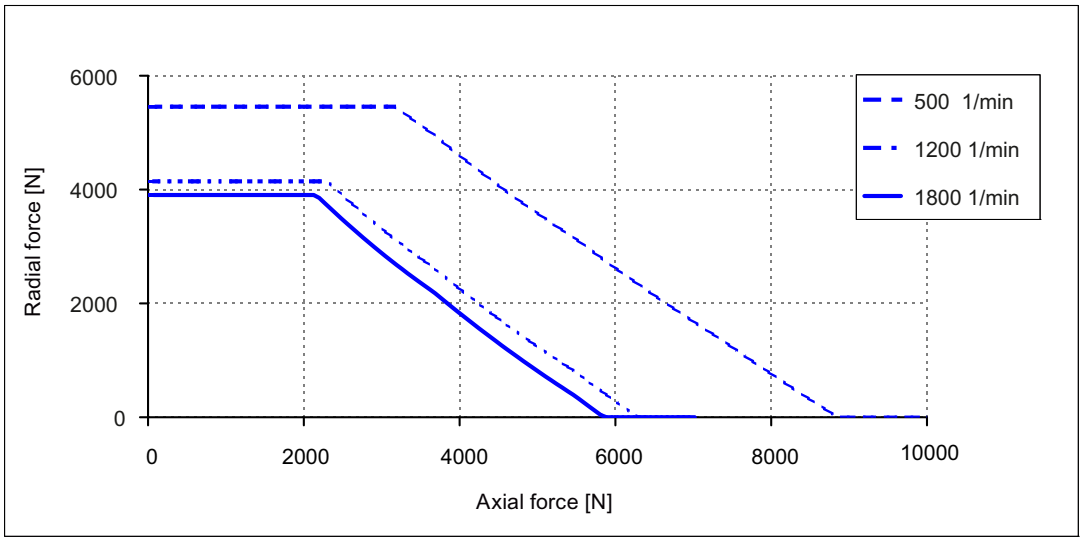



Figure 3-17 Permissible axial force as a function of radial force for 1FW320❑ (20000 h)

## Radial force diagram 1FW320❑ plug-on shaft

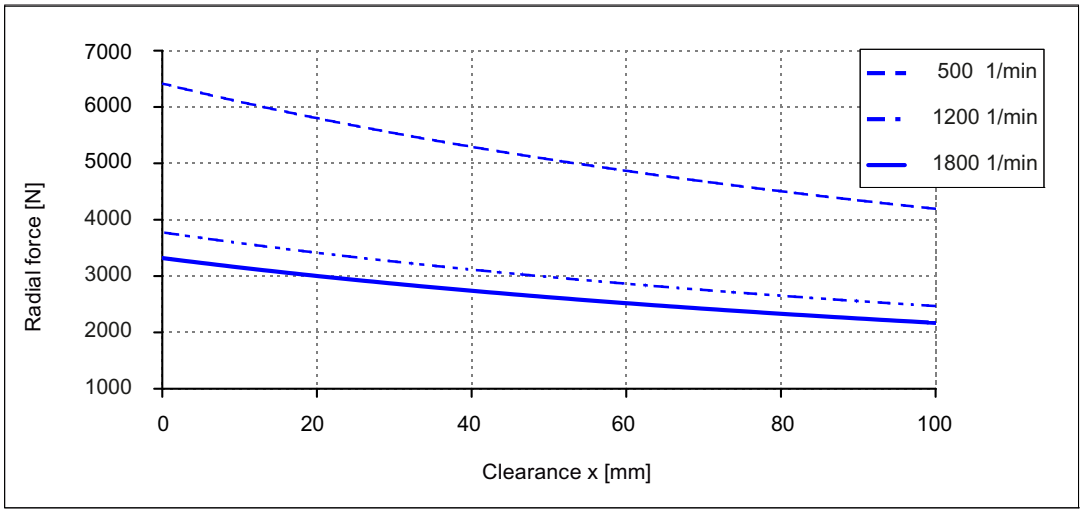



Figure 3-18 Radial force diagram for 1FW320❑, with nominal bearing change interval of 60000 h

## Axial force diagram 1FW320❑ plug-on shaft

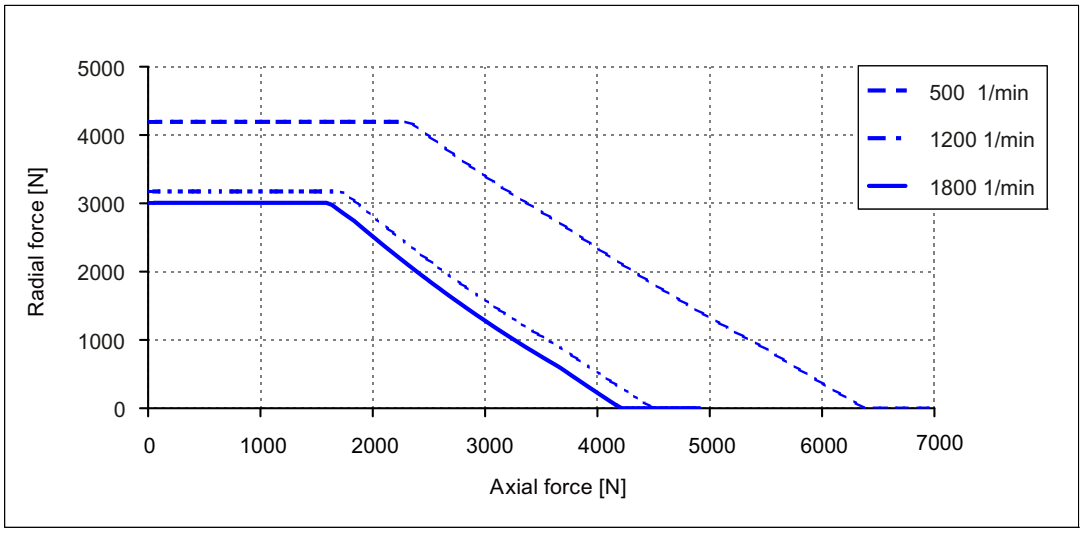



Figure 3-19 Permissible axial force as a function of radial force for 1FW320❑ (60000 h)

## 3.5.3 Solid shaft

### Radial force diagram for 1FW315❑, solid shaft

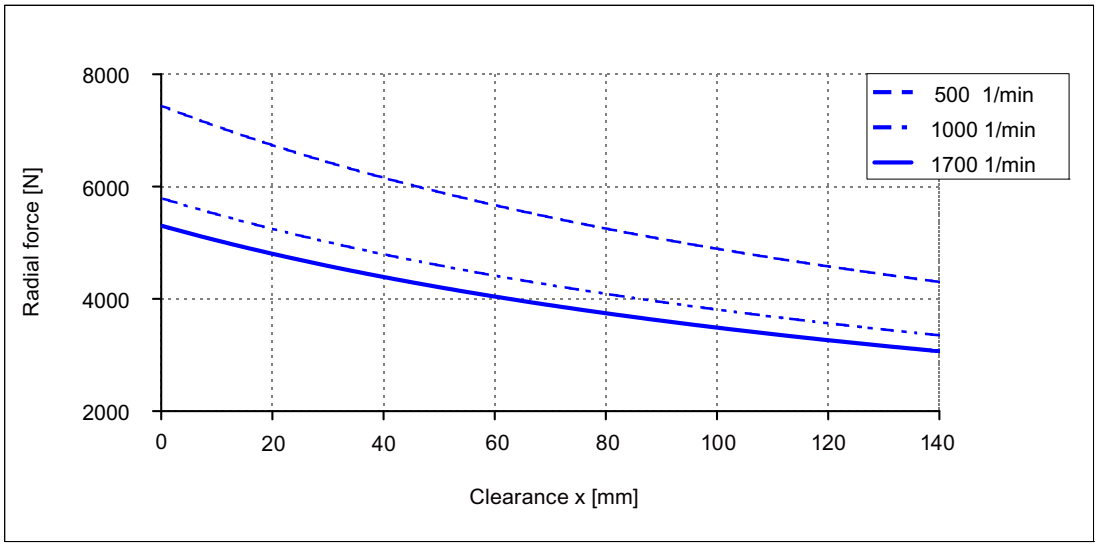



Figure 3-20 Radial force diagram for 1FW315❑, with nominal bearing change interval of 20000 h

### Axial force diagram for 1FW315❑, solid shaft

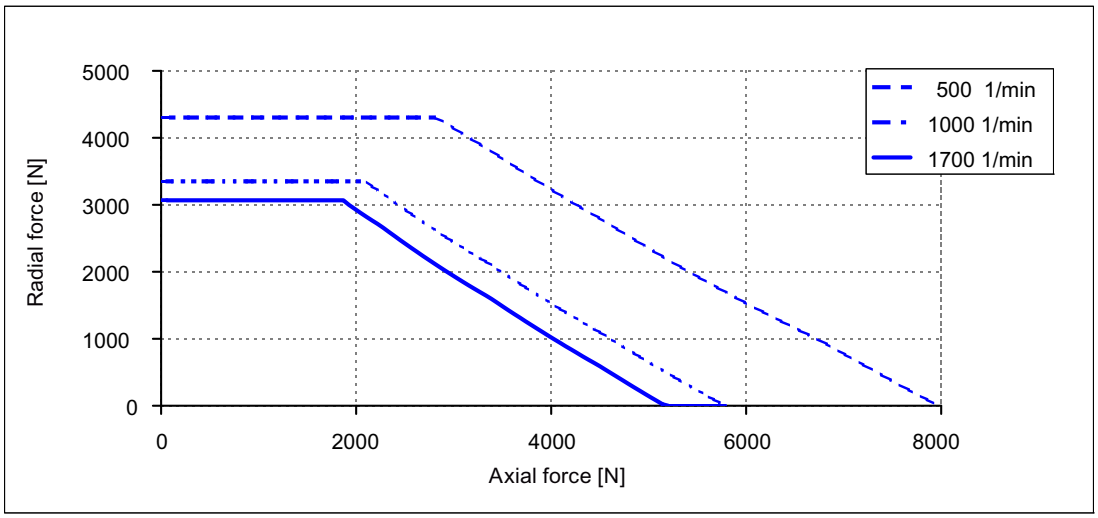



Figure 3-21 Permissible axial force as a function of radial force for 1FW315❑ (20000 h)

## Radial force diagram for 1FW315❑, solid shaft

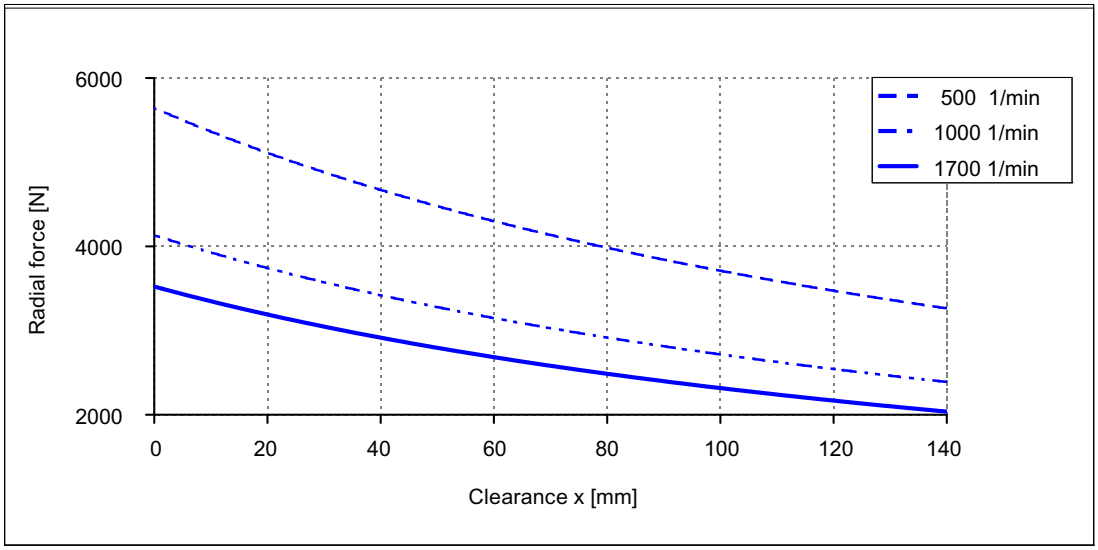



Figure 3-22 Radial force diagram for 1FW315❑, with nominal bearing change interval of 60000 h

## Axial force diagram for 1FW315❑, solid shaft

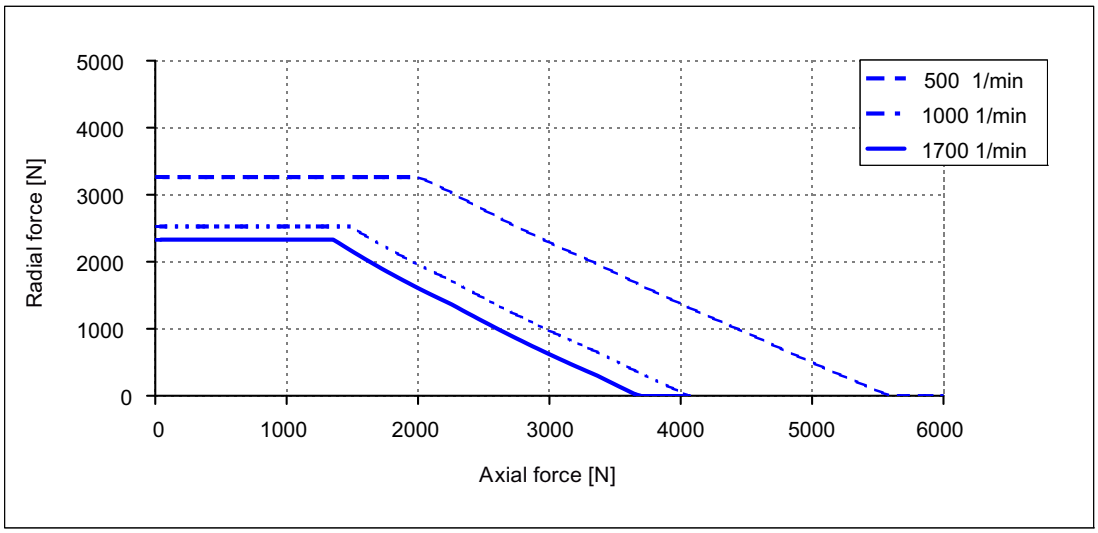



Figure 3-23 Permissible axial force as a function of radial force for 1FW315❑ (60000 h)

## Radial force diagram for 1FW320❑, solid shaft

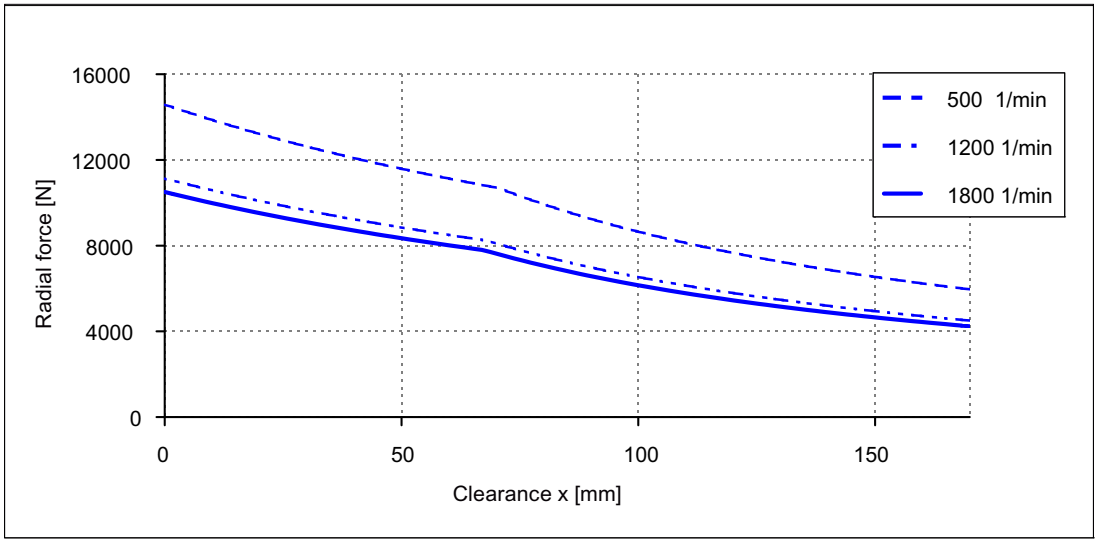



Figure 3-24 Radial force diagram for 1FW320❑, with nominal bearing change interval of 20000 h

## Axial force diagram for 1FW320❑, solid shaft

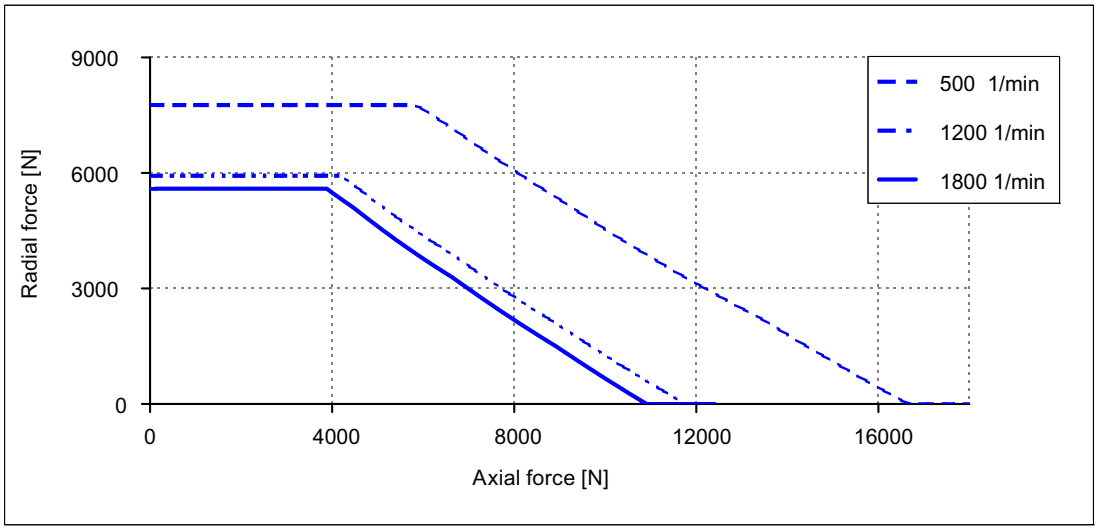



Figure 3-25 Permissible axial force as a function of radial force for 1FW320❑ (20000 h)

## Radial force diagram for 1FW320❑, solid shaft

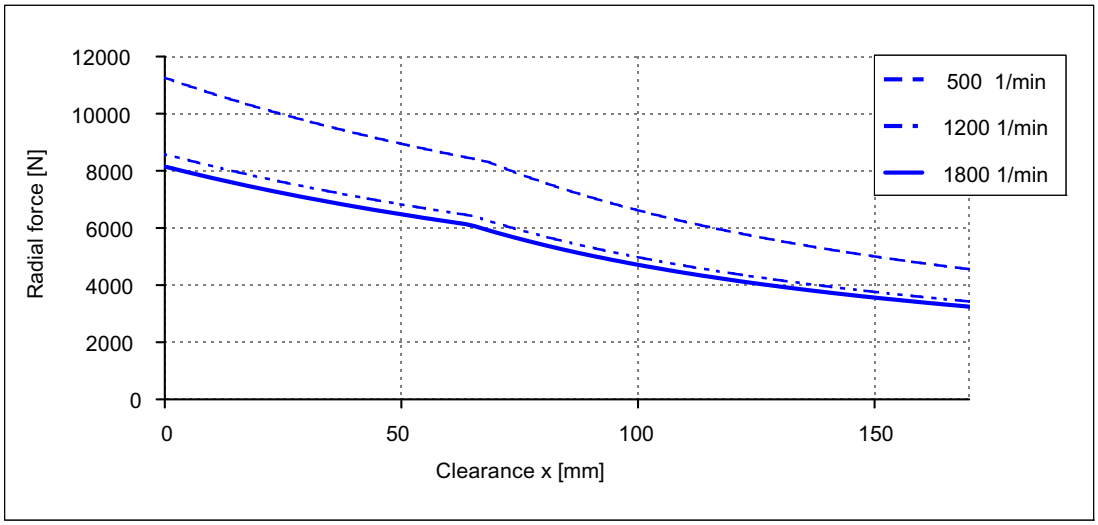



Figure 3-26 Radial force diagram for 1FW320❑, with nominal bearing change interval of 60000 h

## Axial force diagram for 1FW320❑, solid shaft

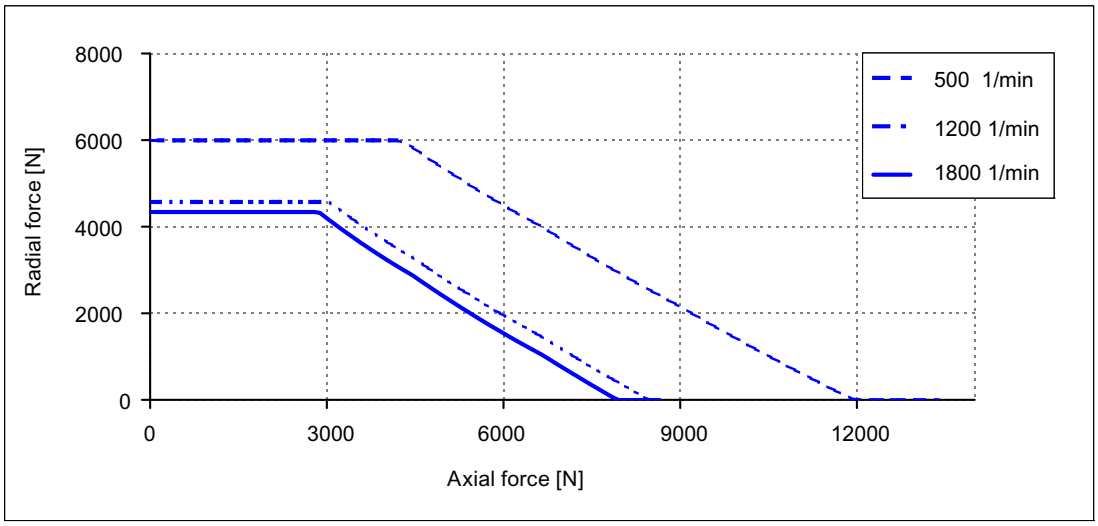



Figure 3-27 Permissible axial force as a function of radial force for 1FW320❑ (60000 h)

# 3.6 Balancing process

## Requirements placed on the process when balancing mounted components - especially belt pulleys

In addition to the balance quality of the motor, the vibration quality of motors with mounted belt pulleys and coupling is essentially determined by the balance quality of the mounted component.

If the motor and mounted component are separately balanced before they are assembled, then the process used to balance the belt pulley or coupling must be adapted to the motor balancing type.

For synchronous motors, a differentiation should be made between the following balancing types:

- Half-key balancing (an "H" is stamped on the shaft face)
- Full-key balancing (an "F" is stamped on the shaft face)
- Smooth shaft end (no keyway)

The balancing type is coded in the order designation.

Table 3- 13 Requirements placed on the balancing process as a function of the motor balancing type

| Balancing equipment/ Process step | Motor Half key balanced | Motor Full key balanced | Motor with plain shaft end |
|---|---|---|---|
| Auxiliary shaft to balance the mounted component | • Auxiliary shaft with keyway<br>• Keyway with the same dimensions as in the motor shaft end<br>• Auxiliary shaft half key balanced | • Auxiliary shaft with keyway<br>• Slot design with the exception of the slot width (as the motor) can be freely selected<br>• Auxiliary shaft full key balanced | • Auxiliary shaft without keyway<br>• If required, use a tapered auxiliary shaft |
| | • Balance quality of the auxiliary shaft ≤ 10 % of the required balance quality of the component to be mounted to the motor | | |
| Attaching the mounted component to the auxiliary shaft for balancing | • Attached using a key<br>• Key design, dimensions and materials the same as at the motor shaft end | • Attached using a key<br>• Key design, dimensions and material the same as used for the full key balancing of the auxiliary shaft | • Attach the component as far as possible without any play, e.g. using a light press fit on the tapered shaft |
| Position the mounted component on the auxiliary shaft | • Select a position between the mounted component and the key of the auxiliary shaft so that it is the same when mounted on the actual motor | • No special requirements | |
| Balance the mounted component | • Two-plane balancing is recommended - i.e. balancing in two planes at both sides of the mounted components at right angles to the axis of rotation | | |

### Special requirements

If special requirements are placed on the smooth running operation of the machine, we recommend that the motor together with the output components is completely balanced. In this case, balancing should be carried out in two planes of the output component.

## 3.7 Vibration severity grade

The motors conform to vibration severity grade A in accordance with EN 60034-14 (IEC 60034-14).

The specified values refer to the motor only. The vibration behavior as a result of the mounting can result in increased values at the motor.

The vibration severity grade is maintained up to the rated speed ($n_N$).

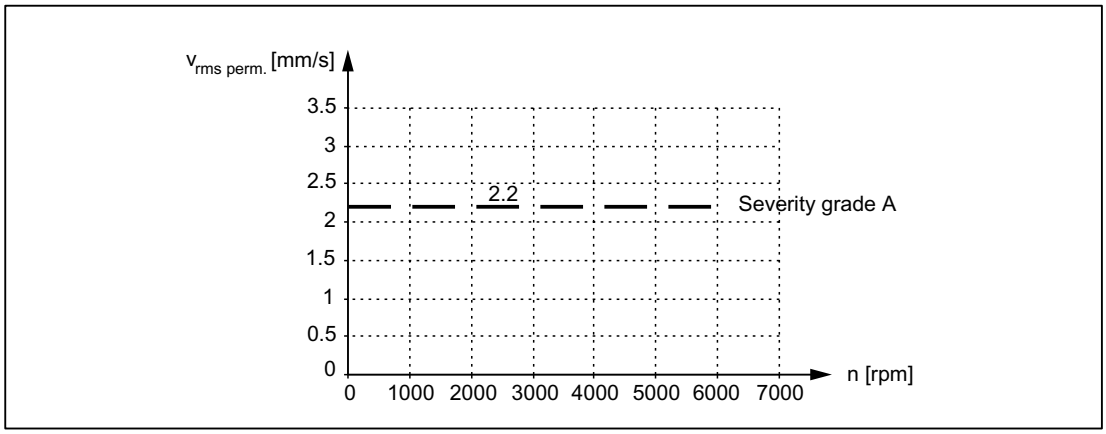



Figure 3-28 Vibration severity grade

## 3.8 Noise emission

When operated in the approved speed range, 1FW3 motors can reach the following measuring-surface sound-pressure level Lp(A):

Max. 73 dB(A) at 4 kHz rated pulse frequency at the nominal operating point

**Note**

**Sound pressure level when reducing the pulse frequency**

When the pulse frequency is reduced, a significantly higher sound pressure level can occur.

The motors are certified for a wide range of installation and operating conditions. These conditions, such as rigid or vibration-isolated foundation design, influence noise emission, sometimes significantly.

## 3.9 Gear ratio

For the "hollow shaft" version, the encoder can be driven by a toothed belt. Order designation (MLFB) 11th position = 5 or 7. The gear ratio is in accordance with the table "Gear ratio".

Table 3- 14 Ratio

| Shaft height | *i* | Remarks |
|---|---|---|
| 1FW315□ | -3.5 | The encoders are connected to the motor shaft through a belt drive (toothed belts). The sign for the gear ratio is negative due to the reverse direction of rotation of the encoder with respect to the motor. |
| 1FW320□ | -3.5 | |
| 1FW328□ | -5 | |
| Toothed belt lifetime: max. 20000 h. | | |

## 3.10 Paint finish

The 1FW3 complete torque motors are shipped with an anthracite paint finish (similar to RAL 7016).

Option: Special paint finish.

# Technical specifications and characteristic curves

# 4

## Permissible operating range

The permissible operating range is limited by thermal, mechanical, and electromagnetic boundaries.

## Permissible winding temperature range

The temperature rise of the motor is caused by the losses generated in the motor (current-dependent losses, no-load losses, friction losses). Utilizing the insulation system according to temperature class 155 (F) has a limiting effect.

## Torque characteristics of motor

The maximum permissible torque depends on the permissible winding overtemperature (100 K) and, in turn, on the mode. To adhere to the temperature limits, the torque must be reduced as the speed increases, starting from static torque $M_0$.

The characteristics refer to continuous duty S1 (100 K).

**⚠ WARNING**

Continuous duty in the area above the S1 characteristic curve is not thermally permitted for the motor.

The speed range is affected by:

- The maximum permissible speed (mechanical) $n_{max\ mech}$ (centrifugal forces on the rotor, bearing lifetime), or
- The maximum permissible speed on the converter $n_{max\ Inv}$ (output frequency, voltage strength of the converter and/or motor)

## Winding versions

A number of winding versions (armature circuit versions) for different rated speeds $n_N$ are possible within one motor frame size.

Table 4- 1 Code letter for the winding version

| Rated speed $n_N$ [rpm] | Winding version (10th position of the Order No.) |
|---|---|
| 150 | E |
| 250 | G |
| 300 | H |
| 400 | J |
| 500 | L |
| 600 | M |
| 750 | P for SH 150 |
| 800 | P for SH 200 |
| 1200 | S |

## Maximum converter output voltage

The maximum converter output voltages differ according to the converter type and line supply voltage.

Table 4- 2 Maximum converter output voltages

| Converter type | Infeed module | Supply voltage | DC link voltage | Output voltage |
|---|---|---|---|---|
| | | $V_{line}$ | $V_{DC\ link}$ | $V_{mot}$ |
| SINAMICS S120 3-ph. 380 - 480 V AC | ALM | 400 V | 600 V | 425 V |
| | ALM | 480 V | 720 V | 510 V |
| | SLM | 400 V | 528 V | 380 V |
| | SLM | 480 V | 634 V | 460 V |

## Torque limit when operating on a SINAMICS S120 with field weakening

The SINAMICS S120 converter injects a field weakening current, which means that the motor can operate above the voltage limiting characteristic. The method used by the converter to inject the field weakening current has a significant influence on the curve characteristic.

The characteristics shown apply to operation on a SINAMICS S120 converter.

Field weakening operation is always active for a SINAMICS S120 converter.

The shape of the characteristics in field weakening mode depends on the position of the voltage limiting characteristic. Therefore, an appropriate torque-speed characteristic is assigned in the field-weakening range for each converter output voltage.

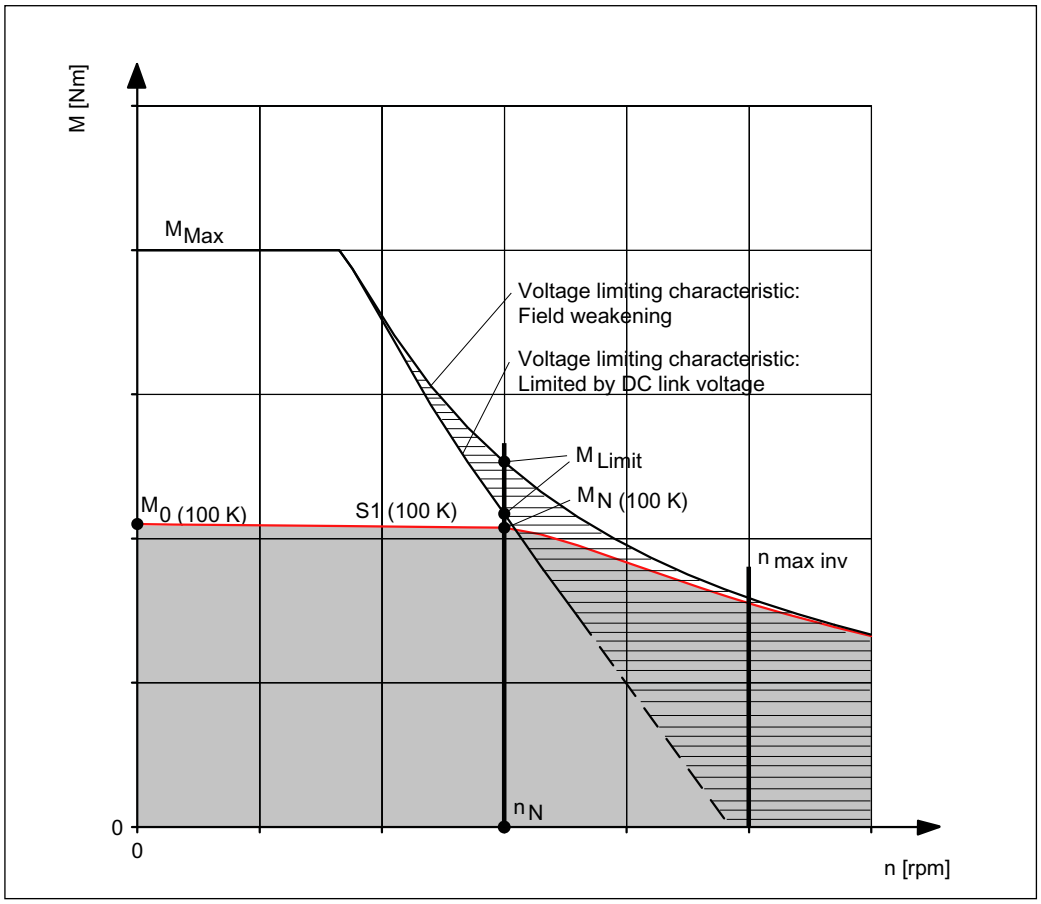



Figure 4-1 Torque characteristic of a synchronous motor operating on a SINAMICS drive system with field weakening (example characteristic)

The permissible speed range has been limited to $n_{max\ Inv}$.

## Torque limit when operating on a SINAMICS S120 without field weakening

It is possible to deactivate the field weakening function with the SINAMICS S120 drive system. This therefore reduces the operating range that is available.

The shape of the voltage limiting characteristic is determined by the winding version and the magnitude of the converter output voltage.

The voltage induced in the motor winding increases as the speed increases. The difference between the DC link voltage of the converter and the induced motor voltage can be used to apply the current.

For converters **without field weakening option**, this limits the magnitude of the current that can be impressed. This causes the torque to drop off quickly at high speeds. All operating points that can be achieved with the motor lie to the left of the voltage limiting characteristic that is shown in the diagram.

The characteristic curve is plotted for each winding version in a separate data sheet (see Chapter "Speed-torque characteristics"). The speed-torque characteristics for different converter output voltages are then assigned to each data sheet.

**Note**

The voltage limit characteristic of a motor with 600 rpm rated speed lies far above that of the same motor type with 200 rpm. However, for the same torque, this motor requires a significantly higher current.

For this reason, you should select the rated speed such that it does not lie too far above the maximum speed required for the application.

The size (rating) of the converter module (output current) can be minimized in this fashion

## Offset of the voltage limit characteristic

**NOTICE**

A offset of the voltage limiting characteristic can only used in the case of approximately linear limiting characteristic curves. The voltage limiting characteristic can be offset only if the condition $V_{mot, new} > V_{iN}$ is fulfilled.

The induced voltage $U_{iN}$ can be taken from the motor rating plate or calculated according to the following formula: $U_{iN} = k_E \bullet n_N / 1000$

In order to identify the limits of the motor for a converter output voltage ($U_{mot}$) other than 380 V, 425 V, 460 V or 510 V, the relevant voltage limiting characteristic curve must be shifted (offset) for the particular new output voltage ($U_{mot, new}$).

The degree of offset is obtained as follows:

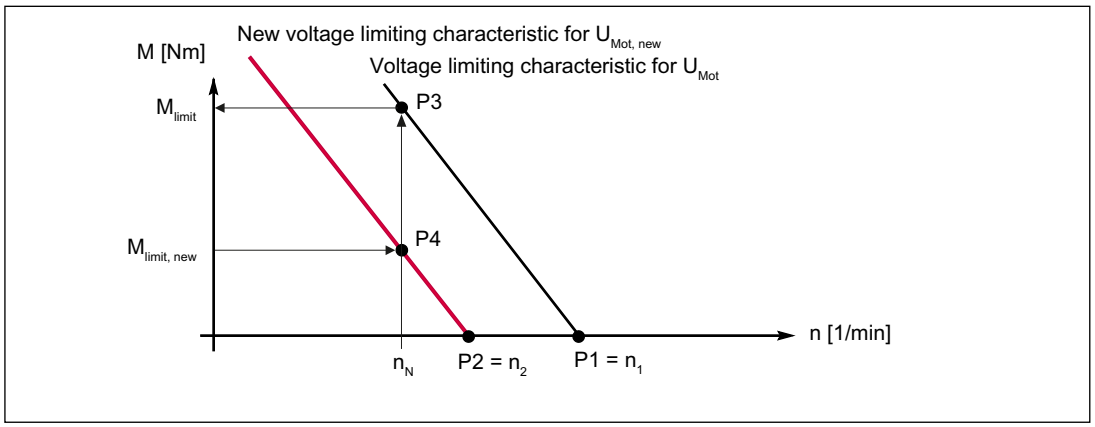
For an output voltage of $V_{mot, new}$, an offset is obtained along the X axis (speed) by a factor of:

$$\frac{U_{mot, new}}{U_{mot}}$$

$V_{mot, new}$ = new converter output voltage

$V_{mot}$ = drive converter output voltage from the characteristic curve for 380 V, 425 V, 460 V or 510 V

## Calculating the new limit torque with the new limiting characteristic




P1 Intersection of the voltage limiting characteristic on the x axis; calculate speed $n_1$.

$$n_1\ [1/min] = \frac{U_{Mot}}{k_E} \bullet 1000$$

P2 Intersection of the new voltage limiting characteristic on the x axis; calculate speed $n_2$

$$n_2\ [rpm] = n_1 \bullet \frac{U_{mot, new}}{U_{Mot}}$$

P3 At $n_N$ draw a line vertically upwards, up to the voltage limiting characteristic. This point of intersection is P3. On the left-hand side, read off $M_{limit}$.

P4 In order to determine P4, $M_{limit, new}$ must first be calculated.

$$M_{limit, new} = \frac{U_{Mot, new} - U_{iN}}{U_{Mot} - U_{iN}} \bullet Mlimit$$

P4 is the intersection of $M_{limit, new}$ and $n_N$. The new voltage limiting characteristic is obtained by connecting P2 and P4.

## Example of offset of voltage limiting characteristic curve without field weakening

Motor 1FW3201-1❑L

$n_N$ = 500 rpm

$k_E$ = 520 V/1000 rpm

$U_{mot, new}$ should be 290 V; in the example, the calculation is made with $U_{Mot}$ = 425 V

It first must be checked as to whether the condition $U_{Mot, new} > U_{iN}$ is fulfilled.

$U_{iN} = k_E \bullet n_N/1000$; $U_{iN} = 520 \bullet 500/1000 = 260$ V → condition $U_{mot, new} > U_{iN}$ is fulfilled.

Calculation P1: $n_1 = \frac{425}{520} \cdot 1000 = 817$ 1/min

Calculation P2: $n_2 = \frac{290}{425} \cdot 817 = 557$ 1/min

Calculation P3: Read off $M_{limit}$ at $n_N$ = 500 rpm and 425 V: approx. 330 Nm

Calculation P4: $M_{limit, new} = \frac{290 - 260}{425 - 260} \cdot 330 = 60$ Nm

Enter and connect points P2 and P4. This line is the new voltage limiting characteristic for $V_{mot, new}$ = 290 V.

## Tolerance data

The characteristic data listed in the data sheets are nominal values that are subject to natural scatter.

Table 4- 3 Tolerance data in the motor list data

| Motor list data | | Typ. value | Guaranteed value |
|---|---|---|---|
| Stall current | $I_0$ | ± 3 % | ± 7,5 % |
| Electrical time constant | $T_{el}$ | ± 5 % | ± 10 % |
| Torque constant | $k_T$ | ± 3 % | ± 7,5 % |
| Voltage constant | $k_E$ | ± 3 % | ± 7,5 % |
| Winding resistance | $R_{ph}$ | ± 5 % | ± 10 % |
| Moment of inertia | $J_{mot}$ | ± 2 % | ± 10 % |

## Effects of temperature and parameter scatter on the characteristic

The torque-speed characteristics specified in the following chapter relate to the nominal values at operating temperature.

## Speed limits $n_{max\ Inv}$

The speed is limited by the mechanical limit speed $n_{max\ mech}$ (centrifugal forces at the rotor, bearing service life) or the electrical limit speed $n_{max\ Inv}$.

**⚠ CAUTION**

When the machine is running (with shaft operated by motor or separately driven) at speeds higher than $n_{max\ Inv}$, a voltage in excess of the maximum permissible converter voltage might be induced in the winding. This can cause irreparable damage to the converter. Operation is not permissible above the speed $n_{max\ Inv}$ without protective measures or other additional measures. Siemens AG accepts no liability for any damage occurring as a result of failing to observe the danger warning.

| Converter type | Max. permissible voltage at the converter $U_{perm.\ inv}$ |
|---|---|
| SINAMICS S120, 380-480 V 3AC | 820 V |

The following formula can be used to determine the maximum permissible speed $n_{max\ Inv}$ up to which the system can be operated without restrictions.

$$n_{max\ Inv}\ [rpm] = \frac{U_{Perm\ Inv}\ [V] \bullet 1000}{k_E\ [V / 1000\ rpm\ ] \bullet \sqrt{2}}$$

$k_E$ = voltage constant (see Chapter "Speed-torque characteristics").

The SINAMICS S120 drive system calculates this value automatically.

When the converter is functioning properly, the voltage that occurs at the motor terminals in field-weakening mode can be limited by generating a voltage in phase opposition to the induced voltage.

## 4.1 Torque-speed characteristic

The voltages and currents specified in the data sheets are rms values. Other rated speeds on request.

The specified rated data refer to $V_{line\ rms}$ = 400 V, Active Line Module, DC link voltage, 600 V DC.

**Note**

**Operation without water cooling**

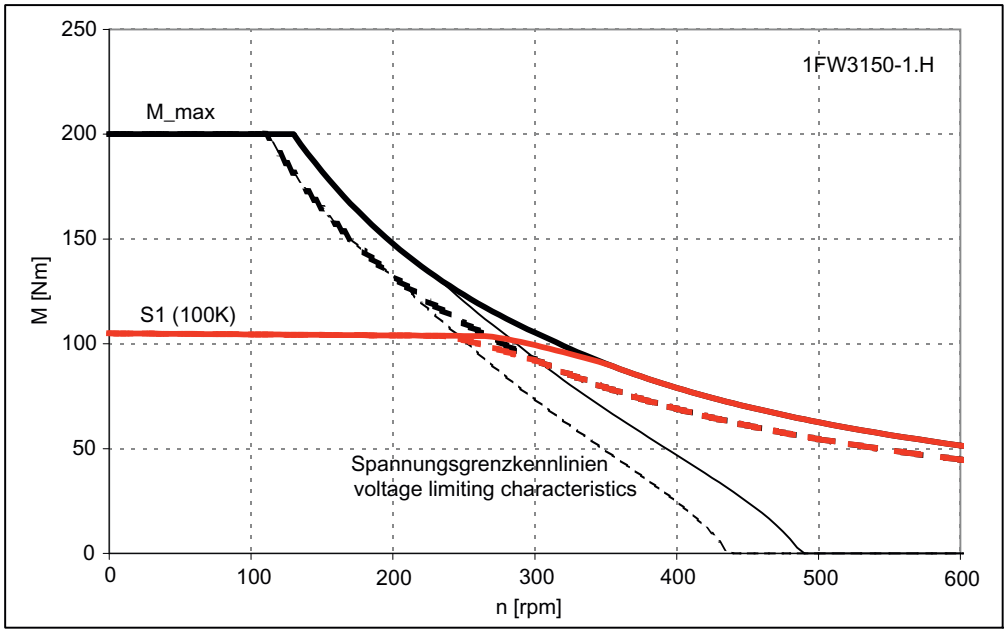
Complete torque motors 1FW3 can be operated without water cooling if the torque is appropriately reduced and the thermal losses can be adequately dissipated. The reduction factor depends on the shaft height, length and speed and can be provided when requested.

### 4.1.1 Shaft height 150

Table 4- 4 1FW3150, rated speed 300 rpm

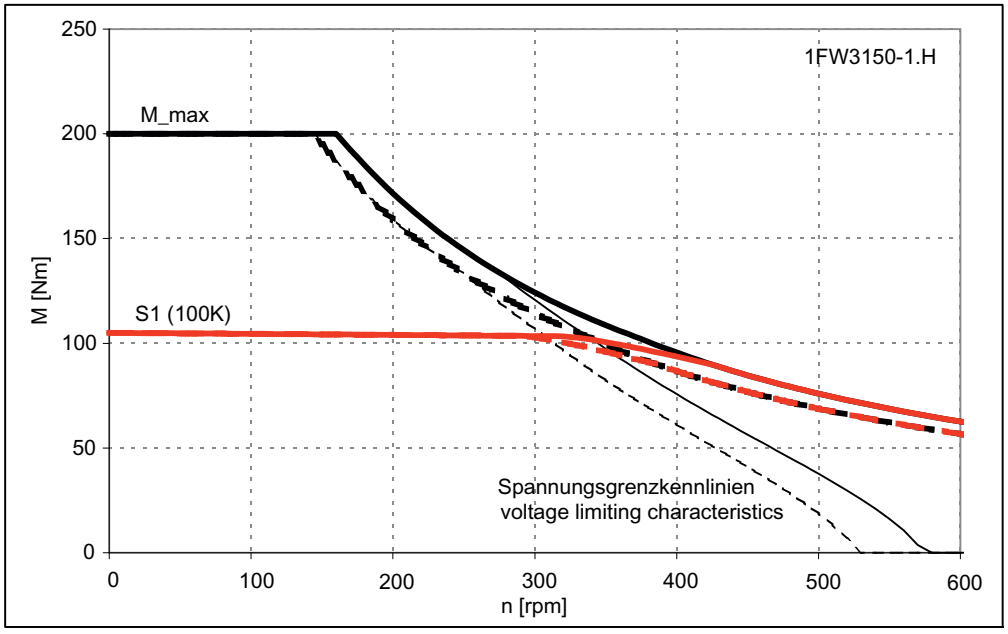
| Configuration data | Code | Unit | 1FW3150-1□H | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 100 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 3.1 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 8.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 105 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 7.3 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ Inv}$ | rpm | 630 | |
| Maximum torque | $M_{max}$ | Nm | 200 | |
| Maximum current | $I_{max}$ | A | 17.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | -- | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_T$ | Nm/A | 14.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 915 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 3.95 | |
| Rotating field inductance | $L_D$ | mH | 110 | |
| Electrical time constant | $T_{el}$ | ms | 27.5 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 6.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.12 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.13E+07 | |
| Weight | m | kg | 87 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.06 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.13E+06 | |
| Weight | m | kg | 102 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 8.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.14 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.17E+07 | |
| Weight | m | kg | 102 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



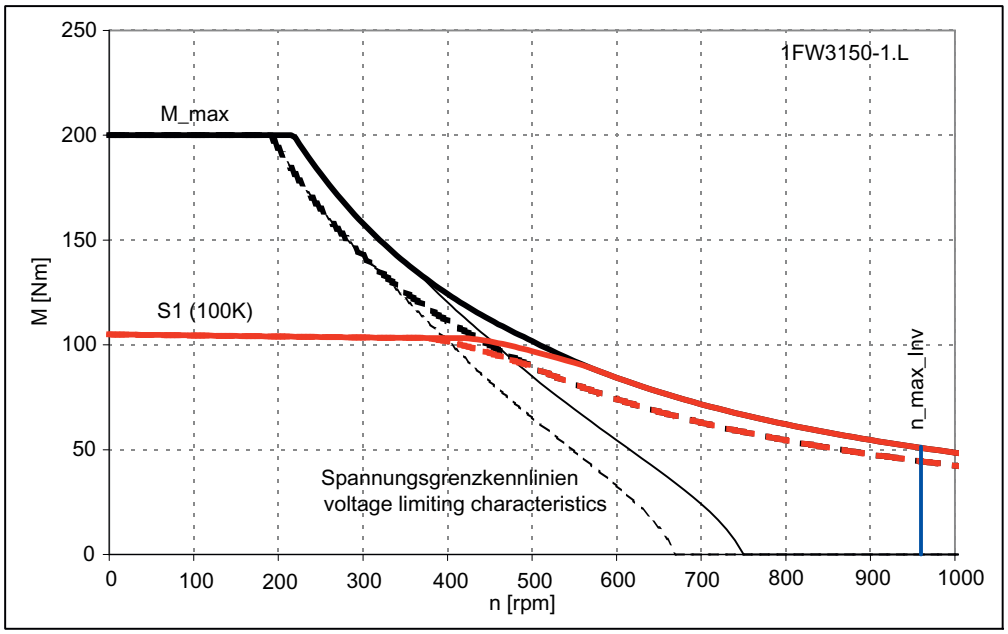

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

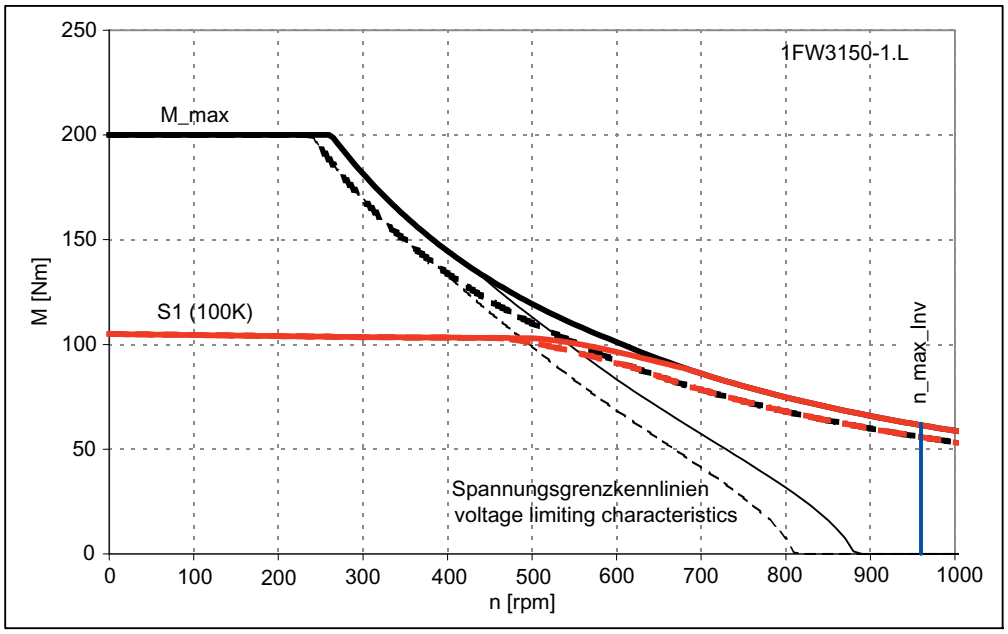
Table 4- 5 1FW3150, rated speed 500 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3150-1□L** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 100 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 5.2 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 12.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 105 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 11.5 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 960 | |
| Maximum torque | $M_{max}$ | Nm | 200 | |
| Maximum current | $I_{max}$ | A | 26.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_T$ | Nm/A | 9.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 600 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 1.68 | |
| Rotating field inductance | $L_D$ | mH | 47 | |
| Electrical time constant | $T_{el}$ | ms | 28.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 6.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.12 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.13E+07 | |
| Weight | m | kg | 87 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.06 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.13E+06 | |
| Weight | m | kg | 102 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 8.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.14 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.17E+07 | |
| Weight | m | kg | 102 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

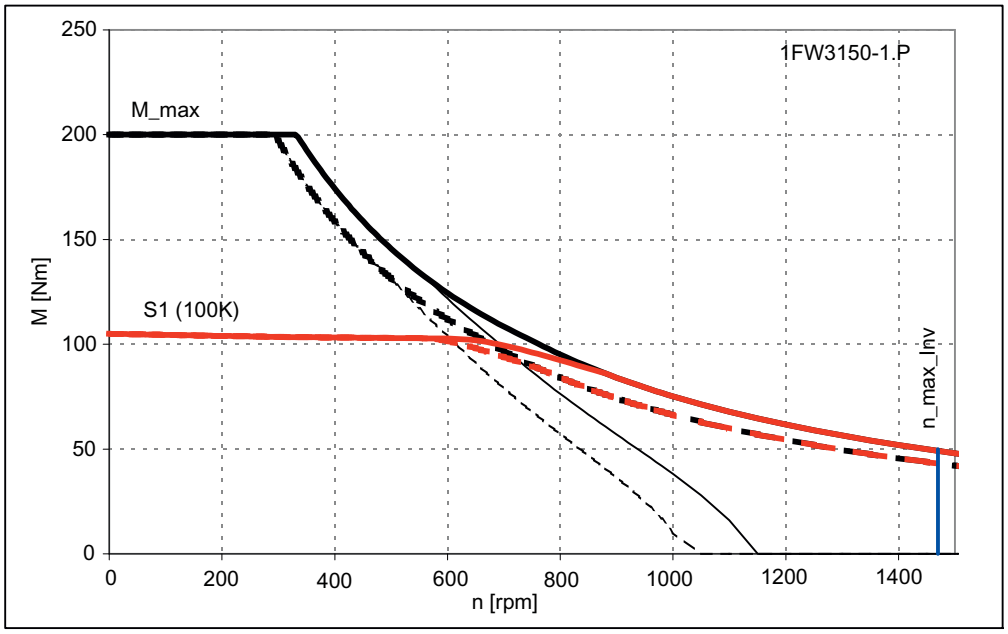



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 6 1FW3150, rated speed 750 rpm

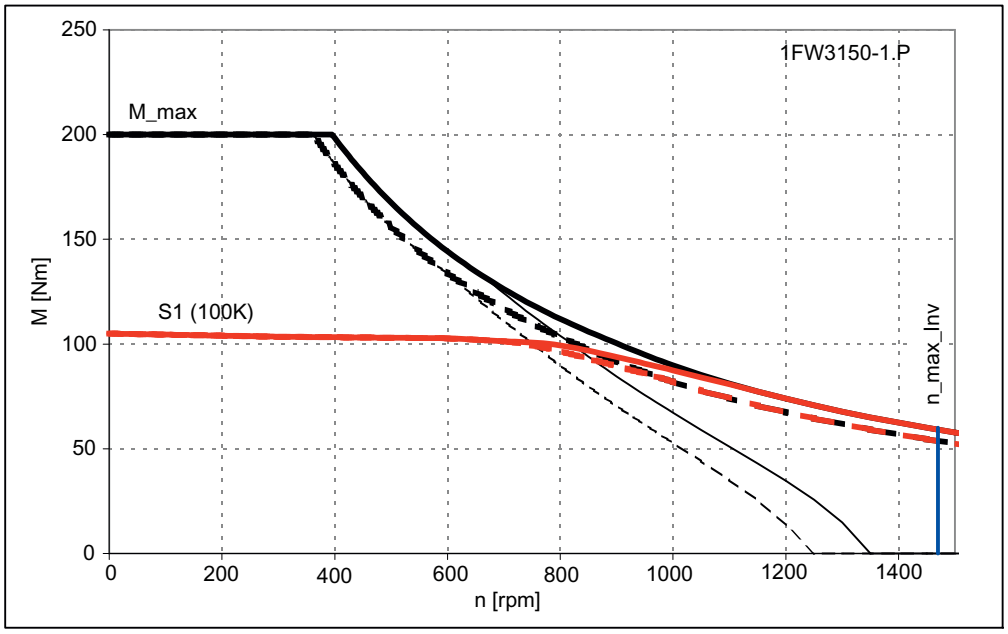
| **Configuration data** | **Code** | **Unit** | **1FW3150-1□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 750 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 100 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 7.9 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 18.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 105 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 17.5 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1470 | |
| Maximum torque | $M_{max}$ | Nm | 200 | |
| Maximum current | $I_{max}$ | A | 41.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant | $k_T$ | Nm/A | 6.1 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 393 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.75 | |
| Rotating field inductance | $L_D$ | mH | 21 | |
| Electrical time constant | $T_{el}$ | ms | 28.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 7.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.12 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.13E+07 | |
| Weight | m | kg | 87 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.06 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.13E+06 | |
| Weight | m | kg | 102 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 8.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.14 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.14E+07 | |
| Weight | m | kg | 102 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



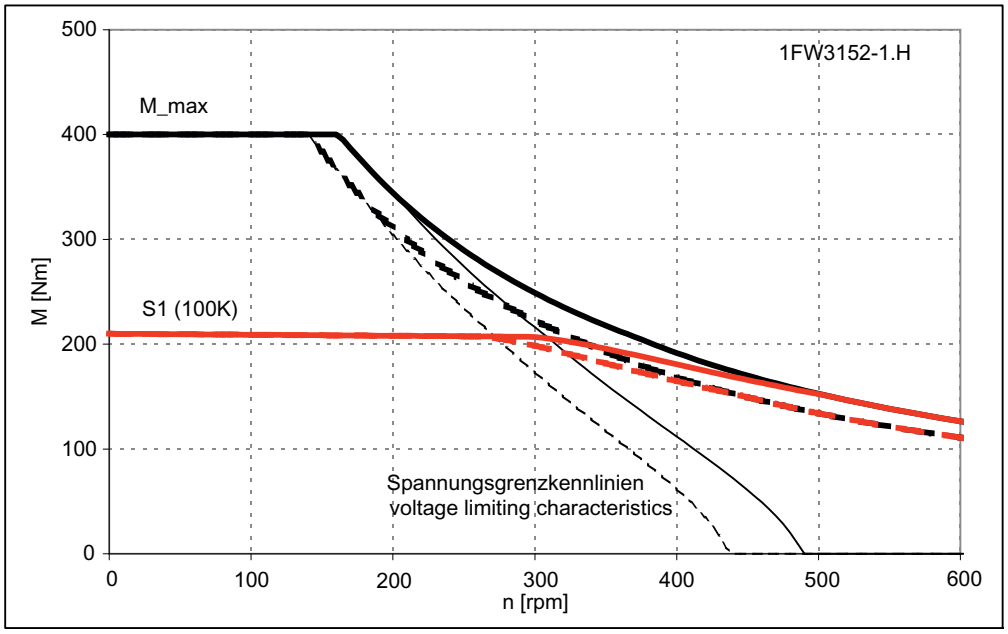

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

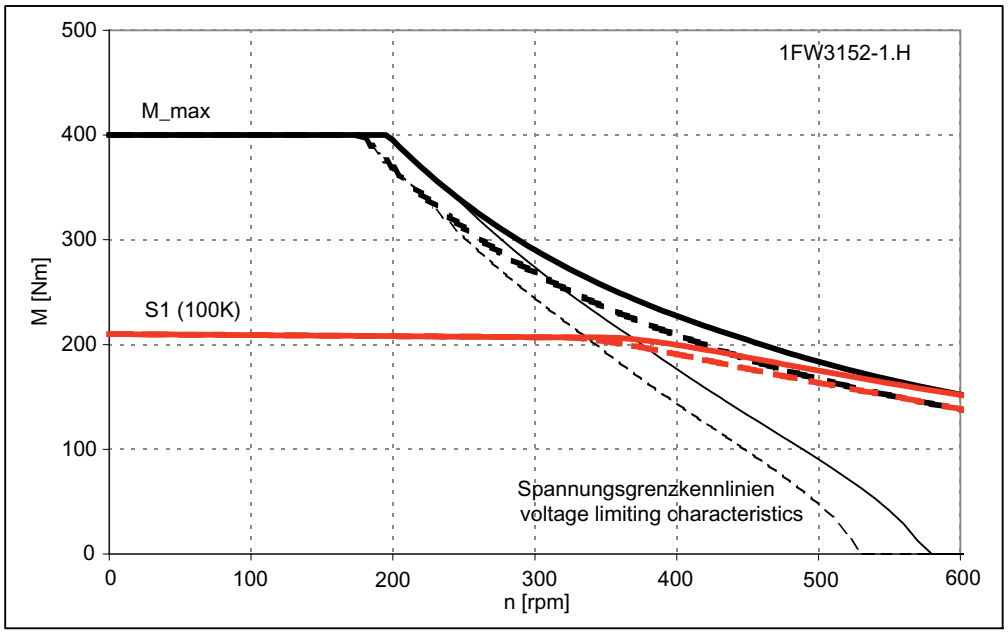
Table 4- 7 1FW3152, rated speed 300 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3152-1□H** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 200 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 6.3 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 14 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 210 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 15.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 630 | |
| Maximum torque | $M_{max}$ | Nm | 400 | |
| Maximum current | $I_{max}$ | A | 35.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 14.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 915 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 1.47 | |
| Rotating field inductance | $L_D$ | mH | 49 | |
| Electrical time constant | $T_{el}$ | ms | 33.5 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.16 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+07 | |
| Weight | m | kg | 108 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.09 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.1E+06 | |
| Weight | m | kg | 121 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 4.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.92E+07 | |
| Weight | m | kg | 124 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

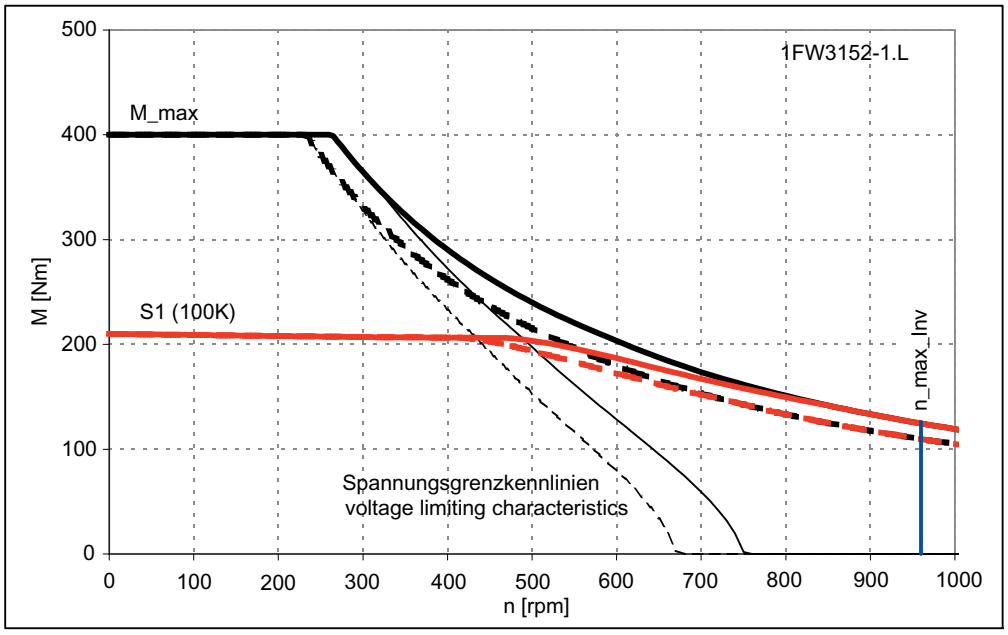



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

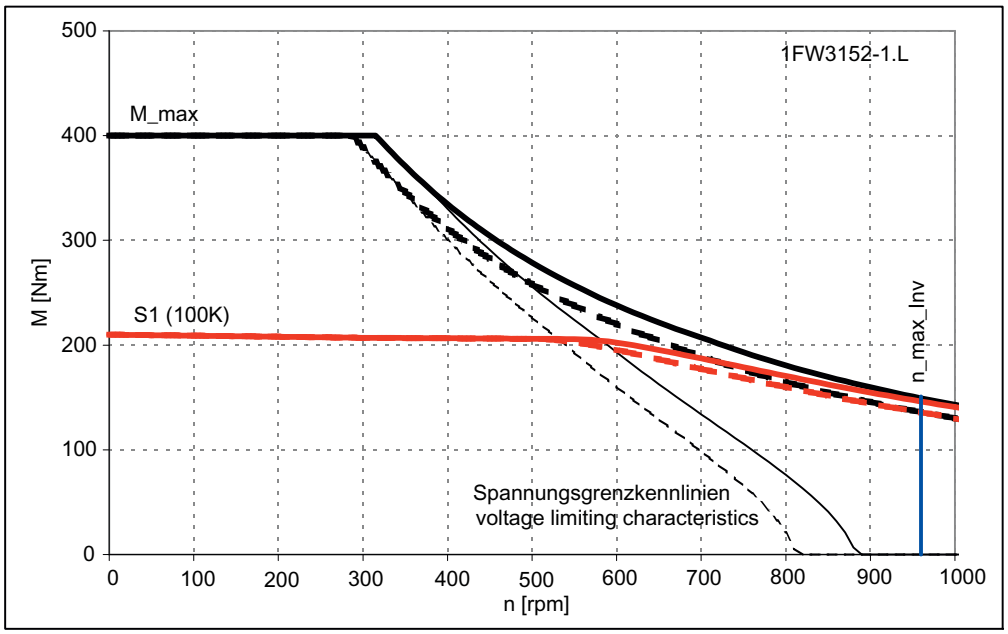
Table 4- 8 1FW3152, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3152-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 200 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 10.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 22.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 210 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 22.5 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 960 | |
| Maximum torque | $M_{max}$ | Nm | 400 | |
| Maximum current | $I_{max}$ | A | 53 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 9.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 600 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.62 | |
| Rotating field inductance | $L_D$ | mH | 21 | |
| Electrical time constant | $T_{el}$ | ms | 34.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.16 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+07 | |
| Weight | m | kg | 108 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.09 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.1E+06 | |
| Weight | m | kg | 121 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 4.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.92E+07 | |
| Weight | m | kg | 124 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

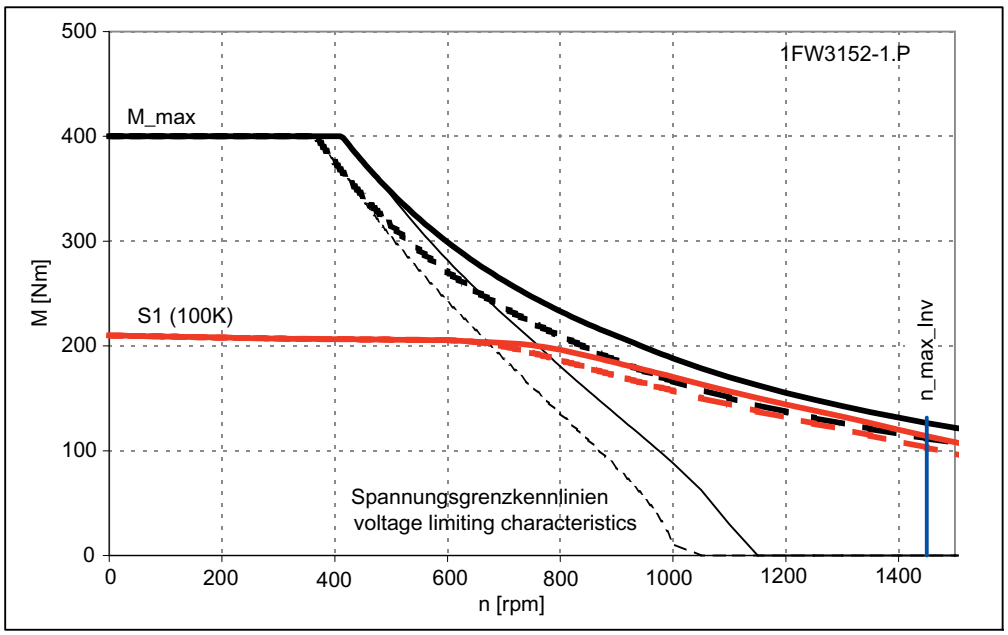



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 9 1FW3152, rated speed 750 rpm

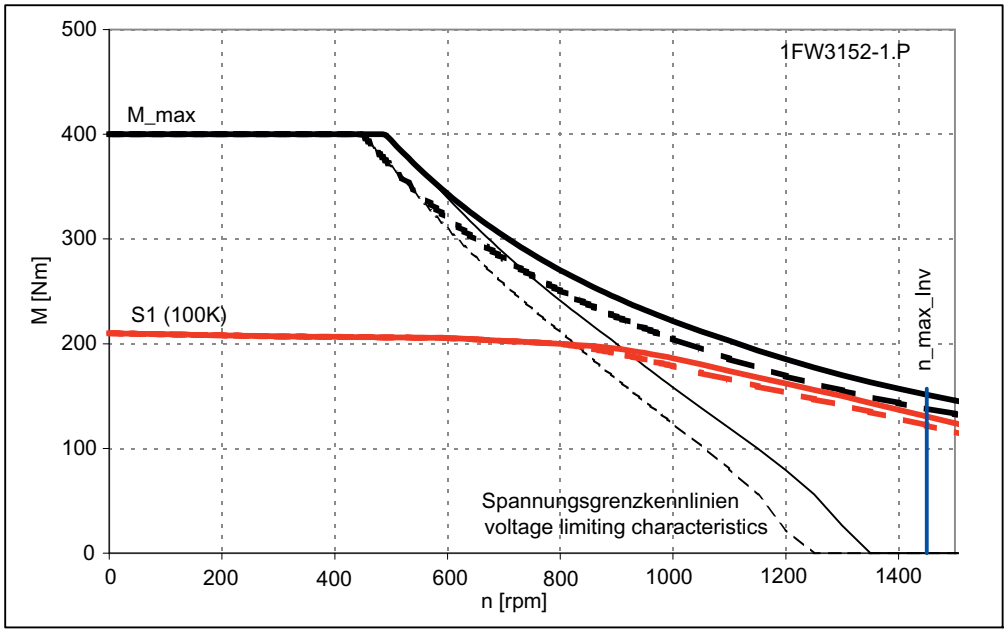
| **Configuration data** | **Code** | **Unit** | **1FW3152-1□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 750 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 200 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 15.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 32.5 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 210 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 33.5 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1450 | |
| Maximum torque | $M_{max}$ | Nm | 400 | |
| Maximum current | $I_{max}$ | A | 79 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 6.3 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 399 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.28 | |
| Rotating field inductance | $L_D$ | mH | 9.5 | |
| Electrical time constant | $T_{el}$ | ms | 33.5 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.16 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+07 | |
| Weight | m | kg | 108 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.09 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.1E+06 | |
| Weight | m | kg | 121 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 4.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.92E+07 | |
| Weight | m | kg | 124 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



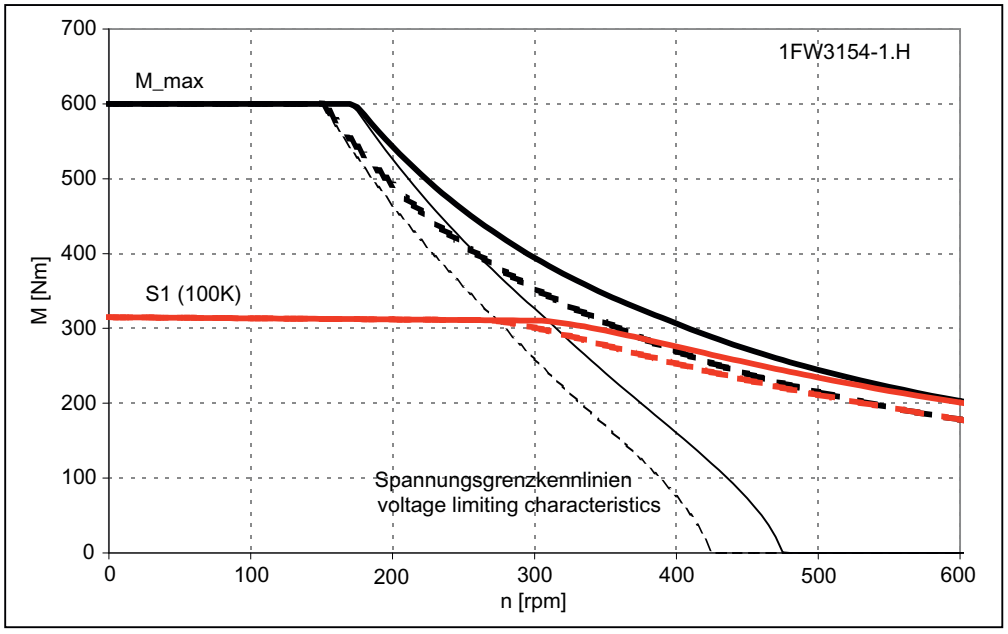

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

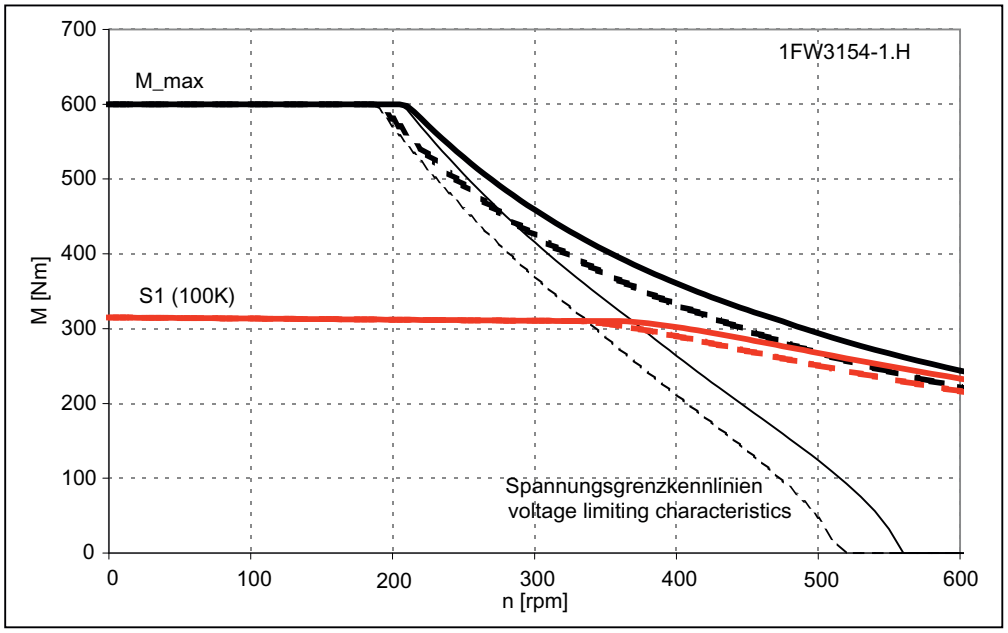
Table 4- 10 1FW3154, rated speed 300 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3154-1□H** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 300 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 9.4 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 20.5 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 315 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 21.5 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 610 | |
| Maximum torque | $M_{max}$ | Nm | 600 | |
| Maximum current | $I_{max}$ | A | 49.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 14.8 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 945 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.92 | |
| Rotating field inductance | $L_D$ | mH | 33 | |
| Electrical time constant | $T_{el}$ | ms | 36.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.66E+07 | |
| Weight | m | kg | 129 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.13 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 9.10E+05 | |
| Weight | m | kg | 143 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.25 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.24E+07 | |
| Weight | m | kg | 143 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

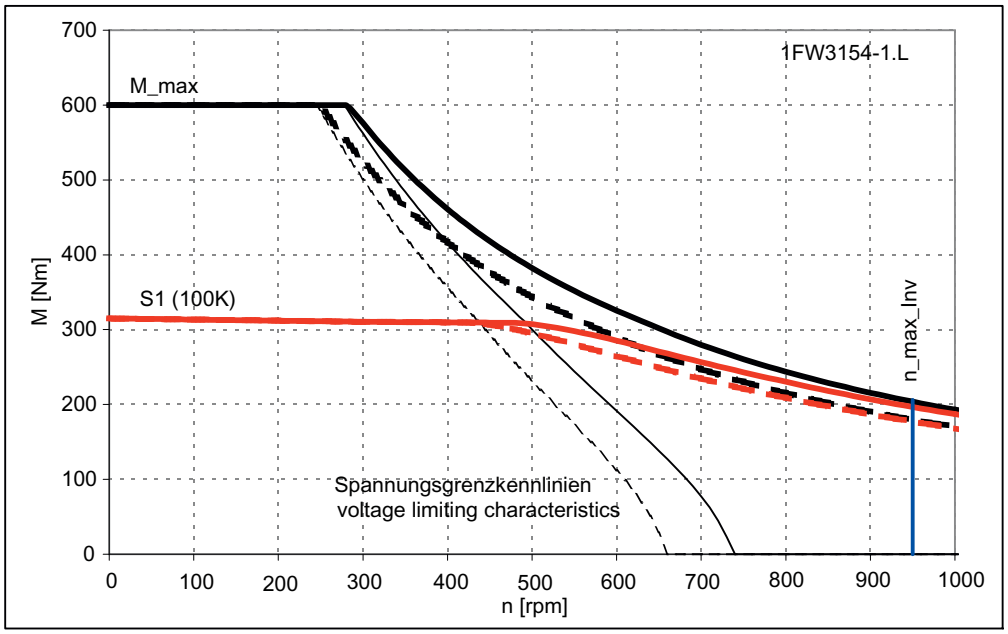



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

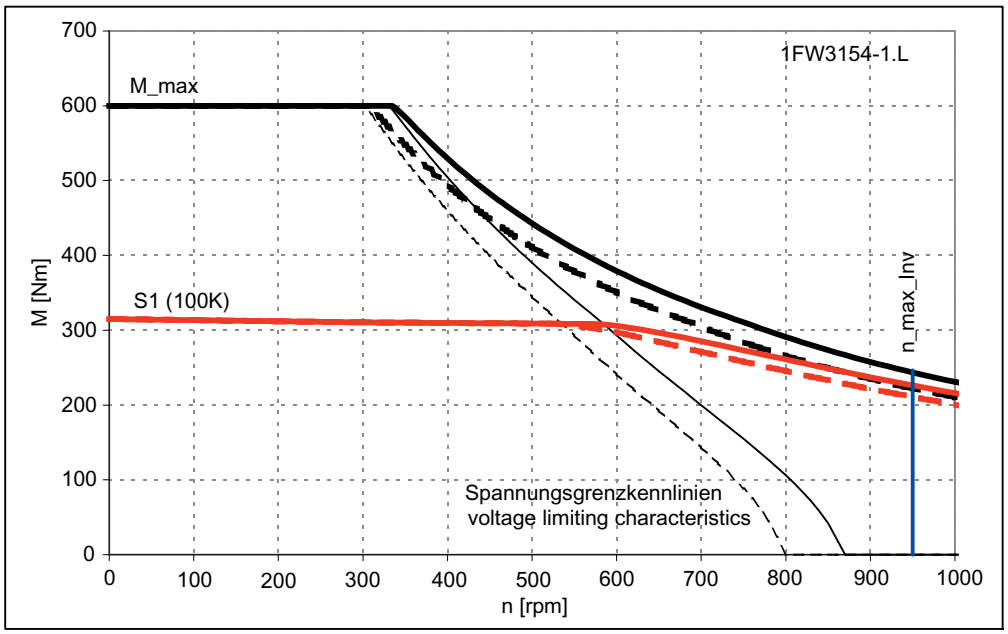
Table 4- 11 1FW3154, rated speed 500 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3154-1□L** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 300 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 15.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 32.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 315 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 33.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 950 | |
| Maximum torque | $M_{max}$ | Nm | 600 | |
| Maximum current | $I_{max}$ | A | 75 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 9.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 610 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.39 | |
| Rotating field inductance | $L_D$ | mH | 14.0 | |
| Electrical time constant | $T_{el}$ | ms | 36.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.66E+07 | |
| Weight | m | kg | 129 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.13 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 9.10E+05 | |
| Weight | m | kg | 143 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.25 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.24E+07 | |
| Weight | m | kg | 143 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

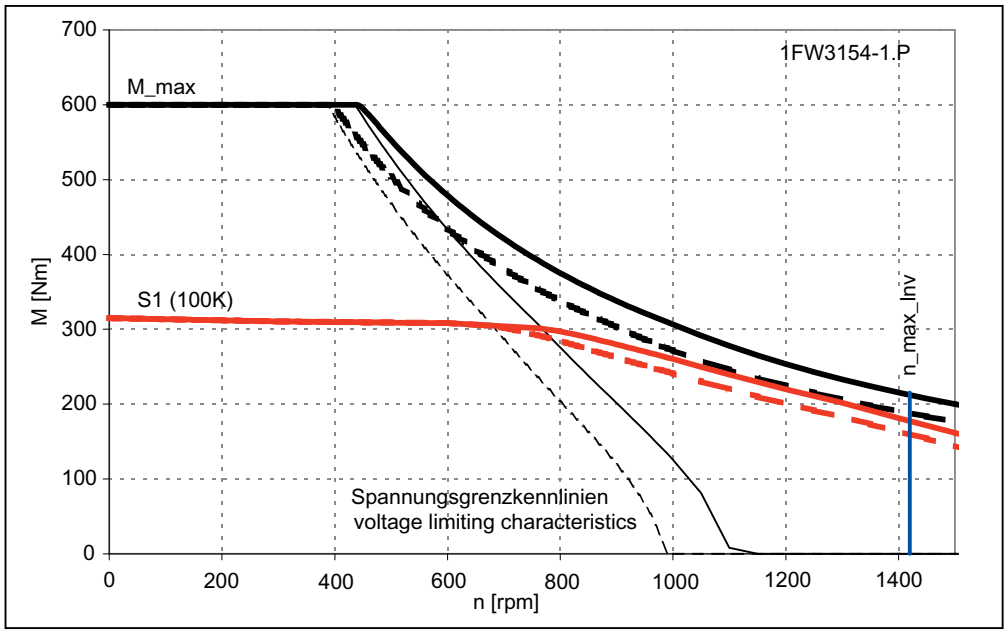



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 12 1FW3154, rated speed 750 rpm

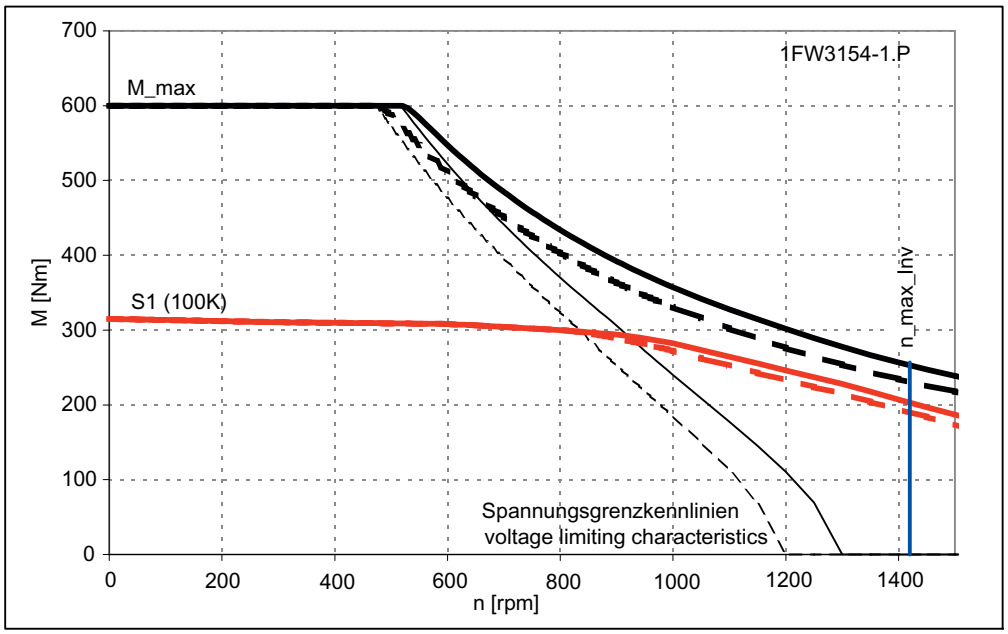
| **Configuration data** | **Code** | **Unit** | **1FW3154-1□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 750 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 300 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 23.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 47.5 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 315 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 49.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1420 | |
| Maximum torque | $M_{max}$ | Nm | 600 | |
| Maximum current | $I_{max}$ | A | 113 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 6.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 407 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.171 | |
| Rotating field inductance | $L_D$ | mH | 6.0 | |
| Electrical time constant | $T_{el}$ | ms | 35.5 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.66E+07 | |
| Weight | m | kg | 129 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.13 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 9.10E+05 | |
| Weight | m | kg | 143 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.25 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.24E+07 | |
| Weight | m | kg | 143 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



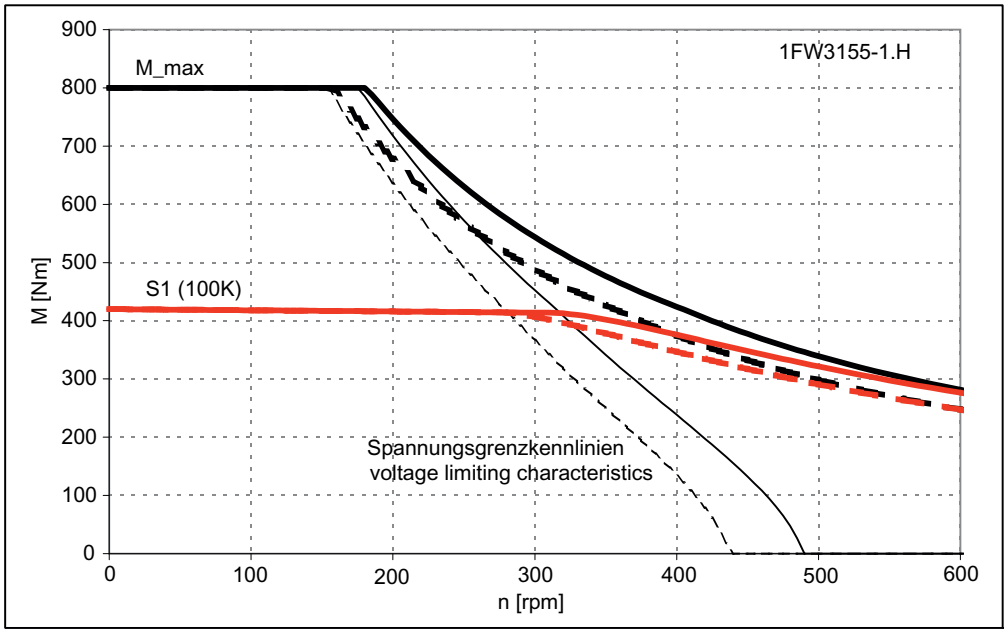

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

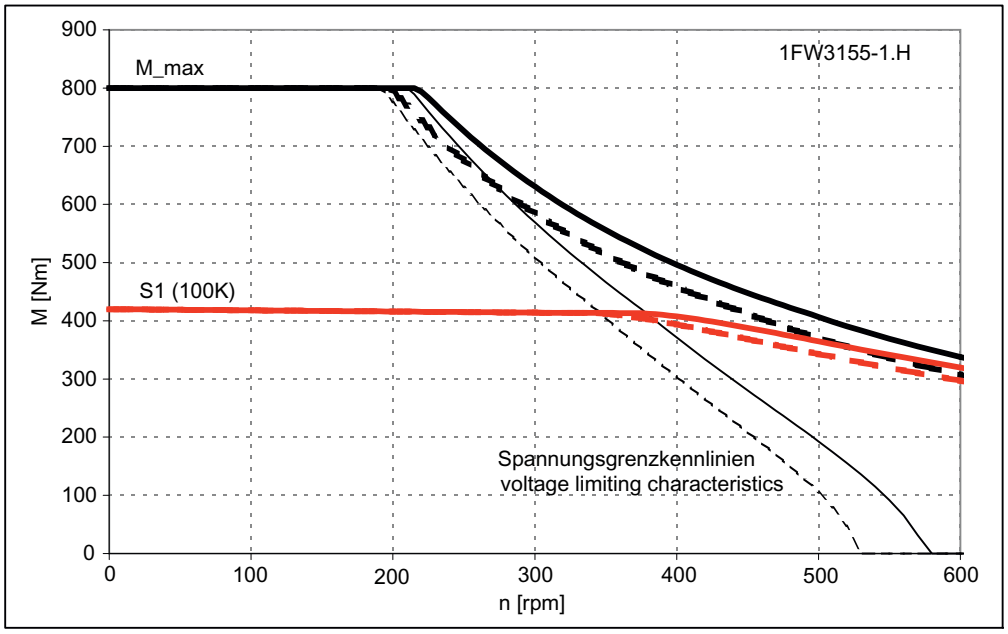
Table 4- 13 1FW3155, rated speed 300 rpm

| Configuration data | Code | Unit | 1FW3155-1□H | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 400 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 12.6 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 28.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 420 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 29.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 630 | |
| Maximum torque | $M_{max}$ | Nm | 800 | |
| Maximum current | $I_{max}$ | A | 67 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_T$ | Nm/A | 14.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 915 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.61 | |
| Rotating field inductance | $L_D$ | mH | 24 | |
| Electrical time constant | $T_{el}$ | ms | 39.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.40E+07 | |
| Weight | m | kg | 150 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.17 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.30E+05 | |
| Weight | m | kg | 164 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.29 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.84E+07 | |
| Weight | m | kg | 163 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

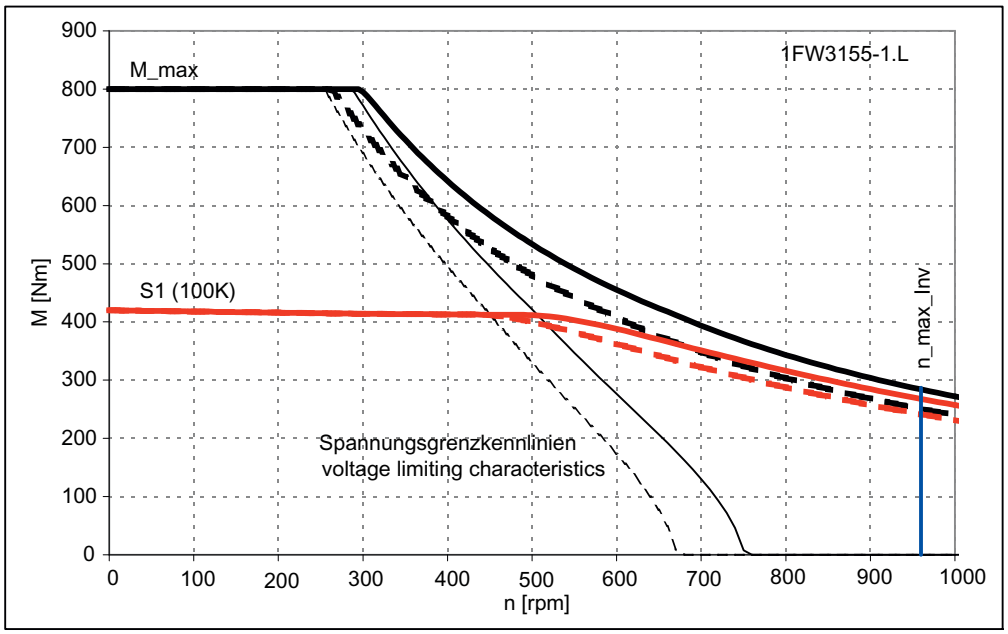



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 14 1FW3155, rated speed 500 rpm

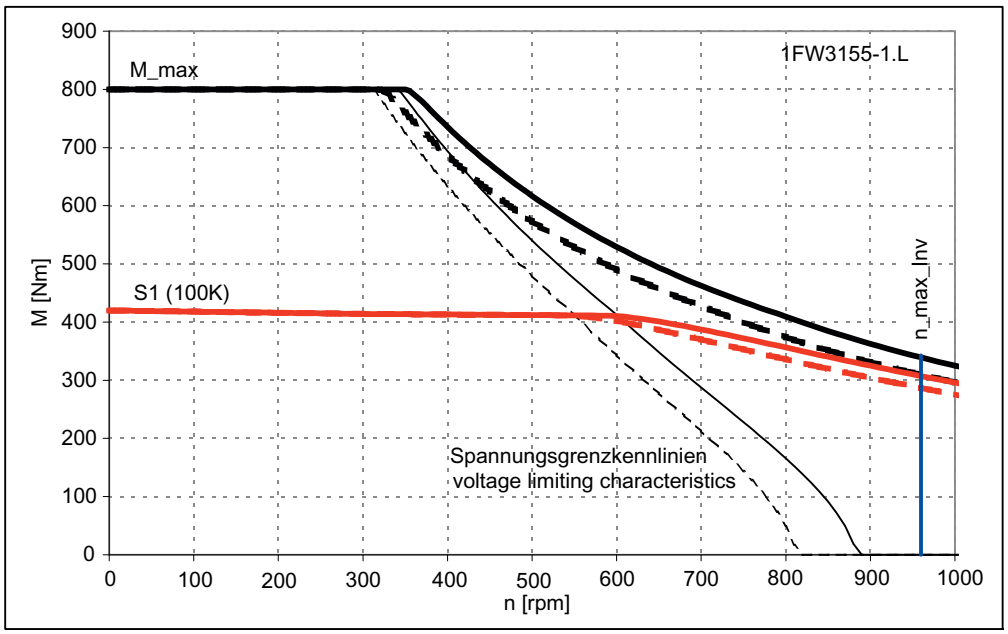
| Configuration data | Code | Unit | 1FW3155-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 400 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 21.0 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 43.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 420 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 45.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 960 | |
| Maximum torque | $M_{max}$ | Nm | 800 | |
| Maximum current | $I_{max}$ | A | 103 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_T$ | Nm/A | 9.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 600 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.265 | |
| Rotating field inductance | $L_D$ | mH | 10.0 | |
| Electrical time constant | $T_{el}$ | ms | 38.0 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.40E+07 | |
| Weight | m | kg | 150 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.17 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.30E+05 | |
| Weight | m | kg | 164 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.29 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.84E+07 | |
| Weight | m | kg | 163 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



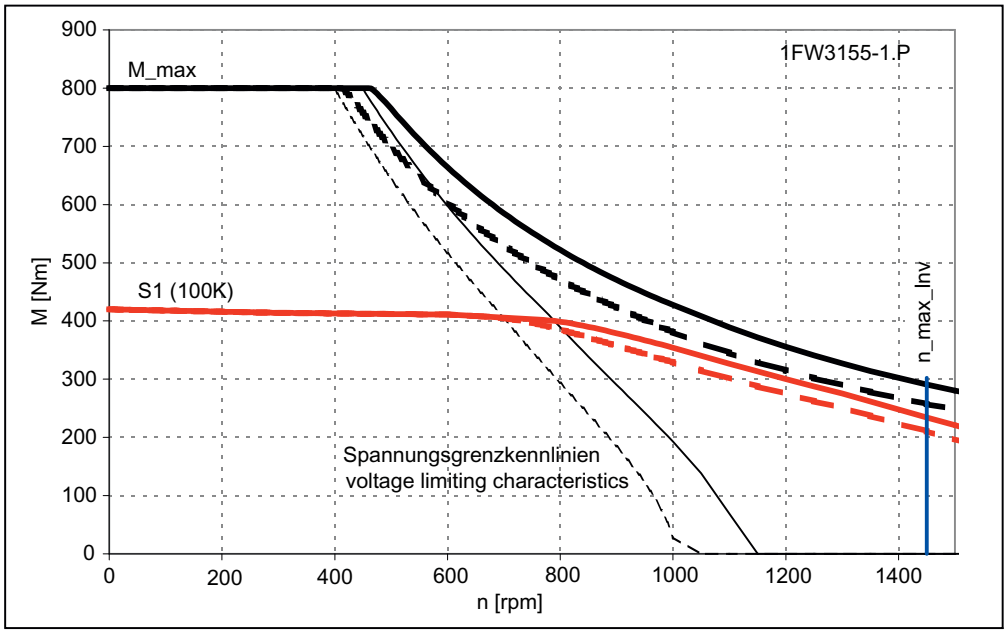

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

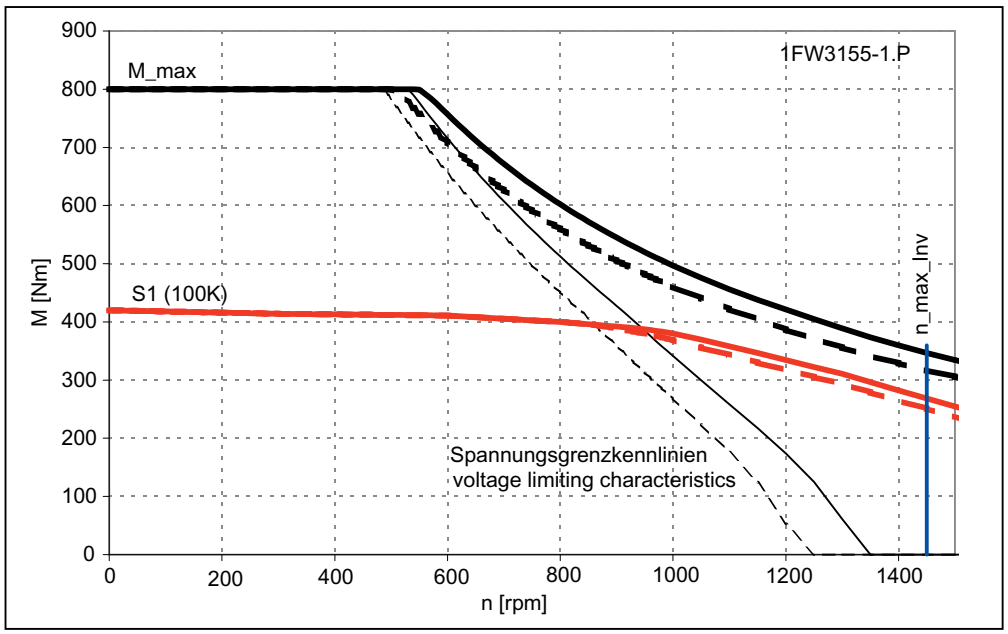
Table 4- 15 1FW3155, rated speed 750 rpm

| Configuration data | Code | Unit | 1FW3155-1□P | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 750 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 400 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 31.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 64 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 420 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 67 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1450 | |
| Maximum torque | $M_{max}$ | Nm | 800 | |
| Maximum current | $I_{max}$ | A | 153 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_T$ | Nm/A | 6.3 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 399 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.112 | |
| Rotating field inductance | $L_D$ | mH | 4.4 | |
| Electrical time constant | $T_{el}$ | ms | 39.5 | |
| Thermal time constant | $T_{th}$ | min | 4.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.40E+07 | |
| Weight | m | kg | 150 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.17 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.30E+05 | |
| Weight | m | kg | 164 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.29 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.84E+07 | |
| Weight | m | kg | 163 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

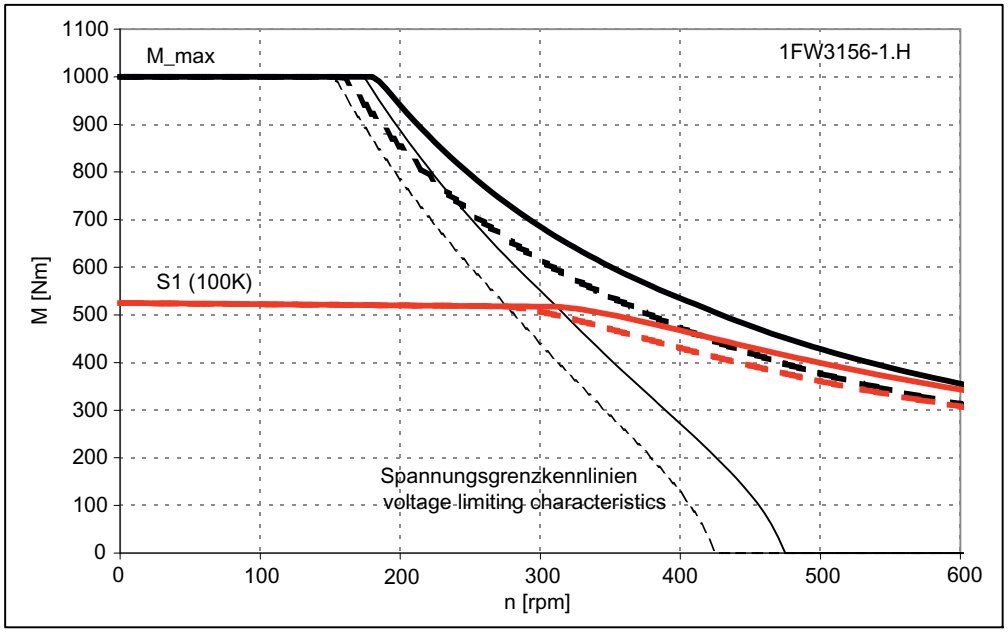



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

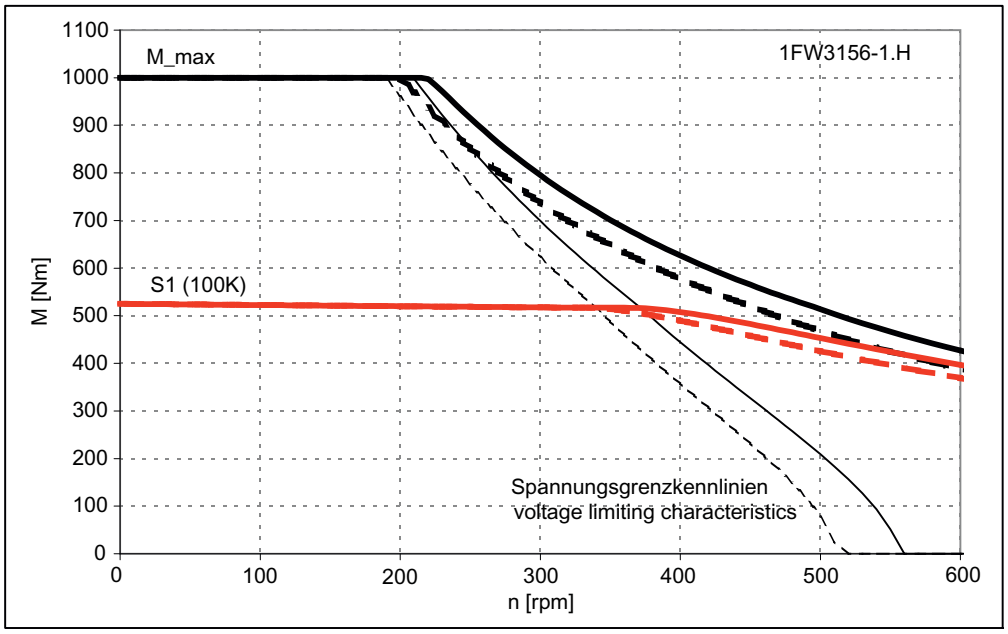
Table 4- 16 1FW3156, rated speed 300 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3156-1□H** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 15.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 34.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 525 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 35.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 610 | |
| Maximum torque | $M_{max}$ | Nm | 1000 | |
| Maximum current | $I_{max}$ | A | 81 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 14.9 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 945 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.5 | |
| Rotating field inductance | $L_D$ | mH | 20 | |
| Electrical time constant | $T_{el}$ | ms | 39.5 | |
| Thermal time constant | $T_{th}$ | min | 5.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.28 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.13E+07 | |
| Weight | m | kg | 171 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 7.60E+05 | |
| Weight | m | kg | 187 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.34 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.55E+07 | |
| Weight | m | kg | 184 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

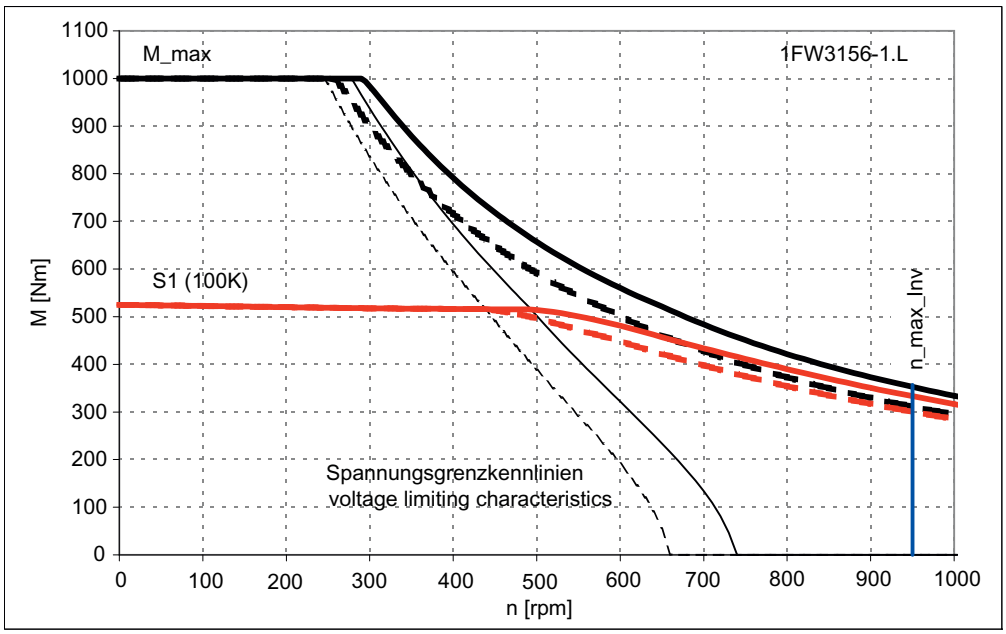



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

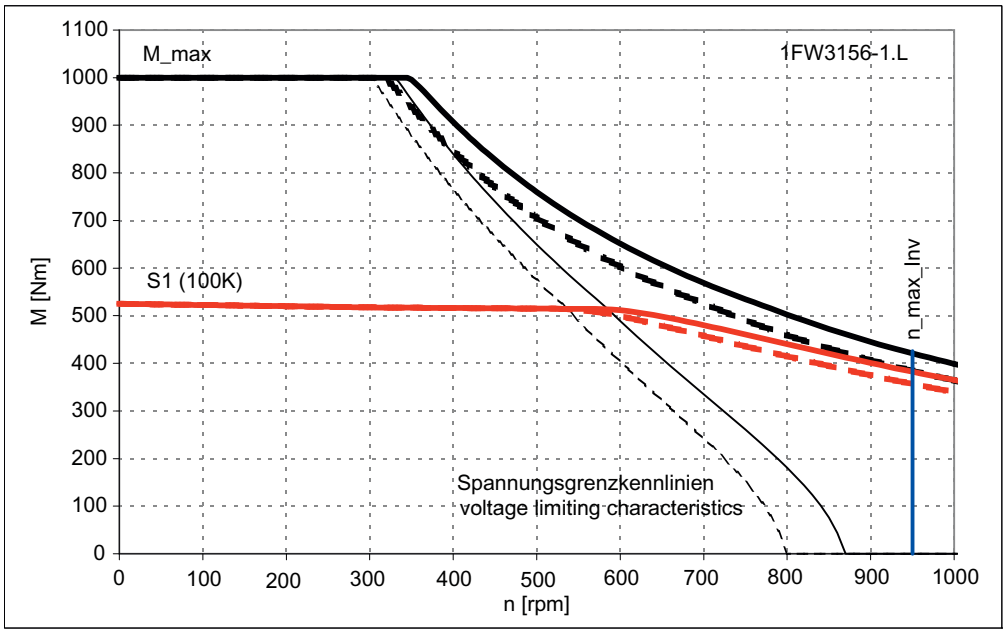
Table 4- 17 1FW3156, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3156-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 26.0 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 53 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 525 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 55 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 950 | |
| Maximum torque | $M_{max}$ | Nm | 1000 | |
| Maximum current | $I_{max}$ | A | 126 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 9.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 610 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.215 | |
| Rotating field inductance | $L_D$ | mH | 8.5 | |
| Electrical time constant | $T_{el}$ | ms | 40.0 | |
| Thermal time constant | $T_{th}$ | min | 5.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.28 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.13E+07 | |
| Weight | m | kg | 171 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 7.60E+05 | |
| Weight | m | kg | 187 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.34 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.55E+07 | |
| Weight | m | kg | 184 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

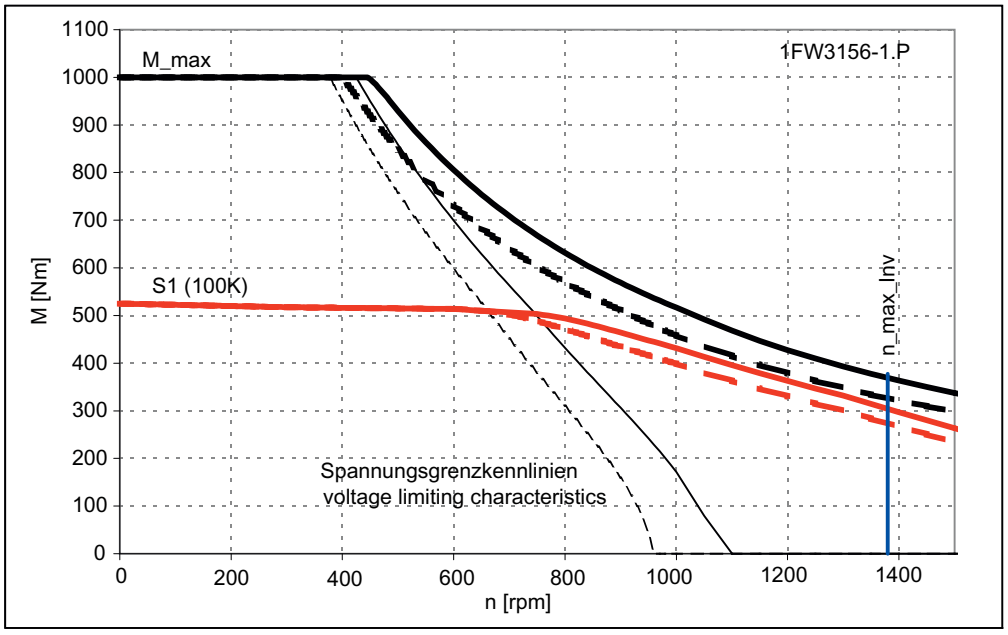



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

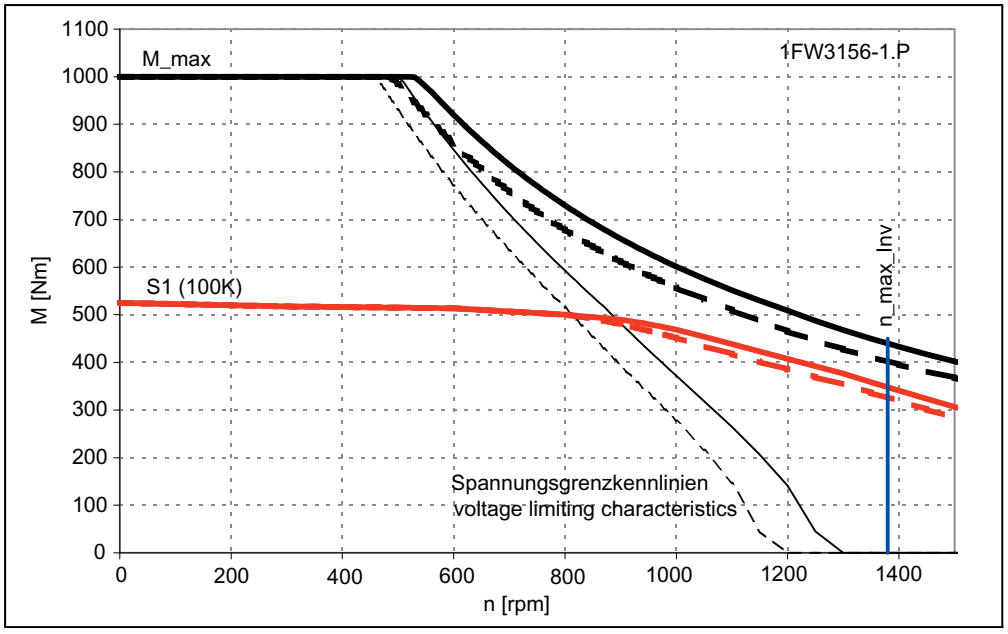
Table 4- 18 1FW3156, rated speed 750 rpm

| Configuration data | Code | Unit | 1FW3156-1□P | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 750 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 39.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 76 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 525 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 80 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1700 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1380 | |
| Maximum torque | $M_{max}$ | Nm | 1000 | |
| Maximum current | $I_{max}$ | A | 183 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 14 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 6.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 419 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.098 | |
| Rotating field inductance | $L_D$ | mH | 3.9 | |
| Electrical time constant | $T_{el}$ | ms | 40.0 | |
| Thermal time constant | $T_{th}$ | min | 5.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.28 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.13E+07 | |
| Weight | m | kg | 171 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.2 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 7.60E+05 | |
| Weight | m | kg | 187 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.34 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.55E+07 | |
| Weight | m | kg | 184 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



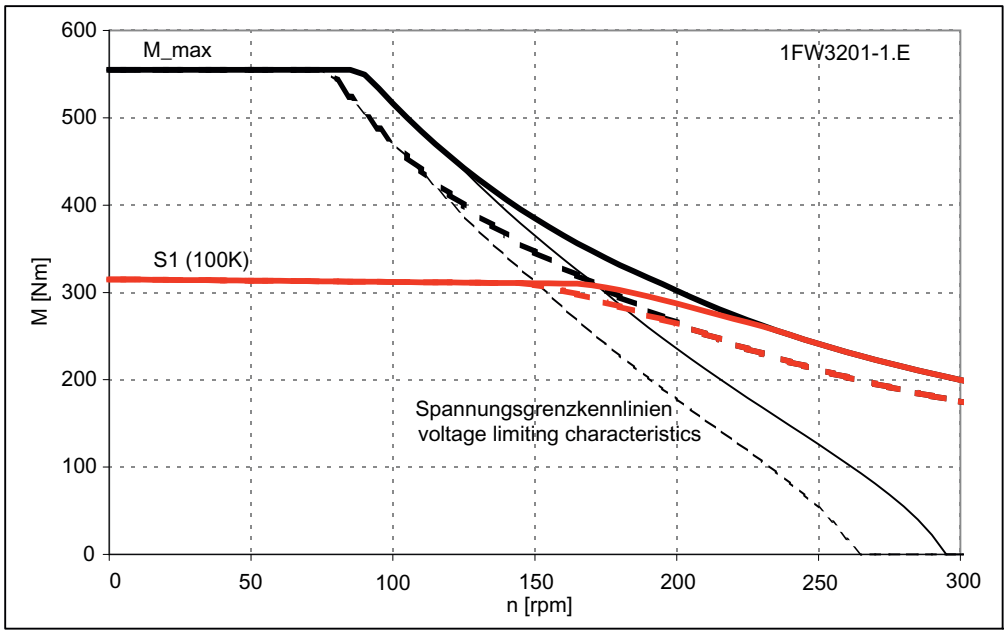

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

## 4.1.2 Shaft height 200, Standard

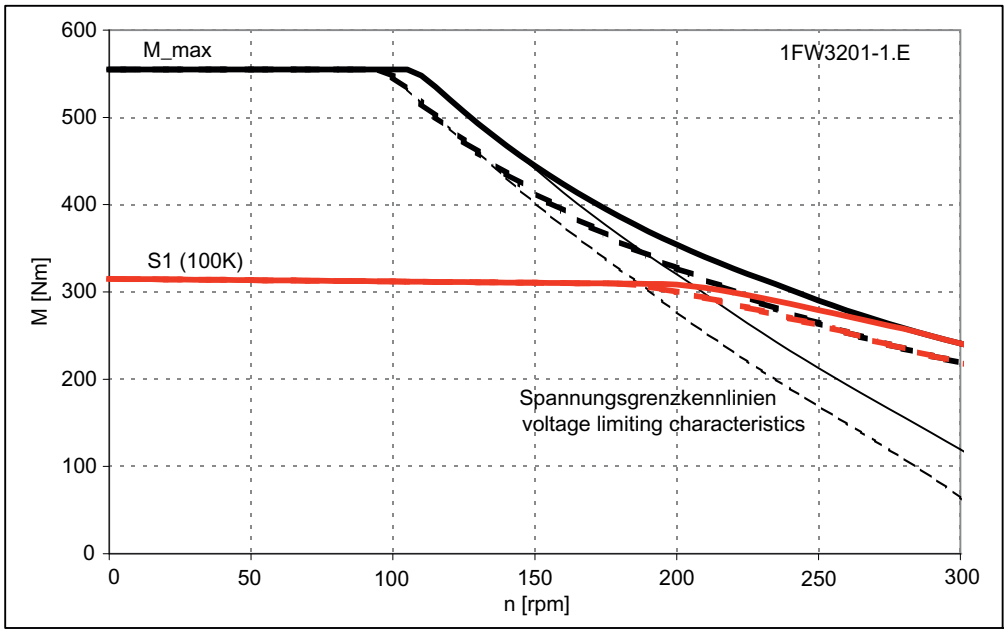
Table 4- 19 1FW3201, rated speed 150 rpm

| Configuration data | Code | Unit | 1FW3201-1□E | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 300 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 4.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 13.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 315 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 13.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 380 | |
| Maximum torque | $M_{max}$ | Nm | 555 | |
| Maximum current | $I_{max}$ | A | 28.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 24.0 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1520 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 1.89 | |
| Rotating field inductance | $L_D$ | mH | 50 | |
| Electrical time constant | $T_{el}$ | ms | 27.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.22 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.73E+07 | |
| Weight | m | kg | 127 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.23 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.48E+06 | |
| Weight | m | kg | 179 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.27 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.90E+07 | |
| Weight | m | kg | 171 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

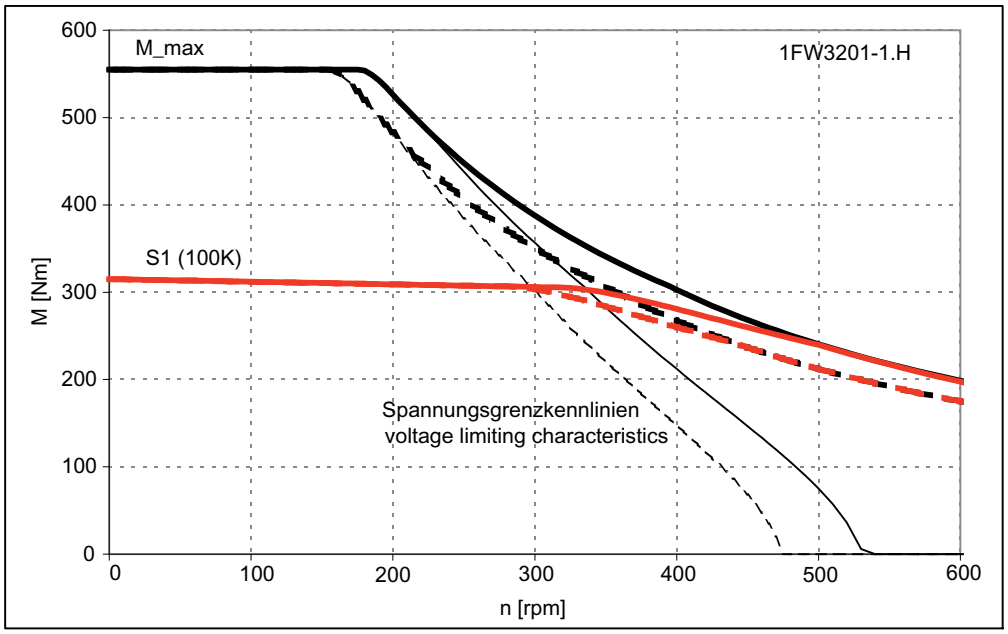



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 20 1FW3201, rated speed 300 rpm

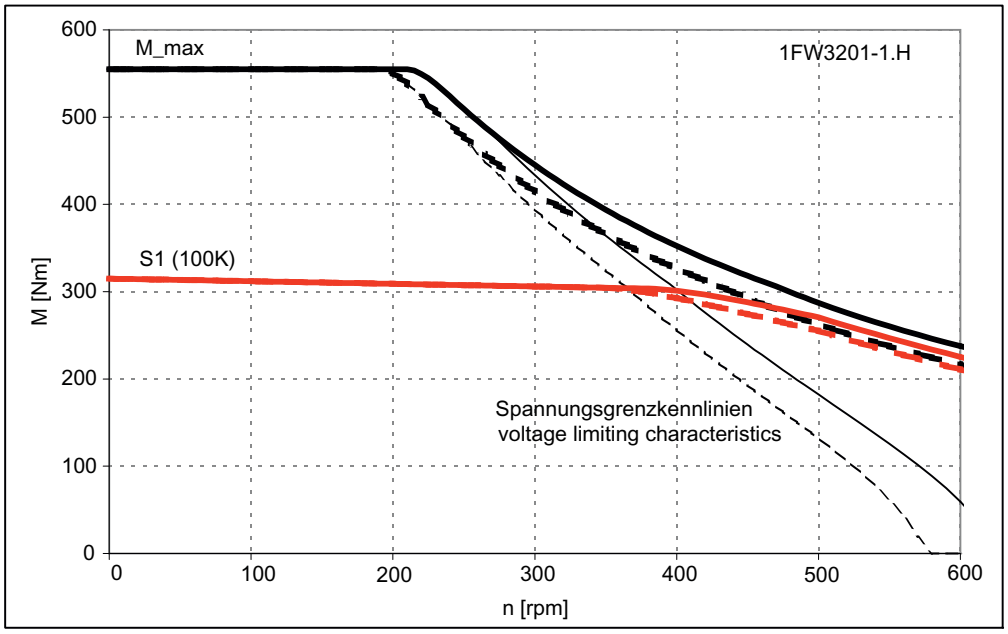
| Configuration data | Code | Unit | 1FW3201-1□H | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 300 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 9.4 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 23.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 315 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 24.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 680 | |
| Maximum torque | $M_{max}$ | Nm | 555 | |
| Maximum current | $I_{max}$ | A | 50 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 13.3 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 845 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.57 | |
| Rotating field inductance | $L_D$ | mH | 15.0 | |
| Electrical time constant | $T_{el}$ | ms | 26.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.22 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.73E+07 | |
| Weight | m | kg | 127 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.23 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.48E+06 | |
| Weight | m | kg | 179 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.27 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.90E+07 | |
| Weight | m | kg | 171 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



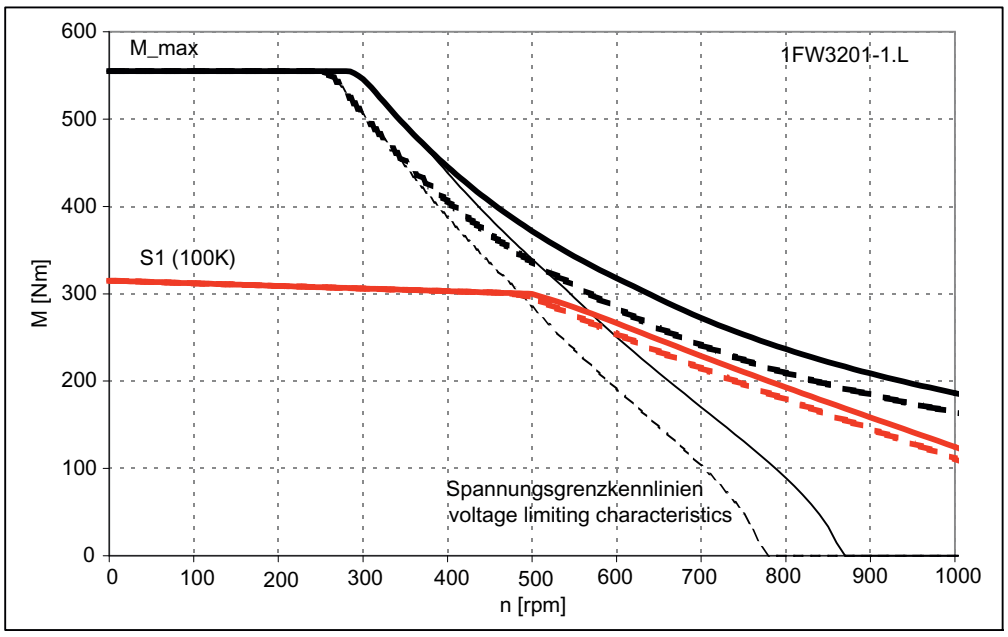

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

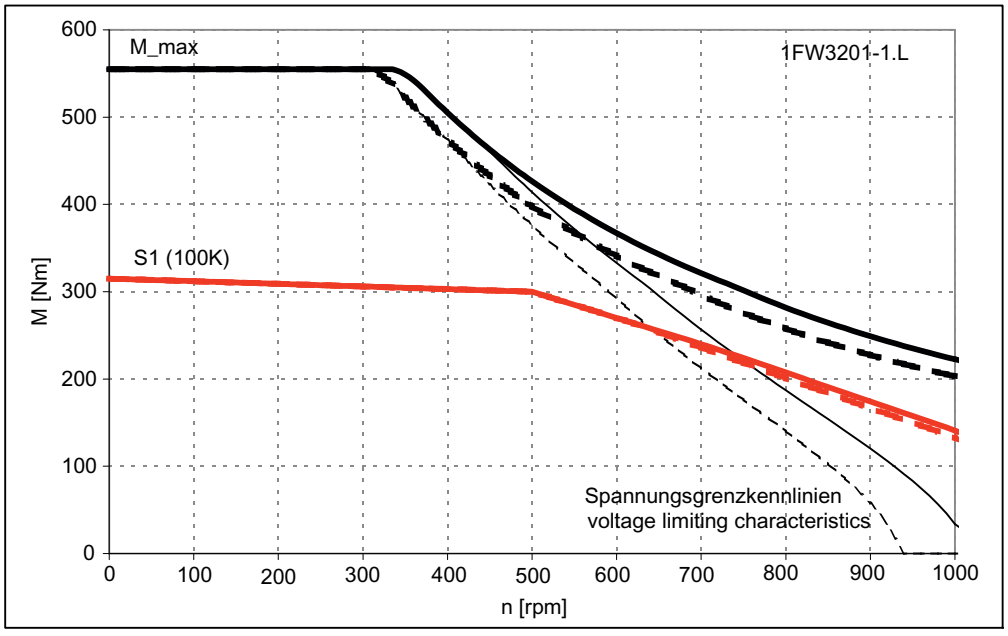
Table 4- 21 1FW3201, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3201-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 15.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 37.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 315 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 38.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1110 | |
| Maximum torque | $M_{max}$ | Nm | 555 | |
| Maximum current | $I_{max}$ | A | 82 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T\ (100\ K)}$ | Nm/A | 8.2 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 520 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.225 | |
| Rotating field inductance | $L_D$ | mH | 6.0 | |
| Electrical time constant | $T_{el}$ | ms | 26.5 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.22 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.73E+07 | |
| Weight | m | kg | 127 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.23 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.48E+06 | |
| Weight | m | kg | 179 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.27 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.90E+07 | |
| Weight | m | kg | 171 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

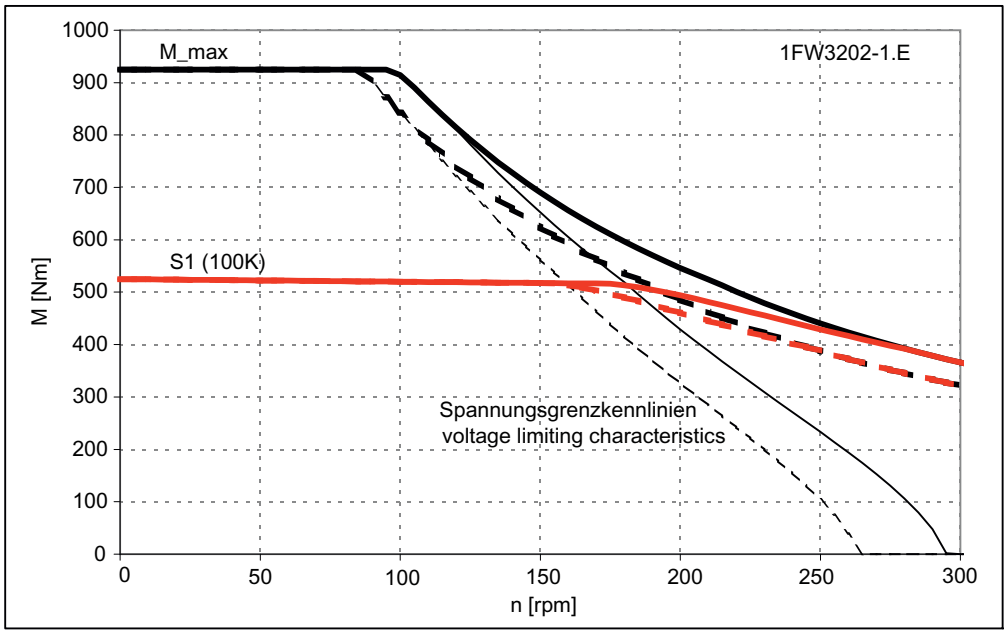



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 22 1FW3202, rated speed 150 rpm

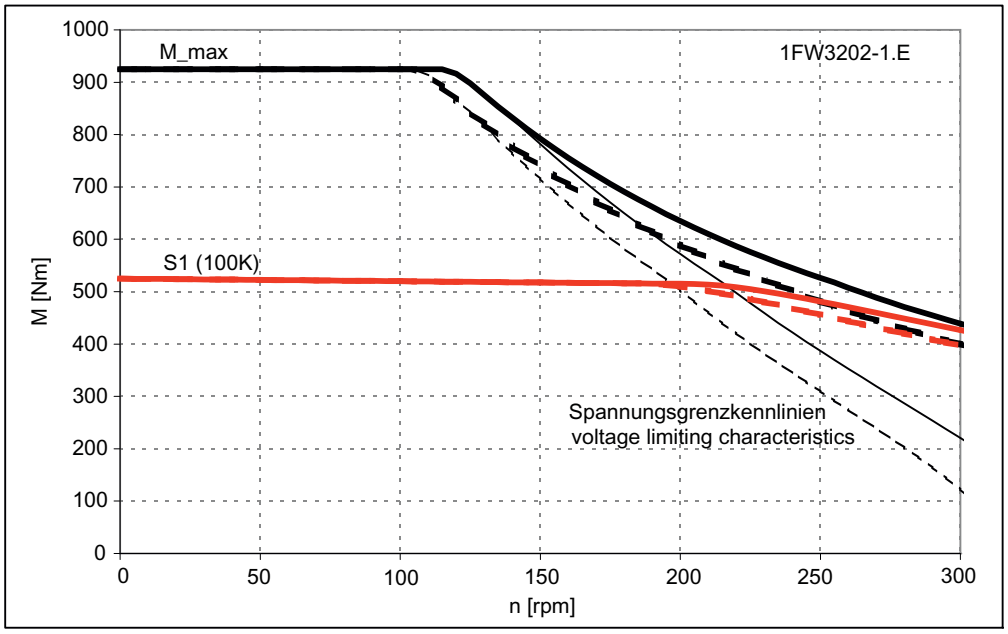
| Configuration data | Code | Unit | 1FW3202-1□E | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 7.9 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 21.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 525 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 22.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 380 | |
| Maximum torque | $M_{max}$ | Nm | 925 | |
| Maximum current | $I_{max}$ | A | 47.0 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 24.0 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1520 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.94 | |
| Rotating field inductance | $L_D$ | mH | 29 | |
| Electrical time constant | $T_{el}$ | ms | 31.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.36 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.74E+07 | |
| Weight | m | kg | 156 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.35 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.28E+06 | |
| Weight | m | kg | 215 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.39 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.05E+07 | |
| Weight | m | kg | 200 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



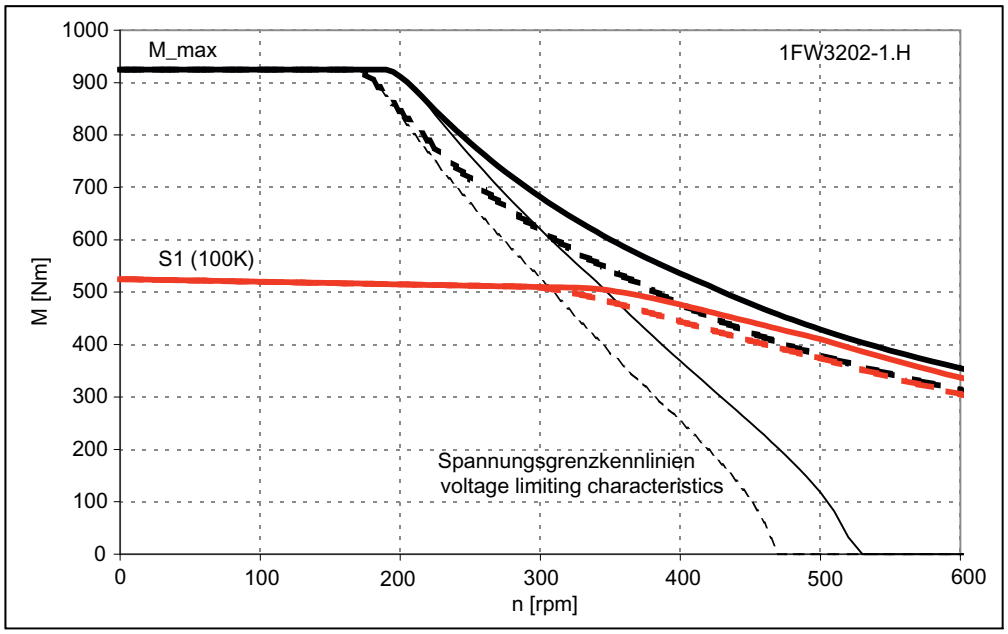

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

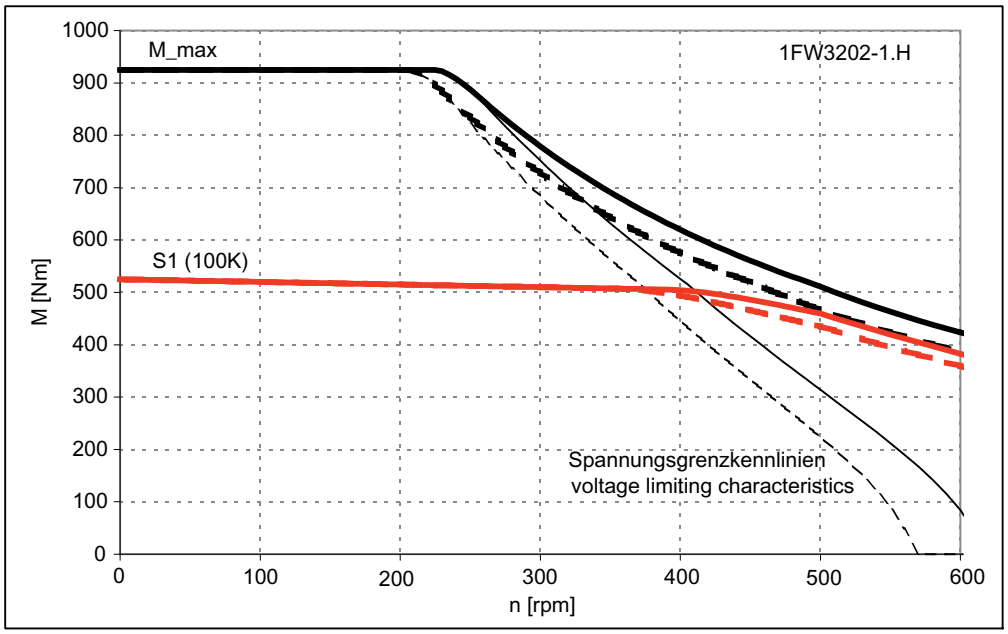
Table 4- 23 1FW3202, rated speed 300 rpm

| Configuration data | Code | Unit | 1FW3202-1□H | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 15.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 37.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 525 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 39.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 670 | |
| Maximum torque | $M_{max}$ | Nm | 925 | |
| Maximum current | $I_{max}$ | A | 81 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 13.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 855 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.285 | |
| Rotating field inductance | $L_D$ | mH | 9.0 | |
| Electrical time constant | $T_{el}$ | ms | 31.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.36 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.74E+07 | |
| Weight | m | kg | 156 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.35 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.28E+06 | |
| Weight | m | kg | 215 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.39 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.05E+07 | |
| Weight | m | kg | 200 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

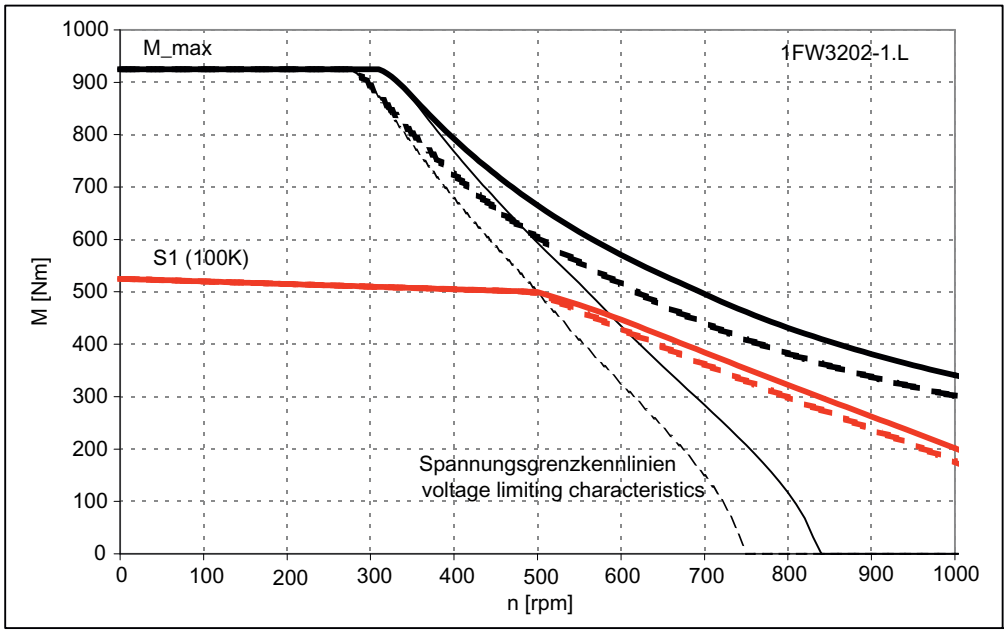



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

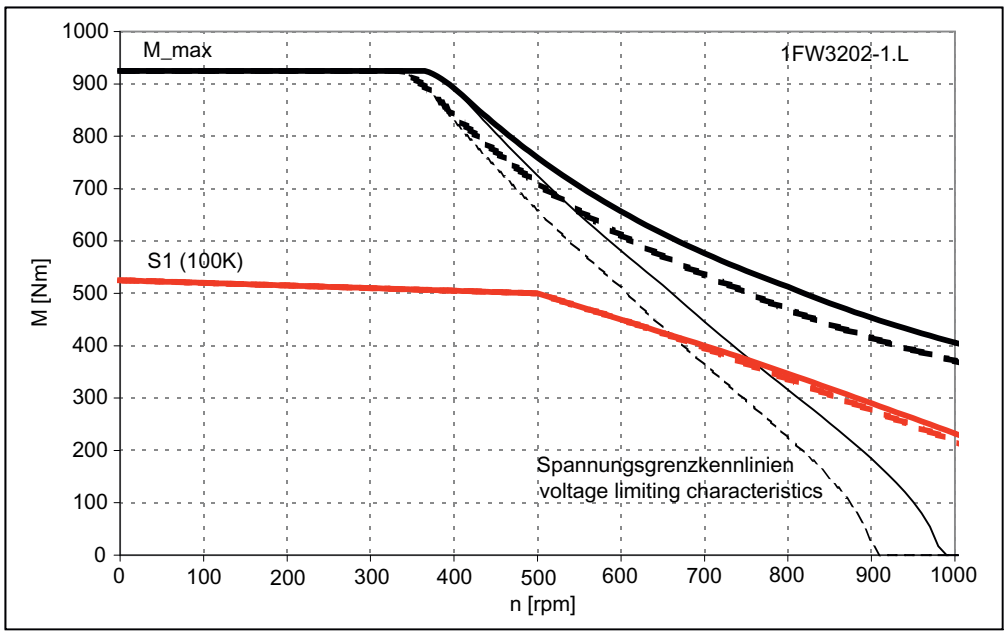
Table 4- 24 1FW3202, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3202-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 26.0 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 59 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 525 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 62 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1070 | |
| Maximum torque | $M_{max}$ | Nm | 925 | |
| Maximum current | $I_{max}$ | A | 131 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 540 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.117 | |
| Rotating field inductance | $L_D$ | mH | 3.5 | |
| Electrical time constant | $T_{el}$ | ms | 30.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.36 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.74E+07 | |
| Weight | m | kg | 156 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.35 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.28E+06 | |
| Weight | m | kg | 215 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.39 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.05E+07 | |
| Weight | m | kg | 200 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

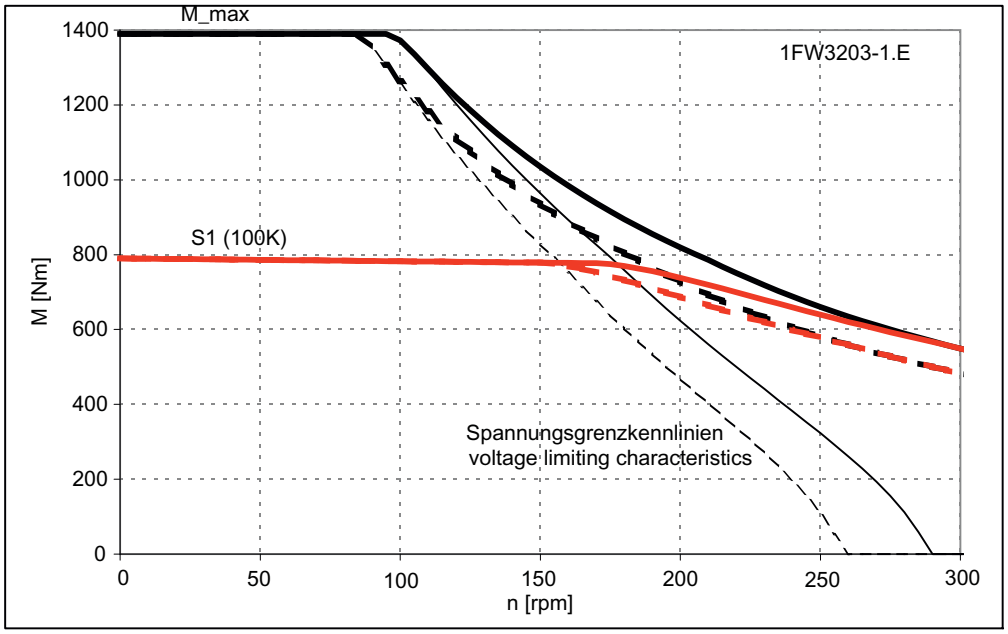



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

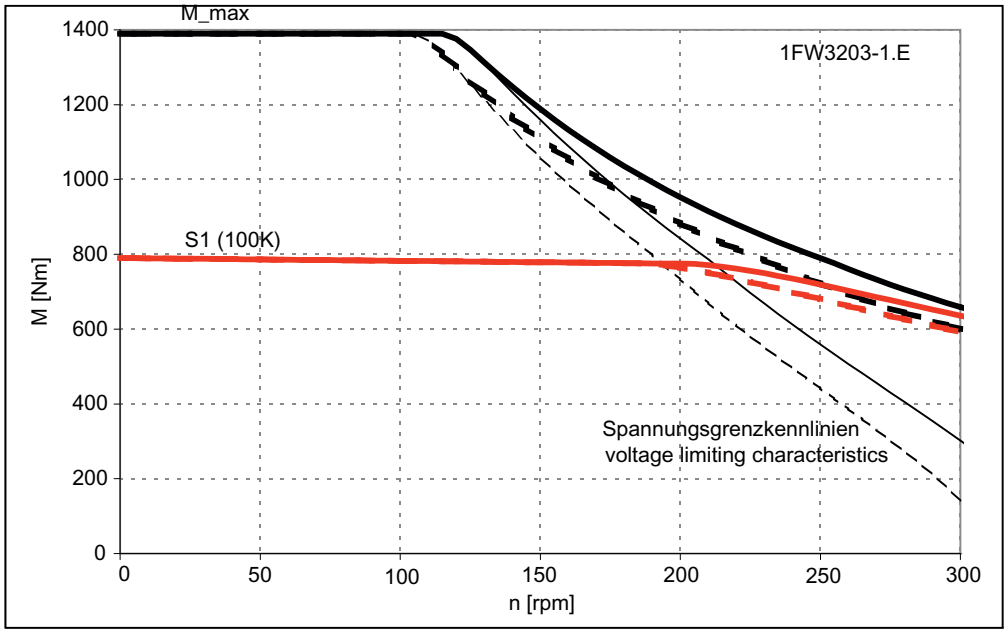
Table 4- 25 1FW3203, rated speed 150 rpm

| Configuration data | Code | Unit | 1FW3203-1□E | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 750 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 11.8 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 31.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 790 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 32.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 370 | |
| Maximum torque | $M_{max}$ | Nm | 1390 | |
| Maximum current | $I_{max}$ | A | 69 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 24.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1555 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.64 | |
| Rotating field inductance | $L_D$ | mH | 20 | |
| Electrical time constant | $T_{el}$ | ms | 31.5 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.49 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.16E+07 | |
| Weight | m | kg | 182 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.46 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.11E+06 | |
| Weight | m | kg | 240 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.52 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.44E+07 | |
| Weight | m | kg | 225 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

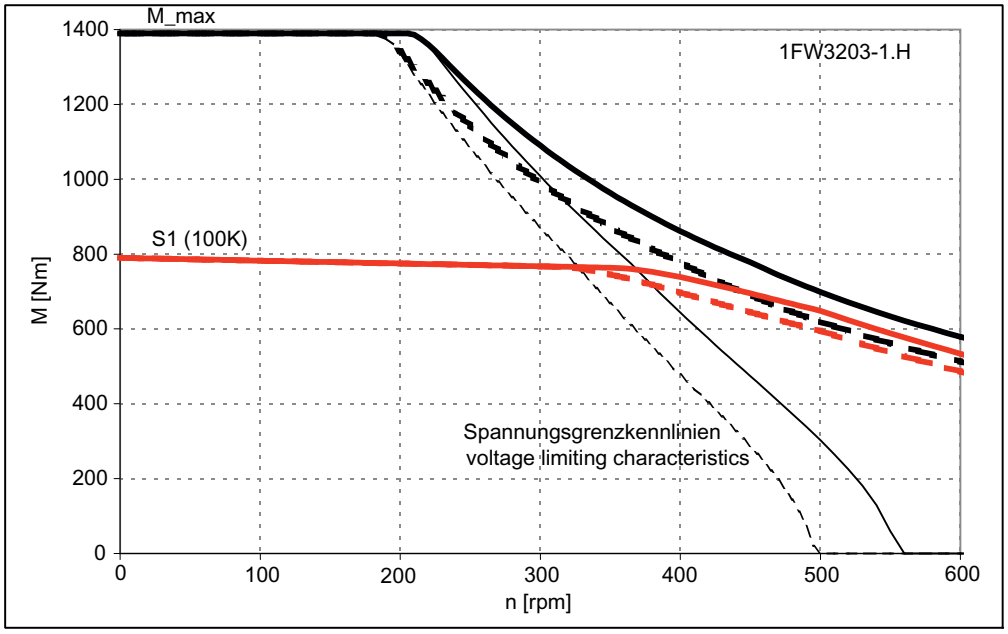



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 26 1FW3203, rated speed 300 rpm

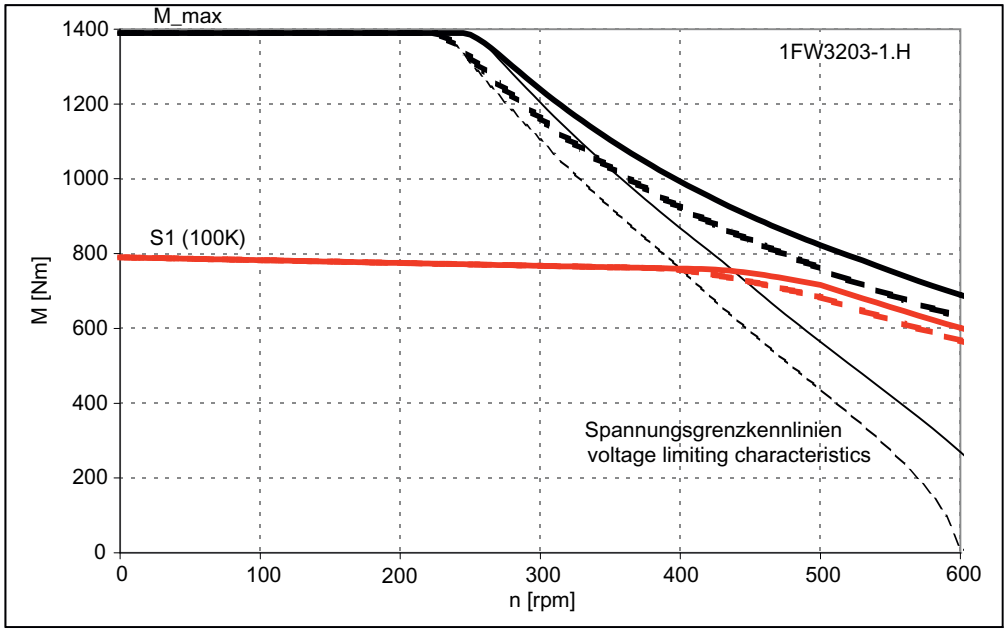
| Configuration data | Code | Unit | 1FW3203-1□H | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 750 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 23.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 59 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 790 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 62 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 710 | |
| Maximum torque | $M_{max}$ | Nm | 1390 | |
| Maximum current | $I_{max}$ | A | 132 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 12.7 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 810 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.162 | |
| Rotating field inductance | $L_D$ | mH | 5.0 | |
| Electrical time constant | $T_{el}$ | ms | 32.0 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.49 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.16E+07 | |
| Weight | m | kg | 182 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.46 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.11E+06 | |
| Weight | m | kg | 240 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.52 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.44E+07 | |
| Weight | m | kg | 225 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



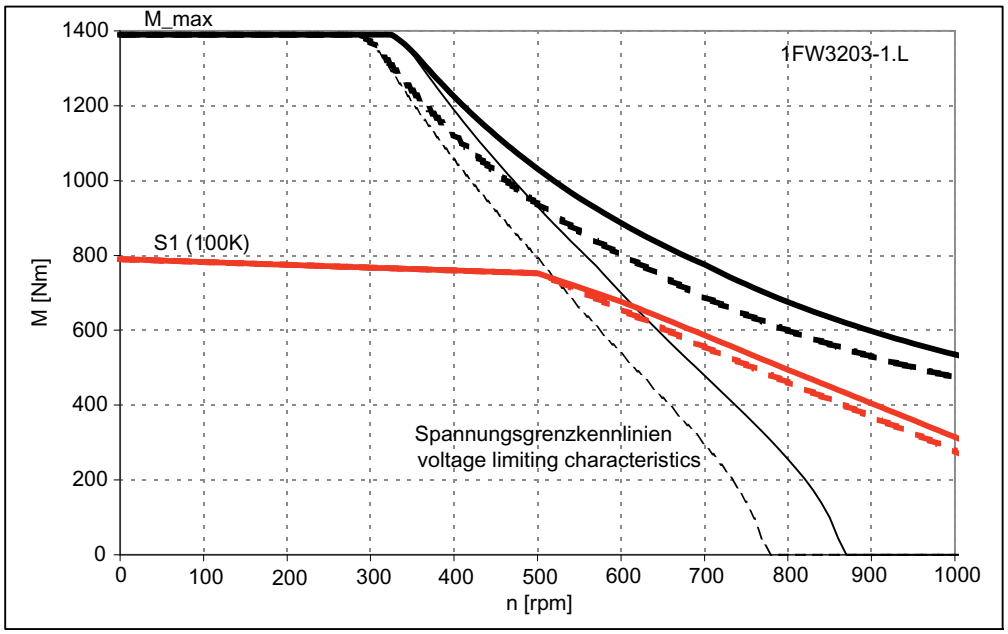

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 27 1FW3203, rated speed 500 rpm

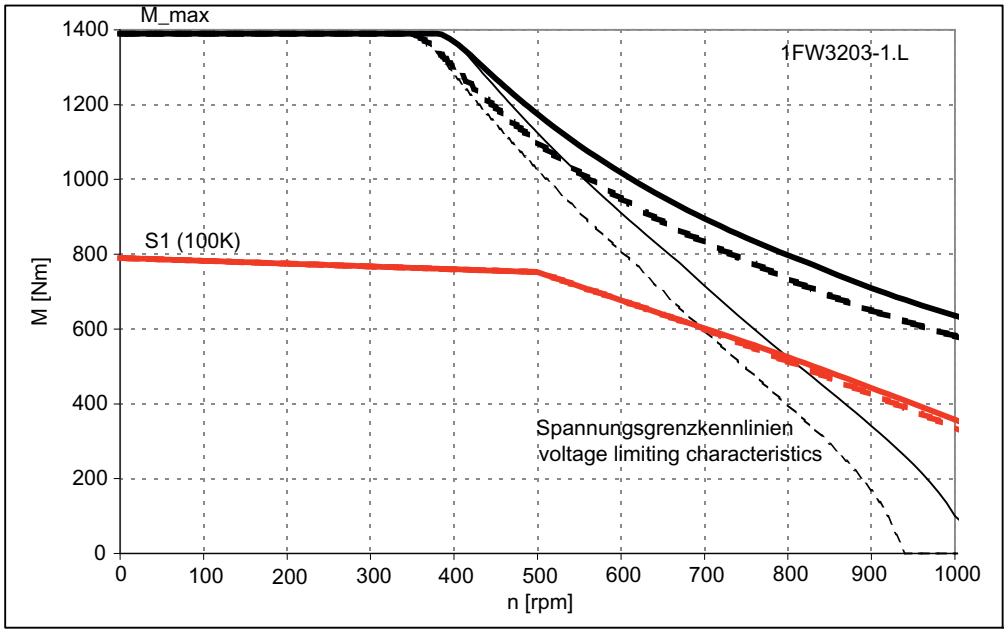
| Configuration data | Code | Unit | 1FW3203-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 750 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 39.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 92 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 790 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 100 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1110 | |
| Maximum torque | $M_{max}$ | Nm | 1390 | |
| Maximum current | $I_{max}$ | A | 205 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.2 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 520 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.07 | |
| Rotating field inductance | $L_D$ | mH | 2.2 | |
| Electrical time constant | $T_{el}$ | ms | 31.5 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.49 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.16E+07 | |
| Weight | m | kg | 182 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.46 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.11E+06 | |
| Weight | m | kg | 240 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.52 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.44E+07 | |
| Weight | m | kg | 225 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



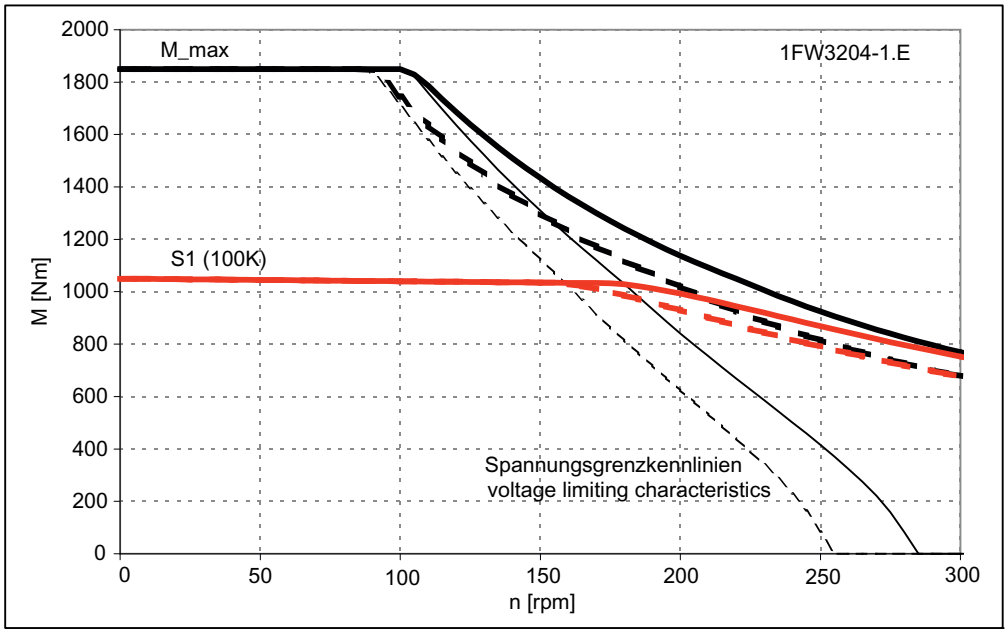

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

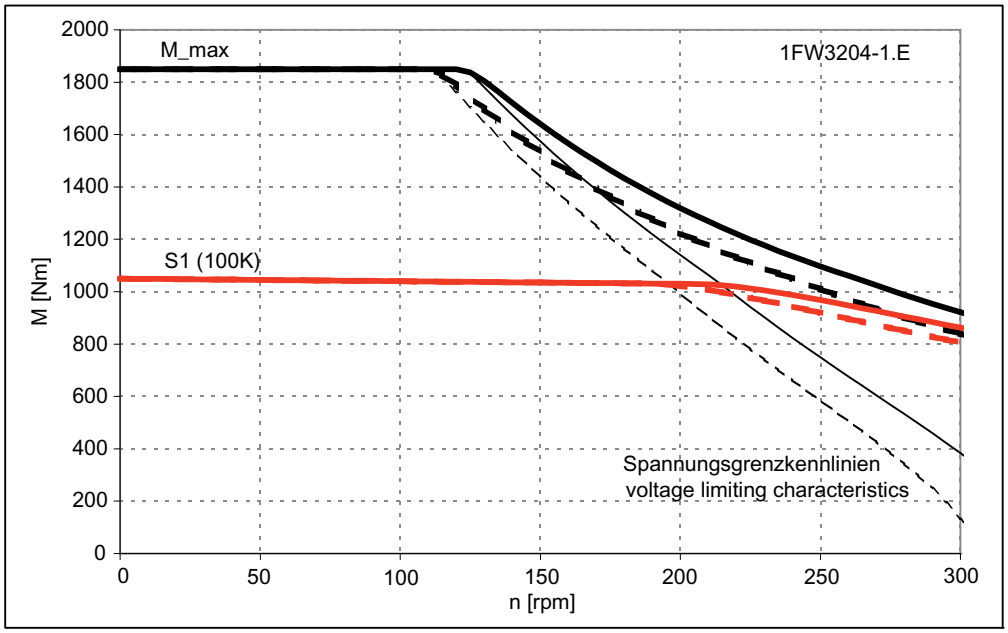
Table 4- 28 1FW3204, rated speed 150 rpm

| Configuration data | Code | Unit | 1FW3204-1□E | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 15.7 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 40.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1050 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 42.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 360 | |
| Maximum torque | $M_{max}$ | Nm | 1850 | |
| Maximum current | $I_{max}$ | A | 90 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 25 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1585 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.44 | |
| Rotating field inductance | $L_D$ | mH | 15.0 | |
| Electrical time constant | $T_{el}$ | ms | 34.0 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.64E+07 | |
| Weight | m | kg | 225 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.61 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.88E+06 | |
| Weight | m | kg | 285 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.00E+07 | |
| Weight | m | kg | 275 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

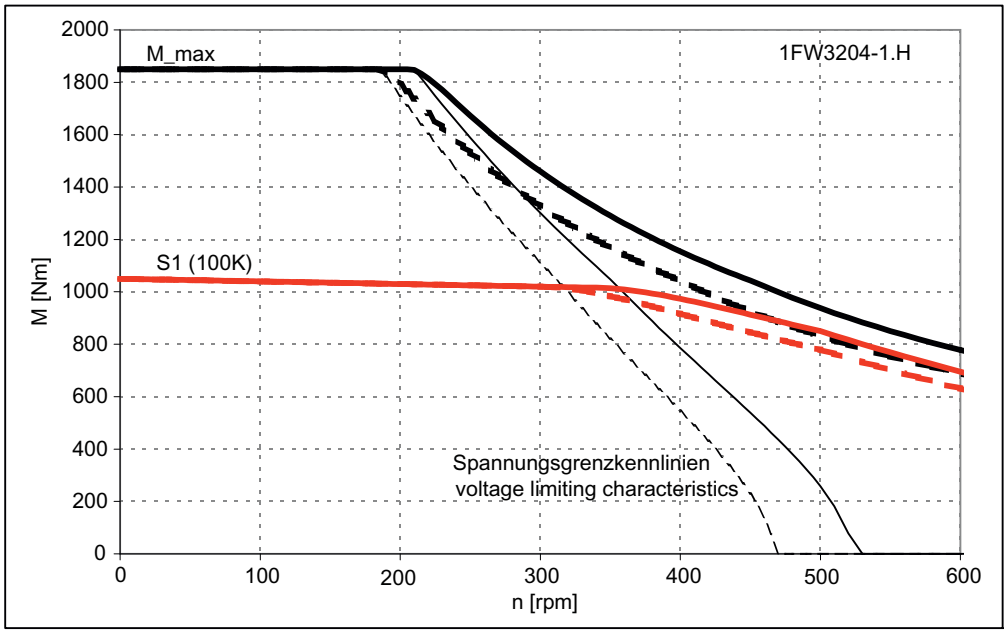



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

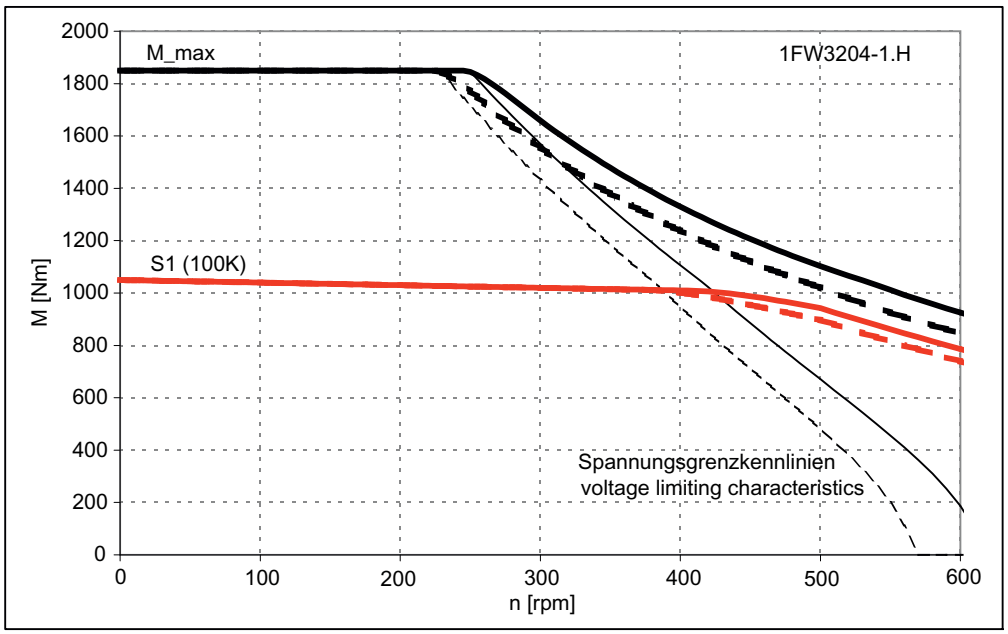
Table 4- 29 1FW3204, rated speed 300 rpm

| Configuration data | Code | Unit | 1FW3204-1□H | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 31.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 74 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1050 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 77 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 670 | |
| Maximum torque | $M_{max}$ | Nm | 1850 | |
| Maximum current | $I_{max}$ | A | 163 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 13.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 855 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.125 | |
| Rotating field inductance | $L_D$ | mH | 4.2 | |
| Electrical time constant | $T_{el}$ | ms | 33.5 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.64E+07 | |
| Weight | m | kg | 225 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.61 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.88E+06 | |
| Weight | m | kg | 285 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.00E+07 | |
| Weight | m | kg | 275 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

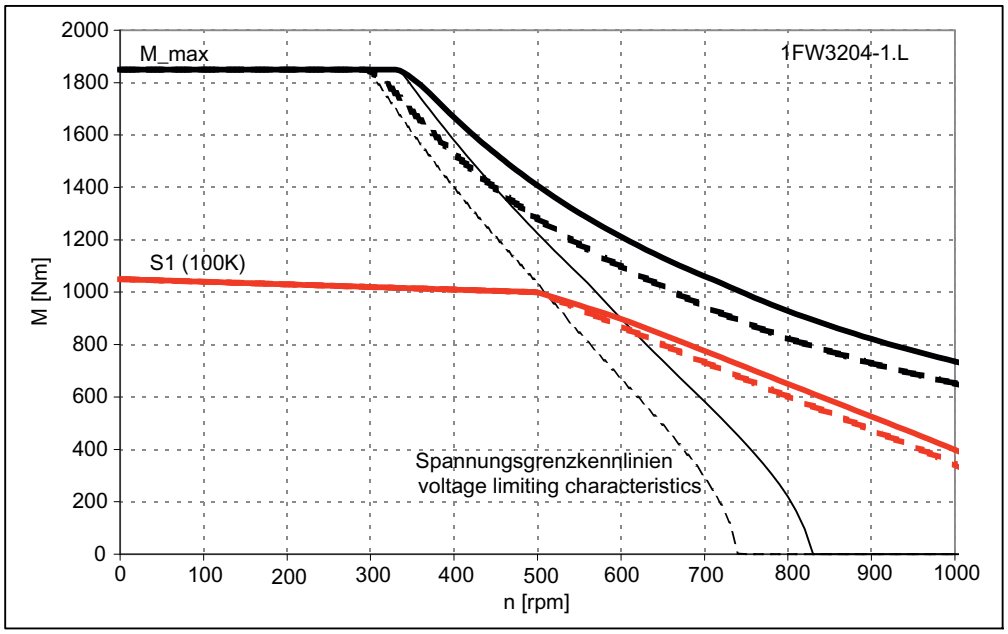



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

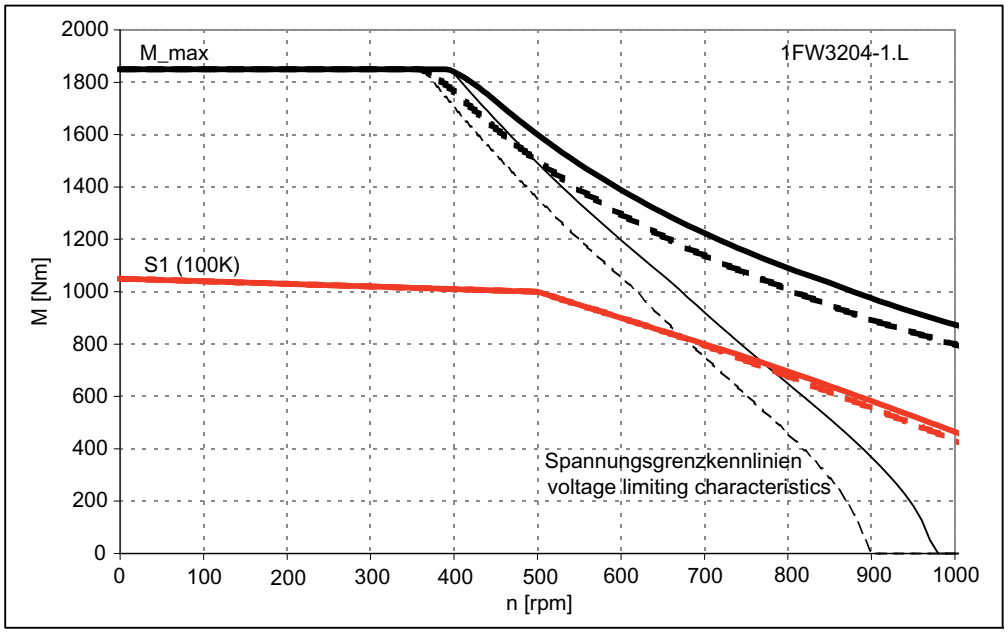
Table 4- 30 1FW3204, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3204-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 52 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 118 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1050 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 129 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1060 | |
| Maximum torque | $M_{max}$ | Nm | 1850 | |
| Maximum current | $I_{max}$ | A | 260 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 545 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.049 | |
| Rotating field inductance | $L_D$ | mH | 1.7 | |
| Electrical time constant | $T_{el}$ | ms | 34.5 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.64E+07 | |
| Weight | m | kg | 225 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.61 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.88E+06 | |
| Weight | m | kg | 285 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.00E+07 | |
| Weight | m | kg | 275 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

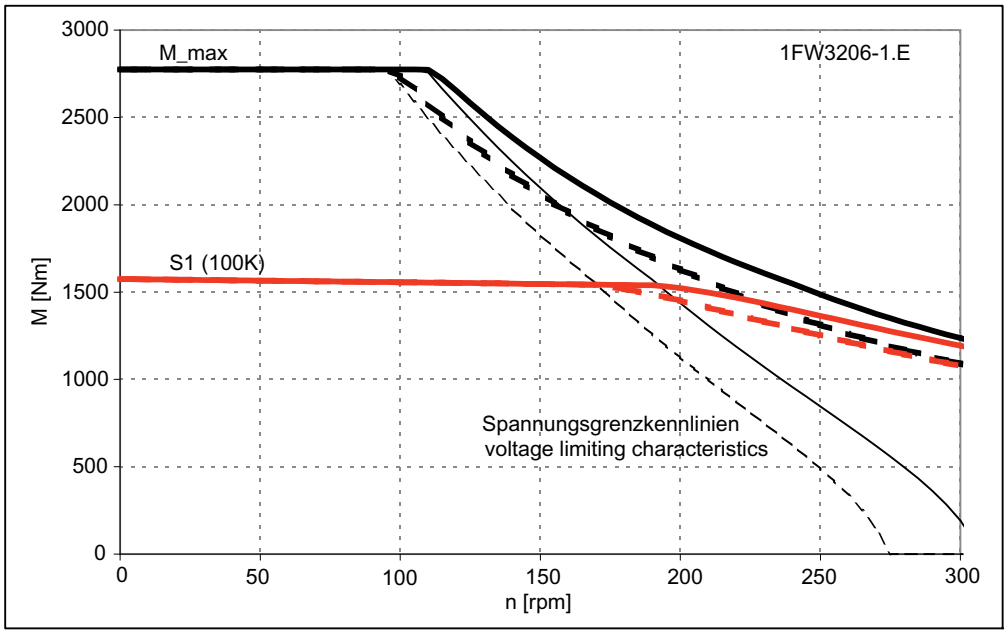



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

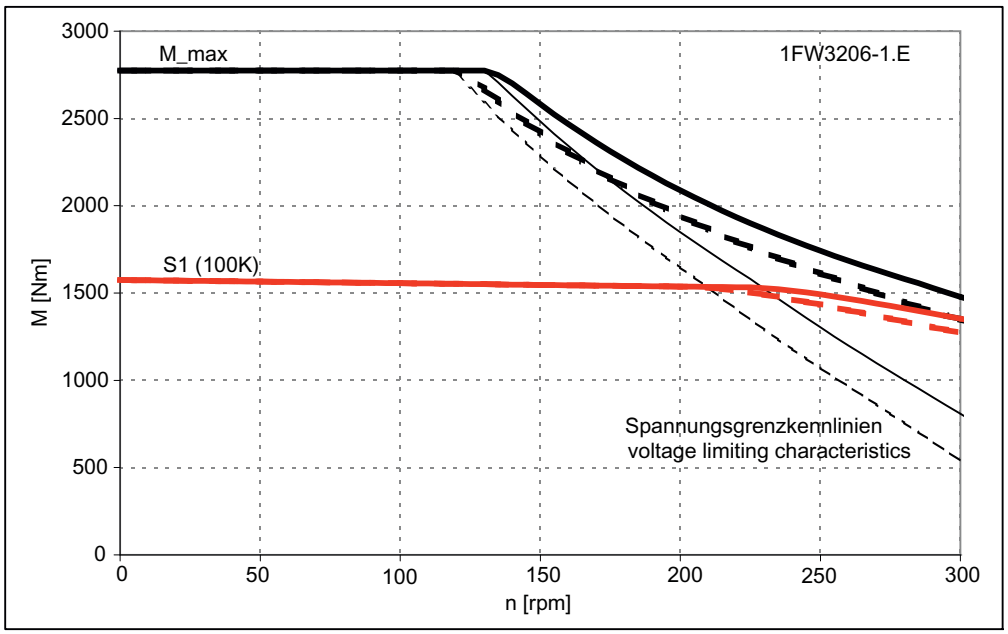
Table 4- 31 1FW3206, rated speed 150 rpm

| Configuration data | Code | Unit | 1FW3206-1□E | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 23.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 65 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1575 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 68 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 390 | |
| Maximum torque | $M_{max}$ | Nm | 2775 | |
| Maximum current | $I_{max}$ | A | 145 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 23.0 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1465 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.255 | |
| Rotating field inductance | $L_D$ | mH | 9.0 | |
| Electrical time constant | $T_{el}$ | ms | 35.0 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.97 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.24E+07 | |
| Weight | m | kg | 280 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.97 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.24E+07 | |
| Weight | m | kg | 345 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.94 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.65E+07 | |
| Weight | m | kg | 330 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

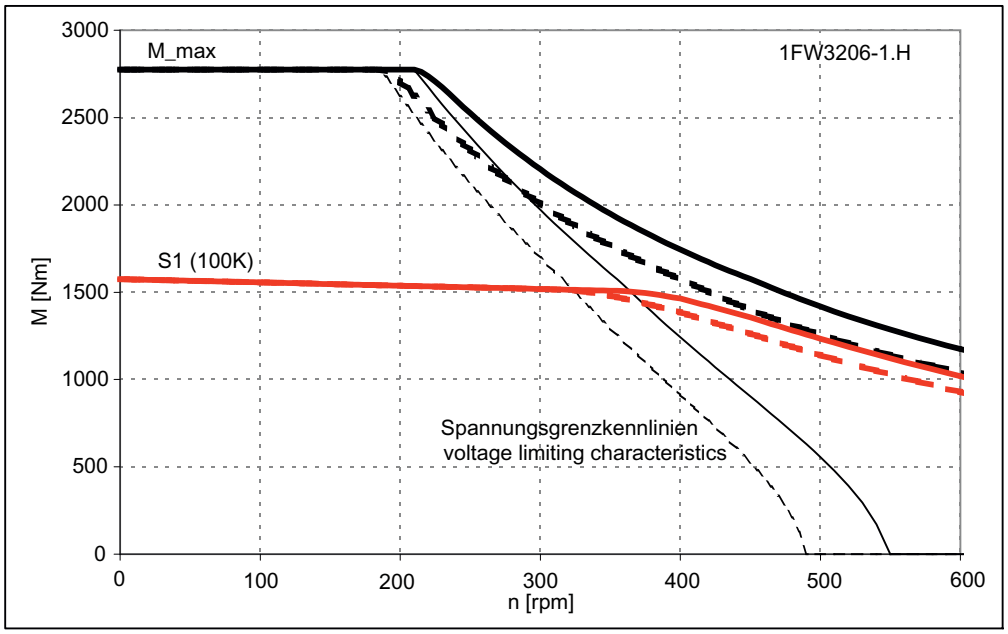



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

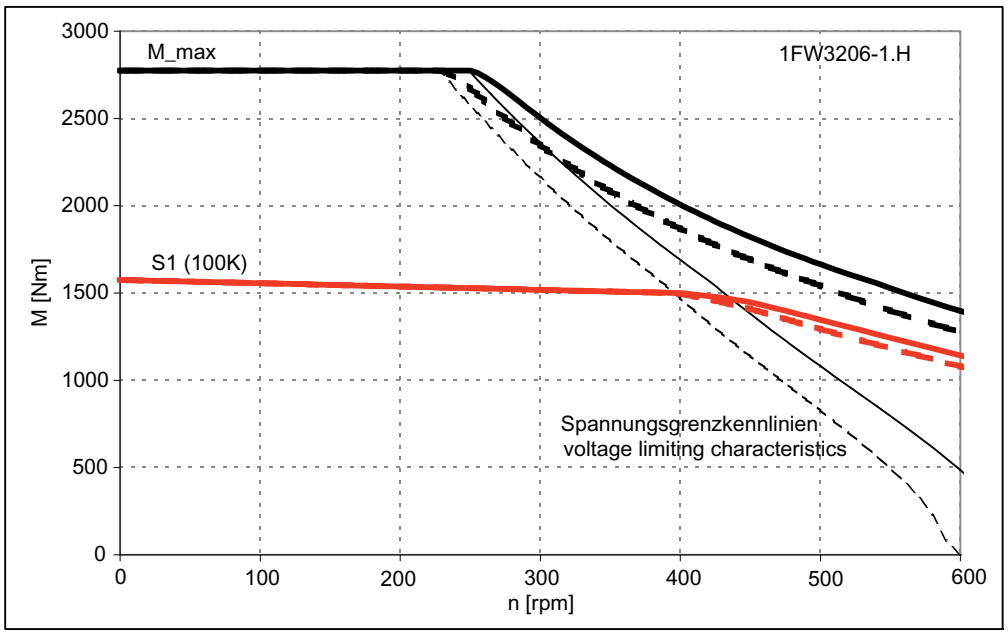
Table 4- 32 1FW3206, rated speed 300 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3206-1□H** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 47.0 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 118 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1575 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 121 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 700 | |
| Maximum torque | $M_{max}$ | Nm | 2775 | |
| Maximum current | $I_{max}$ | A | 255 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 12.8 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 820 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.076 | |
| Rotating field inductance | $L_D$ | mH | 2.7 | |
| Electrical time constant | $T_{el}$ | ms | 35.5 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.97 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.24E+07 | |
| Weight | m | kg | 280 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.84 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.24E+07 | |
| Weight | m | kg | 345 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.94 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.65E+07 | |
| Weight | m | kg | 330 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

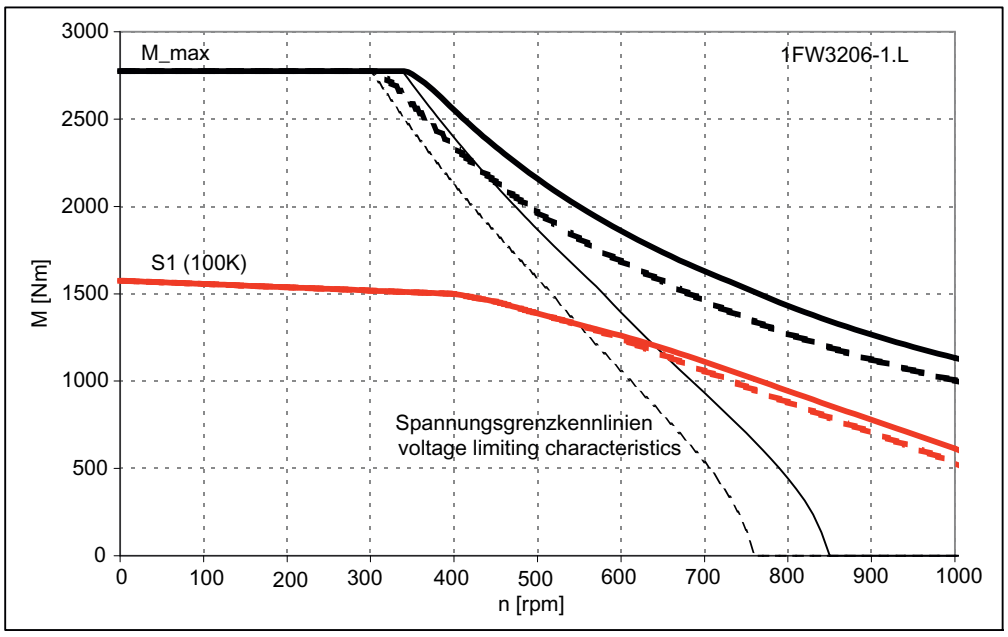



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

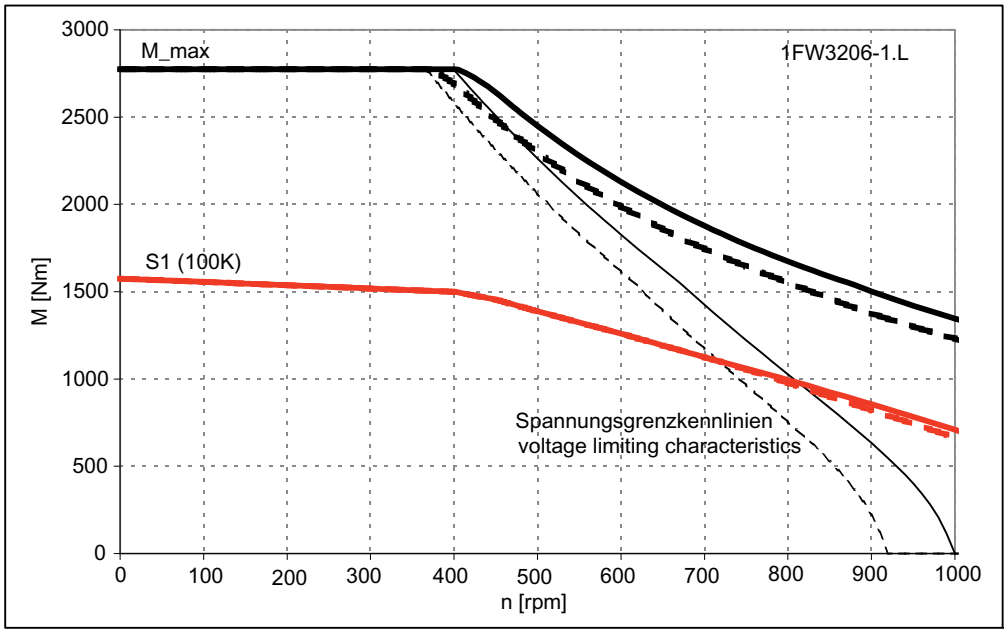
Table 4- 33 1FW3206, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3206-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1400 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 73 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 169 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1575 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 189 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1090 | |
| Maximum torque | $M_{max}$ | Nm | 2775 | |
| Maximum current | $I_{max}$ | A | 400 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.3 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 530 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.032 | |
| Rotating field inductance | $L_D$ | mH | 1.1 | |
| Electrical time constant | $T_{el}$ | ms | 34.5 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.97 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.24E+07 | |
| Weight | m | kg | 280 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.84 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.62E+06 | |
| Weight | m | kg | 345 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.94 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.65E+07 | |
| Weight | m | kg | 330 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

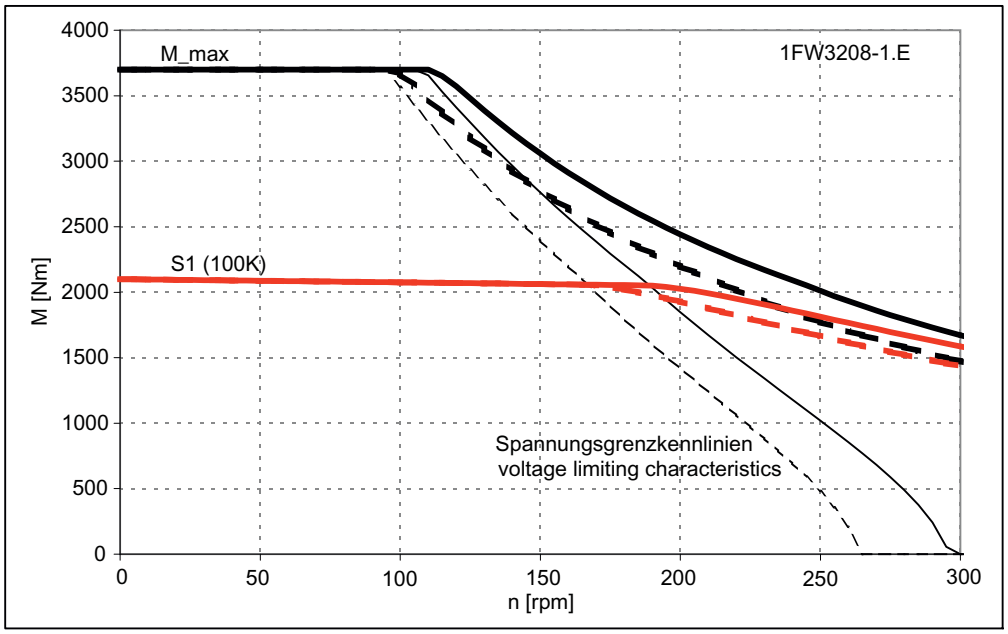



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 34 1FW3208, rated speed 150 rpm

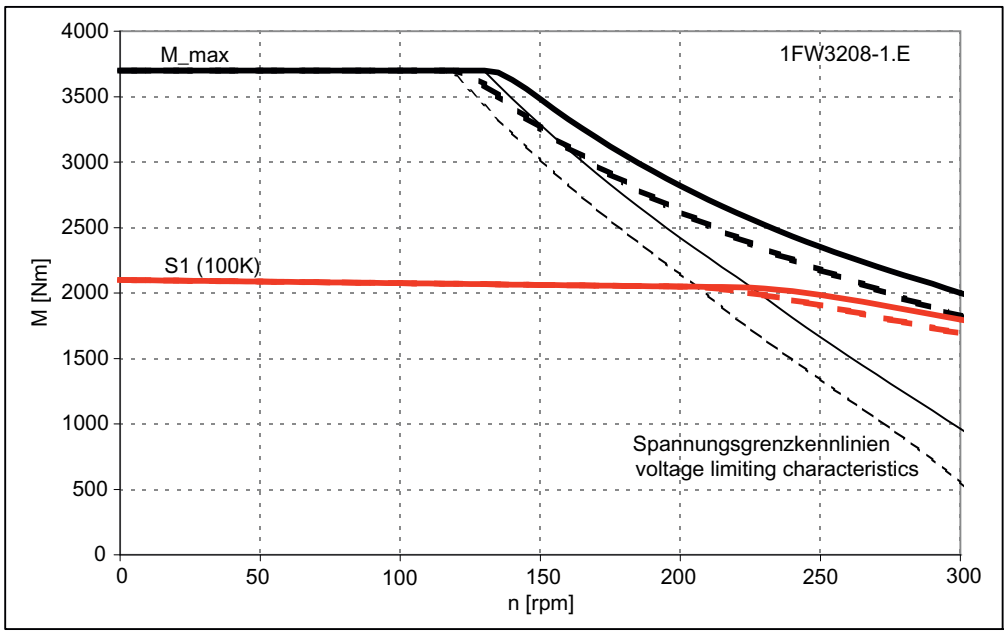
| **Configuration data** | **Code** | **Unit** | **1FW3208-1□E** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 2000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 31.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 84 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 88 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 380 | |
| Maximum torque | $M_{max}$ | Nm | 3700 | |
| Maximum current | $I_{max}$ | A | 187 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 24.0 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1515 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.197 | |
| Rotating field inductance | $L_D$ | mH | 7.0 | |
| Electrical time constant | $T_{el}$ | ms | 35.0 | |
| Thermal time constant | $T_{th}$ | min | 20 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.31 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 9.55E+06 | |
| Weight | m | kg | 350 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.11 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.35E+06 | |
| Weight | m | kg | 415 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+07 | |
| Weight | m | kg | 400 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



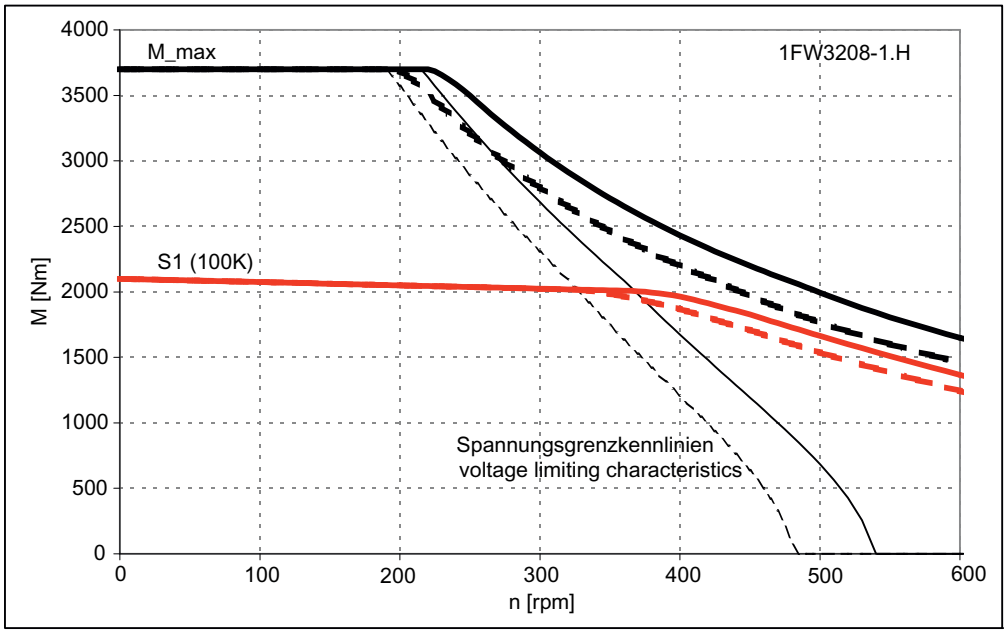

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 35 1FW3208, rated speed 300 rpm

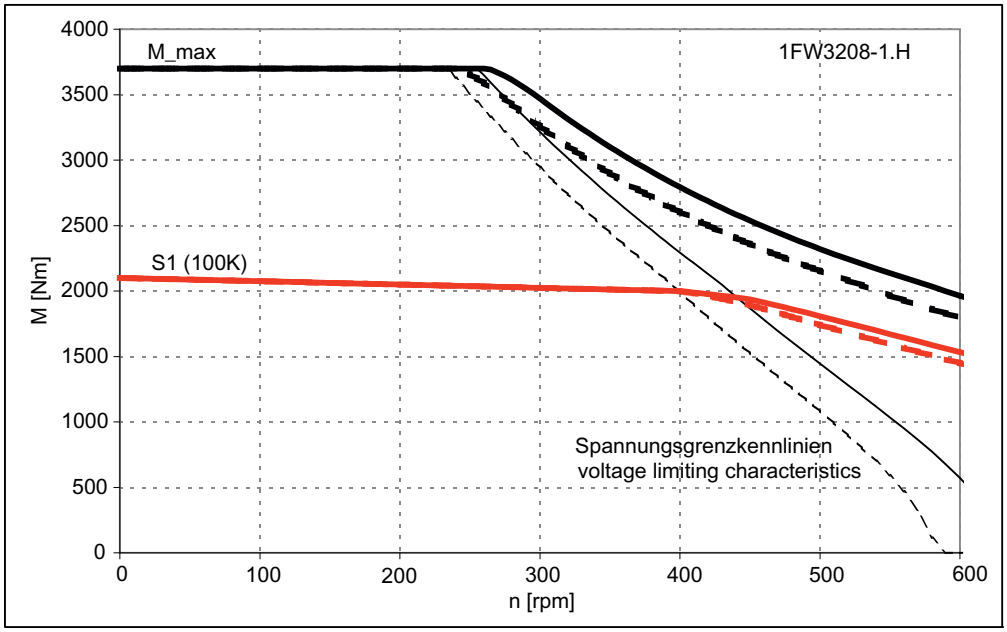
| **Configuration data** | **Code** | **Unit** | **1FW3208-1□H** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 300 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 2000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 63 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 153 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 160 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 690 | |
| Maximum torque | $M_{max}$ | Nm | 3700 | |
| Maximum current | $I_{max}$ | A | 340 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 13.1 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 835 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.056 | |
| Rotating field inductance | $L_D$ | mH | 2.0 | |
| Electrical time constant | $T_{el}$ | ms | 35.5 | |
| Thermal time constant | $T_{th}$ | min | 20 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.31 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 9.55E+06 | |
| Weight | m | kg | 350 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.11 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.35E+06 | |
| Weight | m | kg | 415 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+07 | |
| Weight | m | kg | 400 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



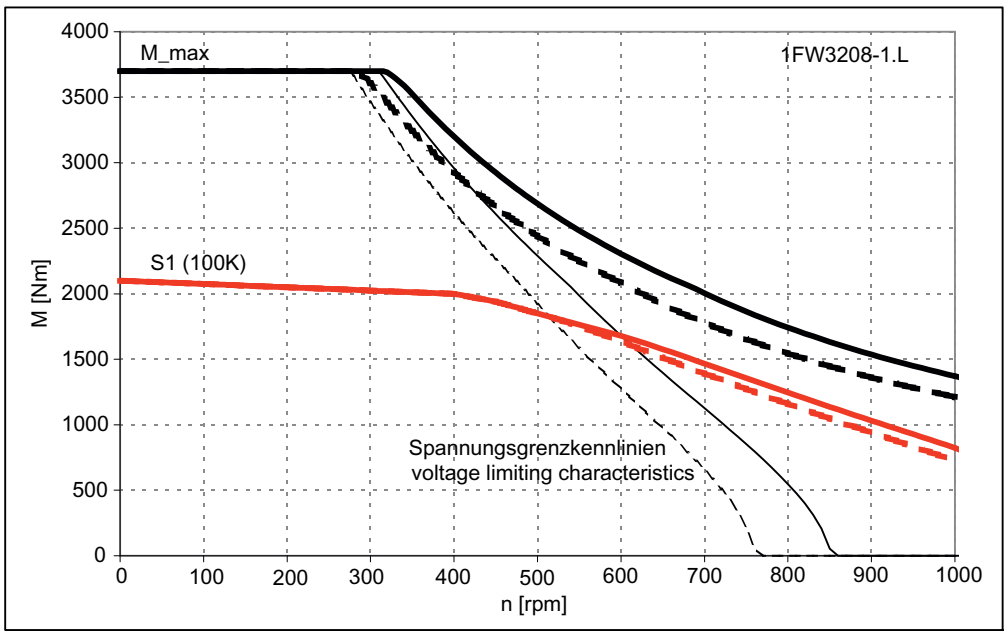

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

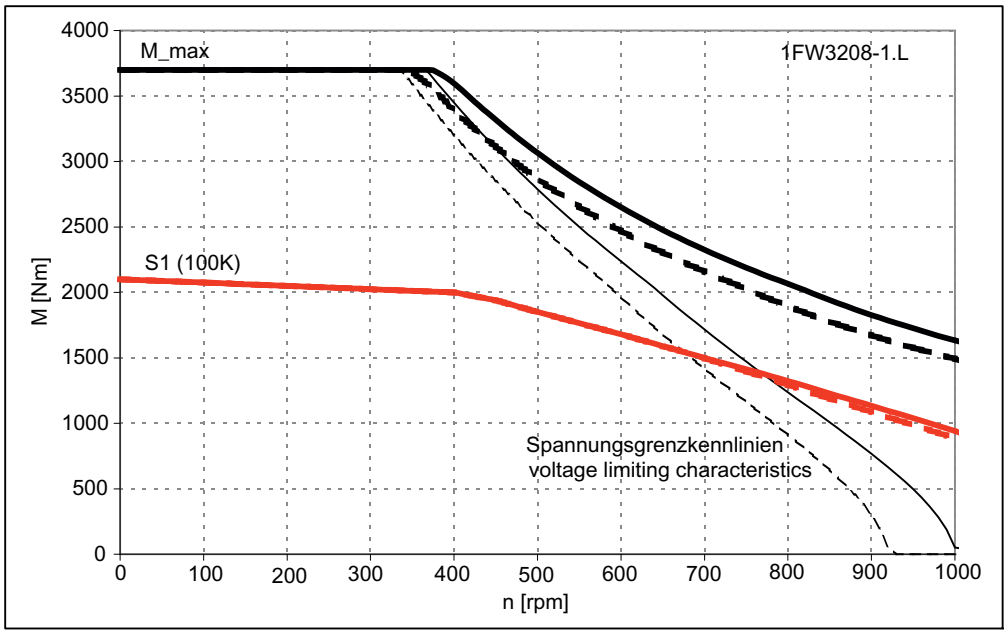
Table 4- 36 1FW3208, rated speed 500 rpm

| Configuration data | Code | Unit | 1FW3208-1□L | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 500 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1850 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 97 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 225 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 255 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1100 | |
| Maximum torque | $M_{max}$ | Nm | 3700 | |
| Maximum current | $I_{max}$ | A | 530 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 28 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -3.5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.2 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 525 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.027 | |
| Rotating field inductance | $L_D$ | mH | 0.9 | |
| Electrical time constant | $T_{el}$ | ms | 33.5 | |
| Thermal time constant | $T_{th}$ | min | 20 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.31 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 9.55E+06 | |
| Weight | m | kg | 350 | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.3 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.11 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.35E+06 | |
| Weight | m | kg | 415 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+07 | |
| Weight | m | kg | 400 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



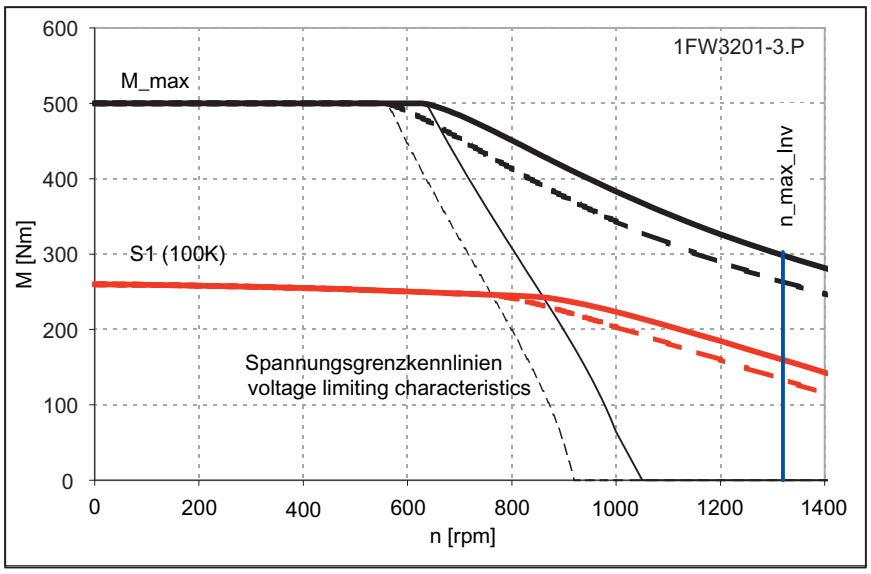

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

## 4.1.3 Shaft height 200, High Speed

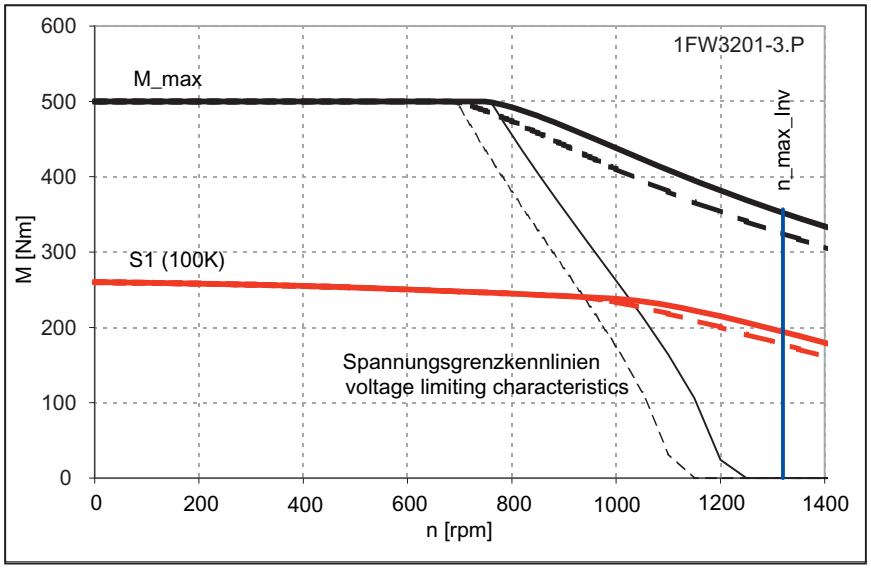
Table 4- 37 1FW3201, rated speed 800 rpm

| Configuration data | Code | Unit | 1FW3201-3□P | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 800 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 245 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 20.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 37.0 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 260 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 38.0 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1320 | |
| Maximum torque | $M_{max}$ | Nm | 500 | |
| Maximum current | $I_{max}$ | A | 80 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 6.8 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 437 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.285 | |
| Rotating field inductance | $L_D$ | mH | 4.1 | |
| Electrical time constant | $T_{el}$ | ms | 14.4 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 4.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.22 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.48E+06 | |
| Weight | m | kg | 176 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 5.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.27 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.90E+07 | |
| Weight | m | kg | 159 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

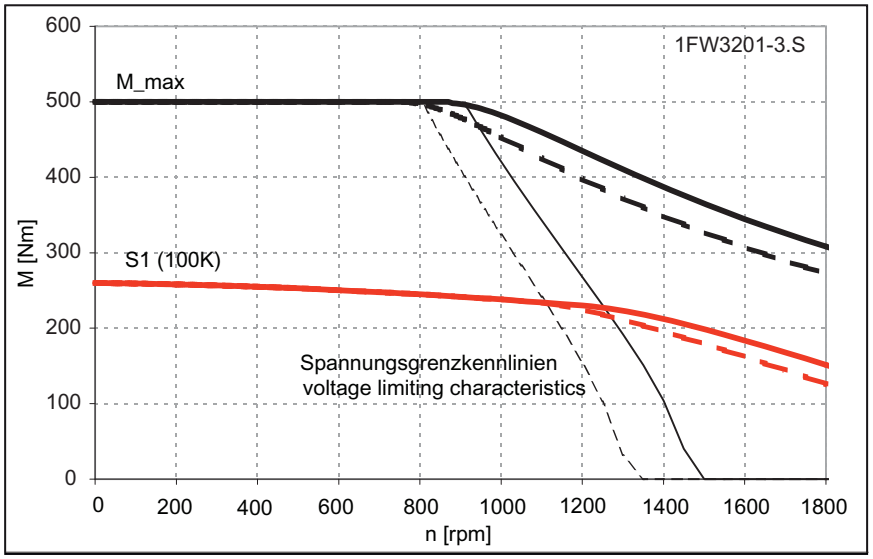



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 38 1FW3201, rated speed 1200 rpm

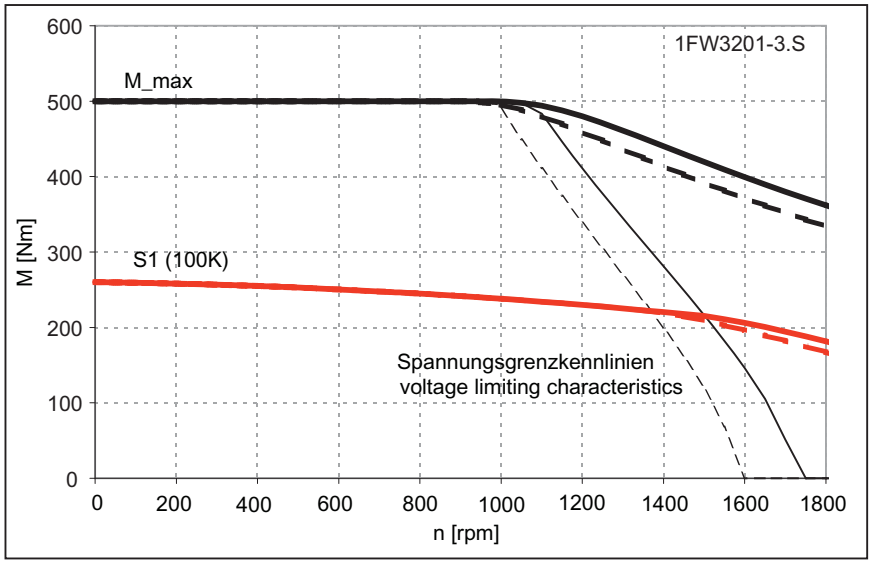
| Configuration data | Code | Unit | 1FW3201-3□S | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 1200 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 230 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 29 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 50 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 260 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 54 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1890 | |
| Maximum torque | $M_{max}$ | Nm | 500 | |
| Maximum current | $I_{max}$ | A | 114 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 4.8 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 306 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.14 | |
| Rotating field inductance | $L_D$ | mH | 2.1 | |
| Electrical time constant | $T_{el}$ | ms | 15.3 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 4.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.22 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.48E+06 | |
| Weight | m | kg | 176 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 5.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.27 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.90E+07 | |
| Weight | m | kg | 159 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



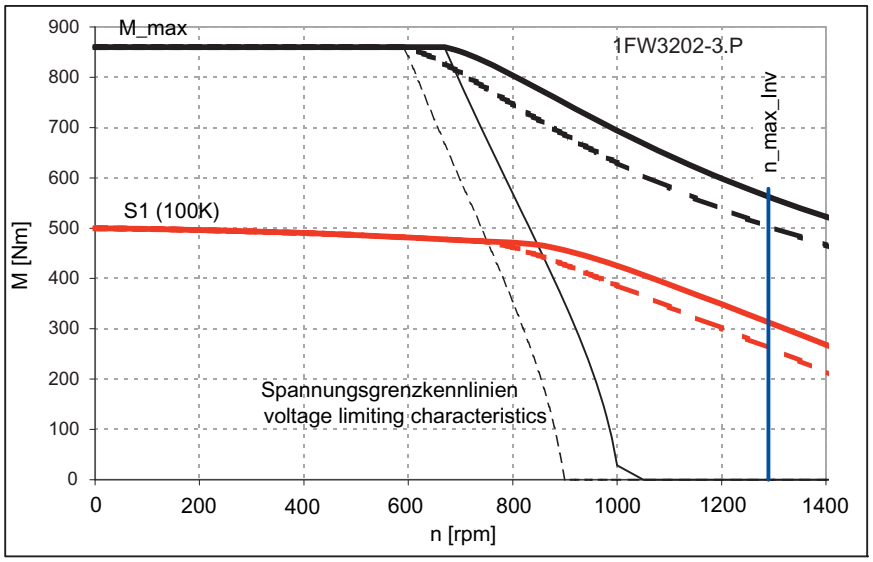

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 39 1FW3202, rated speed 800 rpm

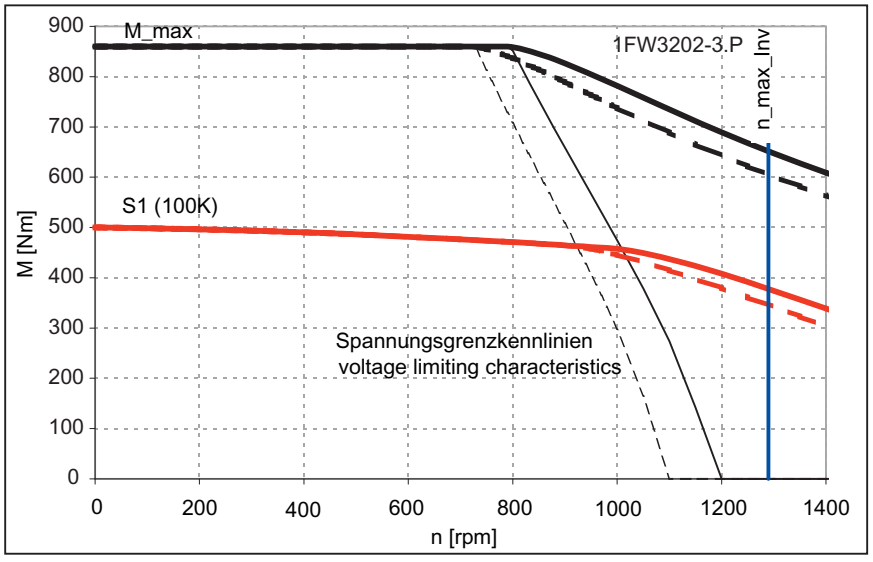
| Configuration data | Code | Unit | 1FW3202-3□P | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 800 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 470 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 39.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 69 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 72 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1290 | |
| Maximum torque | $M_{max}$ | Nm | 860 | |
| Maximum current | $I_{max}$ | A | 133 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 7 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 447 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.126 | |
| Rotating field inductance | $L_D$ | mH | 2.3 | |
| Electrical time constant | $T_{el}$ | ms | 18.2 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.34 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.28E+06 | |
| Weight | m | kg | 205 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.4 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.05E+07 | |
| Weight | m | kg | 188 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



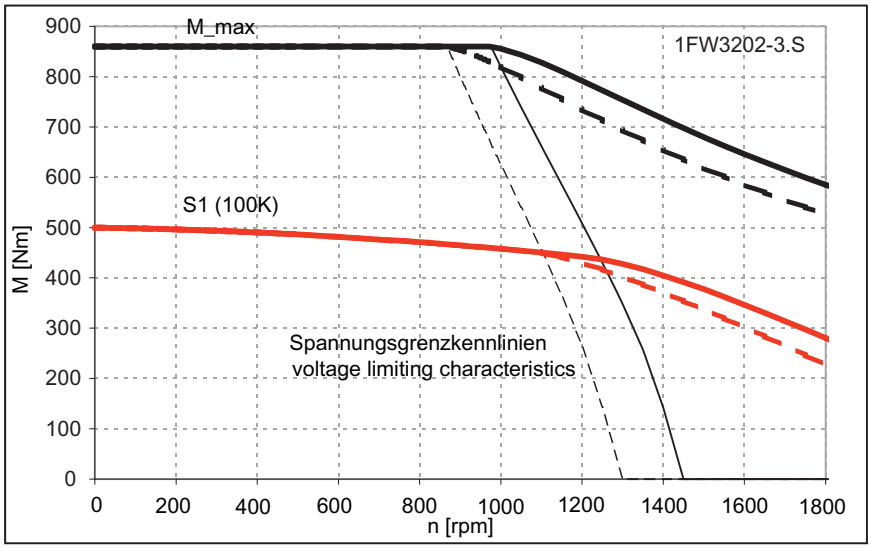

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

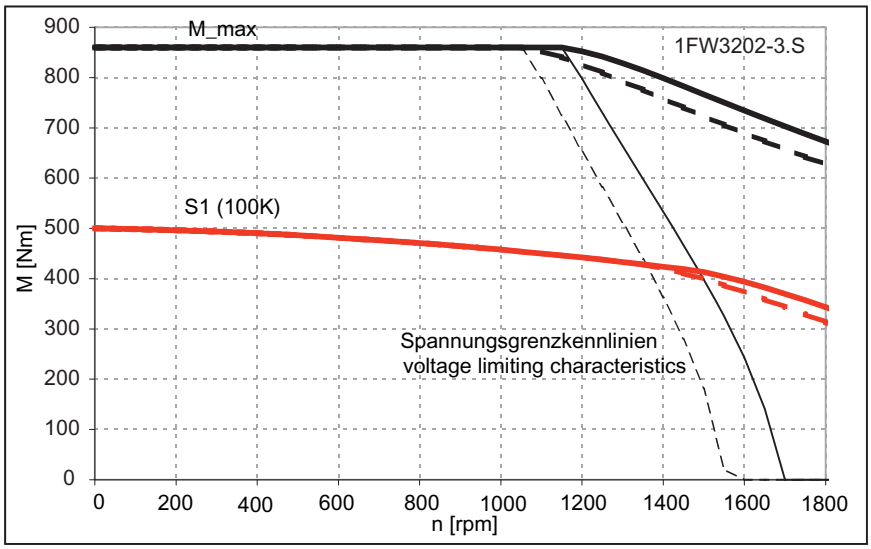
Table 4- 40 1FW3202, rated speed 1200 rpm

| Configuration data | Code | Unit | 1FW3202-3□S | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 1200 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 440 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 55 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 92 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 102 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1850 | |
| Maximum torque | $M_{max}$ | Nm | 860 | |
| Maximum current | $I_{max}$ | A | 190 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 4.9 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 313 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.062 | |
| Rotating field inductance | $L_D$ | mH | 1.1 | |
| Electrical time constant | $T_{el}$ | ms | 18.1 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.34 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.28E+06 | |
| Weight | m | kg | 205 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.4 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 4.05E+07 | |
| Weight | m | kg | 188 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

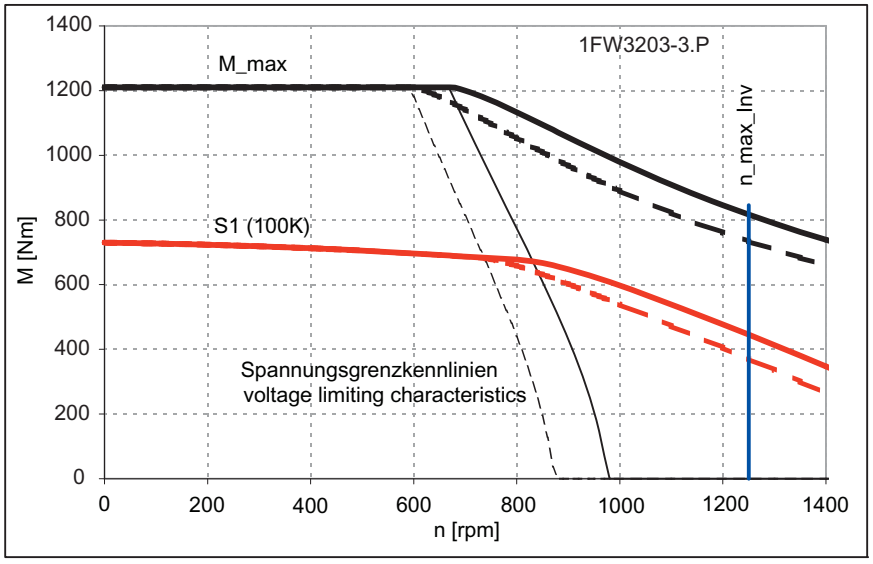



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

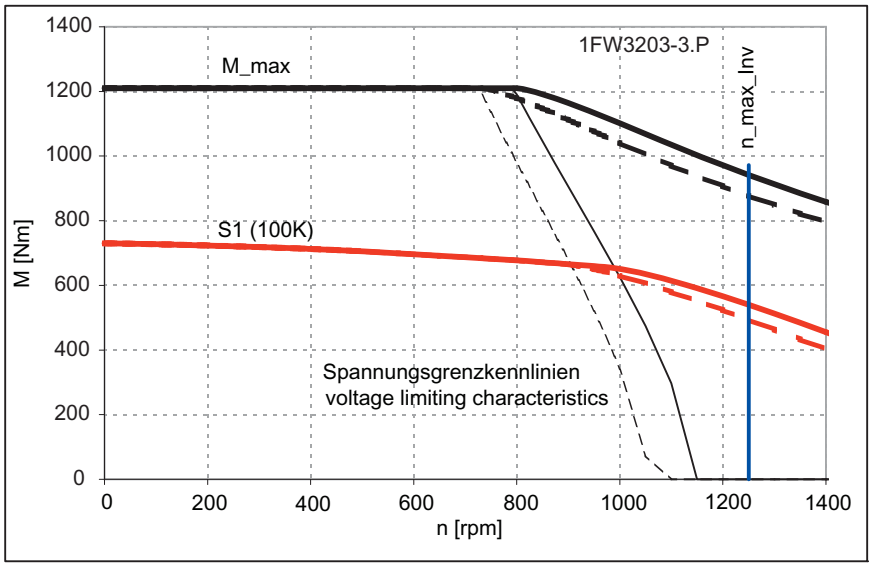
Table 4- 41 1FW3203, rated speed 800 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3203-3□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 800 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 680 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 57 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 96 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 730 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 102 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1250 | |
| Maximum torque | $M_{max}$ | Nm | 1210 | |
| Maximum current | $I_{max}$ | A | 182 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 7.2 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 460 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.084 | |
| Rotating field inductance | $L_D$ | mH | 1.65 | |
| Electrical time constant | $T_{el}$ | ms | 19.8 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.45 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.11E+06 | |
| Weight | m | kg | 235 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.52 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.44E+07 | |
| Weight | m | kg | 215 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

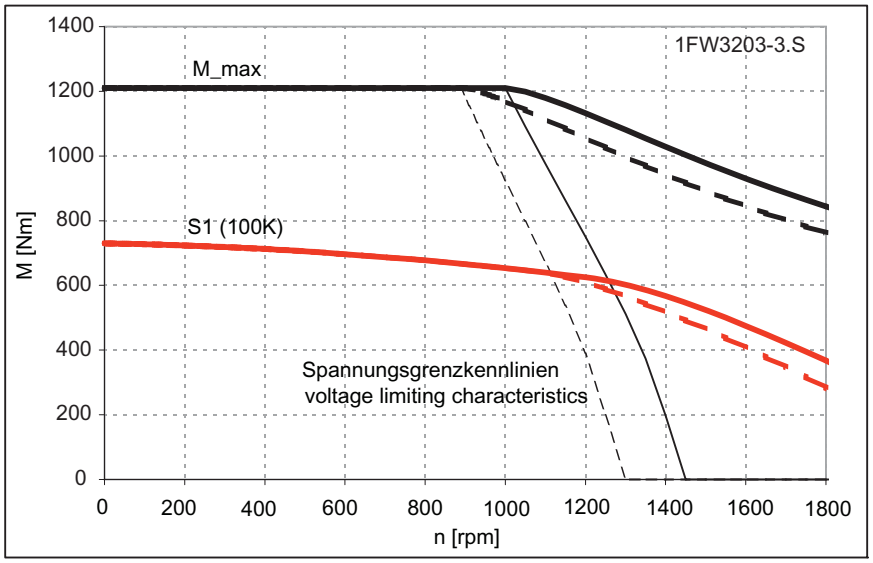



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

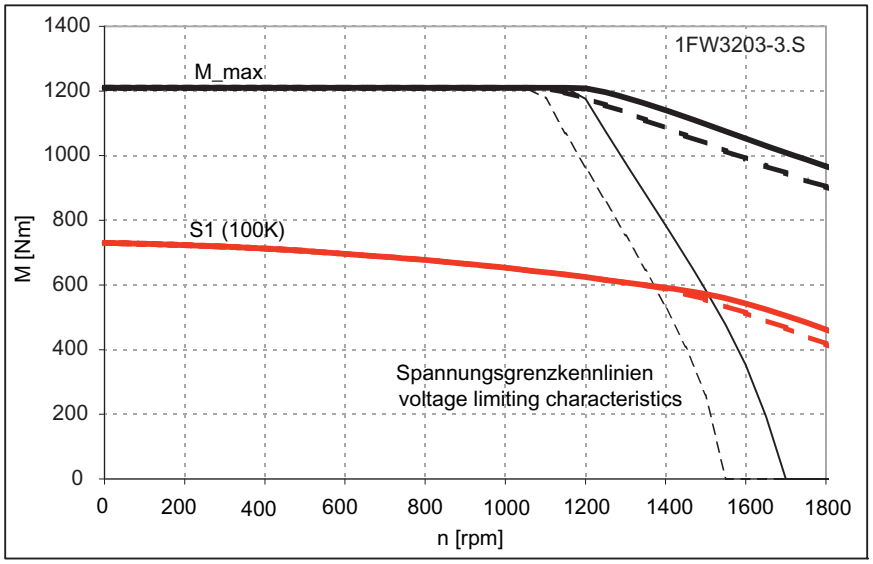
Table 4- 42 1FW3203, rated speed 1200 rpm

| Configuration data | Code | Unit | 1FW3203-3□S | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 1200 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 630 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 79 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 131 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 730 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 149 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1840 | |
| Maximum torque | $M_{max}$ | Nm | 1210 | |
| Maximum current | $I_{max}$ | A | 265 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 4.9 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 314 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.038 | |
| Rotating field inductance | $L_D$ | mH | 0.75 | |
| Electrical time constant | $T_{el}$ | ms | 20 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.45 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.11E+06 | |
| Weight | m | kg | 235 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.5 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.52 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.44E+07 | |
| Weight | m | kg | 215 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

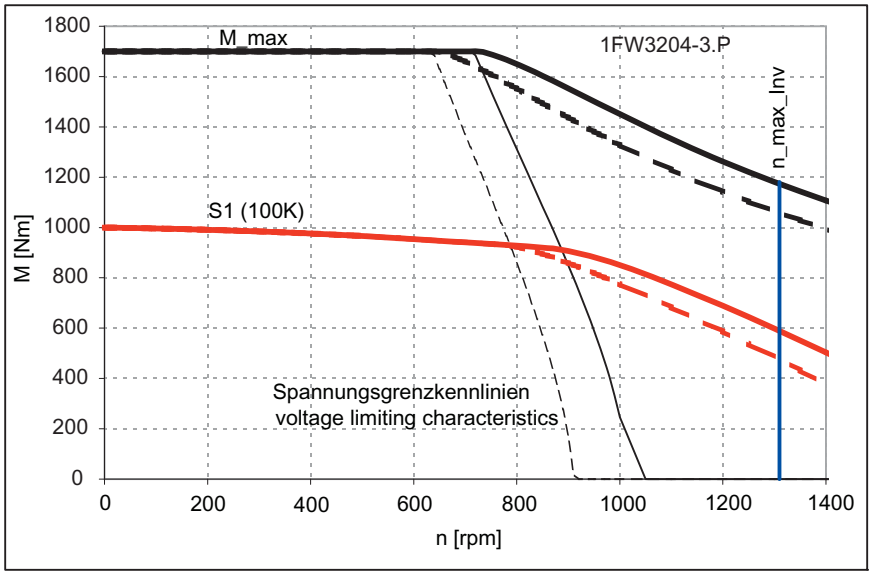



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

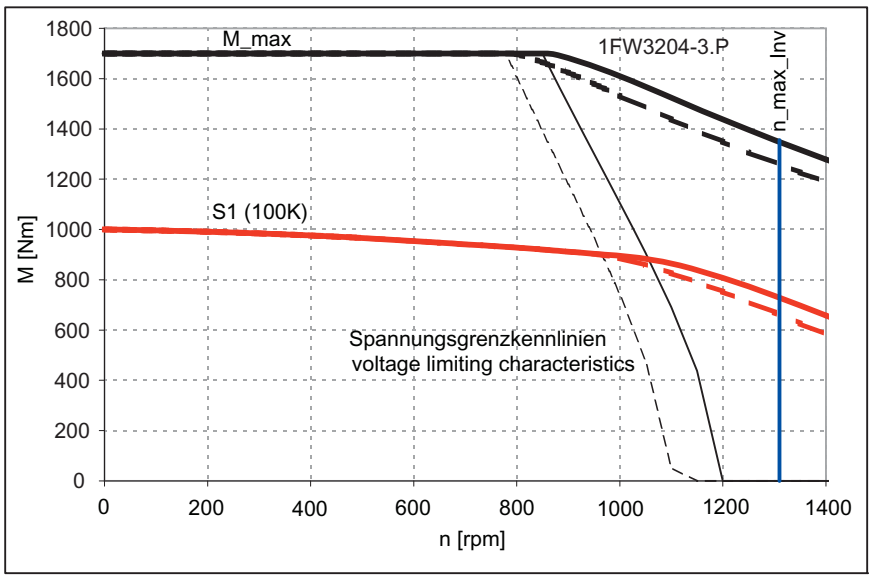
Table 4- 43 1FW3204, rated speed 800 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3204-3□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 800 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 930 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 78 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 137 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1000 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 145 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1310 | |
| Maximum torque | $M_{max}$ | Nm | 1700 | |
| Maximum current | $I_{max}$ | A | 265 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 6.9 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 441 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0465 | |
| Rotating field inductance | $L_D$ | mH | 1.05 | |
| Electrical time constant | $T_{el}$ | ms | 22.5 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.61 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.88E+06 | |
| Weight | m | kg | 285 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.69 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.00E+07 | |
| Weight | m | kg | 260 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

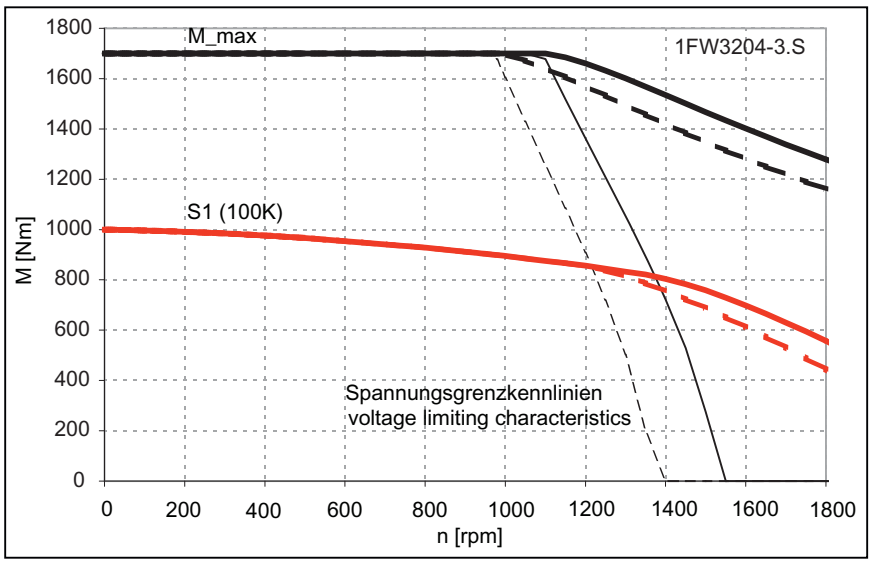



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

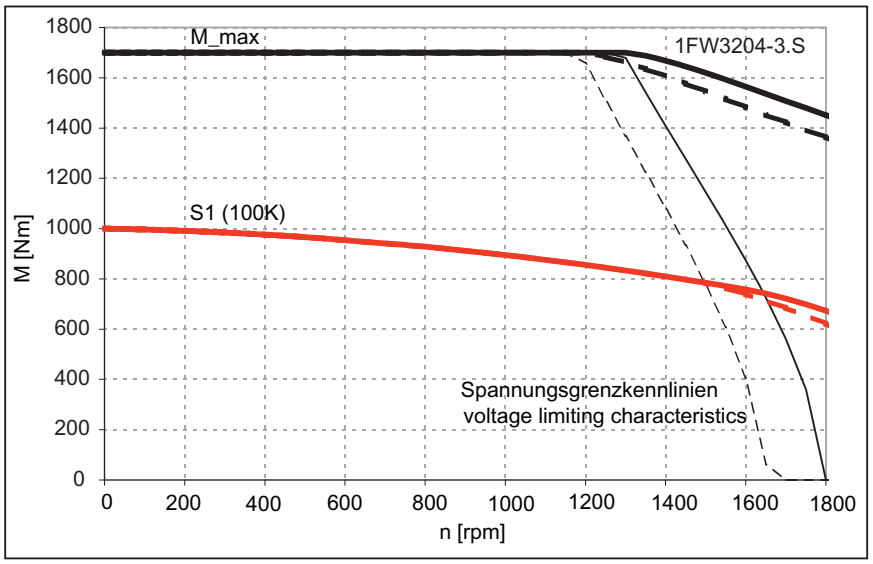
Table 4- 44 1FW3204, rated speed 1200 rpm

| Configuration data | Code | Unit | 1FW3204-3□S | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 1200 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 860 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 108 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 191 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1000 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 220 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1970 | |
| Maximum torque | $M_{max}$ | Nm | 1700 | |
| Maximum current | $I_{max}$ | A | 400 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 4.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 294 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.021 | |
| Rotating field inductance | $L_D$ | mH | 0.46 | |
| Electrical time constant | $T_{el}$ | ms | 22 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.61 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.88E+06 | |
| Weight | m | kg | 285 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.69 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 3.00E+07 | |
| Weight | m | kg | 260 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

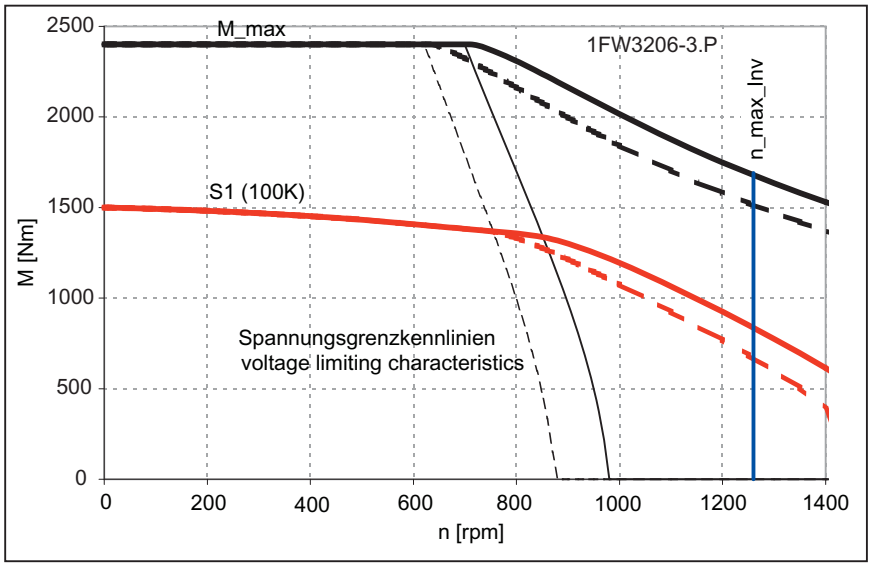



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

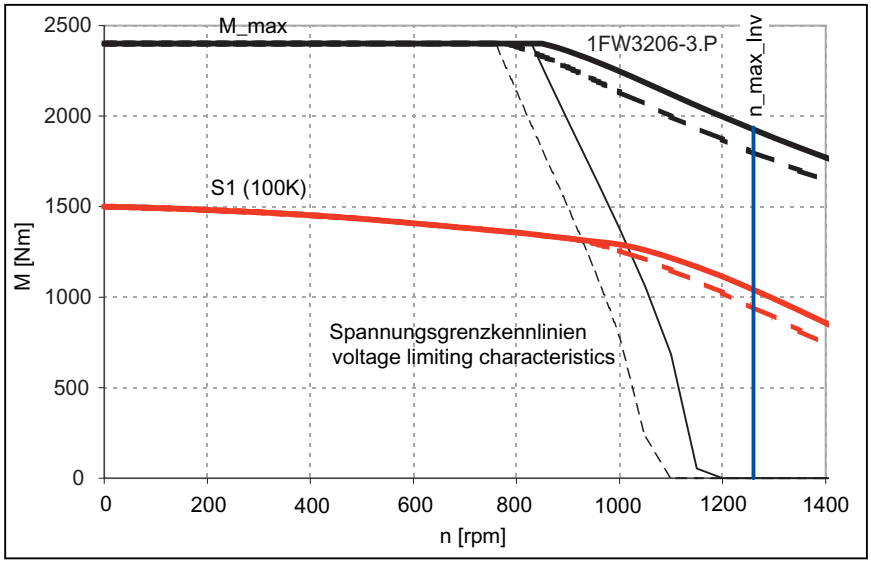
Table 4- 45 1FW3206, rated speed 800 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3206-3□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 800 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1360 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 114 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 192 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 210 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1260 | |
| Maximum torque | $M_{max}$ | Nm | 2400 | |
| Maximum current | $I_{max}$ | A | 365 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 7.2 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 460 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0325 | |
| Rotating field inductance | $L_D$ | mH | 0.8 | |
| Electrical time constant | $T_{el}$ | ms | 24 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.83 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.62E+06 | |
| Weight | m | kg | 370 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.94 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.65E+07 | |
| Weight | m | kg | 340 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

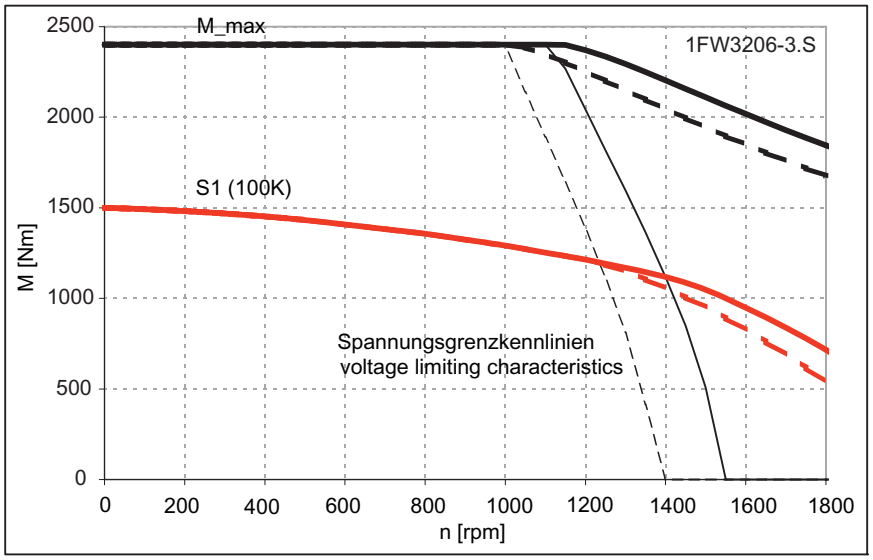



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

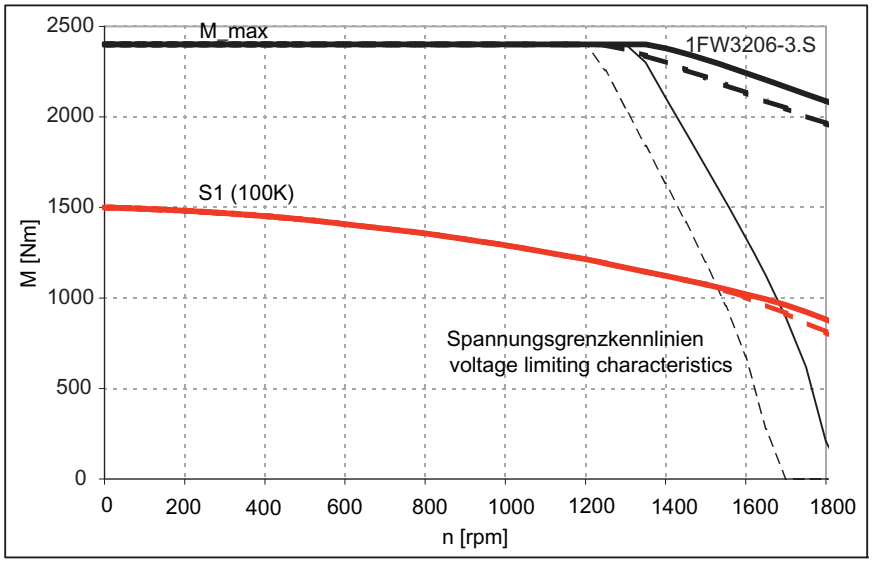
Table 4- 46 1FW3206, rated speed 1200 rpm

| Configuration data | Code | Unit | 1FW3206-3□S | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 1200 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1210 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 152 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 270 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 1500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 330 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1980 | |
| Maximum torque | $M_{max}$ | Nm | 2400 | |
| Maximum current | $I_{max}$ | A | 570 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 4.55 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 292 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0131 | |
| Rotating field inductance | $L_D$ | mH | 0.32 | |
| Electrical time constant | $T_{el}$ | ms | 24 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.83 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.62E+06 | |
| Weight | m | kg | 370 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.8 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 0.94 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.65E+0.7 | |
| Weight | m | kg | 370 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

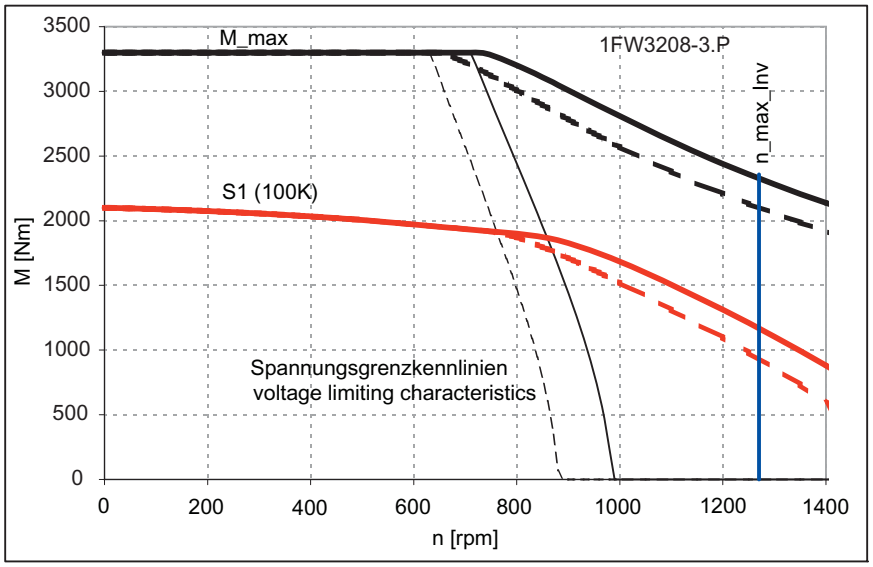



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

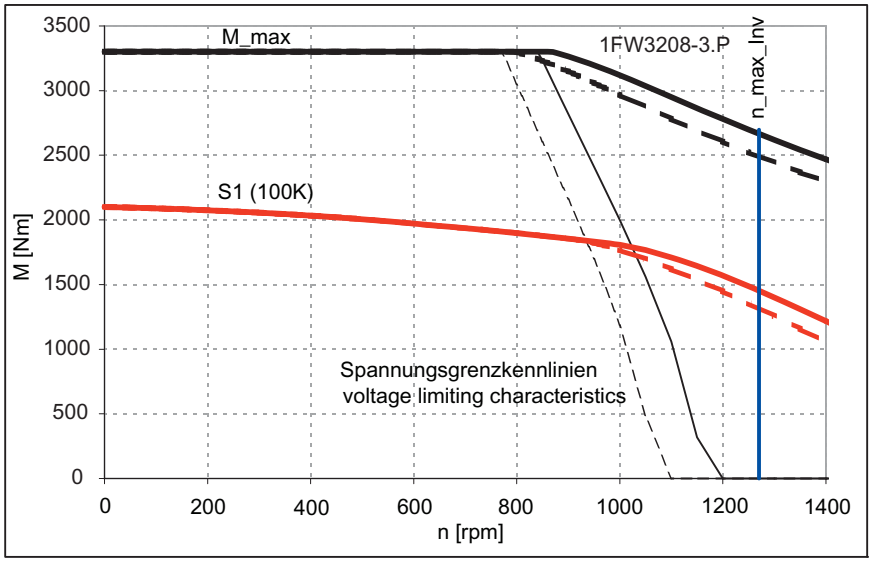
Table 4- 47 1FW3208, rated speed 800 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3208-3□P** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 800 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1900 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 159 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 270 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 295 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1270 | |
| Maximum torque | $M_{max}$ | Nm | 3300 | |
| Maximum current | $I_{max}$ | A | 500 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 7.1 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 456 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0215 | |
| Rotating field inductance | $L_D$ | mH | 0.55 | |
| Electrical time constant | $T_{el}$ | ms | 25.5 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.11 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.35E+06 | |
| Weight | m | kg | 445 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+0.6 | |
| Weight | m | kg | 410 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

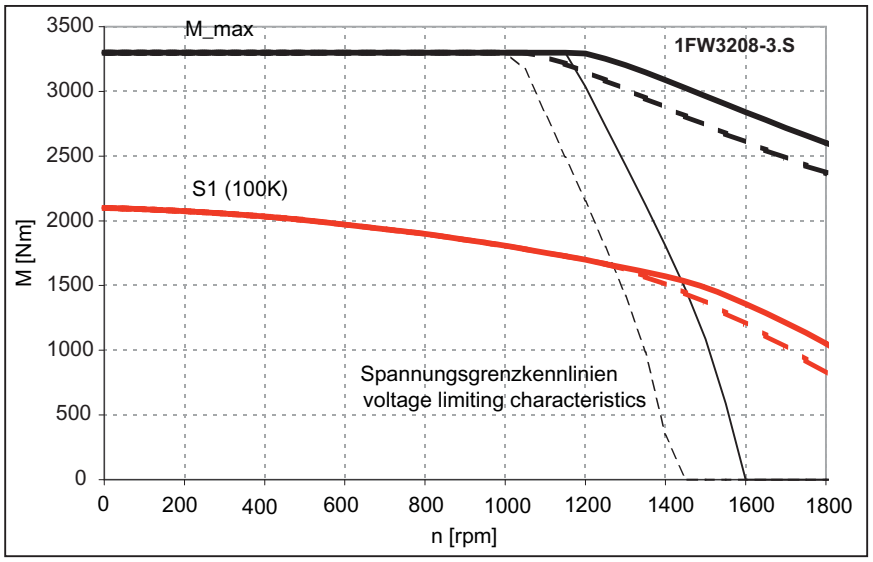



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

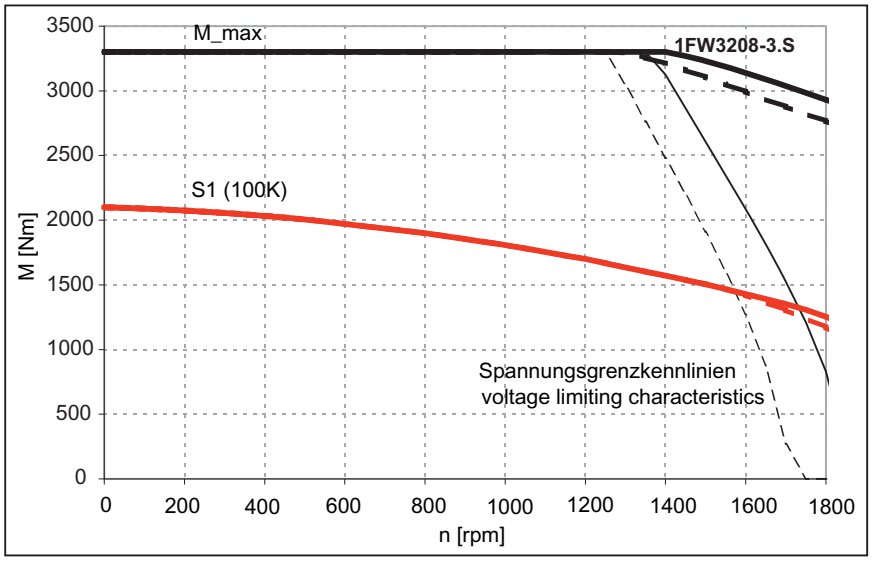
Table 4- 48 1FW3208, rated speed 1200 rpm

| Configuration data | Code | Unit | 1FW3208-3□S | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 1200 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 1700 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 215 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 385 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 470 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1800 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 2050 | |
| Maximum torque | $M_{max}$ | Nm | 3300 | |
| Maximum current | $I_{max}$ | A | 800 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 16 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -4 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 4.45 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 285 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0085 | |
| Rotating field inductance | $L_D$ | mH | 0.22 | |
| Electrical time constant | $T_{el}$ | ms | 25.5 | |
| Thermal time constant | $T_{th}$ | min | 10 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | --- | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | --- | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | --- | |
| Weight | m | kg | --- | |
| **Mechanical data: Solid shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.11 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.35E+06 | |
| Weight | m | kg | 445 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.6 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 1.24 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 2.17E+0.6 | |
| Weight | m | kg | 410 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



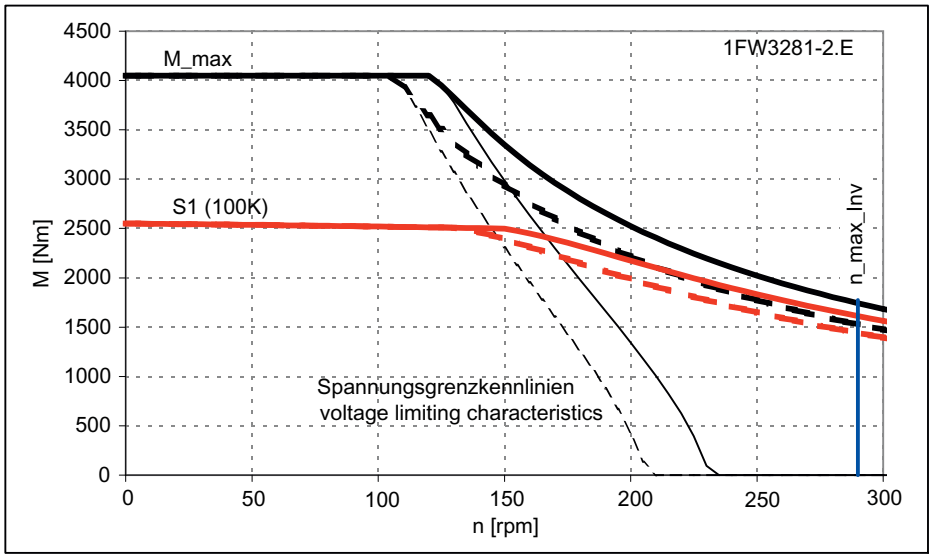

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

### 4.1.4 Shaft height 280, Standard

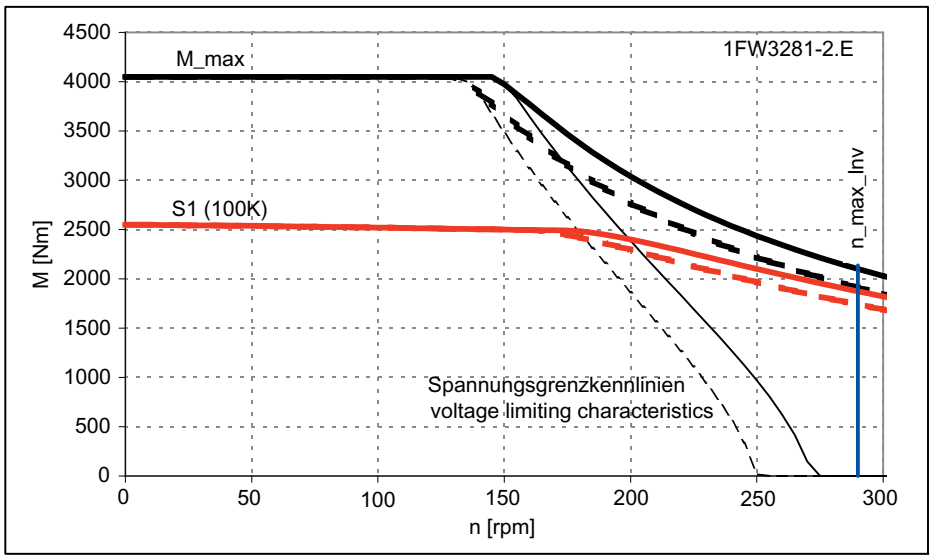
Table 4- 49 1FW3281, rated speed 150 rpm

| Configuration data | Code | Unit | 1FW3281-2□E | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 2500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 39.5 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 82 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2550 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 84 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 290 | |
| Maximum torque | $M_{max}$ | Nm | 4050 | |
| Maximum current | $I_{max}$ | A | 145 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 30.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1945 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.255 | |
| Rotating field inductance | $L_D$ | mH | 9.5 | |
| Electrical time constant | $T_{el}$ | ms | 38.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 600 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.6 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 660 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

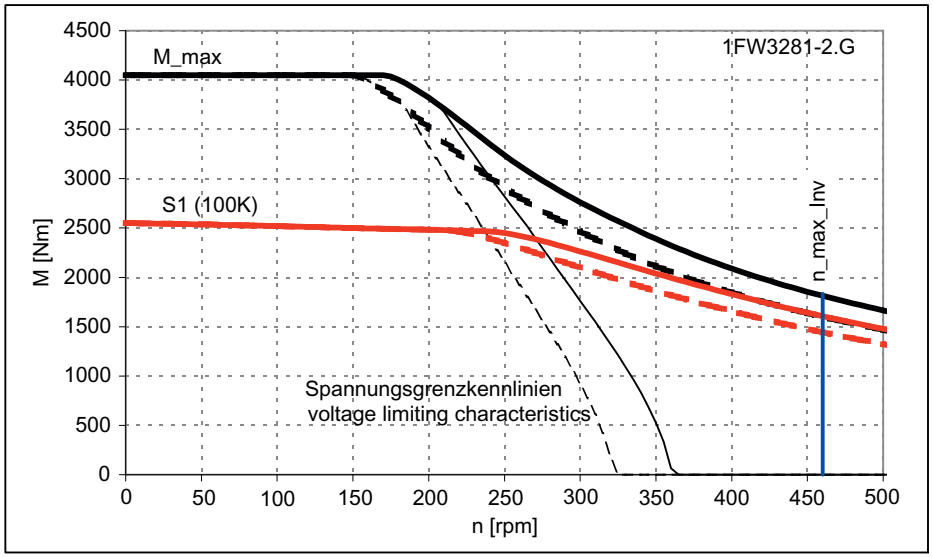



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

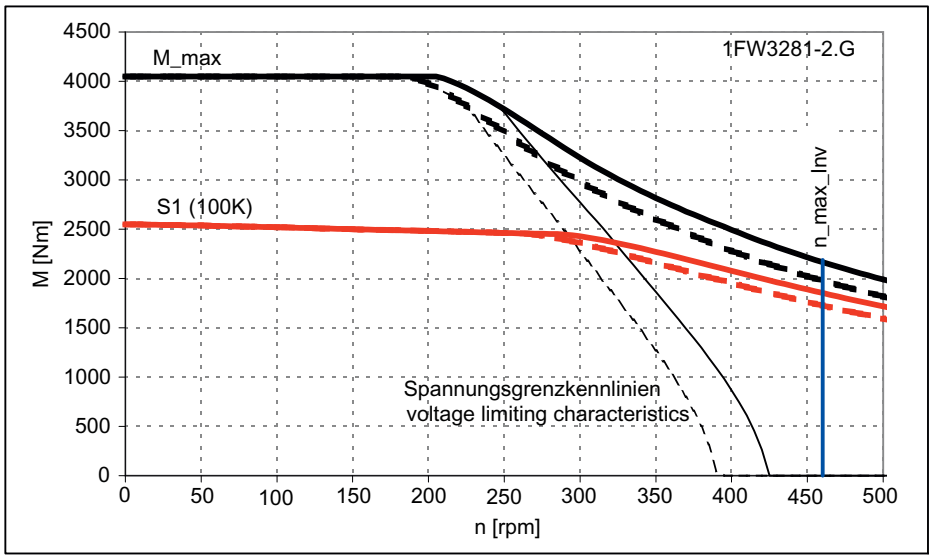
Table 4- 50 1FW3281, rated speed 250 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3281-2□G** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 250 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 2450 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 64 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 126 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2550 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 131 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 460 | |
| Maximum torque | $M_{max}$ | Nm | 4050 | |
| Maximum current | $I_{max}$ | A | 225 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 19.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1245 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.104 | |
| Rotating field inductance | $L_D$ | mH | 4.0 | |
| Electrical time constant | $T_{el}$ | ms | 38.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 600 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.6 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 660 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

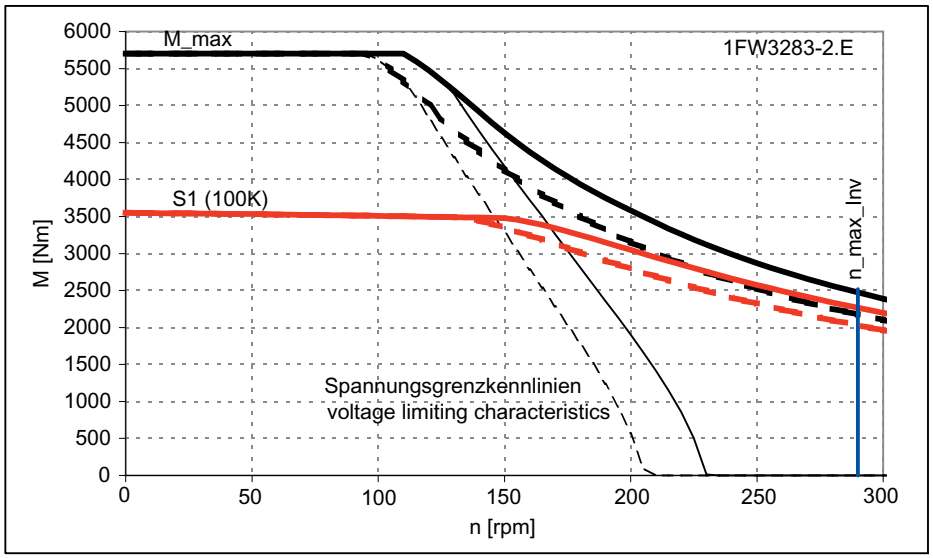



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

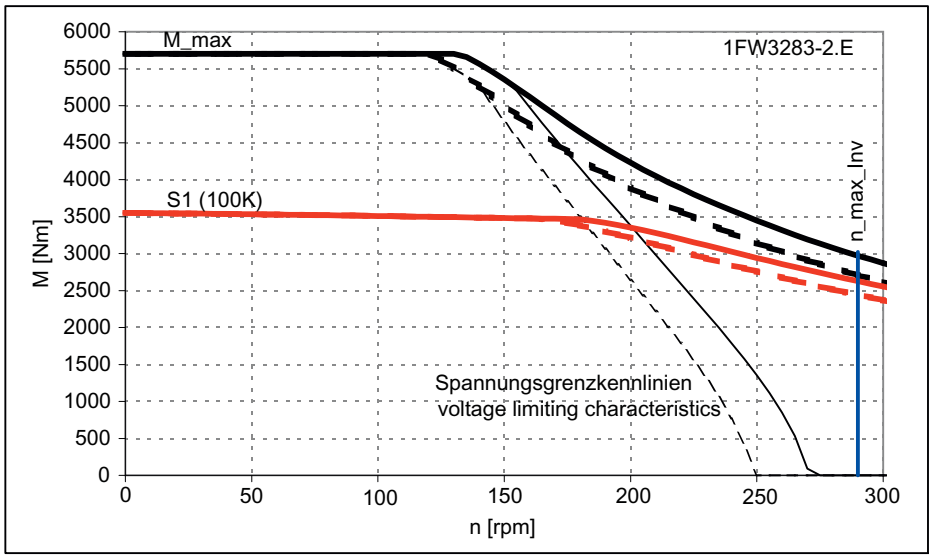
Table 4- 51 1FW3283, rated speed 150 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3283-2□E** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 3500 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 55 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 115 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 3550 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 116 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 290 | |
| Maximum torque | $M_{max}$ | Nm | 5700 | |
| Maximum current | $I_{max}$ | A | 205 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 30.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1955 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.162 | |
| Rotating field inductance | $L_D$ | mH | 7.0 | |
| Electrical time constant | $T_{el}$ | ms | 43.0 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.65 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 690 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.5 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 770 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

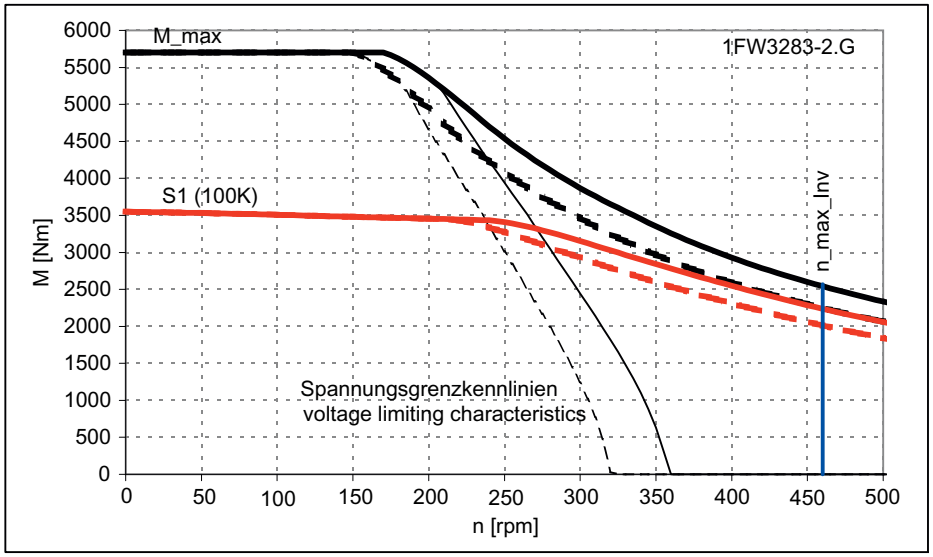



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

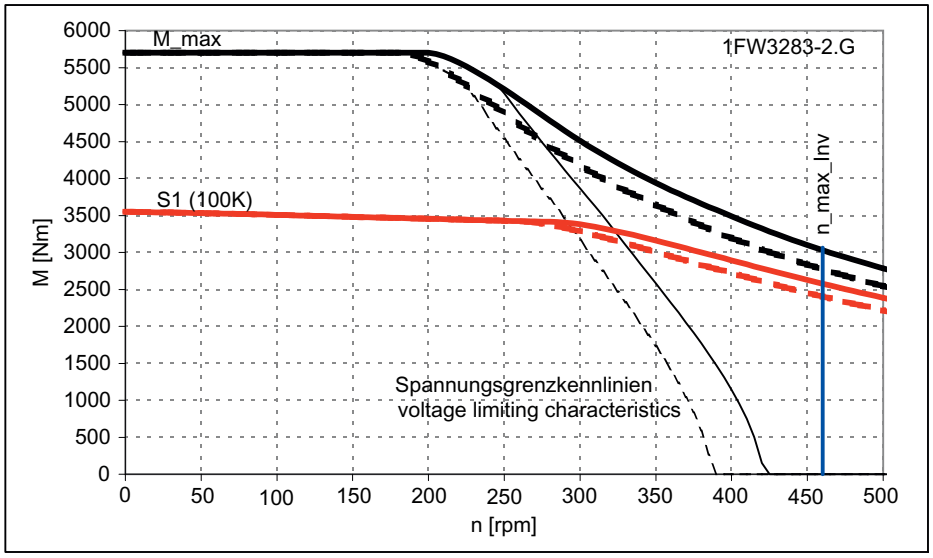
Table 4- 52 1FW3283, rated speed 250 rpm

| Configuration data | Code | Unit | 1FW3283-2□G | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 250 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 3450 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 90 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 176 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 3550 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 181 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 460 | |
| Maximum torque | $M_{max}$ | Nm | 5700 | |
| Maximum current | $I_{max}$ | A | 315 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 19.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1255 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.067 | |
| Rotating field inductance | $L_D$ | mH | 2.9 | |
| Electrical time constant | $T_{el}$ | ms | 43.0 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.65 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 690 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.5 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 770 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

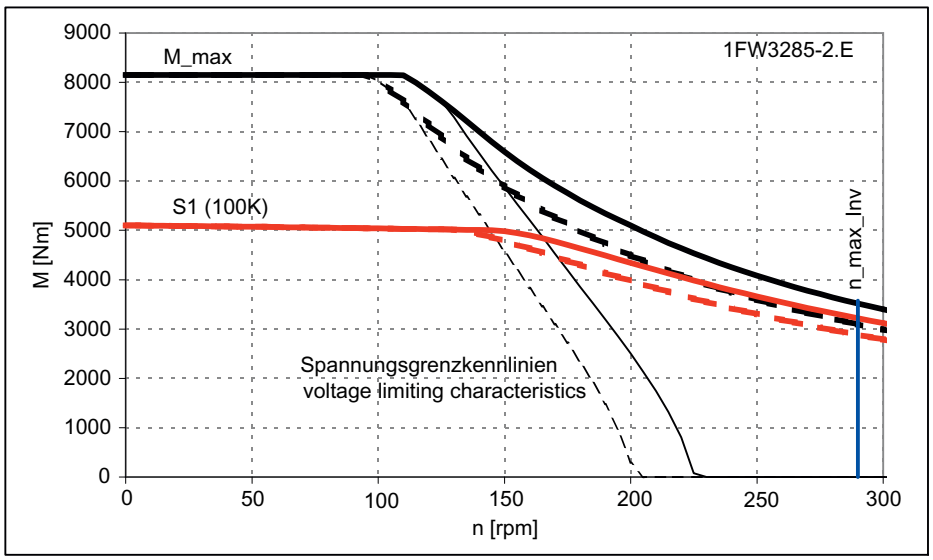



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

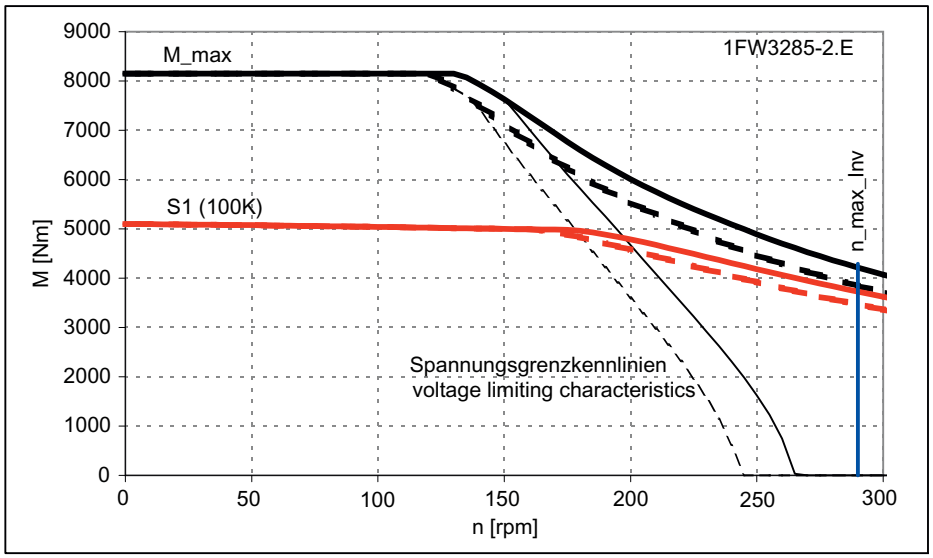
Table 4- 53 1FW3285, rated speed 150 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3285-2□E** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 5000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 79 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 160 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 5100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 163 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 290 | |
| Maximum torque | $M_{max}$ | Nm | 8150 | |
| Maximum current | $I_{max}$ | A | 285 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 31.0 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1995 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.107 | |
| Rotating field inductance | $L_D$ | mH | 5.0 | |
| Electrical time constant | $T_{el}$ | ms | 47.5 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 6.0 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 860 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 5.9 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 920 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

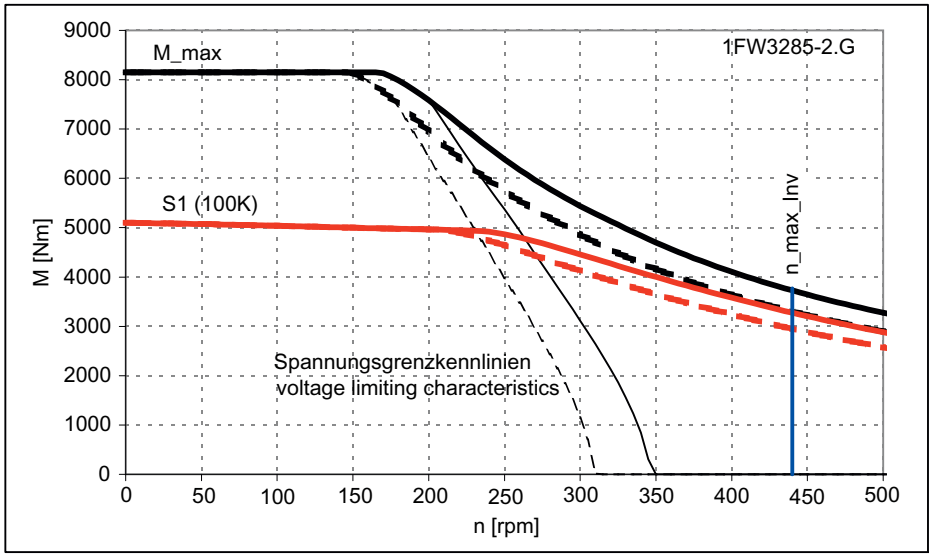



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

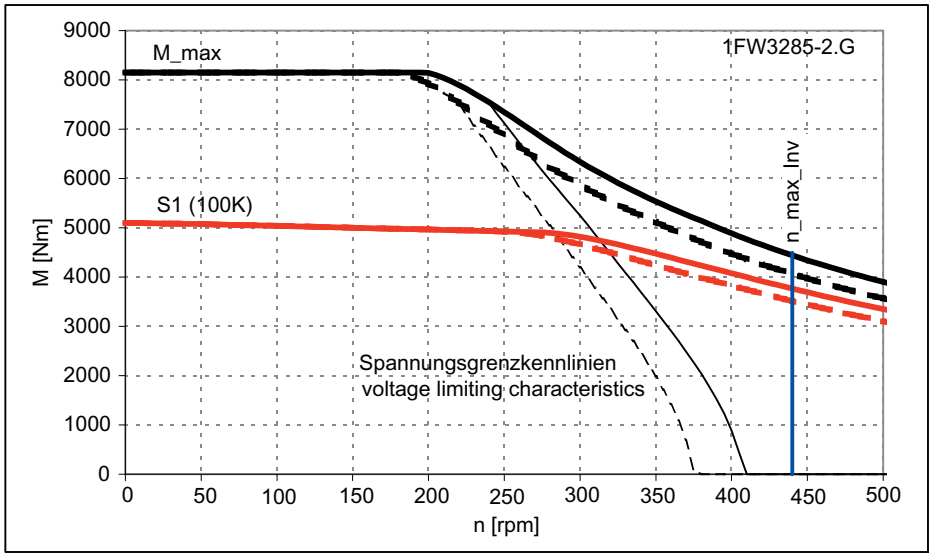
Table 4- 54 1FW3285, rated speed 250 rpm

| Configuration data | Code | Unit | 1FW3285-2□G | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 250 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 4950 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 130 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 245 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 5100 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 250 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 440 | |
| Maximum torque | $M_{max}$ | Nm | 8150 | |
| Maximum current | $I_{max}$ | A | 435 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 20.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1295 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.045 | |
| Rotating field inductance | $L_D$ | mH | 2.2 | |
| Electrical time constant | $T_{el}$ | ms | 47.5 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 6.0 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 860 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 5.9 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 920 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

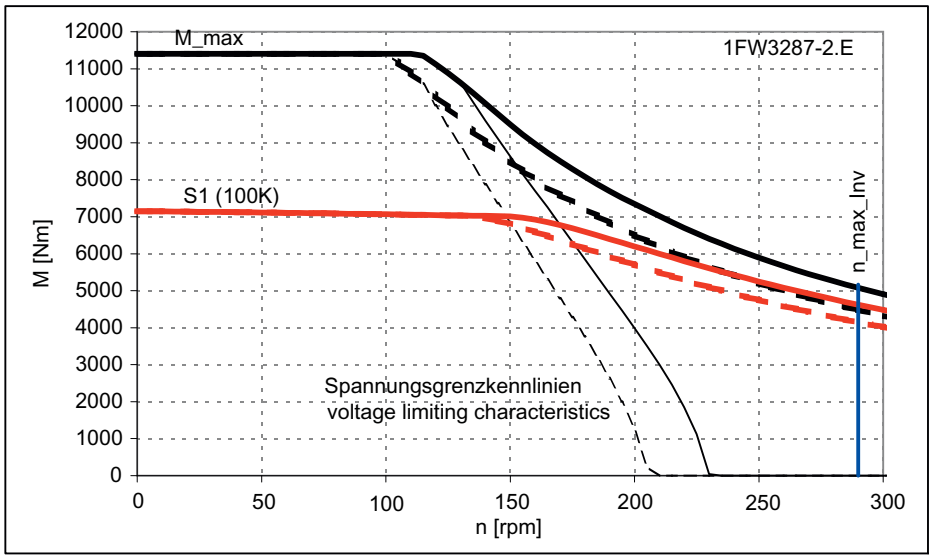



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

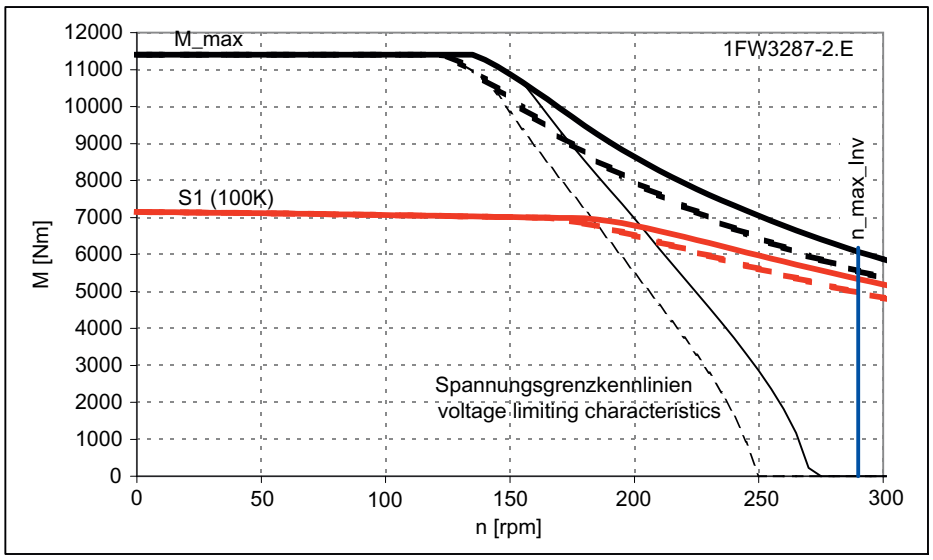
Table 4- 55 1FW3287, rated speed 150 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3287-2□E** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 150 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 7000 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 110 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 230 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 7150 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 235 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 290 | |
| Maximum torque | $M_{max}$ | Nm | 11400 | |
| Maximum current | $I_{max}$ | A | 405 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 30.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1955 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.068 | |
| Rotating field inductance | $L_D$ | mH | 3.5 | |
| Electrical time constant | $T_{el}$ | ms | 51 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1030 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1120 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

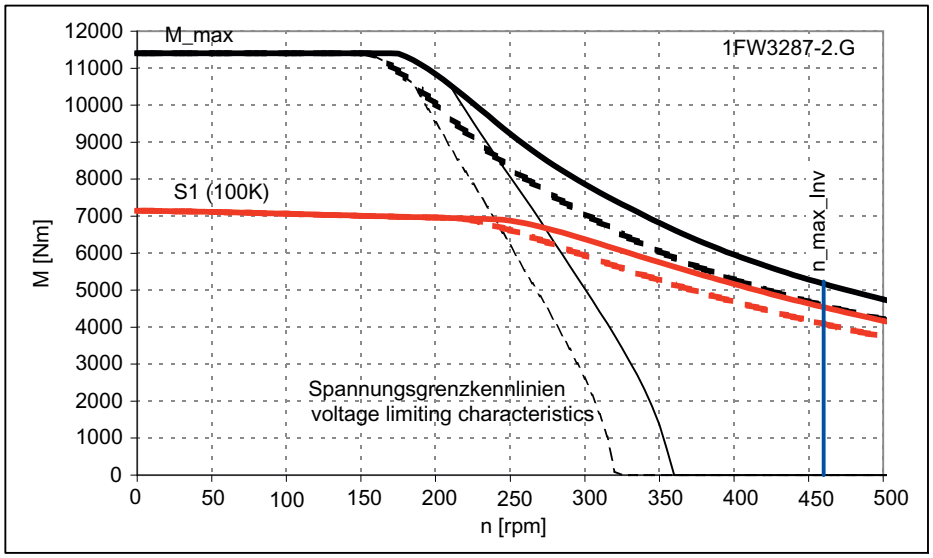



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

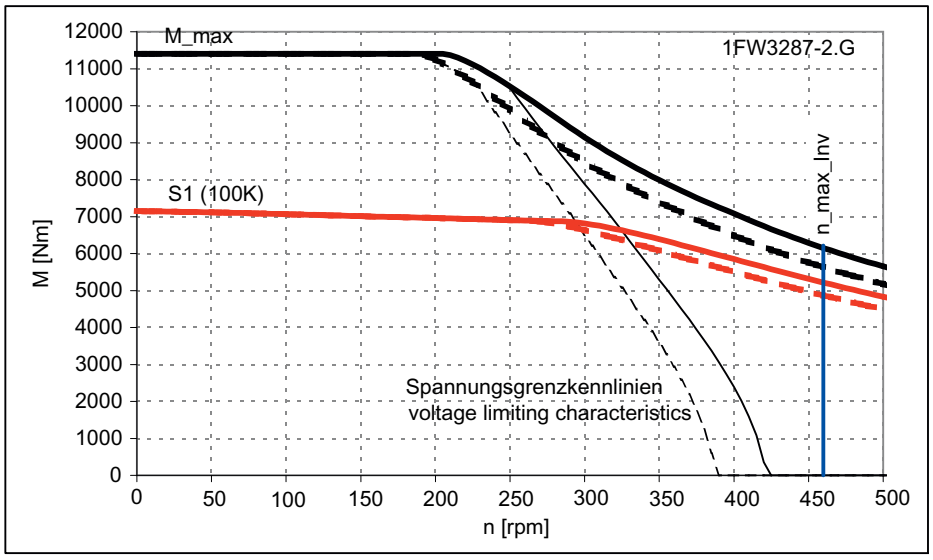
Table 4- 56 1FW3287, rated speed 250 rpm

| Configuration data | Code | Unit | 1FW3287-2□G | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 250 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 6900 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 181 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 350 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 7150 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 365 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 460 | |
| Maximum torque | $M_{max}$ | Nm | 11400 | |
| Maximum current | $I_{max}$ | A | 630 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 19.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 1255 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.028 | |
| Rotating field inductance | $L_D$ | mH | 1.45 | |
| Electrical time constant | $T_{el}$ | ms | 51 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1030 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1120 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)



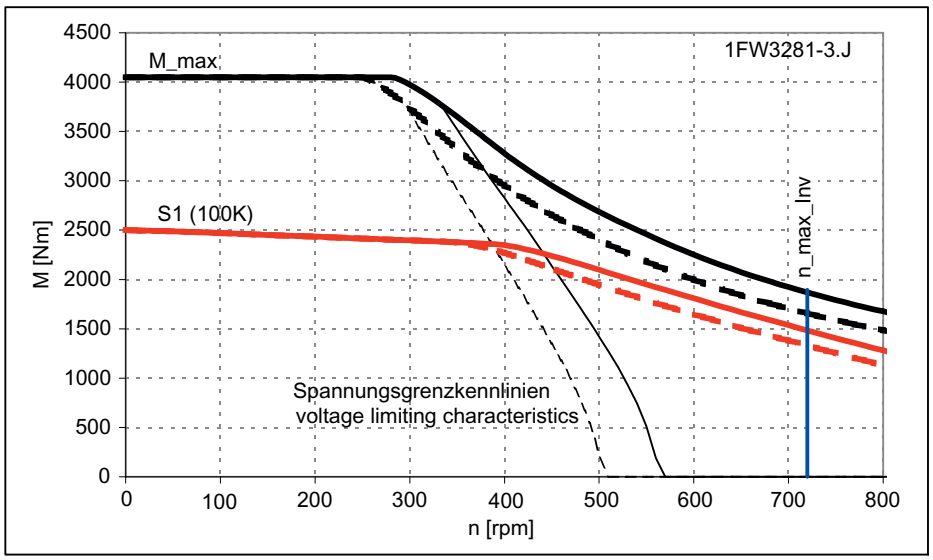

SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

## 4.1.5 Shaft height 280, High Speed

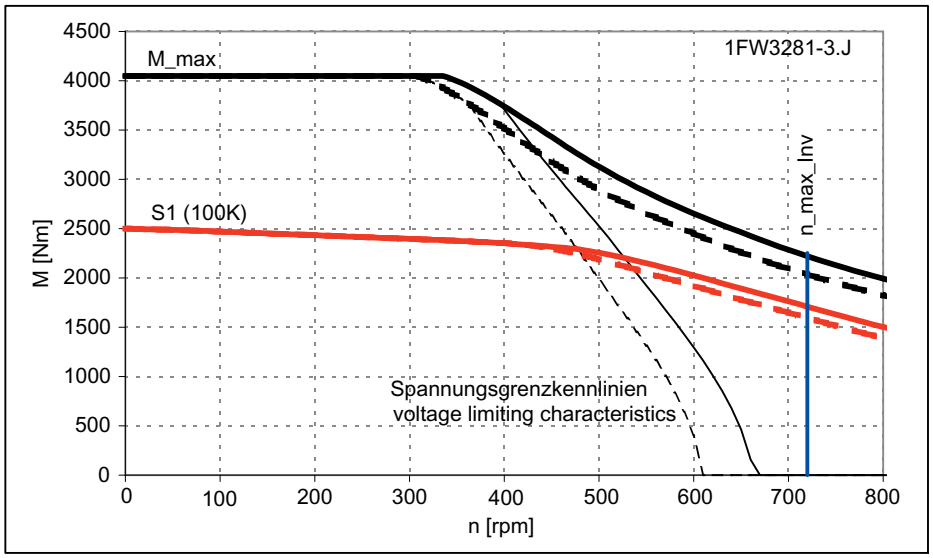
Table 4- 57 1FW3281, rated speed 400 rpm

| Configuration data | Code | Unit | 1FW3281-3□J | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 400 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 2350 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 98 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 188 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 200 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 720 | |
| Maximum torque | $M_{max}$ | Nm | 4050 | |
| Maximum current | $I_{max}$ | A | 350 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 12.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 800 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0425 | |
| Rotating field inductance | $L_D$ | mH | 1.65 | |
| Electrical time constant | $T_{el}$ | ms | 38.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 600 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.6 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 660 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

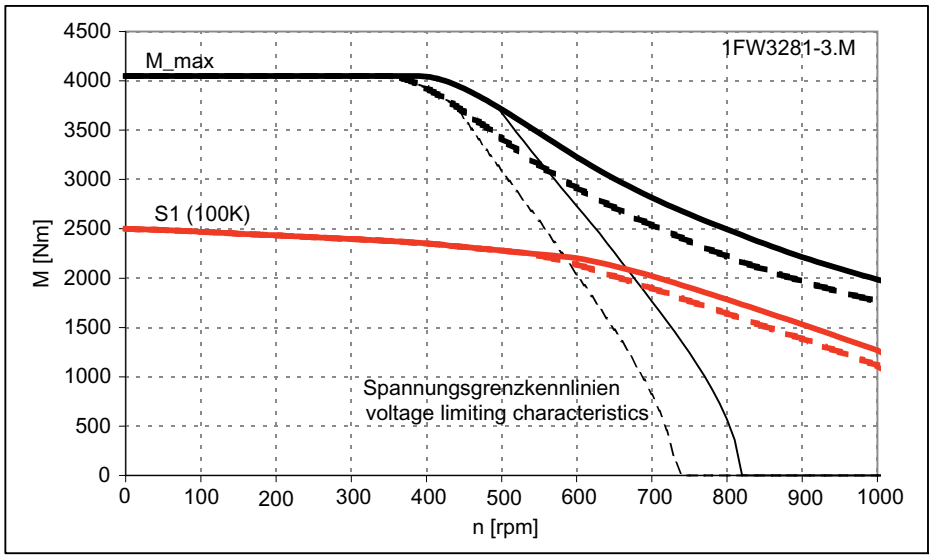



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

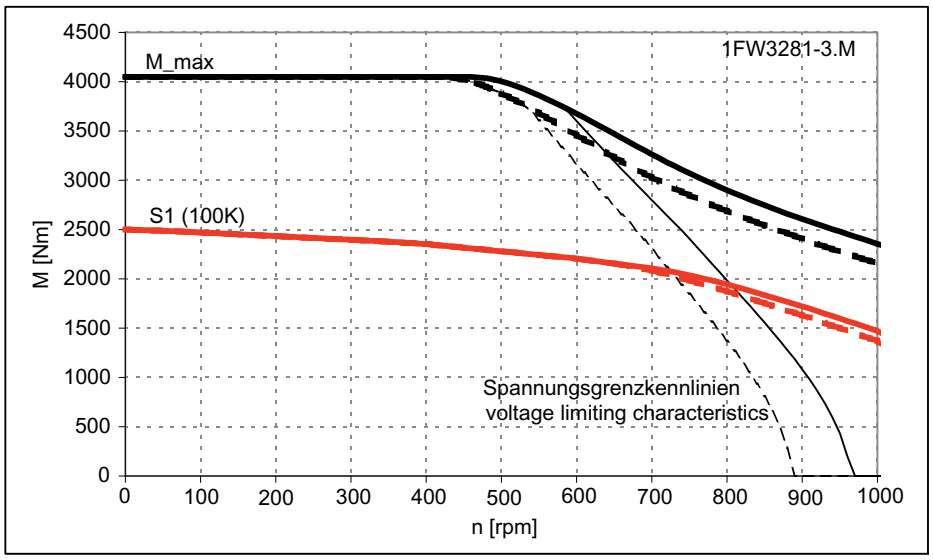
Table 4- 58 1FW3281, rated speed 600 rpm

| **Configuration data** | **Code** | **Unit** | **1FW3281-3□M** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 600 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 2200 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 138 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 255 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 2500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 290 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1050 | |
| Maximum torque | $M_{max}$ | Nm | 4050 | |
| Maximum current | $I_{max}$ | A | 510 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.6 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 550 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.02 | |
| Rotating field inductance | $L_D$ | mH | 0.75 | |
| Electrical time constant | $T_{el}$ | ms | 38.0 | |
| Thermal time constant | $T_{th}$ | min | 10.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.1 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 600 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 3.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 3.6 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.32E+08 | |
| Weight | m | kg | 660 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

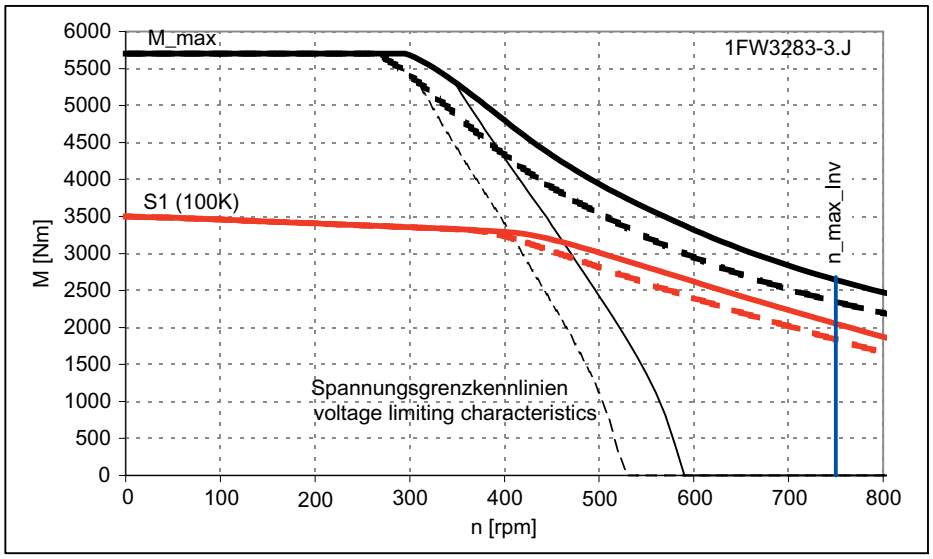



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

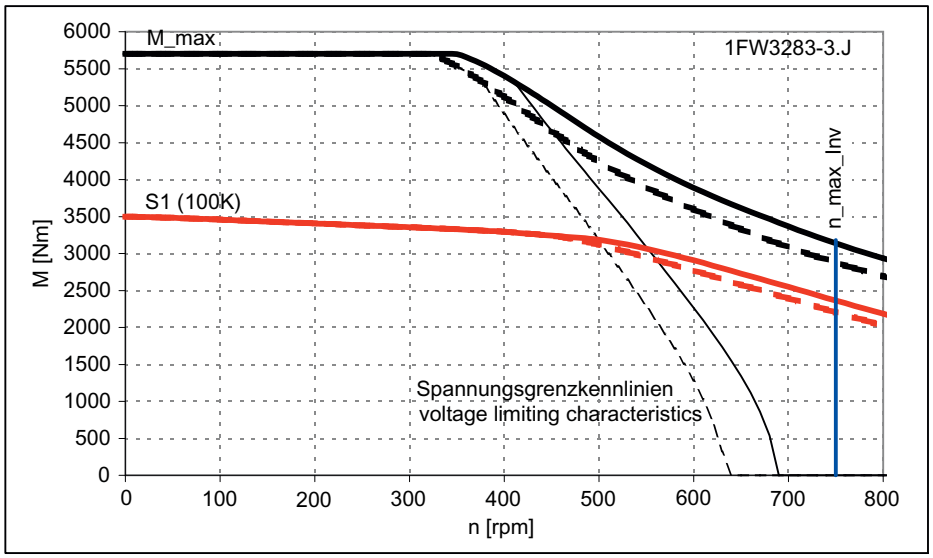
Table 4- 59 1FW3283, rated speed 400 rpm

| Configuration data | Code | Unit | 1FW3283-3□J | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 400 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 3300 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 138 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 275 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 3500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 290 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 750 | |
| Maximum torque | $M_{max}$ | Nm | 5700 | |
| Maximum current | $I_{max}$ | A | 520 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 12.0 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 765 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.025 | |
| Rotating field inductance | $L_D$ | mH | 1.1 | |
| Electrical time constant | $T_{el}$ | ms | 43.0 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.65 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 690 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.5 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 770 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

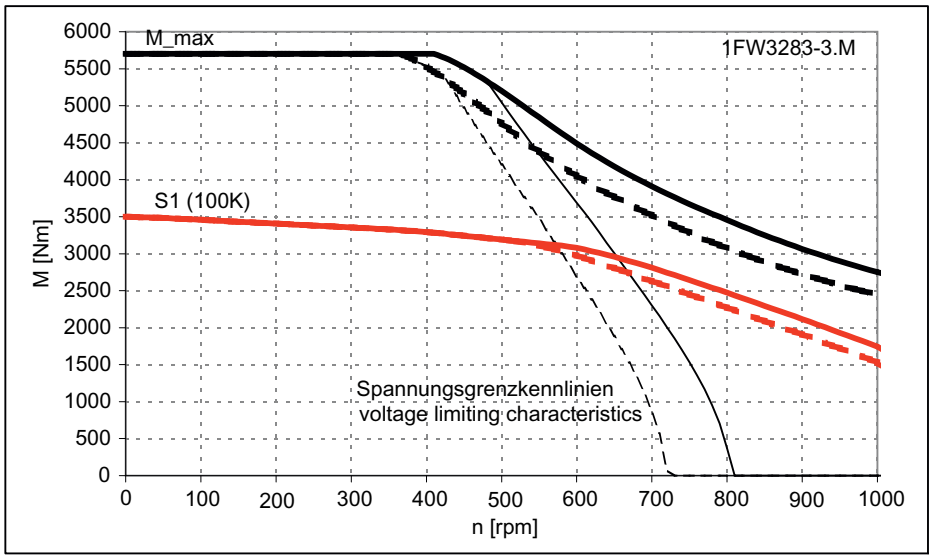



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

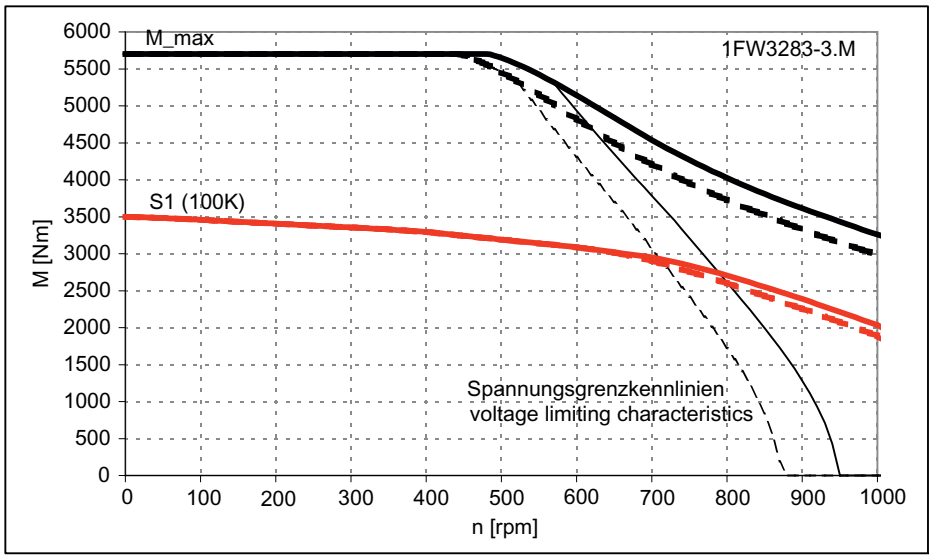
Table 4- 60 1FW3283, rated speed 600 rpm

| Configuration data | Code | Unit | 1FW3283-3□M | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 600 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 3100 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 195 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 355 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 3500 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 400 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1030 | |
| Maximum torque | $M_{max}$ | Nm | 5700 | |
| Maximum current | $I_{max}$ | A | 710 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.7 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 560 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0132 | |
| Rotating field inductance | $L_D$ | mH | 0.55 | |
| Electrical time constant | $T_{el}$ | ms | 43.0 | |
| Thermal time constant | $T_{th}$ | min | 12.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.65 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 690 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.4 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 4.5 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 1.08E+08 | |
| Weight | m | kg | 770 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

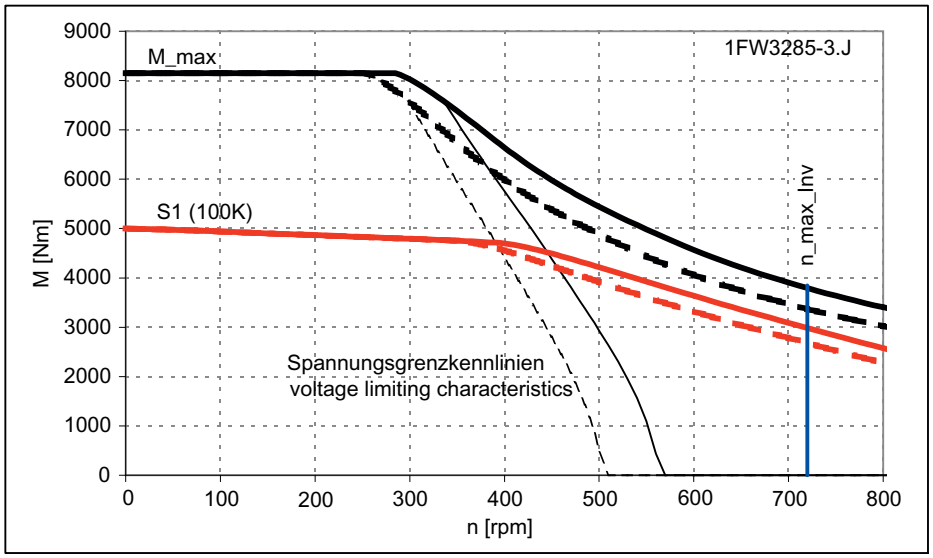



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

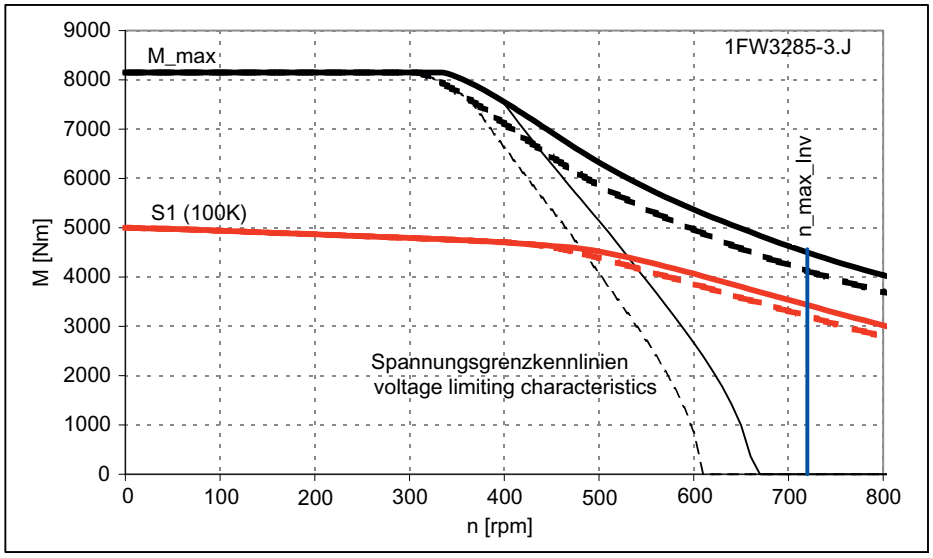
Table 4- 61 1FW3285, rated speed 400 rpm

| Configuration data | Code | Unit | 1FW3285-3□J | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 400 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 4700 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 197 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 375 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 5000 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 400 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 720 | |
| Maximum torque | $M_{max}$ | Nm | 8150 | |
| Maximum current | $I_{max}$ | A | 710 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 12.5 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 800 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0171 | |
| Rotating field inductance | $L_D$ | mH | 0.8 | |
| Electrical time constant | $T_{el}$ | ms | 47.5 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 2.0 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 6.0 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 860 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 5.9 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 920 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

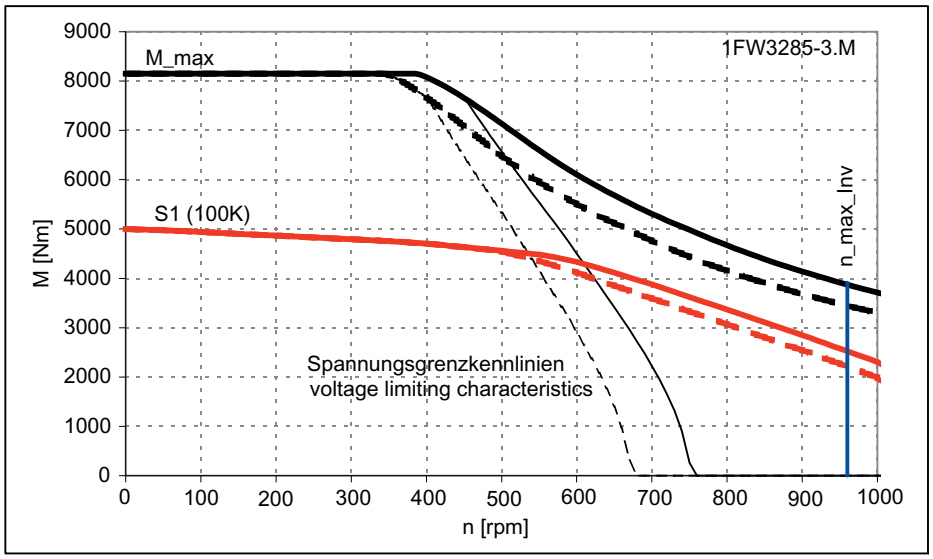



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

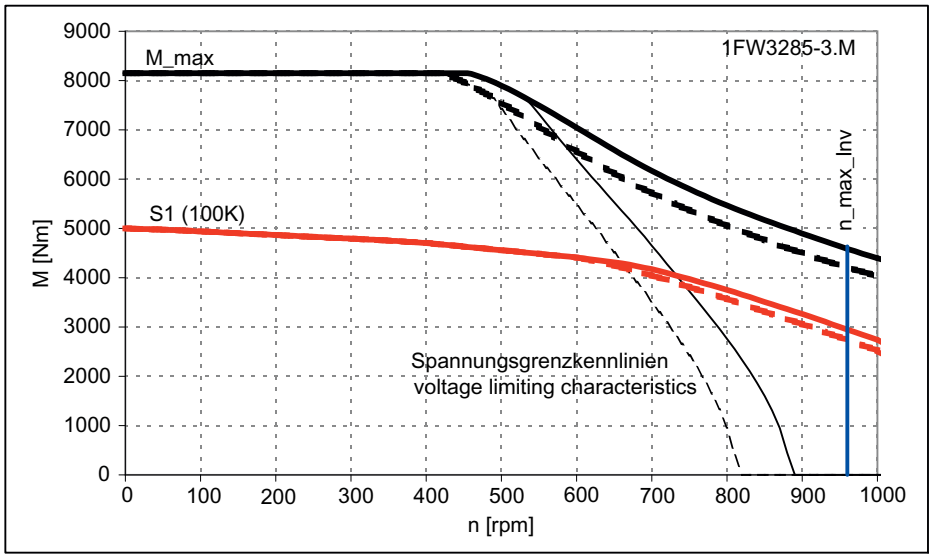
Table 4- 62 1FW3285, rated speed 600 rpm

| Configuration data | Code | Unit | 1FW3285-3□M | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 600 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 4400 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 275 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 470 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 5000 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 530 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 960 | |
| Maximum torque | $M_{max}$ | Nm | 8150 | |
| Maximum current | $I_{max}$ | A | 940 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 9.4 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 600 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0096 | |
| Rotating field inductance | $L_D$ | mH | 0.46 | |
| Electrical time constant | $T_{el}$ | ms | 47.5 | |
| Thermal time constant | $T_{th}$ | min | 14.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 6.0 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 860 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.9 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 5.9 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 8.47E+07 | |
| Weight | m | kg | 920 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

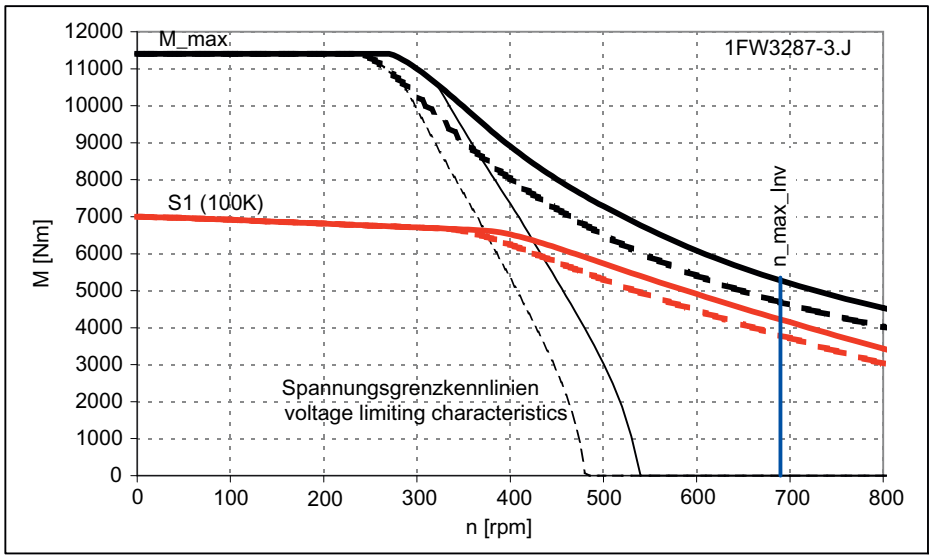



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

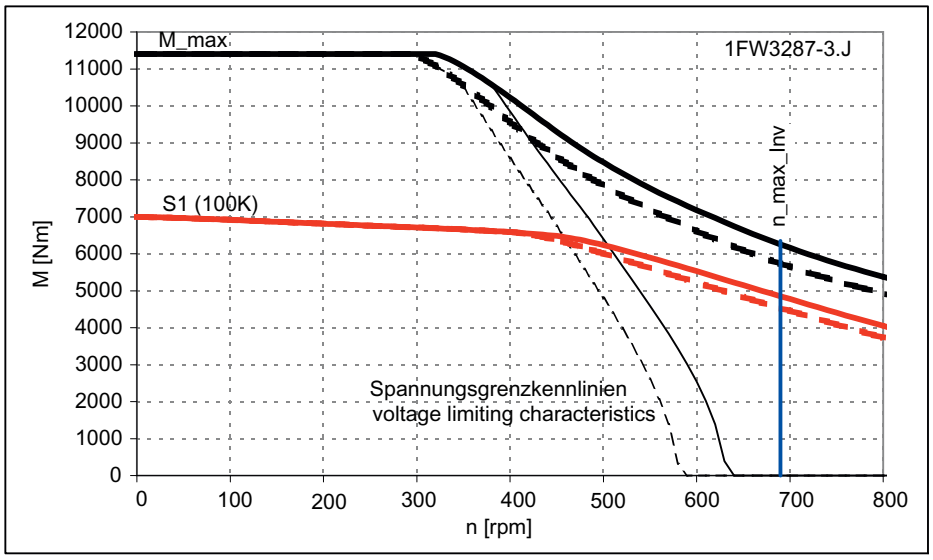
Table 4- 63 1FW3287, rated speed 400 rpm

| Configuration data | Code | Unit | 1FW3287-3□J | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 400 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 6600 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 275 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 500 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 7000 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 530 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 690 | |
| Maximum torque | $M_{max}$ | Nm | 11400 | |
| Maximum current | $I_{max}$ | A | 950 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 13.1 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 835 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0125 | |
| Rotating field inductance | $L_D$ | mH | 0.65 | |
| Electrical time constant | $T_{el}$ | ms | 51 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1030 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1120 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)
SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)

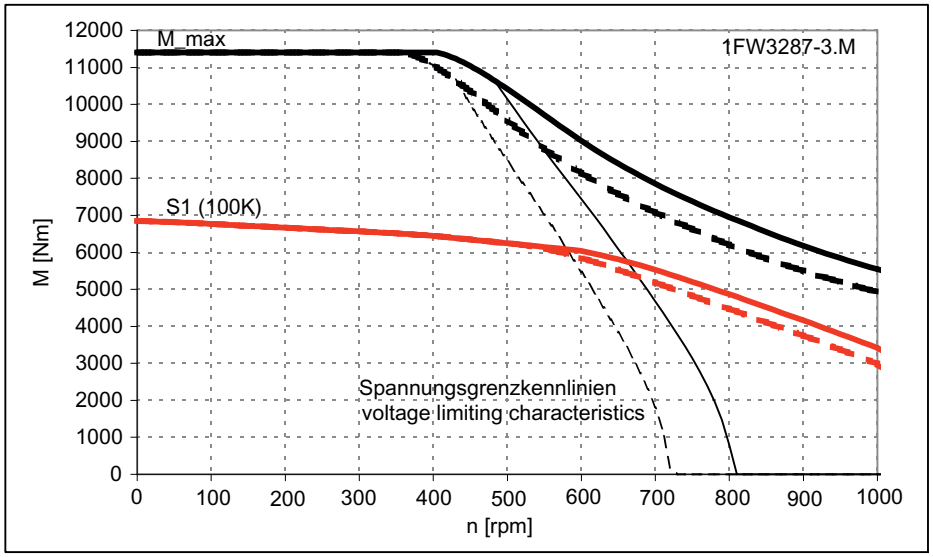



SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)
SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

Table 4- 64 1FW3287, rated speed 600 rpm

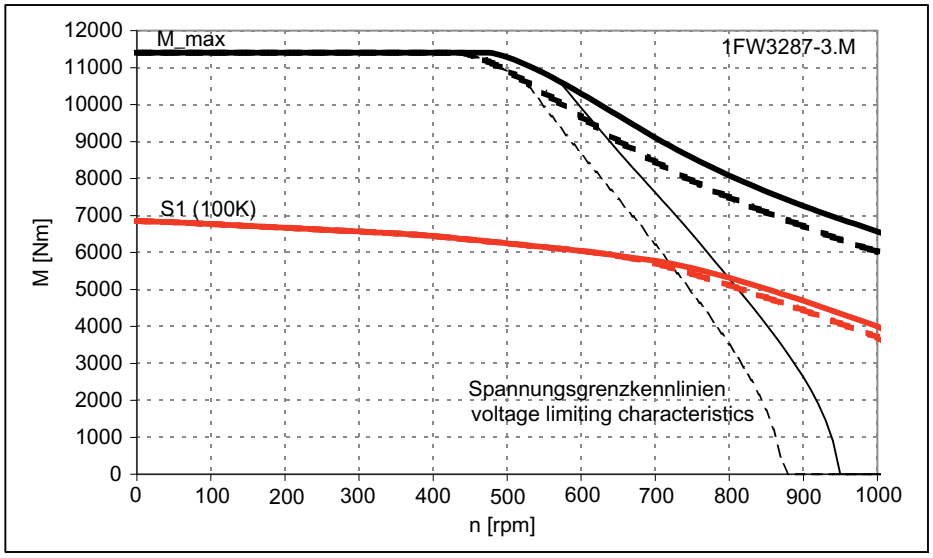
| **Configuration data** | **Code** | **Unit** | **1FW3287-3□M** | |
|---|---|---|---|---|
| Rated speed | $n_N$ | rpm | 600 | |
| Rated torque (100 K) | $M_{N\ (100\ K)}$ | Nm | 6050 | |
| Rated power (100 K) | $P_{N\ (100\ K)}$ | kW | 380 | |
| Rated current (100 K) | $I_{N\ (100\ K)}$ | A | 700 | |
| Static torque (100 K) | $M_{0\ (100\ K)}$ | Nm | 6850 | |
| Stall current (100 K) | $I_{0\ (100\ K)}$ | A | 790 | |
| **Limiting data** | | | | |
| Max. permissible speed (mech.) | $n_{max\ mech.}$ | rpm | 1000 | |
| Max. permissible speed (converter) | $n_{max\ 830\ V}$ | rpm | 1030 | |
| Maximum torque | $M_{max}$ | Nm | 11400 | |
| Maximum current | $I_{max}$ | A | 1420 | |
| **Motor data** | | | | |
| Number of poles | 2p | | 20 | |
| Ratio of speed measurement (belt-mounted encoder) | $i_{enc}$ | -- | -5 | |
| Torque constant (100 K) | $k_{T(100\ K)}$ | Nm/A | 8.7 | |
| Voltage constant (at 20 °C) | $k_E$ | V/1000 rpm | 560 | |
| Winding resistance (at 20 °C) | $R_{ph}$ | Ω | 0.0055 | |
| Rotating field inductance | $L_D$ | mH | 0.29 | |
| Electrical time constant | $T_{el}$ | ms | 51 | |
| Thermal time constant | $T_{th}$ | min | 16.0 | |
| **Mechanical data: Hollow-shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.8 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1030 | |
| **Mechanical data: Plug-on shaft version** | | | | |
| Mechanical time constant | $T_{mech}$ | ms | 1.7 | |
| Moment of inertia | $J_{mot}$ | $kgm^2$ | 7.7 | |
| Shaft torsional stiffness | $c_t$ | Nm/rad | 6.58E+07 | |
| Weight | m | kg | 1120 | |

The specified rated data are valid for a 600 V DC link voltage




SINAMICS ALM 400 V-Netz (Zwischenkreisspannung 600 V DC)
SINAMICS ALM 400 V line (DC-link voltage 600 V)

SINAMICS BLM/SLM 400 V-Netz (Zwischenkreisspannung 540 V DC)
SINAMICS BLM/SLM 400 V line (DC-link voltage 540 V)




SINAMICS ALM 480 V-Netz (Zwischenkreisspannung 720 V DC)
SINAMICS ALM 480 V line (DC-link voltage 720 V)

SINAMICS BLM/SLM 480 V-Netz (Zwischenkreisspannung 650 V DC)
SINAMICS BLM/SLM 480 V line (DC-link voltage 650 V)

## 4.2 Dimension drawings

### CAD CREATOR

Thanks to its easy to understand interface, the CAD CREATOR allows you to find the following quickly

- dimension drawings
- 2D/3D CAD data

and supports you when generating plant/system documentation regarding project-specific information. The data for motors, drives and CNC controls is currently available in the online version.

You can find further information on the Internet at: http://www.siemens.com/cadcreator

**Motors**

- 1FK7, 1FT7, 1FT6 synchronous motors
- 1FE1 built-in synchronous motors
- 1FW3 complete torque motors
- 1FW6 built-in torque motors
- 1FK7, 1FT7, 1FT6 geared motors
- 1PH8 synchronous/induction motors
- 1PH7, 1PH4, 1PL6, 1PM4, 1PM6 induction motors
- 2SP1 motor spindles
- 1FN3 linear motors

**SINAMICS S120**

- Control Units
- Power Modules (blocksize, chassis)
- Line Modules (booksize, chassis)
- Line-side components
- Motor Modules (booksize, chassis)
- DC link components
- Additional system components
- Load-side power components
- Encoder system connection
- MOTION-CONNECT connection system

**SIMOTION**

- SIMOTION D
- SIMOTION C

**SINUMERIK solution line**

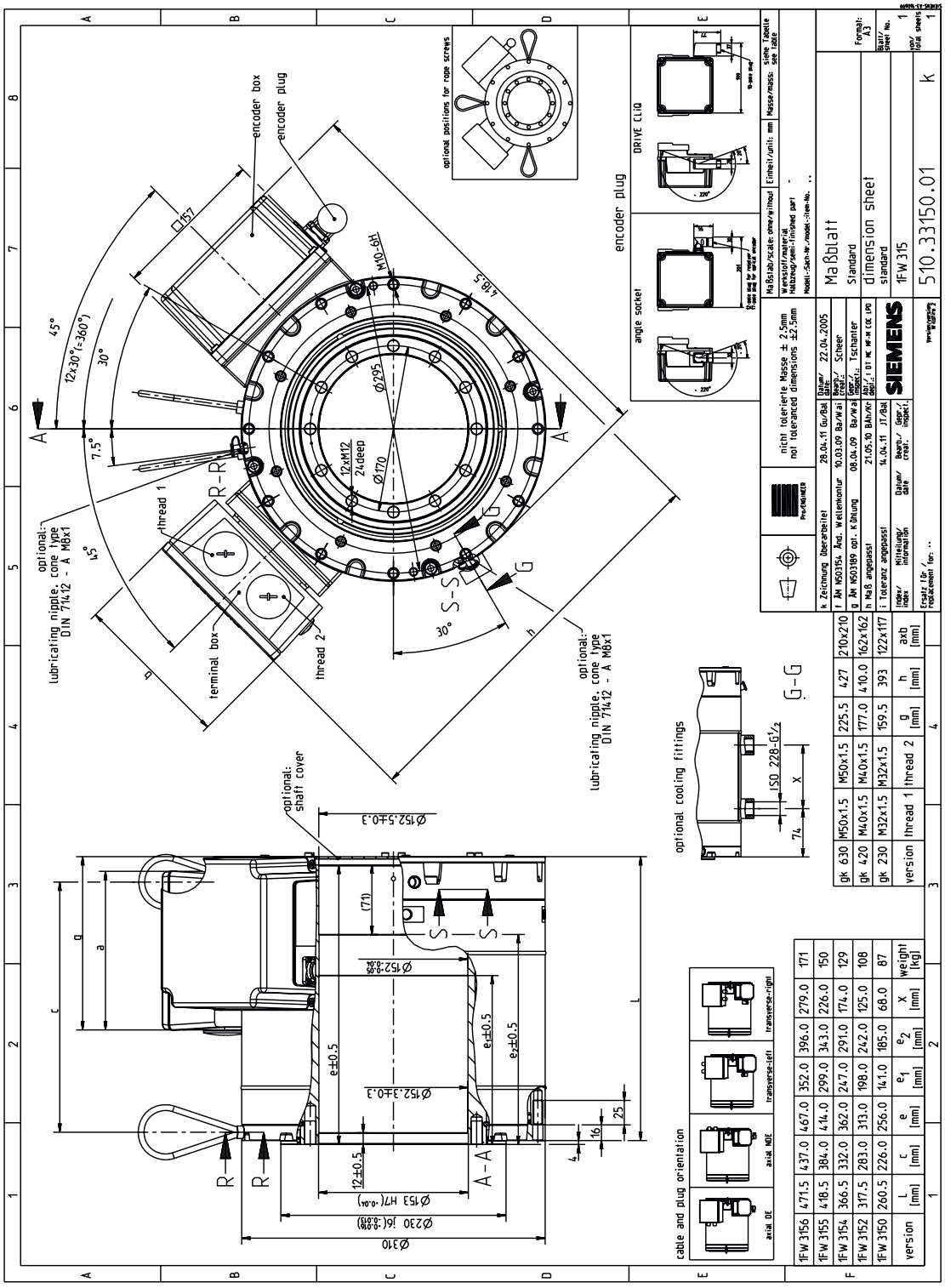
- Control systems
- Operator components for CNC controls

## How up-to-date are the dimension drawings

**Note**

Siemens AG reserves the right to change the dimensions of the motors as part of mechanical design improvements without prior notice. This means that dimensions drawings can go out-of-date. Up-to-date dimension drawings can be requested at no charge from your local SIEMENS representative.

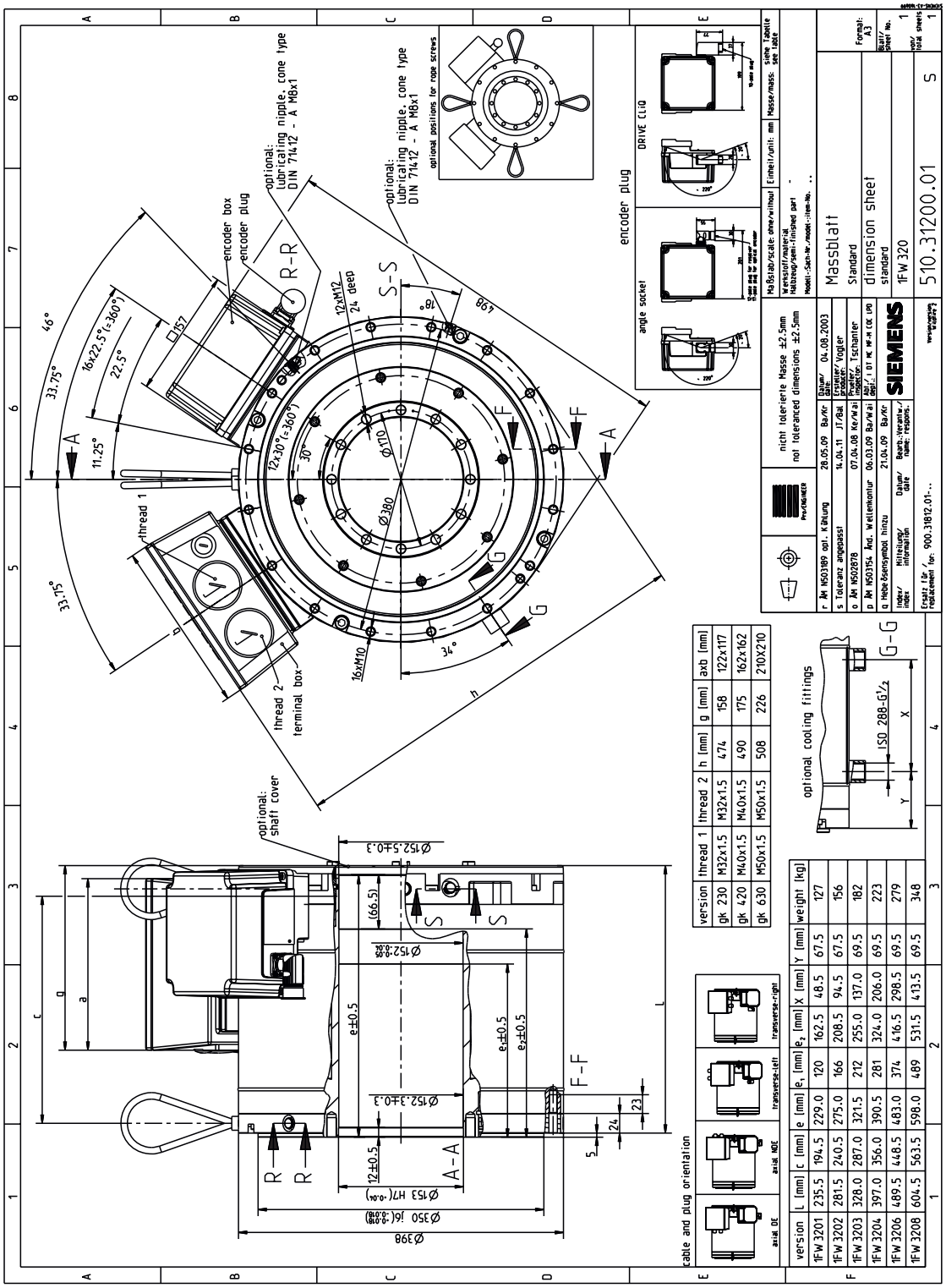
## 4.2.1 Hollow shaft




| version | L [mm] | c [mm] | e [mm] | $e_1$ [mm] | $e_2$ [mm] | X [mm] | weight [kg] |
|---|---|---|---|---|---|---|---|
| 1FW 3156 | 471.5 | 437.0 | 467.0 | 352.0 | 396.0 | 279.0 | 171 |
| 1FW 3155 | 418.5 | 384.0 | 414.0 | 299.0 | 343.0 | 226.0 | 150 |
| 1FW 3154 | 366.5 | 332.0 | 362.0 | 247.0 | 291.0 | 174.0 | 129 |
| 1FW 3152 | 317.5 | 283.0 | 313.0 | 198.0 | 242.0 | 125.0 | 108 |
| 1FW 3150 | 260.5 | 226.0 | 256.0 | 141.0 | 185.0 | 68.0 | 87 |

| version | thread 1 | thread 2 | g [mm] | h [mm] | axb [mm] |
|---|---|---|---|---|---|
| gk 630 | M50x1.5 | M50x1.5 | 225.5 | 427 | 210x210 |
| gk 420 | M40x1.5 | M40x1.5 | 177.0 | 410.0 | 162x162 |
| gk 230 | M32x1.5 | M32x1.5 | 159.5 | 393 | 122x117 |

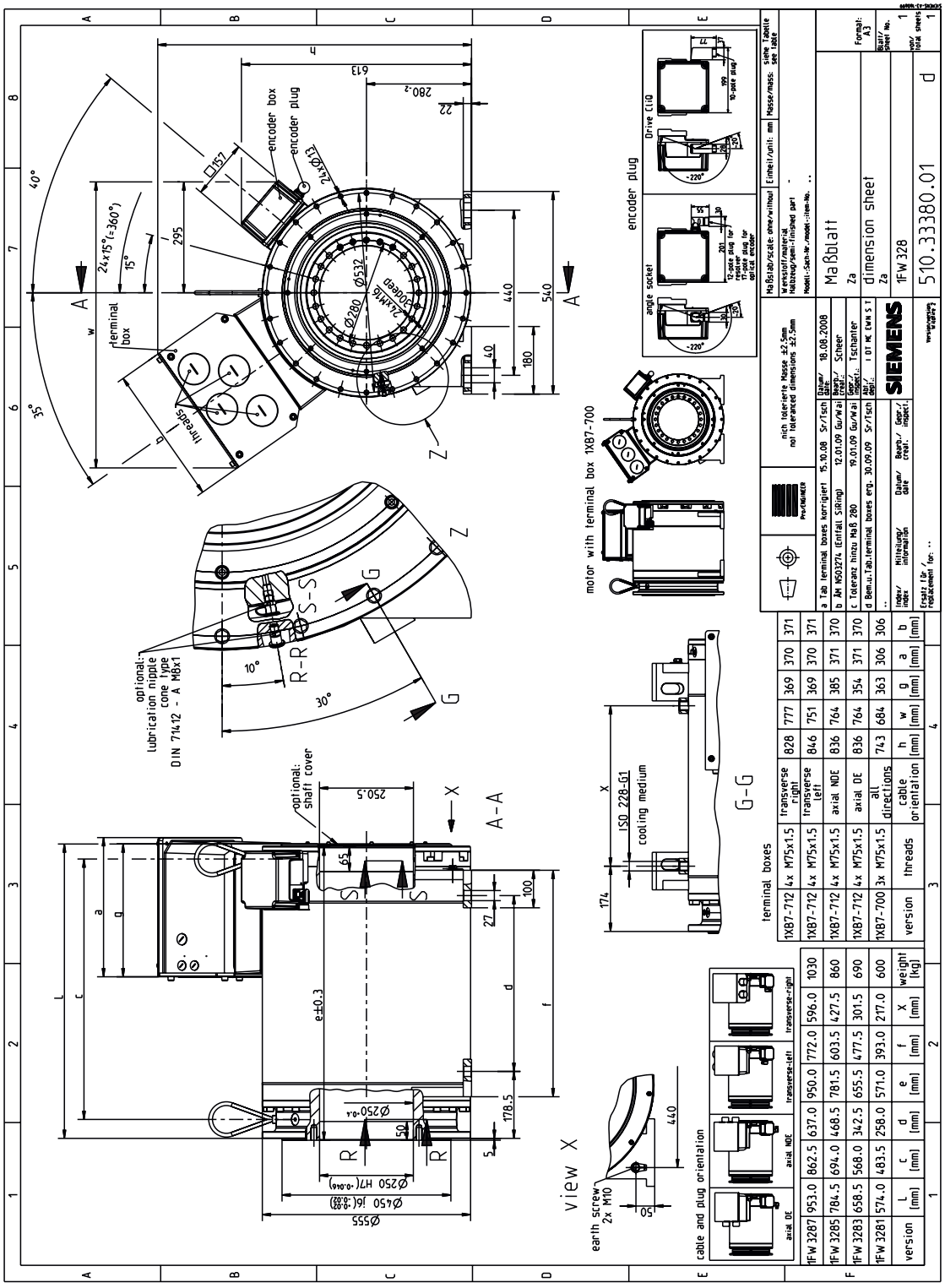
Figure 4-2 1FW315x hollow shaft




| version | thread 1 | thread 2 | h [mm] | g [mm] | axb [mm] |
|---|---|---|---|---|---|
| qk 230 | M32x1.5 | M32x1.5 | 474 | 158 | 122x117 |
| qk 420 | M40x1.5 | M40x1.5 | 490 | 175 | 162x162 |
| qk 630 | M50x1.5 | M50x1.5 | 508 | 226 | 210X210 |

| version | L [mm] | c [mm] | e [mm] | $e_1$ [mm] | $e_2$ [mm] | X [mm] | Y [mm] | weight [kg] |
|---|---|---|---|---|---|---|---|---|
| 1FW 3201 | 235.5 | 194.5 | 229.0 | 120 | 162.5 | 48.5 | 67.5 | 127 |
| 1FW 3202 | 281.5 | 240.5 | 275.0 | 166 | 208.5 | 94.5 | 67.5 | 156 |
| 1FW 3203 | 328.0 | 287.0 | 321.5 | 212 | 255.0 | 137.0 | 69.5 | 182 |
| 1FW 3204 | 397.0 | 356.0 | 390.5 | 281 | 324.0 | 206.0 | 69.5 | 223 |
| 1FW 3206 | 489.5 | 448.5 | 483.0 | 374 | 416.5 | 298.5 | 69.5 | 279 |
| 1FW 3208 | 604.5 | 563.5 | 598.0 | 489 | 531.5 | 413.5 | 69.5 | 348 |

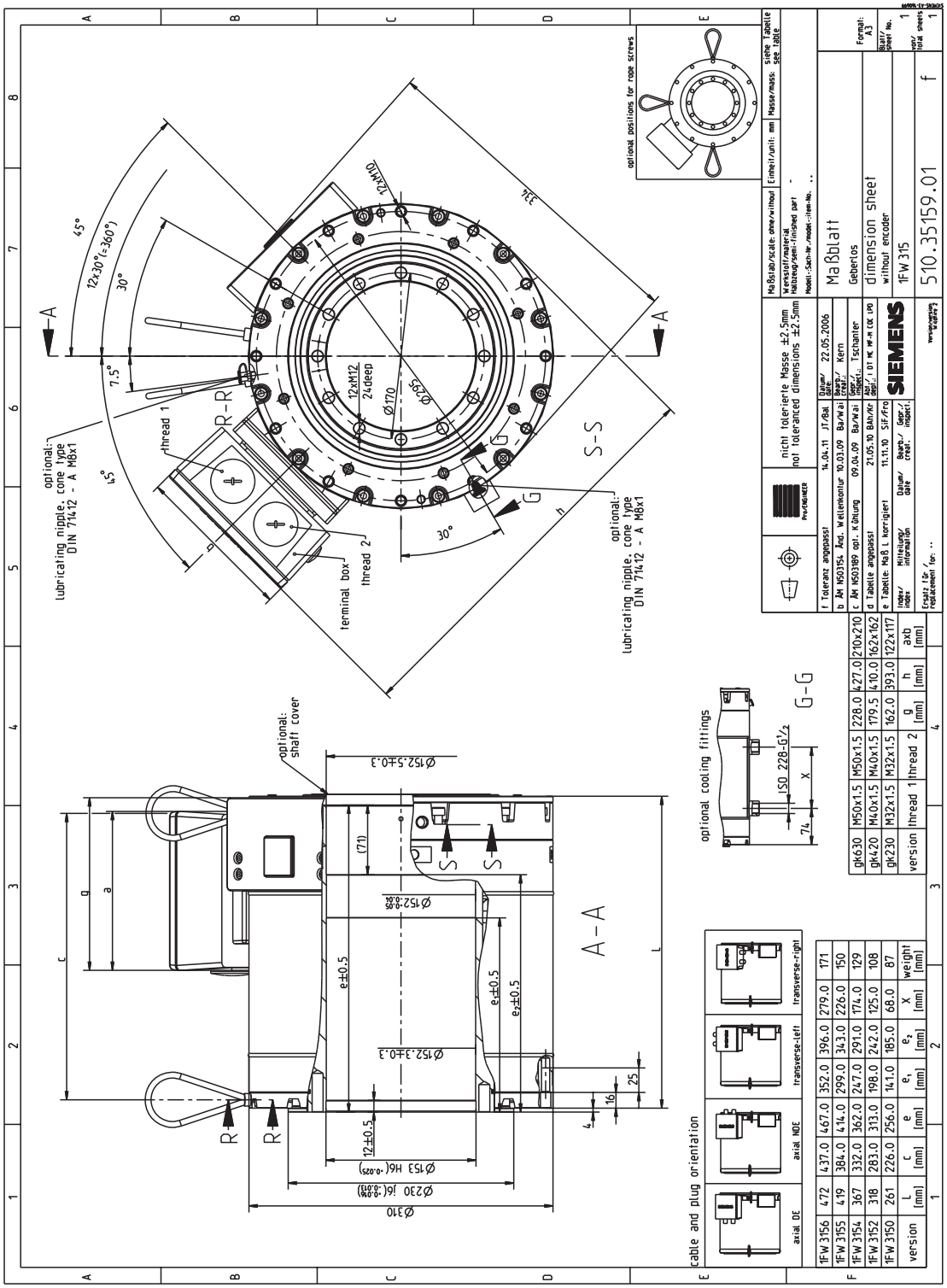
Figure 4-3 1FW320x, hollow shaft




| version | L [mm] | c [mm] | d [mm] | e [mm] | f [mm] | X [mm] | weight [kg] |
|---|---|---|---|---|---|---|---|
| 1FW3287 | 953.0 | 862.5 | 637.0 | 950.0 | 772.0 | 596.0 | 1030 |
| 1FW3285 | 784.5 | 694.0 | 468.5 | 781.5 | 603.5 | 427.5 | 860 |
| 1FW3283 | 658.5 | 568.0 | 342.5 | 655.5 | 477.5 | 301.5 | 690 |
| 1FW3281 | 574.0 | 483.5 | 258.0 | 571.0 | 393.0 | 217.0 | 600 |

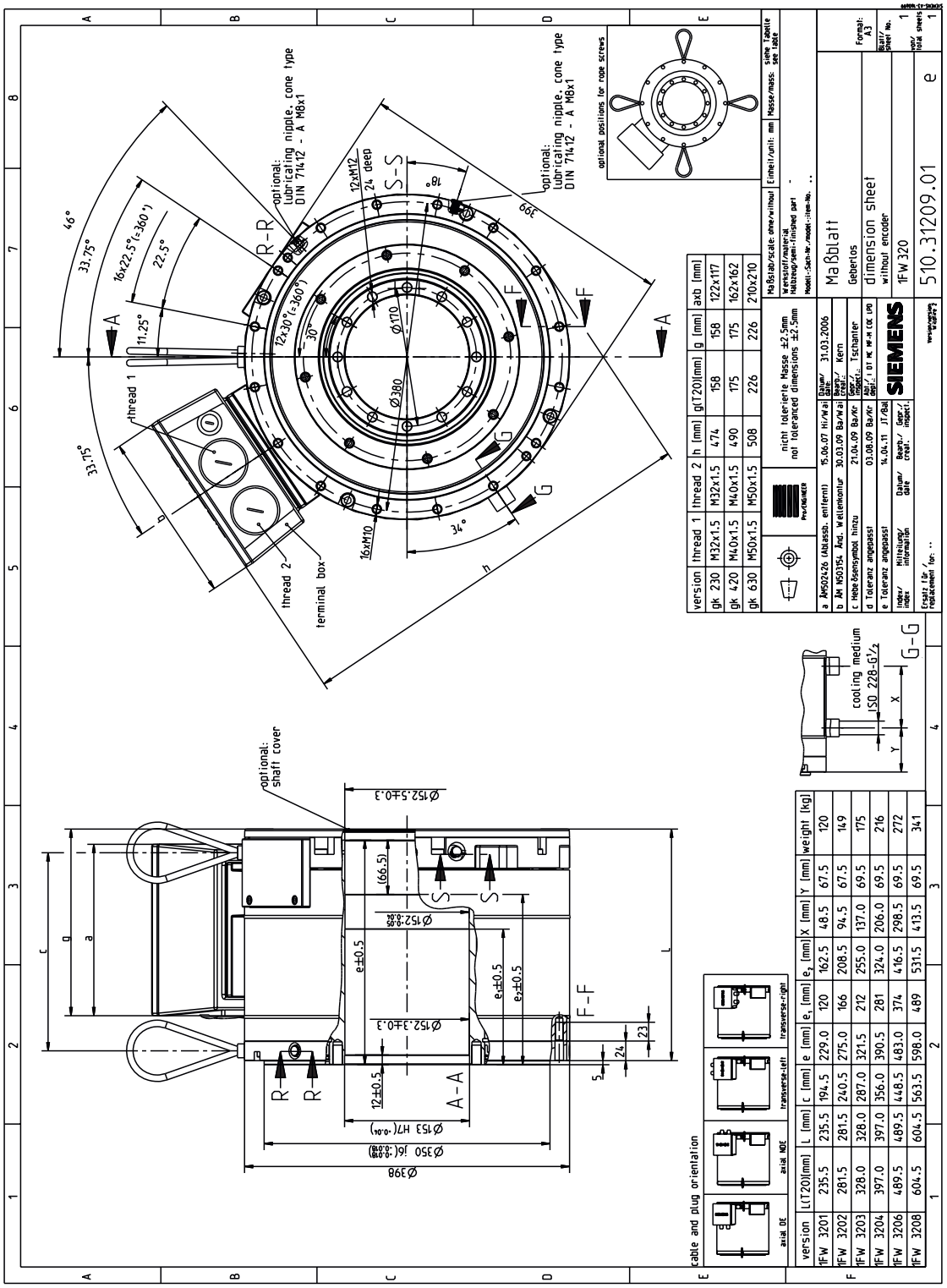
| version | threads | cable orientation | h [mm] | w [mm] | g [mm] | a [mm] | b [mm] |
|---|---|---|---|---|---|---|---|
| 1XB7-712 | 4x M75x1.5 | transverse right | 828 | 777 | 369 | 370 | 371 |
| 1XB7-712 | 4x M75x1.5 | transverse left | 846 | 751 | 369 | 370 | 371 |
| 1XB7-712 | 4x M75x1.5 | axial NDE | 836 | 764 | 385 | 371 | 370 |
| 1XB7-712 | 4x M75x1.5 | axial DE | 836 | 764 | 354 | 371 | 370 |
| 1XB7-700 | 3x M75x1.5 | all directions | 743 | 684 | 363 | 306 | 306 |

## 4.2.2 Encoderless




| version | L (mm) | c (mm) | e (mm) | $e_1$ (mm) | $e_2$ (mm) | X (mm) | weight (mm) |
|---|---|---|---|---|---|---|---|
| 1FW3156 | 472 | 437.0 | 467.0 | 352.0 | 396.0 | 279.0 | 171 |
| 1FW3155 | 419 | 384.0 | 414.0 | 299.0 | 343.0 | 226.0 | 150 |
| 1FW3154 | 367 | 332.0 | 362.0 | 247.0 | 291.0 | 174.0 | 129 |
| 1FW3152 | 318 | 283.0 | 313.0 | 198.0 | 242.0 | 125.0 | 108 |
| 1FW3150 | 261 | 226.0 | 256.0 | 141.0 | 185.0 | 68.0 | 87 |

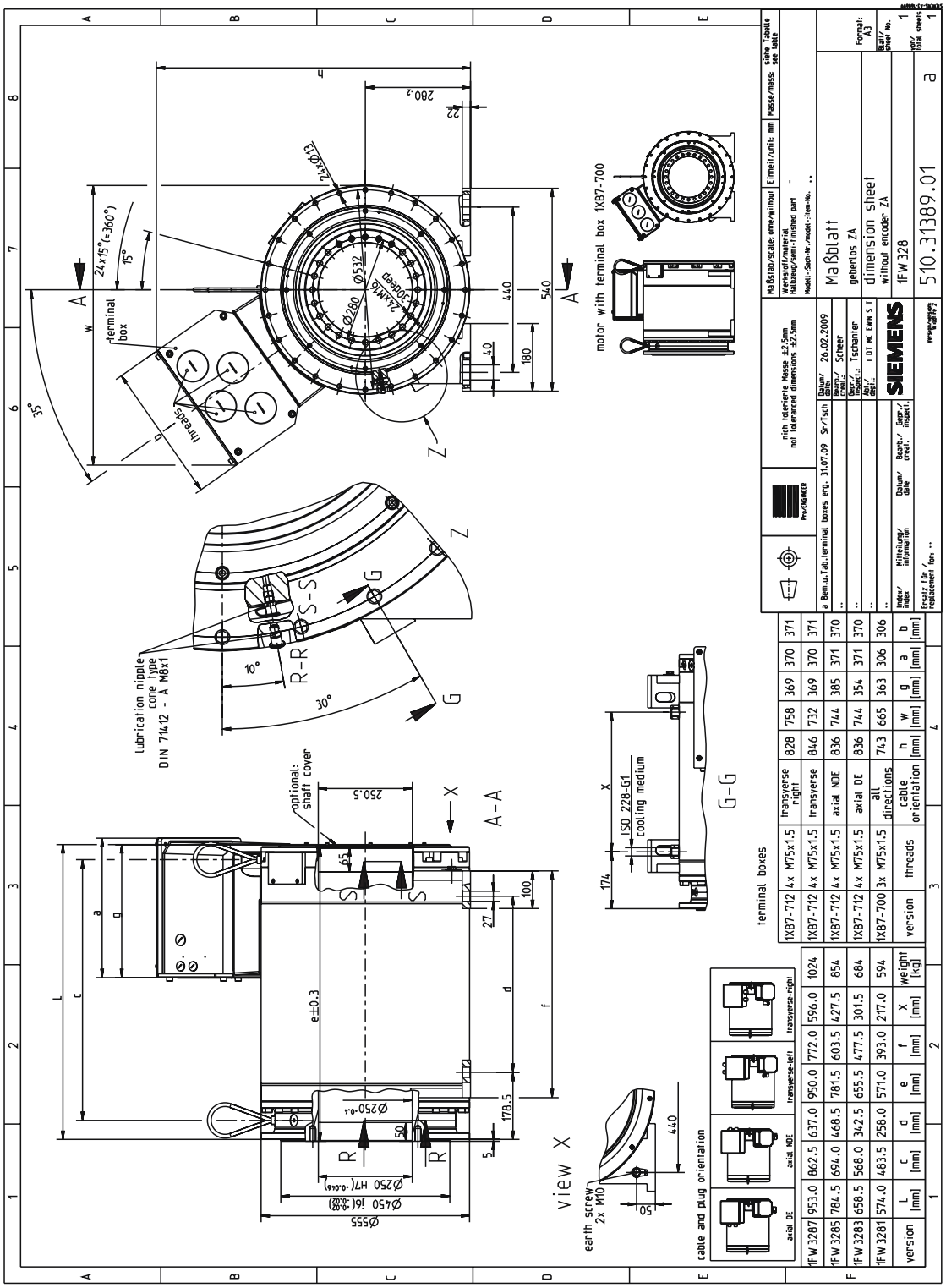
| version thread 1 | thread 2 | g (mm) | h (mm) | axb (mm) |
|---|---|---|---|---|
| gk630 | M50x1.5 | M50x1.5 | 228.0 | k27.0 | 210x210 |
| gk420 | M40x1.5 | M40x1.5 | 179.5 | 410.0 | 162x162 |
| gk230 | M32x1.5 | M32x1.5 | 162.0 | 393.0 | 122x117 |




| version | thread 1 | thread 2 | h [mm] | gT120[mm] | g [mm] | axb [mm] |
|---|---|---|---|---|---|---|
| gk 230 | M32x1.5 | M32x1.5 | 474 | 158 | 158 | 122x117 |
| gk 420 | M40x1.5 | M40x1.5 | 490 | 175 | 175 | 162x162 |
| gk 630 | M50x1.5 | M50x1.5 | 508 | 226 | 226 | 210x210 |

| version | L (LT120)[mm] | L [mm] | c [mm] | e [mm] | e1 [mm] | e2 [mm] | X [mm] | Y [mm] | weight [kg] |
|---|---|---|---|---|---|---|---|---|---|
| 1FW 3201 | 235.5 | 235.5 | 194.5 | 229.0 | 120 | 162.5 | 48.5 | 67.5 | 120 |
| 1FW 3202 | 281.5 | 281.5 | 240.5 | 275.0 | 166 | 208.5 | 94.5 | 67.5 | 149 |
| 1FW 3203 | 328.0 | 328.0 | 287.0 | 321.5 | 212 | 255.0 | 137.0 | 69.5 | 175 |
| 1FW 3204 | 397.0 | 397.0 | 356.0 | 390.5 | 281 | 324.0 | 206.0 | 69.5 | 216 |
| 1FW 3206 | 489.5 | 489.5 | 448.5 | 483.0 | 374 | 416.5 | 298.5 | 69.5 | 272 |
| 1FW 3208 | 604.5 | 604.5 | 563.5 | 598.0 | 489 | 531.5 | 413.5 | 69.5 | 341 |

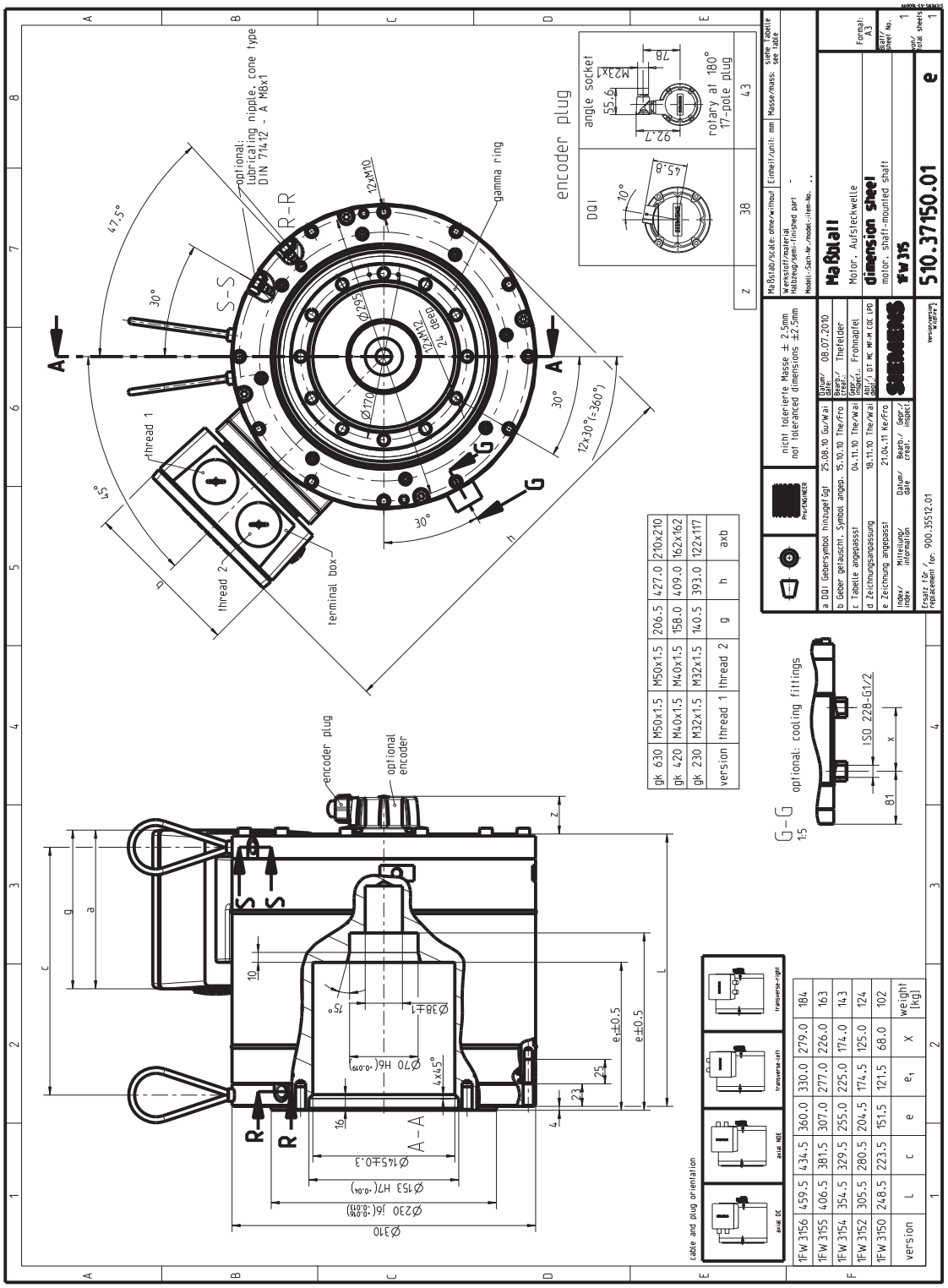
Figure 4-6 1FW320x, without encoder




| version | L [mm] | c [mm] | d [mm] | e [mm] | f [mm] | X [mm] | weight [kg] |
|---|---|---|---|---|---|---|---|
| 1FW3287 | 953.0 | 862.5 | 637.0 | 950.0 | 772.0 | 596.0 | 1024 |
| 1FW3285 | 784.5 | 694.0 | 468.5 | 781.5 | 603.5 | 427.5 | 854 |
| 1FW3283 | 658.5 | 568.0 | 342.5 | 655.5 | 477.5 | 301.5 | 684 |
| 1FW3281 | 574.0 | 483.5 | 258.0 | 571.0 | 393.0 | 217.0 | 594 |

| version | threads | cable orientation | h [mm] | w [mm] | g [mm] | a [mm] | b [mm] |
|---|---|---|---|---|---|---|---|
| 1XB7-712 | 4x M75x1.5 | transverse right | 828 | 758 | 369 | 370 | 371 |
| 1XB7-712 | 4x M75x1.5 | transverse | 846 | 732 | 369 | 370 | 371 |
| 1XB7-712 | 4x M75x1.5 | axial NDE | 836 | 744 | 385 | 371 | 370 |
| 1XB7-712 | 4x M75x1.5 | axial DE | 836 | 744 | 354 | 371 | 370 |
| 1XB7-700 | 3x M75x1.5 | all directions | 743 | 665 | 363 | 306 | 306 |

## 4.2.3 Plug-on shaft




| | gk 630 | gk 420 | gk 230 | version | thread 1 | g | h | axb |
|---|---|---|---|---|---|---|---|---|
| | M50x1.5 | M40x1.5 | M32x1.5 | | M50x1.5 | 206.5 | 427.0 | 210x210 |
| | M40x1.5 | M40x1.5 | M32x1.5 | | M40x1.5 | 158.0 | 409.0 | 162x162 |
| | M32x1.5 | M32x1.5 | M32x1.5 | | M32x1.5 | 140.5 | 393.0 | 122x117 |

| | 1FW3156 | 1FW3155 | 1FW3154 | 1FW3152 | 1FW3150 | version | L | c | e | $e_1$ | X | weight [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | 459.5 | 406.5 | 354.5 | 305.5 | 248.5 | | 434.5 | 381.5 | 329.5 | 280.5 | 223.5 | |
| | 360.0 | 307.0 | 255.0 | 204.5 | 151.5 | | | | | | | |
| | 330.0 | 277.0 | 225.0 | 174.5 | 121.5 | | | | | | | |
| | 279.0 | 226.0 | 174.0 | 125.0 | 68.0 | | | | | | | |
| | 184 | 163 | 143 | 124 | 102 | | | | | | | |

Figure 4-8 1FW315x, plug-on shaft

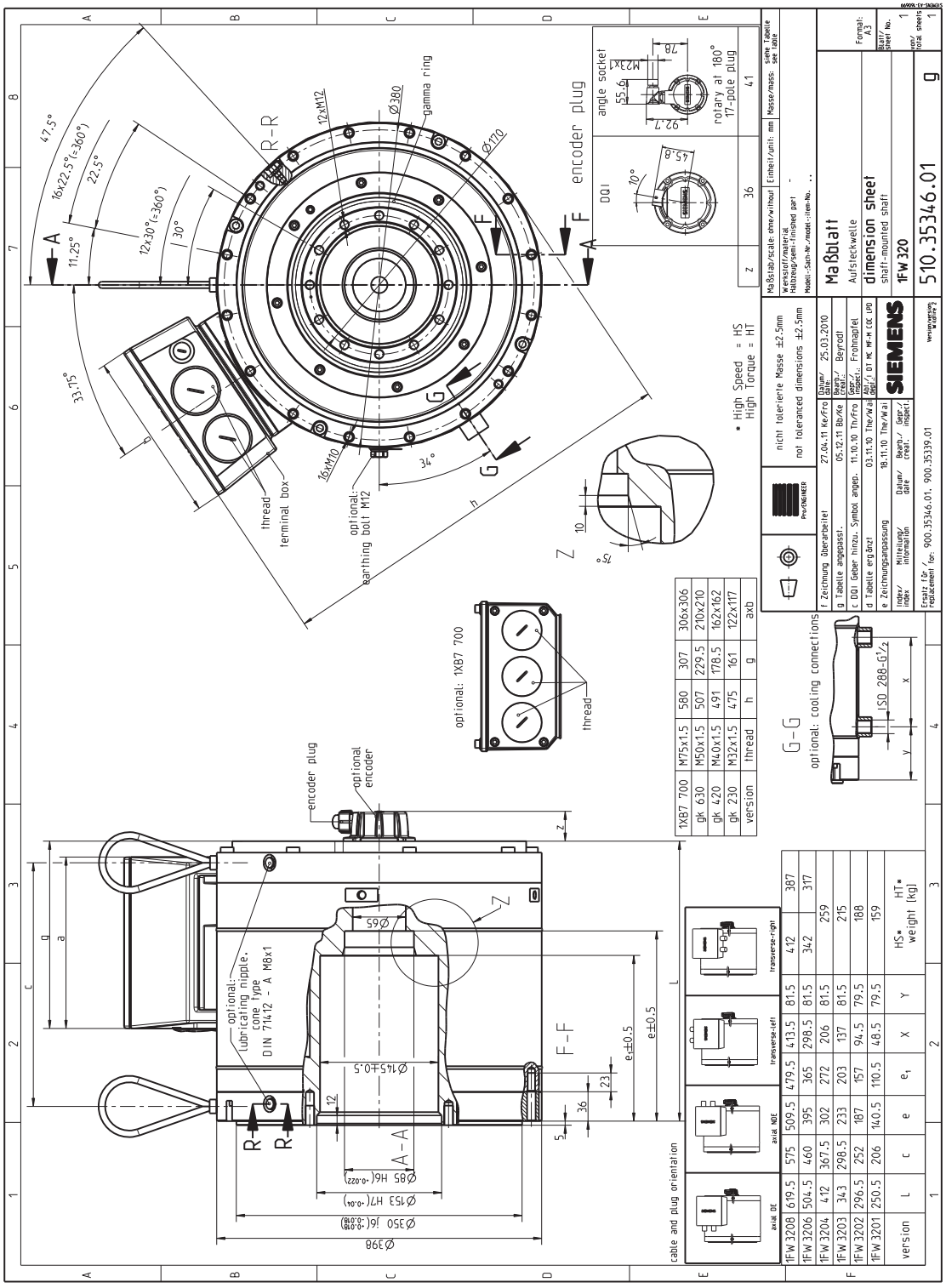
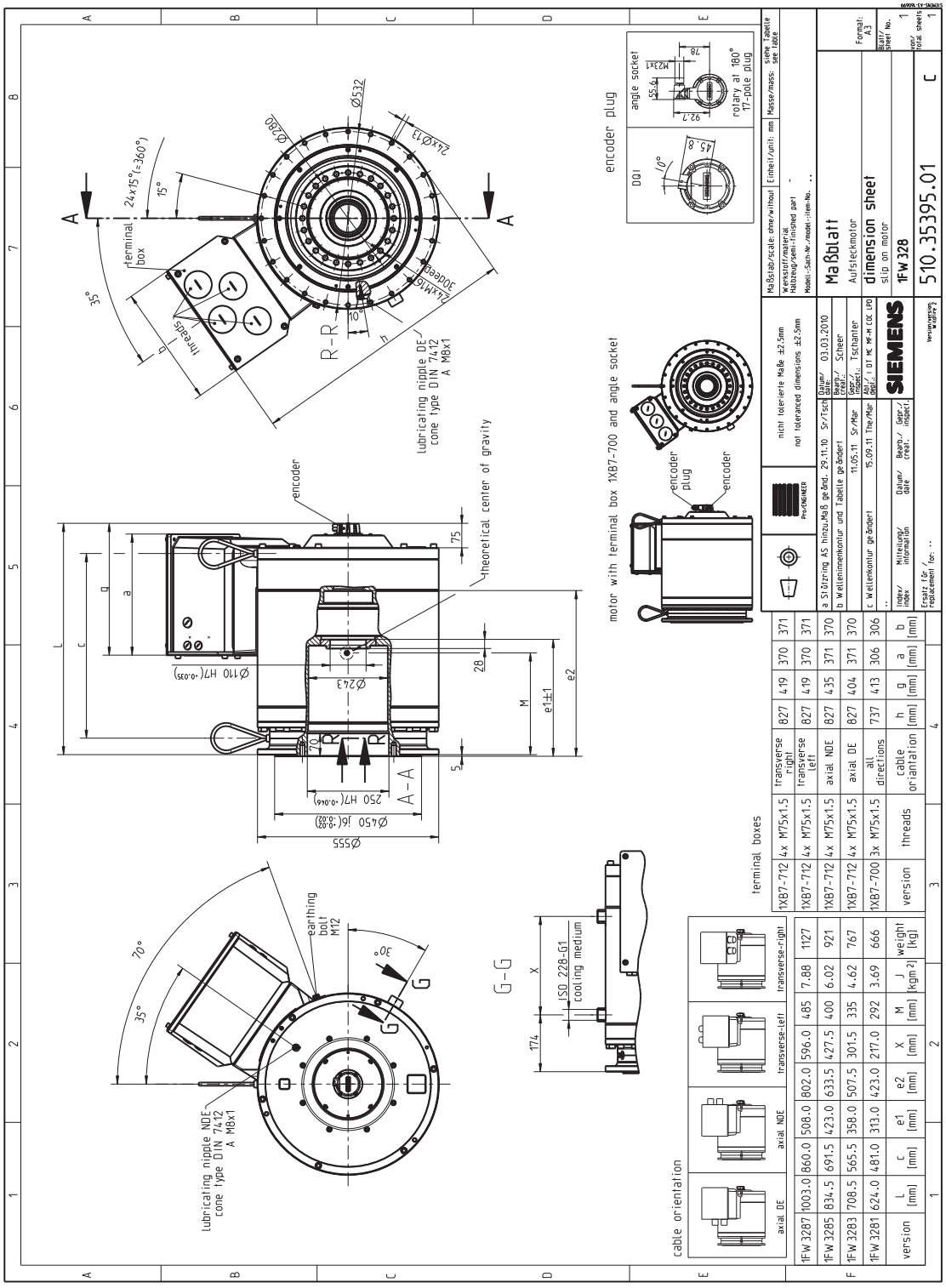



Figure 4-9 1FW320x, plug-on shaft




| version | L [mm] | c [mm] | e1 [mm] | e2 [mm] | X [mm] | M [mm] | J [kgm²] | weight [kg] | transverse-right | transverse-left | axial NDE | axial DE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1FW3287 | 1003.0 | 860.0 | 508.0 | 802.0 | 596.0 | 485 | 7.88 | 1127 | | | | |
| 1FW3285 | 834.5 | 691.5 | 423.0 | 633.5 | 427.5 | 400 | 6.02 | 921 | | | | |
| 1FW3283 | 708.5 | 565.5 | 358.0 | 507.5 | 301.5 | 335 | 4.62 | 767 | | | | |
| 1FW3281 | 624.0 | 481.0 | 313.0 | 423.0 | 217.0 | 292 | 3.69 | 666 | | | | |

| version | threads | cable orientation | h [mm] | g [mm] | a [mm] | b [mm] |
|---|---|---|---|---|---|---|
| 1XB7-712 | 4x M75x1.5 | transverse right | 827 | 419 | 370 | 371 |
| 1XB7-712 | 4x M75x1.5 | transverse left | 827 | 419 | 370 | 371 |
| 1XB7-712 | 4x M75x1.5 | axial NDE | 827 | 435 | 371 | 370 |
| 1XB7-712 | 4x M75x1.5 | axial DE | 827 | 404 | 371 | 370 |
| 1XB7-712 | 3x M75x1.5 | all directions | 737 | 413 | 306 | 306 |

## 4.2.4 Solid shaft

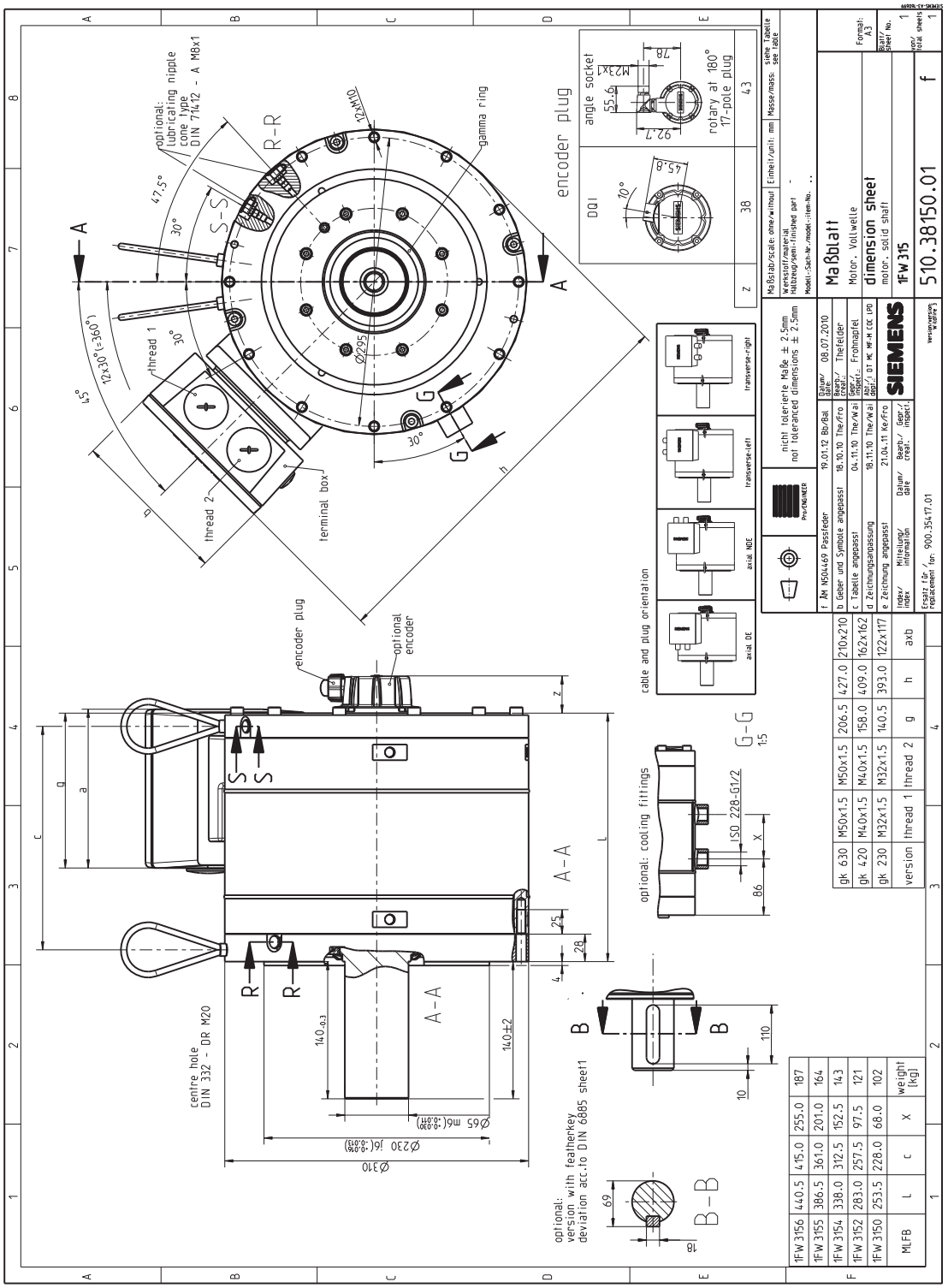
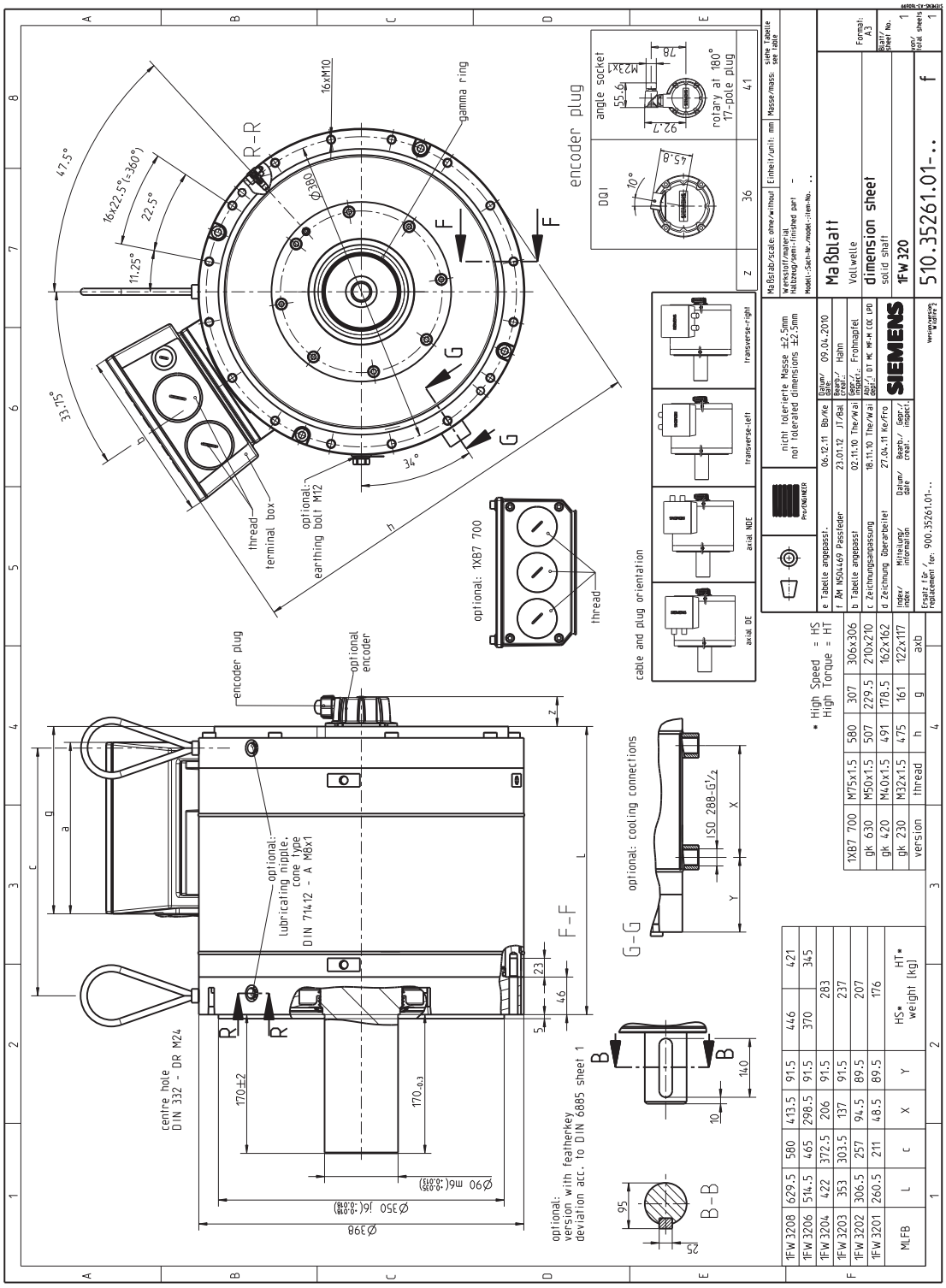



Figure 4-11 1FW315x, solid shaft




| | 1XB7 700 | gk 630 | gk 420 | gk 230 | version |
|---|---|---|---|---|---|
| a | M75x1.5 | M50x1.5 | M40x1.5 | M32x1.5 | thread |
| b | 580 | 507 | 491 | 475 | h |
| c | 307 | 229.5 | 178.5 | 161 | g |
| d | 306x306 | 210x210 | 162x162 | 122x117 | axb |

| | MLFB | L | c | X | Y | HS* weight [kg] | HT* weight [kg] |
|---|---|---|---|---|---|---|---|
| F | 1FW3208 | 629.5 | 580 | 413.5 | 91.5 | 446 | 421 |
| | 1FW3206 | 514.5 | 465 | 298.5 | 91.5 | 370 | 345 |
| | 1FW3204 | 422 | 372.5 | 206 | 91.5 | | 283 |
| | 1FW3203 | 353 | 303.5 | 137 | 91.5 | | 237 |
| | 1FW3202 | 306.5 | 257 | 94.5 | 89.5 | | 207 |
| | 1FW3201 | 260.5 | 211 | 48.5 | 89.5 | | 176 |

Figure 4-12 1FW320x, solid shaft

# Motor components

# 5

## 5.1 Thermal motor protection

### KTY 84 (PTC thermistor)

A temperature-dependent resistor is integrated as temperature sensor to monitor the motor temperature.

Table 5- 1 Properties and technical data

| Designation | Description |
|---|---|
| Type | KTY 84 (PTC thermistor) |
| Resistance when cold (20 °C) | Approx. 580 Ω |
| Resistance when hot (100 °C) | Approx. 1000 Ω |
| Standard temperature thresholds for SINAMICS | Prewarning: 120 °C ±5 °C<br>Shutdown: 155 °C ±5 °C |
| Connection | via signal cable |

| ⚠ WARNING |
|---|
| The polarity must be carefully observed. |

The resistance of the KTY 84 thermistor changes proportionally to the winding temperature change (refer to the following Fig.).

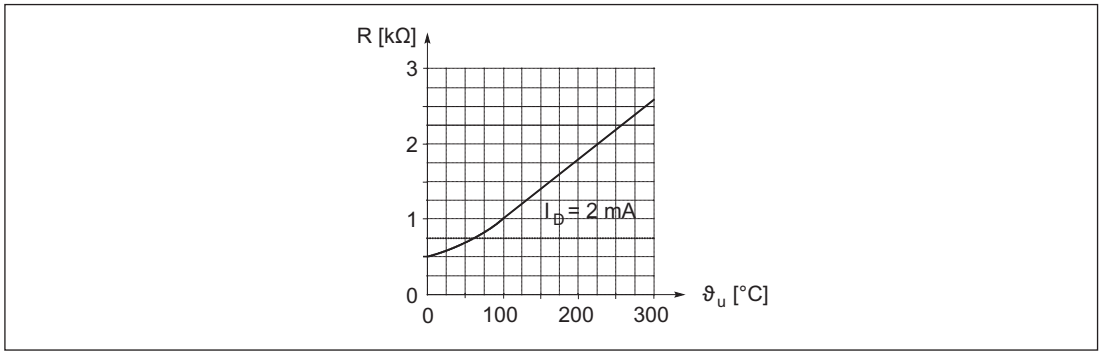



Figure 5-1 Resistance characteristic of the KTY 84 as a function of the temperature

The KTY 84 is evaluated in the converter whose closed-loop control takes into account the temperature characteristic of the motor winding. When a fault occurs, an appropriate message is output on the converter. When the motor temperature increases, a message "Alarm motor overtemperature" is output; this must be externally evaluated. If this signal is ignored, the drive converter shuts down with the appropriate fault message after a preset time period or when the motor limiting temperature or the shutdown temperature is exceeded.

**⚠ CAUTION**

The integrated temperature sensor KTY protects the complete torque motors against overload conditions:

up to 2 • $I_0$ and speed ≠ 0

There is no adequate protection for thermally critical load situations, e.g. a high overload at motor standstill. This is the reason that, for example, a thermal overcurrent relay or a PTC thermistor (optional) must be provided as additional protection.

If the maximum overload condition lasts longer than 4 s, then additional motor protection must be provided.

The temperature sensor is designed so that the DIN/EN requirement for "protective separation" is fulfilled.

**⚠ WARNING**

If the user carries-out an additional high-voltage test, then the ends of the temperature sensor cables must be short-circuited before the test is carried-out! If the test voltage is connected to a temperature sensor terminal, then it will be destroyed.

## PTC thermistors (optional)

For special applications (e.g. when a load is applied with the motor stationary or for extremely low speeds), the temperature of all of the three motor phases should be additionally monitored using a PTC thermistor triplet.

Ordering options: order code A11.

Table 5- 2 Connection and evaluation of the PTC thermistor triplet

| Standard | 1FW315□ and 1FW320□ motors with DRIVE-CLiQ interface and encoders (9. MLFB position) = D, F, U |
|---|---|
| The PTC thermistor must be evaluated using an external tripping/evaluation unit (this is not included in the scope of supply). This means that the sensor cable is monitored for wire breakage and short-circuit by this unit. The motor must be de-energized within 1 s when the response temperature is exceeded.<br>The thermistor connections are located in the power terminal box on the terminal block. A cable entry hole M16 x 1.5 is provided in the terminal box to connect this PTC thermistor. | The PTC thermistor is connected to the drive system via the DRIVE-CLiQ cable. Evaluation of the PTC thermistor must be activated in the SINAMICS (see references: /GH1/ SINAMICS S120, Control Units and Additional System Components). |

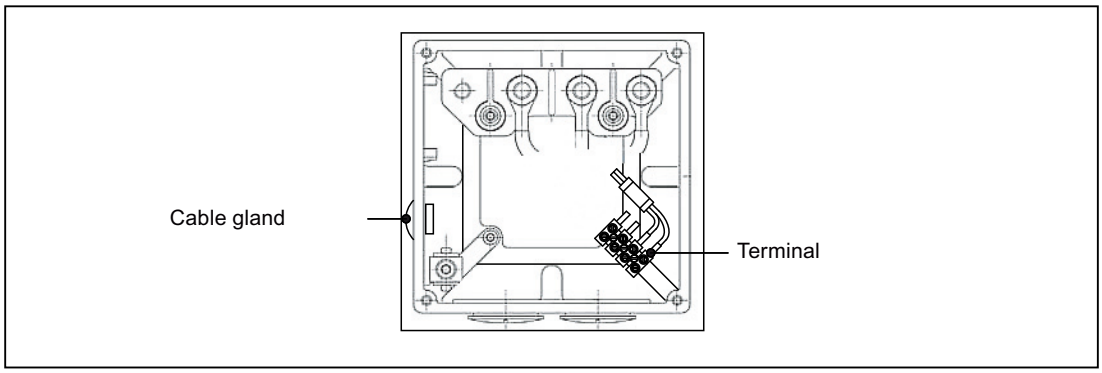



Figure 5-2 Connection for 3x PTC

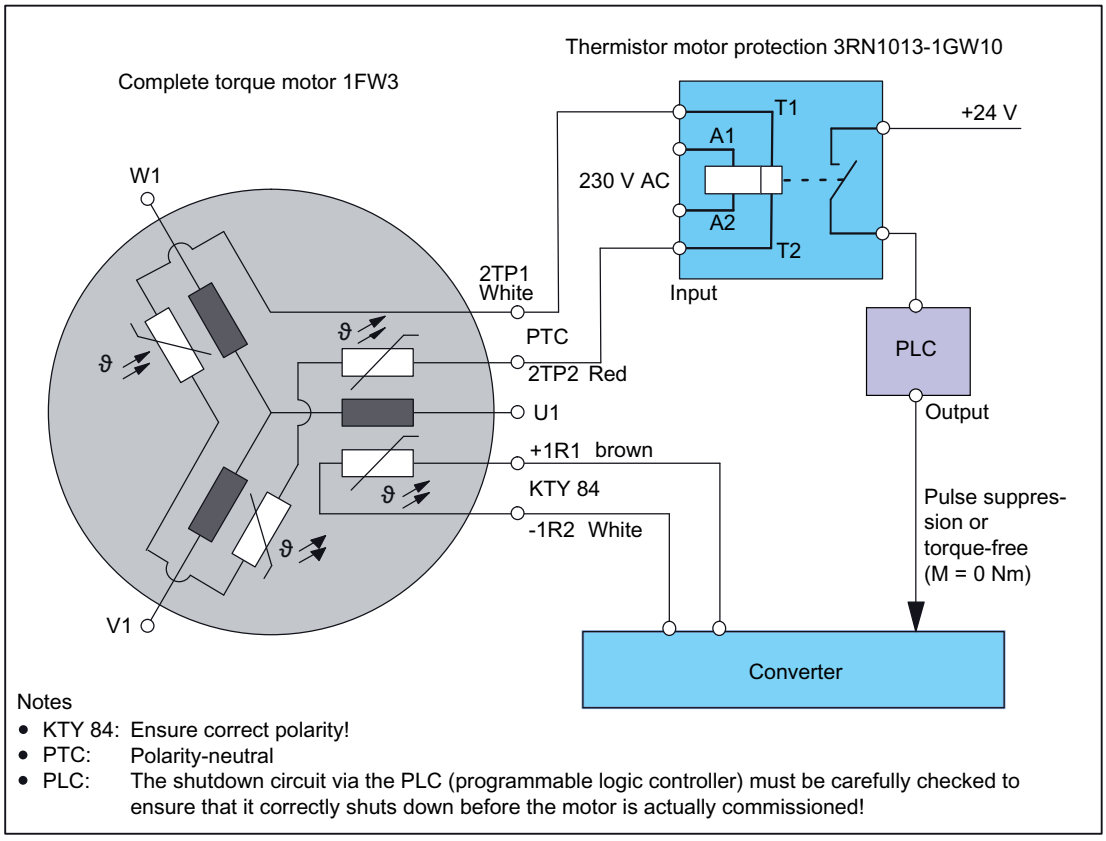



Figure 5-3 Temperature monitoring connection

Table 5- 3 Technical specifications for the PTC thermistor triplet

| Designation | Description |
|---|---|
| Type | PTC thermistor triplet |
| Thermistor resistance (20°C) | ≤ 750 Ω |
| Resistance when hot (180°C) | ≥ 1710 Ω |
| Response temperature | 180 °C |
| Connection | Via external evaluation unit |
| Note:<br>The PTC thermistors do not have a linear characteristic and are, therefore, not suitable to determine the instantaneous temperature. Characteristic to DIN VDE 0660 Part 303, DIN 44081, DIN 44082. | |

## 5.2 Encoders

**⚠ CAUTION**

**Encoder replacement and adjustment**

The encoders are adjusted in the factory for SIEMENS drive converters. Another encoder adjustment may be required when operating the motor with a third-party converter.

If the encoder is incorrectly adjusted to the motor EMF, this can result in uncontrolled motion.

When a belt-mounted encoder is replaced, the position of the encoder system with respect to the motor EMF must be adjusted. Only qualified personnel may replace an encoder.

When replacing an absolute encoder it must be re-referenced.

When replacing a coaxially mounted encoder, the encoder system does not have to be adjusted. The position with respect to the motor EMF is ensured using mechanical components.

## Encoder selection and identification in the order number (MLFB)

| | |
|---|---|
| with/without DRIVE-CLiQ interface | 9th position of the Order No. (MLFB) = see table below |

Table 5- 4 Letter code of the 9th position of the Order No. (MLFB)

| Encoder type | 9th position in the MLFB |
|---|---|
| **Motors without DRIVE-CLiQ interfaces** | |
| Incremental encoder, sin/cos 1 Vpp, 2048 S/R with C and D tracks, encoder IC2048S/R, belt mounted | A |
| Absolute encoder 2048 S/R singleturn, 4096 revolutions multiturn, with EnDat interface, encoder AM2048S/R, belt mounted or coaxially mounted at NDE | E |
| Multi-pole resolver (p = x), belt mounted | S |
| **Motors with DRIVE-CLiQ interfaces** | |
| Absolute encoder 24 bit singleturn (resolution 16777216), encoder AS24DQI | B |
| Absolute encoder 24 bit singleturn (resolution 16777216) + 12 bit multiturn (traversing range 4096 revolutions), encoder AM24DQI | C |
| Incremental encoder, 22-bit (resolution 4194304, internal 2048 S/R) + commutation position, 11 bit, encoder IC22DQ, belt-mounted | D |
| Absolute encoder 22 bit singleturn (resolution 4194304, internal 2048 S/R) + 12 bit multiturn (traversing range 4096 revolutions), encoder AM22DQ, belt-mounted | F |
| Resolver 15-bit (resolution 32.768, internal, multi-pole), R15DQ encoder, belt mounted | U |

| | |
|---|---|
| Belt-mounted encoder | 11th position of the Order No. (MLFB) = 6<br>15th position of the Order No. (MLFB) = M or S |
| Coaxial encoder mounting | 11th position of the Order No. (MLFB) = 7<br>15th position of the Order No. (MLFB) = A or C |

## 5.2.1 Encoder connection for motors with DRIVE-CLiQ interface

For motors with a DRIVE-CLiQ interface, the analog encoder signal is internally converted to a digital signal. There is no further conversion of the encoder signal in the drive system required. Motors with DRIVE-CLiQ interface simplify commissioning and diagnostics, as the motor and encoder system are identified automatically.

**⚠ CAUTION**

The DRIVE-CLiQ encoder contains motor and encoder-specific data as well as an electronic type plate. This is the reason that this may only be operated on the original motor - and may not be mounted onto other motors or replaced by the DRIVE-CLiQ encoder from other motors.

The DRIVE-CLiQ encoder interface has direct contact to components that can be damaged/destroyed by electrostatic discharge (ESD). The precautionary ESD measures listed in the preface should be carefully observed.

### Cables

For all encoder types (incremental encoder, absolute value encoder and Resolver) the same DRIVE-CLiQ cables can be used between the motor and converter:

Table 5- 5 Pre-assembled cable

| 6FX | □ | 002 | - | □DC□□ | - | □□□ | 0 |
|---|---|---|---|---|---|---|---|
| | ↓ | | | | | ↓ ↓ ↓ | |
| | ↓ | | | | | Length | |
| | 5 MOTION-CONNECT®500 | | | | | Max. cable length 100 m | |
| | 8 MOTION-CONNECT®800 | | | | | Max. cable length 50 m | |

Only prefabricated cables from Siemens (MOTION-CONNECT) may be used.

For other technical data and length code, refer to Catalog, Chapter "MOTION-CONNECT connection system".

## 5.2.2 Encoder connection for motors without DRIVE-CLiQ interface

For motors without an integrated DRIVE-CLiQ interface, the analog encoder signal in the drive system is converted into a digital signal. For these motors as well as external encoders, the encoder signals must be connected to SINAMICS S120 via Sensor Modules.

## 5.2.3 Incremental encoder sin/cos 1Vpp

### Description

This encoder senses relative movements and does not supply absolute position information. In combination with an evaluation logic, a zero point can be determined using the integrated reference mark, which can be used to calculate the absolute position.

The encoder outputs sine and cosine signals. These can be interpolated using evaluation logic (usually 2048x) and the direction of rotation can be determined. In the version with DRIVE-CLiQ interface, this evaluation logic is already integrated in the encoder.

### Function and technical data

- Angular measuring system for the commutation
- Speed actual value sensing
- Indirect incremental measuring system for the position control loop
- One zero pulse (reference mark) per revolution

Table 5- 6 Technical data for incremental encoders

| Encoder type | 9th position in the order number | Operating voltage | Max. current drain | A-B track: Resolution incremental (sin/cos periods per revolution) | C-D track: Rotor/commutation position (sin/cos periods per revolution) | Angular error |
|---|---|---|---|---|---|---|
| **without DRIVE-CLiQ interface** | | | | | | |
| Incremental encoder sin/cos 1 Vpp, 2048 S/R with C and D tracks | A | 5 V ± 5 % | 140 mA | 2048 S/R (1 Vpp) | 1 S/R (1 Vpp) | ± 40 " |
| **with DRIVE-CLiQ interface** | | | | | | |
| Incremental encoder 22 bit resolution 4.194.304, internal 2048 S/R) + commutation position 11 bit | D | 24 V | 180 mA | 4.194.304 (=22 bit) | 2048 (=11 bit) | ± 40 " |

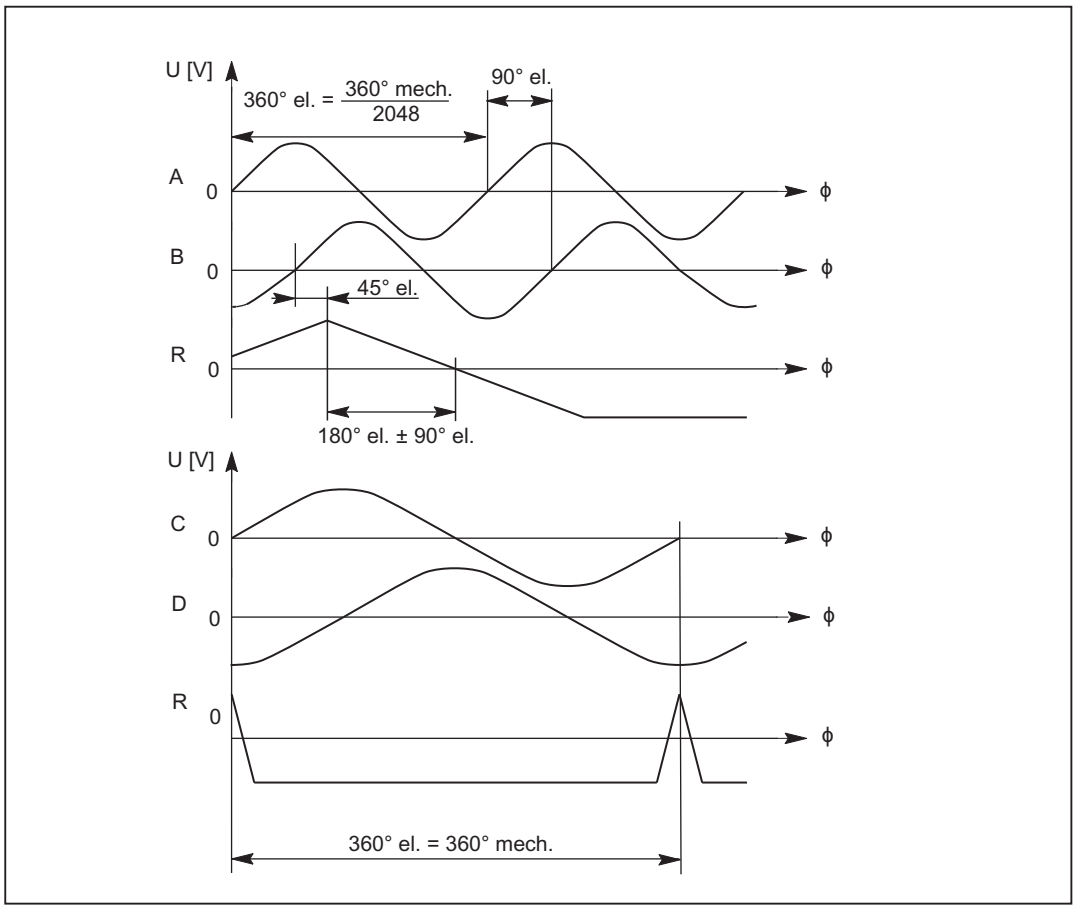
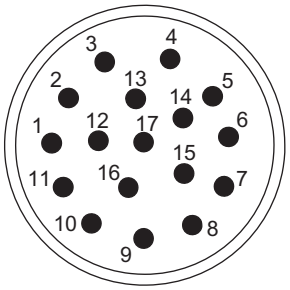



Figure 5-4 Signal sequence and assignment for encoder IC2048S/R without DRIVE-CLiQ interface for a positive direction of rotation

## Connection pin assignment for 17-pin flange socket with pin contacts

Table 5- 7 Connection pin assignment, 17-pin flange socket

| PIN No. | Signal | |
|---|---|---|
| 1 | A |  When viewing the plug-in side (pins) |
| 2 | A* | |
| 3 | R | |
| 4 | D* | |
| 5 | C | |
| 6 | C* | |
| 7 | M encoder | |
| 8 | +1R1 | |
| 9 | –1R2 | |
| 10 | P encoder | |
| 11 | B | |
| 12 | B* | |
| 13 | R* | |
| 14 | D | |
| 15 | M sense | |
| 16 | P sense | |
| 17 | Not connected | |

## Cables

Table 5- 8 Pre-assembled cable

| 6FX | □ | 002 | - | 2CA31 | - | □□□ | 0 |
|---|---|---|---|---|---|---|---|
| | ↓<br>↓<br>5 MOTION-CONNECT®500<br>8 MOTION-CONNECT®800 | | | | | ↓ ↓ ↓<br>Length<br><br>Max. cable length 100 m | |

Mating connector: 6FX2003-0SU17 (socket)

For other technical data and length code, refer to catalog, Chapter "MOTION-CONNECT connection system"

## 5.2.4 Absolute encoders

### Description, multiturn absolute encoder

This encoder outputs an absolute angular position between 0° and 360° in the specified resolution. An internal measuring gearbox enables it to differentiate between 4096 rotations.

### Description, absolute value singleturn

This encoder outputs an absolute angular position between 0° and 360° in the specified resolution. In contrast to the multi-turn absolute encoder, it has no measuring gearbox and can therefore only supply the position value within one revolution.

### Function and technical data

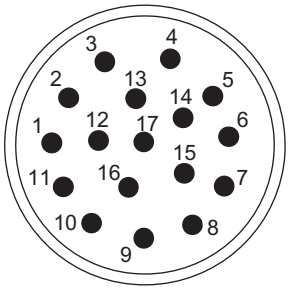
- Angular measuring system for the commutation
- Speed actual value sensing
- For single-turn encoders: Indirect measuring system for absolute position determination within a traversing range of 1 revolution
- For multi-turn encoders: Indirect measuring system for determining the absolute position within a traversing range of 4096 revolutions

Table 5- 9 Technical specifications, absolute encoder

| Encoder type | 9th position in the order number | Operating voltage | Max. current drain | Absolute resolution (singleturn) | Traversing-range (multiturn) | A-B track: Resolution incremental (sin/cos periods per revolution) | Angular error |
|---|---|---|---|---|---|---|---|
| **without DRIVE-CLiQ interface** | | | | | | | |
| Absolute encoder 2048 S/R, (4096 revolutions, multi-turn, with EnDat interface 2.1 | E | 5 V ±5 % | 200 mA | --- | 4096 (=12 bit) | 2048 S/R (1 Vpp) | ±40" |
| **with DRIVE-CLiQ interface** | | | | | | | |
| Absolute encoder, single-turn, 24 bit | B | 24 V | 110 mA | 16.777.216 (=24 bit) | --- | --- | ±40" |
| Absolute encoder 24 bit + 12 bit multiturn | C | 24 V | 110 mA | 16.777.216 (=24 bit) | 4096 (=12 bit) | --- | ±40" |
| Absolute encoder singleturn 22 bit + 12 bit multiturn | F | 5 V ±5 % | 200 mA | 4.194.304 (=22 bit) | 4096 (=12 bit) | --- | ±40" |

## Connection pin assignment for 17-pin flange socket with pin contacts

Table 5- 10 Connection pin assignment, 17-pin flange socket

| PIN No. | Signal | |
|---|---|---|
| 1 | A |  When viewing the plug-in side (pins) |
| 2 | A* | |
| 3 | Data | |
| 4 | Not connected | |
| 5 | Clock | |
| 6 | not connected | |
| 7 | M encoder | |
| 8 | +1R1 | |
| 9 | –1R2 | |
| 10 | P encoder | |
| 11 | B | |
| 12 | B* | |
| 13 | Data* | |
| 14 | Clock* | |
| 15 | M sense | |
| 16 | P sense | |
| 17 | not connected | |

## Cables

Table 5- 11 Pre-assembled cable

| 6FX | □ | 002 | - | 2EQ10 | - | □□□ | 0 |
|---|---|---|---|---|---|---|---|
| | ↓<br>↓<br>5 MOTION-CONNECT®500<br>8 MOTION-CONNECT®800 | | | | | ↓ ↓ ↓<br>Length<br><br>Max. cable length 100 m | |

Mating connector: 6FX2003-0SU17 (socket)

For other technical data and length code, refer to catalog, Chapter "MOTION-CONNECT connection system"

## 5.2.5 Multi-pole resolver

### Description

The number of sine and cosine periods per revolution corresponds to the number of pole pairs of the resolver. Resolvers can detect relative motion. The absolute position within one resolver output signal period can be determined.

### Function and technical data

- Angular measuring system for the commutation
- Speed actual value sensing
- Indirect incremental measuring system for the position control loop

Table 5- 12 Technical specifications, resolvers

| Properties | 8-pole (for SH 200) | 4-pole (for SH 150 and SH 280) |
|---|---|---|
| Excitation voltage | + 5 $V_{rms}$ to + 13 $V_{rms}$ | |
| Excitation frequency | 4 kHz to 10 kHz | |
| Current consumption | < 80 $mA_{rms}$ | |
| Angular error, peak-to-peak (mech.) | < 4 ' | < 10 ' |
| Electrical transformation ratio | 0.5 | |

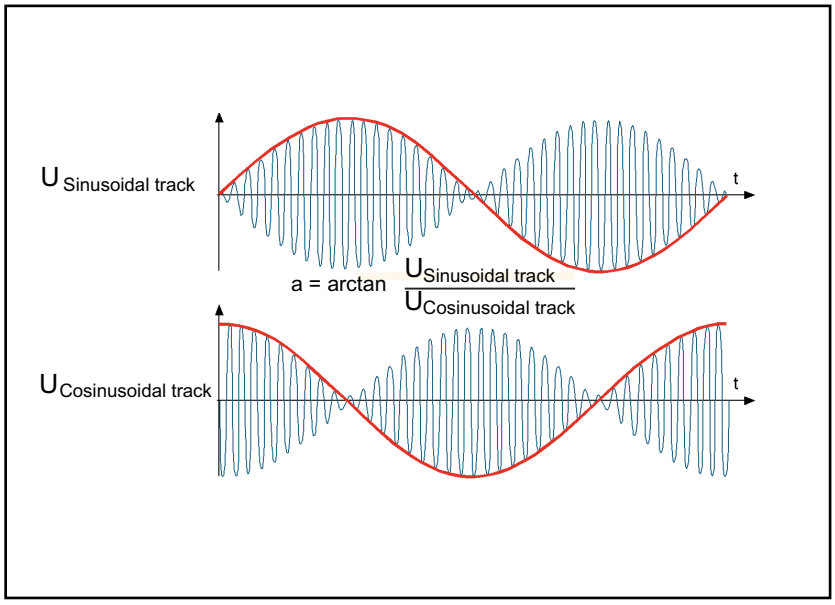
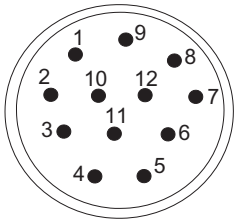



Figure 5-5 Output signals, resolver

### Connection pin assignment for 12-pin flange socket with pin contacts

Table 5- 13 Connection pin assignment, 12-pin flange socket

| PIN No. | Signal | |
|---|---|---|
| 1 | S2 |  When viewing the plug-in side (pins) |
| 2 | S4 | |
| 3 | not connected | |
| 4 | not connected | |
| 5 | not connected | |
| 6 | not connected | |
| 7 | R2 | |
| 8 | +1R1 | |
| 9 | –1R2 | |
| 10 | R1 | |
| 11 | S1 | |
| 12 | S3 | |

### Cables

Table 5- 14 Pre-assembled cable

| 6FX | □ | 002 | - | 2CF02 | - | □□□ | 0 |
|---|---|---|---|---|---|---|---|
| | ↓<br>↓<br>5 MOTION-CONNECT®500<br>8 MOTION-CONNECT®800 | | | | | ↓↓↓<br>Length<br>Max. cable length 150 m | |

Mating connector: 6FX2003-0SU12 (socket)

For other technical data and length code, refer to catalog, Chapter "MOTION-CONNECT connection system"

## 5.2.6 Encoder with belt drive

The encoder in the encoder box (on the stator side) is coupled via a belt. This means, for example, the hollow shaft can be used to route media. Gear ratio, refer to Chapter "Mechanical properties of the motors".

| NOTICE |
|---|
| Only qualified personnel may replace a belt. To do this, a device is required to measure the belt tension. |

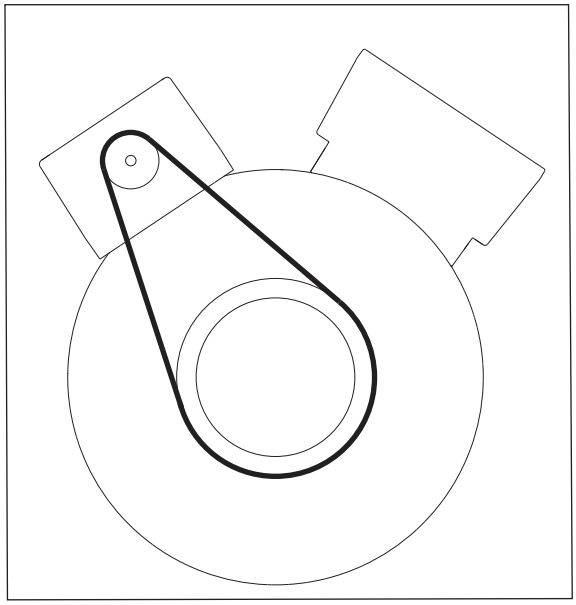


Figure 5-6 Encoder with belt drive

### 5.2.7 Coaxial encoder mounting

Coaxial encoder mounting is available for high dynamic requirements and the highest precision. The encoder module can be easily replaced without requiring readjustment.

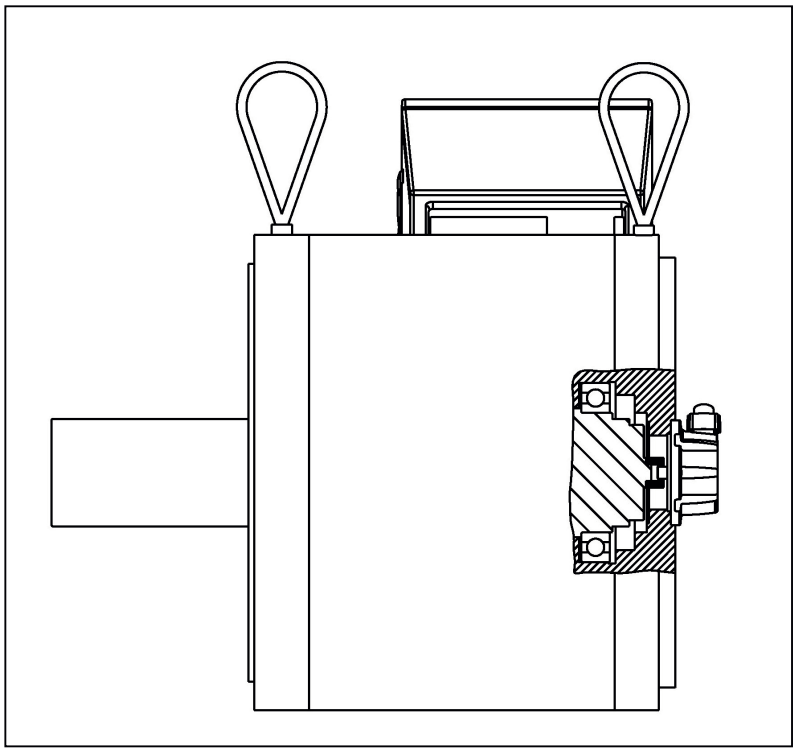


Figure 5-7 Coaxial encoder mounting

### 5.2.8 Motor version without encoder

The cable gland and the terminal in the terminal box are used to connect the KTY temperature sensor as well as the replacement KTY temperature sensor.

## 5.3 Braking resistors (armature short-circuit braking)

### 5.3.1 Function description

For transistor PWM converters, when the DC link voltage values are exceeded or if the electronics fails, then electrical braking is no longer possible. If the drive which is coasting down, can represent a potential hazard, then the motor can be braked by short-circuiting the armature. Armature short-circuit braking should be initiated at the latest by the limit switch in the traversing range of the feed axis.

The friction of the mechanical system and the switching times of the contactors must be taken into account when determining the distance that the feed axis takes to come to a complete stop. In order to avoid mechanical damage, mechanical stops should be located at the end of the absolute traversing range.

For servomotors with integrated holding brake, the holding brake can be simultaneously applied to create an additional braking torque – however, with some delay.

| CAUTION |
| --- |
| The converter pulses must first be canceled and this actually implemented before an armature short-circuit contactor is closed or opened. This prevents the contactor contacts from burning and eroding and destroying the converter. |

| ⚠ WARNING |
| --- |
| The drive must always be operationally braked using the setpoint input. For additional information, refer to the Converter Configuration Manual. |

The optimum braking torque of the servomotor in regenerative operation can be obtained using armature short-circuit with a matching external resistor circuit.

Possible ordering address: http://www.frizlen.com

**Note**

It goes without saying that equivalent products from other manufacturers may be used. Our recommendations should be considered as such. We cannot accept any liability for the quality and properties/features of third-party products.

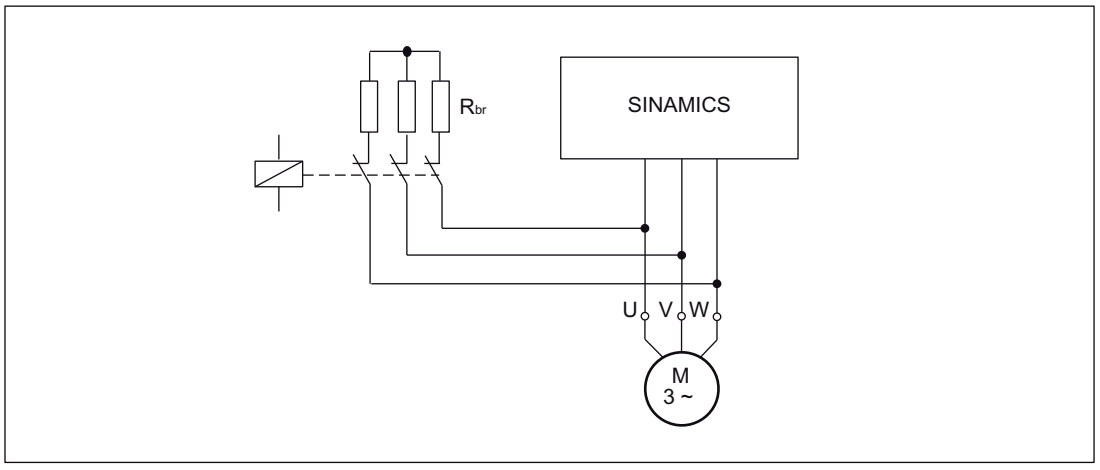



Figure 5-8 Circuit (schematic) with brake resistors

## Ordering address

Frizlen GmbH & Co. KG
Gottlieb-Daimler-Str. 61, 71711 Murr
Germany
Phone: +49 (0) 7144 / 8100 - 0
Fax: +49 (0) 7144 / 2076 - 30
E-mail: info@frizlen.com
Internet at: www.frizlen.com

**Note**

We cannot accept any liability for the quality and properties/features of third-party products.

## Rating

The ratings of the resistors must match the particular $I^2t$ load capability. The resistors can be dimensioned so that a surface temperature of 300 °C can occur briefly (max. 500 ms). In order to prevent the resistors from being destroyed, braking from the rated speed can occur max. every 2 minutes. Other braking cycles must be specified when ordering the resistors. The external moment of inertia and the intrinsic motor moment of inertia are decisive when dimensioning these resistors.

The kinetic energy must be specified when ordering in order to determine the resistor rating.

$$W = \frac{1}{2} \cdot J \cdot \omega^2$$

$$\omega = \frac{2 \cdot \pi}{60} \cdot n$$

W = kinetic energy [Ws]
J = Moment of inertia [$kgm^2$]
ω = Angular speed [$s^{-1}$]
n = Speed [rpm]

## Calculating the braking time

Braking time: $t_B = \frac{J_{tot} \cdot n}{9.55 \cdot M_B}$

Moment of inertia: $J_{tot} = J_{mot} + J_{external}$

$t_B$ = Braking time [s]
n = operating speed [rpm]
$M_B$ = average braking torque [Nm]
$J_{tot}$ = moment of inertia [$kgm^2$]
$J_{mot}$ = motor moment of inertia [$kgm^2$]
$J_{external}$ = external moment of inertia [$kgm^2$]

| NOTICE |
| --- |
| When determining the run-on distance, the friction (taken into account as allowance in $M_B$) of the mechanical transmission elements and the switching delay times of the contactors must be taken into consideration. In order to prevent mechanical damage, mechanical end stops should be provided at the end of the absolute traversing range of the machine axes. |

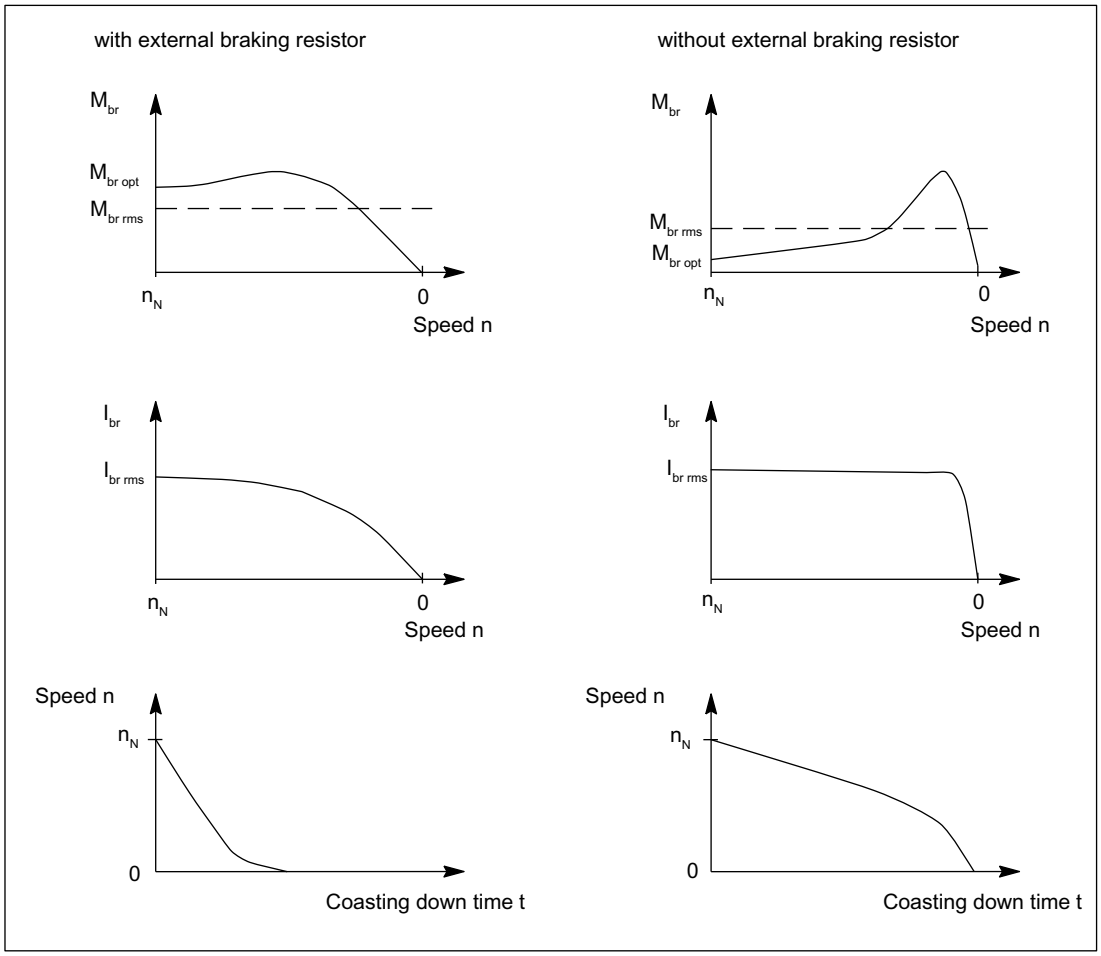



Figure 5-9 Armature short-circuit braking

## 5.3.2 Dimensioning of braking resistors

The correct dimensioning ensures an optimum braking time. The braking torques which are obtained are also listed in the tables. The data apply for braking from the rated speed. If the motor brakes from another speed, then the braking time **cannot** be linearly reduced. However, longer braking times cannot occur if the speed at the start of braking is less than the rated speed.

The data in the following table is calculated for rated values according to the data sheet. The variance during production as well as iron saturation have not been taken into account here. Higher currents and torques can occur than those calculated as a result of the saturation.

The ratings of the resistors must match the particular $I^2t$ load capability.

## Dynamic braking

Table 5- 15 Dynamic braking 1FW3, SH 150 Standard

| Motor type | External braking resistor $R_{opt}$ [Ω] | Average braking torque $M_{br\ rms}$ [Nm] | | Max. braking torque $M_{br\ max}$ [Nm] | rms braking current $I_{br\ rms}$ [A] | |
|---|---|---|---|---|---|---|
| | | without external braking resistor | with external braking resistor | | without external braking resistor | with external braking resistor |
| **Standard** | | | | | | |
| 1FW3150-1□H | 11 | 21.5 | 32.5 | 40.5 | 5.3 | 4.75 |
| 1FW3150-1□L | 8.3 | 17.8 | 34.5 | 42.5 | 8.6 | 7.7 |
| 1FW3150-1□P | 5.5 | 14.8 | 35.5 | 44.0 | 13.5 | 12.1 |
| 1FW3152-1□H | 5.0 | 46.5 | 75 | 93 | 12.2 | 11.0 |
| 1FW3152-1□L | 3.7 | 37.5 | 80 | 99 | 20.0 | 17.9 |
| 1FW3152-1□P | 2.4 | 32.0 | 85 | 105 | 32.0 | 28.5 |
| 1FW3154-1□H | 3.3 | 73 | 122 | 151 | 19.3 | 17.3 |
| 1FW3154-1□L | 2.4 | 60 | 130 | 161 | 32.0 | 28.5 |
| 1FW3154-1□P | 1.6 | 50 | 137 | 170 | 51.0 | 45.0 |
| 1FW3155-1□H | 2.3 | 97 | 164 | 205 | 27.0 | 24.0 |
| 1FW3155-1□L | 1.7 | 77 | 173 | 215 | 43.5 | 39.0 |
| 1FW3155-1□P | 1.1 | 66 | 188 | 235 | 71 | 64.0 |
| 1FW3156-1□H | 2.0 | 119 | 205 | 255 | 32.5 | 29.5 |
| 1FW3156-1□L | 1.4 | 96 | 215 | 270 | 54 | 48.0 |
| 1FW3156-1□P | 0.97 | 84 | 240 | 295 | 85 | 76.0 |

Table 5- 16 Dynamic braking 1FW3, SH 200 Standard and High Speed

| Motor type | External braking resistor $R_{opt}$ [Ω] | Average braking torque $M_{br\ rms}$ [Nm] | | Max. braking torque $M_{br\ max}$ [Nm] | rms braking current $I_{br\ rms}$ [A] | |
|---|---|---|---|---|---|---|
| | | without external braking resistor | with external braking resistor | | without external braking resistor | with external braking resistor |
| **Standard** | | | | | | |
| 1FW3201-1□E | 4.4 | 76 | 106 | 132 | 10.4 | 9.4 |
| 1FW3201-1□H | 3.2 | 54 | 110 | 136 | 19.5 | 17.5 |
| 1FW3201-1□L | 2.2 | 39 | 109 | 135 | 31.5 | 28.0 |
| 1FW3202-1□E | 2.5 | 133 | 196 | 245 | 19.1 | 17.3 |
| 1FW3202-1□H | 1.8 | 94 | 205 | 255 | 36.0 | 32.0 |
| 1FW3202-1□L | 1.2 | 69 | 205 | 255 | 57.0 | 52.0 |
| 1FW3203-1□E | 1.8 | 192 | 290 | 355 | 27.5 | 25.0 |
| 1FW3203-1□H | 1.0 | 141 | 310 | 390 | 58.0 | 52.0 |
| 1FW3203-1□L | 0.77 | 101 | 310 | 385 | 89.0 | 80 |
| 1FW3204-1□E | 1.3 | 265 | 410 | 510 | 38.5 | 35.0 |
| 1FW3204-1□H | 0.82 | 200 | 450 | 560 | 78.0 | 70.0 |
| 1FW3204-1□L | 0.57 | 144 | 455 | 560 | 126 | 113 |
| 1FW3206-1□E | 0.76 | 400 | 610 | 760 | 62.0 | 56.0 |
| 1FW3206-1□H | 0.54 | 270 | 630 | 780 | 115 | 103 |
| 1FW3206-1□L | 0.37 | 215 | 670 | 830 | 190 | 170 |
| 1FW3208-1□E | 0.58 | 550 | 850 | 1060 | 83 | 75 |
| 1FW3208-1□H | 0.38 | 395 | 910 | 1130 | 164 | 147 |
| 1FW3208-1□L | 0.31 | 255 | 790 | 980 | 225 | 200 |
| **High Speed** | | | | | | |
| 1FW3201-3□P | 1.1 | 118 | 205 | 255 | 70 | 64 |
| 1FW3201-3□S | 0.97 | 84 | 195 | 240 | 95 | 86 |
| 1FW3202-3□P | 0.67 | 194 | 390 | 485 | 130 | 117 |
| 1FW3202-3□S | 0.52 | 151 | 390 | 485 | 186 | 167 |
| 1FW3203-3□P | 0.49 | 270 | 570 | 710 | 186 | 166 |
| 1FW3203-3□S | 0.36 | 205 | 570 | 710 | 270 | 245 |
| 1FW3204-3□P | 0.31 | 365 | 830 | 1030 | 280 | 255 |
| 1FW3204-3□S | 0.22 | 280 | 830 | 1030 | 425 | 380 |
| 1FW3206-3□P | 0.24 | 510 | 1210 | 1500 | 395 | 350 |
| 1FW3206-3□S | 0.15 | 385 | 1210 | 1500 | 620 | 560 |
| 1FW3208-3□P | 0.17 | 670 | 1670 | 2100 | 550 | 495 |
| 1FW3208-3□S | 0.1 | 520 | 1670 | 2100 | 880 | 790 |

Table 5- 17 Dynamic braking 1FW3, SH 280 Standard and High Speed

| Motor type | Braking resistor external $R_{opt}$ [Ω] | Average braking torque $M_{br\ rms}$ [Nm] | | Max. braking torque $M_{br\ rms}$ [Nm] | rms braking current $I_{br\ rms}$ [A] | |
|---|---|---|---|---|---|---|
| | | without external braking resistor | with external braking resistor | | without external braking resistor | with external braking resistor |
| **Standard** | | | | | | |
| 1FW3281-2□E | 0.63 | 850 | 1230 | 1520 | 94 | 85 |
| 1FW3281-2□G | 0.5 | 640 | 1230 | 1530 | 148 | 133 |
| 1FW3283-2□E | 0.48 | 1120 | 1720 | 2150 | 131 | 118 |
| 1FW3283-2□G | 0.37 | 840 | 1720 | 2150 | 205 | 184 |
| 1FW3285-2□E | 0.36 | 1520 | 2450 | 3050 | 184 | 166 |
| 1FW3285-2□G | 0.28 | 1120 | 2450 | 3050 | 285 | 255 |
| 1FW3287-2□E | 0.25 | 2050 | 3450 | 4250 | 265 | 235 |
| 1FW3287-2□G | 0.19 | 1500 | 3450 | 4300 | 410 | 370 |
| **High Speed** | | | | | | |
| 1FW3281-3□J | 0.36 | 480 | 1230 | 1530 | 230 | 205 |
| 1FW3281-3□M | 0.26 | 360 | 1220 | 1520 | 335 | 300 |
| 1FW3283-3□J | 0.24 | 620 | 1710 | 2150 | 335 | 300 |
| 1FW3283-3□M | 0.2 | 460 | 1710 | 2100 | 460 | 410 |
| 1FW3285-3□J | 0.18 | 830 | 2450 | 3050 | 465 | 415 |
| 1FW3285-3□M | 0.16 | 630 | 2500 | 3100 | 620 | 550 |
| 1FW3287-3□J | 0.14 | 1090 | 3450 | 4250 | 610 | 550 |
| 1FW3287-3□M | 0.098 | 830 | 3450 | 4300 | 930 | 830 |

# Connection system

# 6

## 6.1 SINAMICS drive I/O

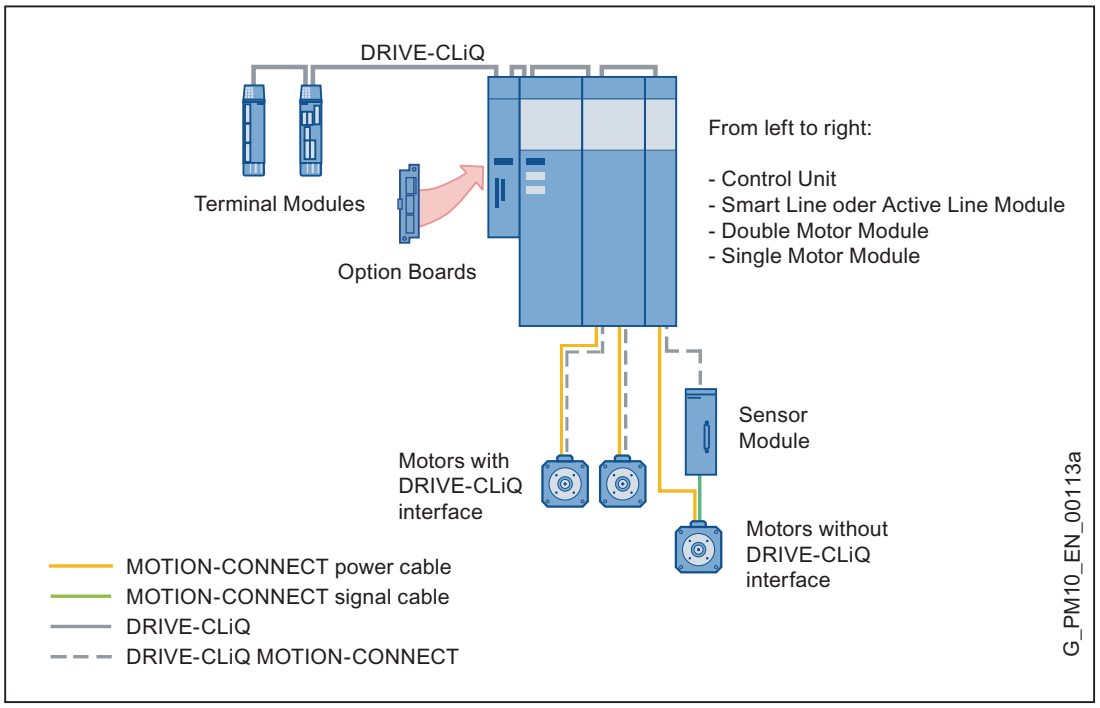



Figure 6-1 SINAMICS S120 system overview

**WARNING**

Before carrying out any work on the motor, please ensure that it is powered-down and the system is locked-out so that the motor cannot re-start!

The motors may not be connected to the line supply.

The complete torque motors can be operated in a 4-quadrant drive system. They can be connected to either a regulated or non-regulated infeed unit.

**Note**

The encoders are adjusted in the factory for SIEMENS drive converters. Another encoder adjustment may be required when operating the motor with a third-party converter.

# 6.2 Line connection

**CAUTION**

Carefully observe the current which the motor draws for your particular application! Adequately dimension the connecting cables according to IEC 60204-1 (see table "Cable cross section and current-carrying capacity").

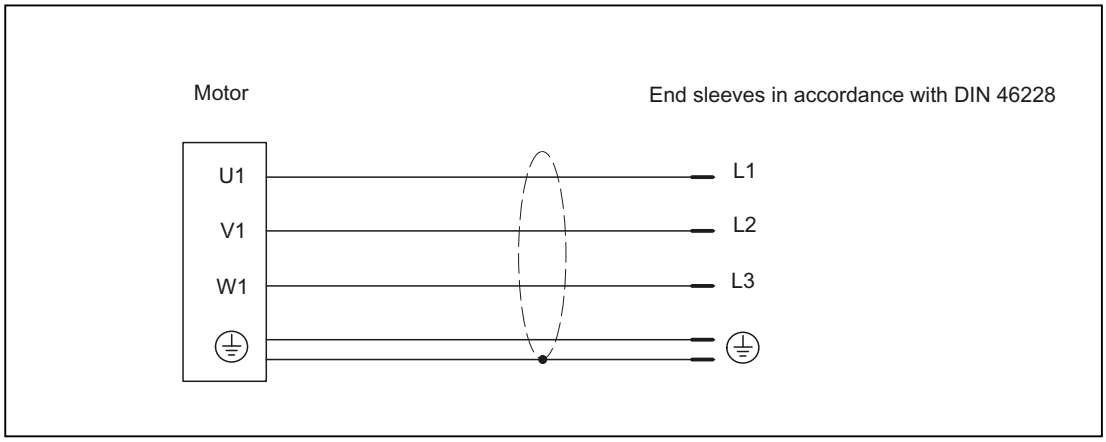



Figure 6-2 Power cable

## Terminal box connection

The type designation of the mounted terminal box as well as details for connecting-up the line feeder cables can be taken from Table "Cable cross-sections (Cu) and outer diameter of the connecting cables in the standard version". A circuit diagram to connected-up the motor winding is provided in the terminal box when the motors are shipped.

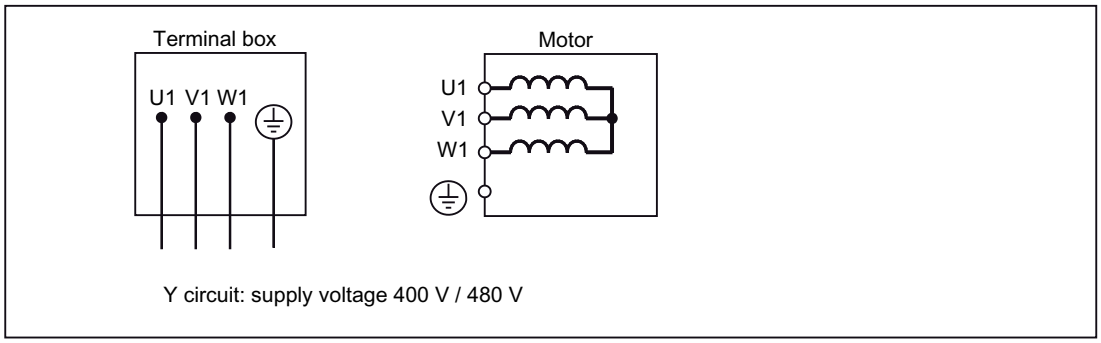



Figure 6-3 Circuit diagram

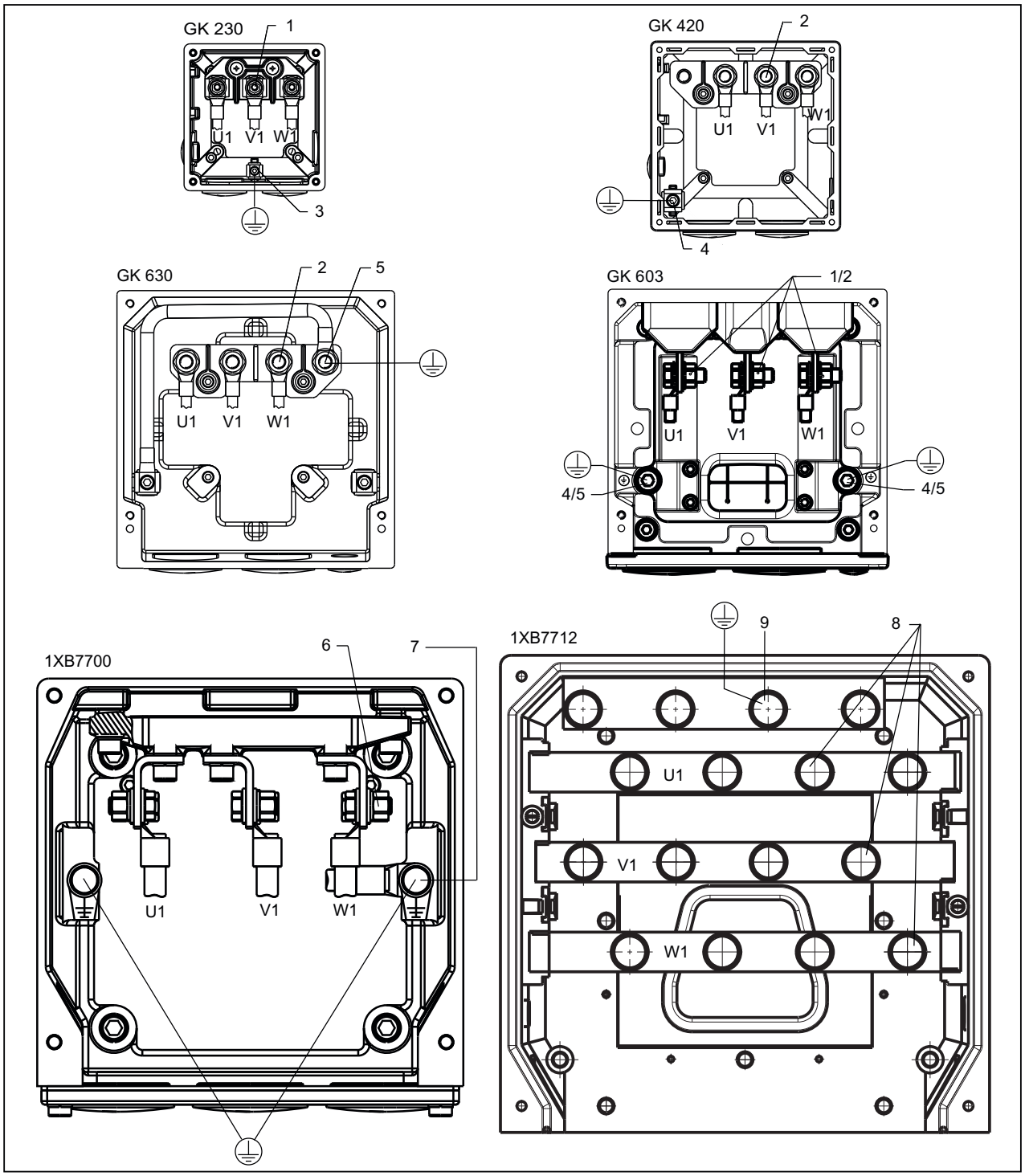



Figure 6-4 Terminal assignment in the terminal boxes

Table 6- 1 Description of the diagram "Terminal assignment in the terminal box"

| No. | Description | No. | Description |
|---|---|---|---|
| 1 | M5 connecting studs | 6 | Connecting bar 3 x M12 |
| 2 | M10 connecting studs | 7 | Grounding screw M12 max. 120 mm² |
| 3 | M4 grounding screw | 8 | M16 connecting studs |
| 4 | M6 grounding screw | 9 | M16 grounding studs |
| 5 | M10 grounding studs | | |

Table 6- 2 Cable cross-sections (Cu) and outer diameter of the connecting cables in the standard version

| Shaft height | Rated current $I_N$ | Terminal box type | Terminal stud | Thread for cable gland | Max. connectable cross-section | Cable diameter |
|---|---|---|---|---|---|---|
| 150 | $I_N \leq 50$ A | GK 230 | ∅ 5 mm | 2 x M32 x 1.5 | 2 x 16 mm² | 11 ... 24 mm |
| | 50 A < $I_N \leq 105$ A | GK 420 | ∅ 10 mm | 2 x M40 x 1.5 | 2 x 35 mm² | 19 ... 31 mm |
| | 105 A < $I_N \leq 260$ A | GK 630 | ∅ 10 mm | 2 x M50 x 1.5 | 2 x 50 mm² | 27 ... 38 mm |
| | $I_N \leq 260$ A | GK 603 [1] | ∅ 5 mm<br>∅ 10 mm | 2 x M63 x 1.5 | 2 x 50 mm² | 11 ... 38 mm |
| 200 | $I_N \leq 50$ A | GK 230 | ∅ 5 mm | 2 x M32 x 1.5 | 2 x 16 mm² | 11 ... 24 mm |
| | 50 A < $I_N \leq 105$ A | GK 420 | ∅ 10 mm | 2 x M40 x 1.5 | 2 x 35 mm² | 19 ... 31 mm |
| | 105 A < $I_N \leq 260$ A | GK 630 | ∅ 10 mm | 2 x M50 x 1.5 | 2 x 50 mm² | 27 ... 38 mm |
| | 260 A < $I_N \leq 480$ A | 1XB7700 | ∅ 12 mm | 3 x M75 x 1.5 | 3 x 120 mm² | 41 ... 56 mm |
| | $I_N \leq 260$ A | GK 603 [1] | ∅ 5 mm<br>∅ 10 mm | 2 x M63 x 1.5 | 2 x 50 mm² | 11 ... 38 mm |
| 280 | $I_N \leq 450$ A | 1XB7700 | ∅ 12 mm | 3 x M75 x 1.5 | 3 x 120 mm² | 41 ... 56 mm |
| | 450 A < $I_N \leq 800$ A | 1XB7712 | ∅ 16 mm | 4 x M75 x 1.5 | 4 x 120 mm² | 41 ... 56 mm |

[1] Terminal box with removable front plate (option)

**Note**

MOTION-CONNECT 500 power cables are available up to a cross-section of 120 mm² and MOTION-CONNECT 800PLUS up to 50 mm².

The listed cables are UL and/or CSA approved.

The approvals can be taken from the current catalog in Chapter "MOTION-CONNECT connection system".

# 6.3 Signal connection

DRIVE-CLiQ is the preferred method for connecting the encoder systems to SINAMICS.

Motors with a DRIVE-CLiQ interface can be ordered for this purpose. Motors with a DRIVE-CLiQ interface can be directly connected to the associated motor module via the available MOTION-CONNECT DRIVE-CLiQ cables. The MOTION-CONNECT DRIVE-CLiQ cable is connected to the motor in degree of protection IP67. The DRIVE-CLiQ interface supplies power to the motor encoder via the integrated 24 VDC supply and transfers the motor encoder and temperature signals and the electronic type plate data, e.g. a unique identification number, rating data (voltage, current, torque) to the control unit. The MOTION-CONNECT DRIVE-CLiQ cable is used universally for connecting the various encoder types. These motors simplify commissioning and diagnostics, as the motor and encoder type are identified automatically.

## Motors with DRIVE-CLiQ interfaces

Motors with DRIVE-CLiQ interfaces can be connected to the associated Motor Module directly via the MOTION-CONNECT DRIVE-CLiQ cables available. This means that data are transferred directly to the control unit.

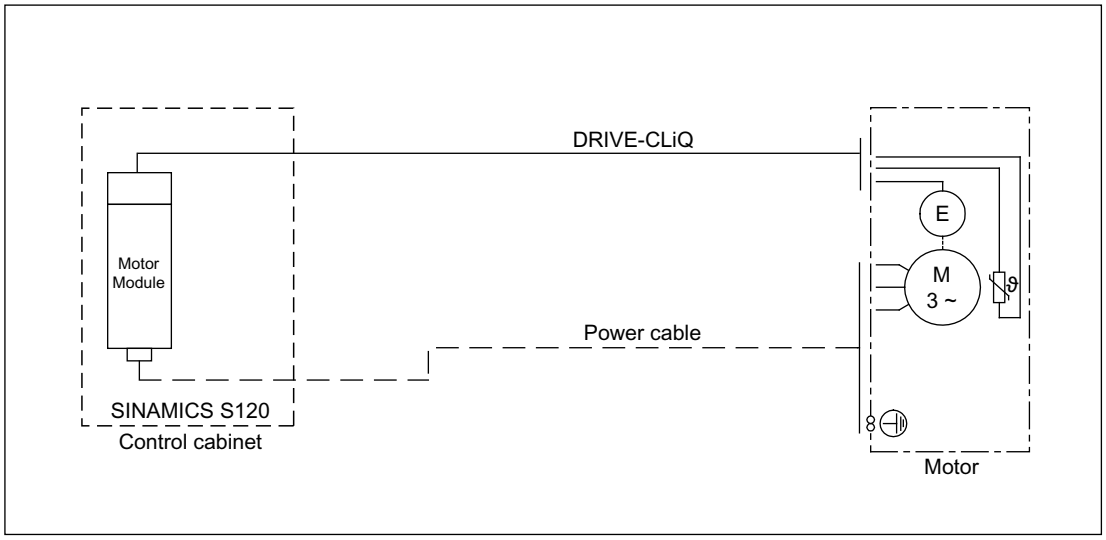



Figure 6-5 Connecting encoders using the DRIVE-CLiQ interface

## Motors without DRIVE-CLiQ interfaces

If a motor is not equipped with a DRIVE-CLiQ interface, the speed encoder and temperature sensor are connected via a signal connector.

Motors that are not equipped with DRIVE-CLiQ require a Cabinet-Mounted Sensor Module (SMC) when operated with SINAMICS S120. The motor is connected to the SMC via a signal line. The SMC is connected to the Motor Module via a MOTION-CONNECT DRIVE-CLiQ cable.

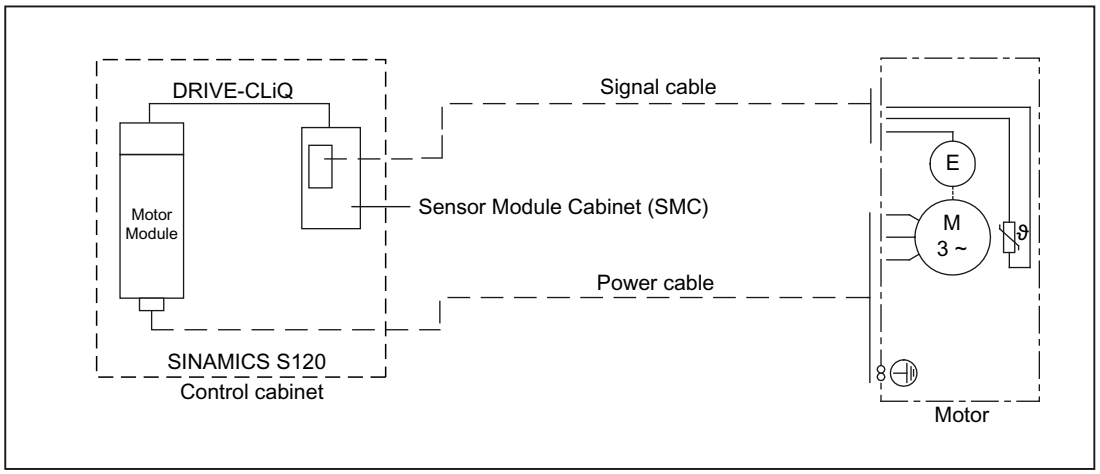



Figure 6-6 Connecting encoders without DRIVE-CLiQ interface

## 6.4 Rotating the connector at the motor

Signal connector and integrated Sensor Module can be rotated to a limited extent.

| NOTICE |
|---|
| **When rotating the connector, the following must be observed**<br>• It is not permissible that the specified rotation range is exceeded.<br>• In order to guarantee the degree of protection, max. 10 revolutions are permissible.<br>• Do not exceed the max. torque when rotating, refer to the table "Rotating torques".<br>• Connectors should be rotated using the matching mating connector located on the connector thread.<br>• Connecting cables must be secured against tension and bending.<br>• The motor connectors must then be secured so that they cannot rotate.<br>• It is not permissible to subject the connector to continuous force. |

Table 6- 3 Maximum rotating torques that occur

| Connector | Max. rotating torques that occur [Nm] |
|---|---|
| Signal connector | 8 |
| Integrated Sensor Module | 8 |

Signal cable

The manufacturer mounts the plug-in connection for the signal cable (at the encoder terminal box). When inserting the connector, the coding grove must be inserted aligned in the socket connecter and the union nut must be tightened by hand to the end stop.

## 6.5 Connecting-up information

Pre-assembled cables offer many advantages over cables assembled by customers themselves. In addition to being sure that they will work perfectly and the high quality, there are also cost benefits.

Use the power and signal cables from the MOTION CONNECT family. The maximum cable lengths should be carefully observed. Technical data of the cables, refer to Catalog, Chapter "MOTION-CONNECT connection system".

Apply the EMC installation guideline of the converter manufacturer. For Siemens converters, this is available under Order No. 6FC5297-□AD30-0AP□.

### Cable installation

- Shielded power and signal cables must be used.
- In exceptional cases, it is possible to use twisted motor cables or three-core cables with additional ground conductor. Only remove insulation from the cable ends so that the insulation completely extends up to the cable lug, to the terminal, or end sleeve.
- Protruding wire ends must be avoided.
- The connecting cables should be freely arranged in the terminal box so that the protective conductor has an overlength and the cable conductor insulation cannot be damaged. Connecting cables should be appropriately strain relieved.
- The cable lug size must be adapted to the dimensions of the terminal board connections and the cross section of the line supply cable.
- Take measures to ensure that connecting cables cannot rotate, are not subject to strain and pushing force and also provide anti-kink protection. It is not permissible to subject cables to continuous force.
- Take special care that the required minimum air clearances are actually maintained:

Table 6- 4 Minimum air clearance

| | | |
|---|---|---|
| Max. terminal voltage | < 600 V | < 1000 V |
| Minimum air clearance | 5.5 mm | 8 mm |

- The screwed electrical connections must be tightened with the specified tightening torques:

Table 6- 5 Tightening torques

| Thread Ø | M4 | M5 | M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|---|
| Tightening torque (Nm) | 0.8 ... 1.2 | 1.8 ... 2.5 | 2.7 ... 4 | 5.5 ... 8 | 9 ... 13 | 14 ... 20 | 27 ... 40 |

**Note**

In order to avoid disturbing effects (e.g. as a result of EMC), the signal cables must be routed separately away from power cables.

## Internal potential bonding (for 1FW315□ and 1FW320□)

The potential bonding between the grounding terminal in the box enclosure and the motor housing is established through the terminal box retaining bolts. The contact locations below the heads of the bolts are bare and are protected against corrosion.

The standard screws that are used to connect the terminal box cover to the terminal box are sufficient as potential bonding between the terminal box cover and the terminal box enclosure.

## Outer protective conductor or potential bonding conductor

**Note**

For 1FW328□ and for 1FW3204-3* / 1FW3206-3* / 1FW3208-3*, there is an additional connection point on the frame to connect an outer protective conductor or potential bonding conductor.

(For shaft height 1FW315□ and 1FW320-1* this is not required.)

## Connect-up the ground conductor

The grounding conductor cross-section must be compliance with the appropriate installation/erection regulations, e.g. acc. to IEC/EN 60204-1.

For motors with a rated power > 100 kW, the ground conductor must be additionally connected to the motor frame. A threaded hole is provided for the ground conductor at the designated connection point. This is suitable for connecting stranded conductors with cable lugs or straps with an appropriately terminated conductor end.

Please note the following when connecting-up:

- The connecting surface must be bare and must be protected against corrosion using a suitable substance, e.g. using acid-free Vaseline
- Spring washer and normal washer must be located under the head of the screw
- The minimum screw-in depth and tightening torque of the clamping screw must be maintained (refer to the Table )

Table 6- 6 Screw-in depth and tightening torque

| Screw | Minimum screw-in depth | Tightening torque |
|---|---|---|
| M10 x 30 | 15 mm | 28 - 42 Nm |

## After connecting-up, the following should be checked/tested

- The inside of the terminal box must be clean and free of any cable pieces
- All of the terminal screws must be tight
- The minimum air clearances must be maintained
- The cable glands must be reliably sealed
- Unused cable glands must be closed and the plugs must be tightly screwed in place
- All of the sealing surfaces must be in a perfect condition

## Current-carrying capacity for power and signal cables

The current-carrying capacity of PVC/PUR-insulated copper cables is specified for routing types B1, B2 and C under continuous operating conditions in the table with reference to an ambient air temperature of 40 °C. For other ambient temperatures, the values must be corrected by the factors from the "Derating factors" table.

Table 6- 7 Cable cross section and current-carrying capacity

| Cross section | Current-carrying capacity rms; AC 50/60 Hz or DC for routing type | | |
|---|---|---|---|
| [mm²] | B1 [A] | B2 [A] | C [A] |
| **Electronics (according to EN 60204-1)** | | | |
| 0,20 | - | 4,3 | 4,4 |
| 0,50 | - | 7,5 | 7,5 |
| 0,75 | - | 9 | 9,5 |
| **Power (according to EN 60204-1)** | | | |
| 0,75 | 8,6 | 8,5 | 9,8 |
| 1,00 | 10,3 | 10,1 | 11,7 |
| 1,50 | 13,5 | 13,1 | 15,2 |
| 2,50 | 18,3 | 17,4 | 21 |
| 4 | 24 | 23 | 28 |
| 6 | 31 | 30 | 36 |
| 10 | 44 | 40 | 50 |
| 16 | 59 | 54 | 66 |
| 25 | 77 | 70 | 84 |
| 35 | 96 | 86 | 104 |
| 50 | 117 | 103 | 125 |
| 70 | 149 | 130 | 160 |
| 95 | 180 | 165 | 194 |
| 120 | 208 | 179 | 225 |

| Cross section | Current-carrying capacity rms; AC 50/60 Hz or DC for routing type | | |
|---|---|---|---|
| [mm²] | B1 [A] | B2 [A] | C [A] |
| **Power (according to IEC 60364-5-52)** | | | |
| 150 | - | - | 259 [1] |
| 185 | - | - | 296 [1] |
| > 185 | Values must be taken from the standard | | |

[1] Extrapolated values

Table 6- 8 Derating factors for power and signal cables

| Ambient air temperature [°C] | Derating factor according to EN 60204-1 Table D1 |
|---|---|
| 30 | 1,15 |
| 35 | 1,08 |
| 40 | 1,00 |
| 45 | 0,91 |
| 50 | 0,82 |
| 55 | 0,71 |
| 60 | 0,58 |

## 6.6 Routing cables in a damp environment

| NOTICE |
|---|
| If the motor is mounted in a humid environment, the power and signal cables must be routed as shown in the following figure. |

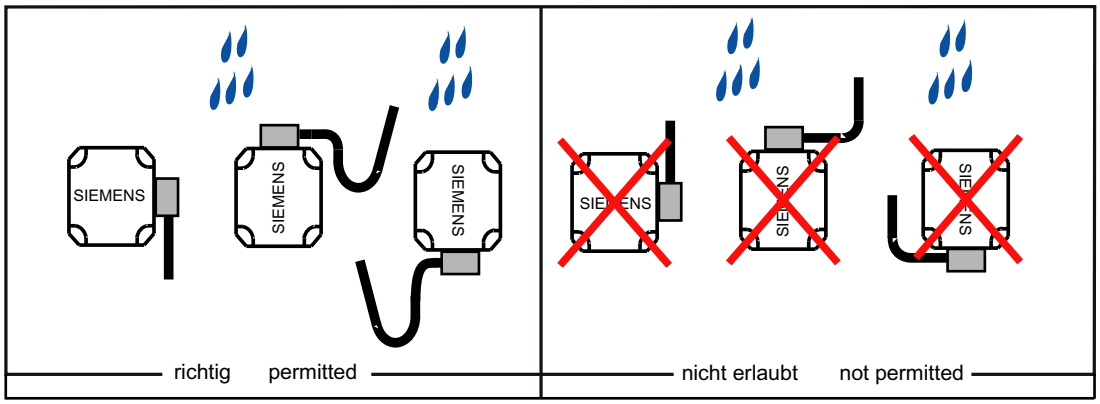



Figure 6-7 Principle of cable routing in a wet/moist environment

# Assembly 7

## 7.1 Warning and danger information when mounting

**⚠ DANGER**

Torque motors are equipped with strong magnets. This is the reason that when the motors are open there are **strong magnetic fields** and **high magnetic forces of attraction**.

It is not permissible that personnel with heart pacemakers or metal implants work on an opened motor.

Keep clocks/watches and magnetic data mediums (e.g. floppy disks, credit cards, etc.), away from these motors.

**⚠ WARNING**

These motors are electrically operated. When electrical equipment is operated, certain parts of these motors are at hazardous voltage levels. If this motor is not correctly handled/operated, this can result in death or severe bodily injury as well as significant material damage.

Please carefully observe the warning information in this chapter and on the product itself.

- Only **qualified personnel** are permitted to carry-out installation/mounting and repair work on this motor.
- When transporting, use the cable slings provided
- All work on the motor should be undertaken with the system in a no-voltage condition
- The motor should be connected-up according to the circuit diagram provided
- In the motor terminal box, it must be ensured that the connecting cables are connected so that there is electrical isolation between the cables and the terminal box cover
- It must be ensured that the terminal box is sealed
- It is not permissible to use cables with insulation that is either defective or damaged
- Only spare parts, certified by the manufacturer, may be used
- Check that they match the conditions at the installation location (e.g. temperatures, installation altitude)
- It is prohibited that the motors are used in hazardous zones and areas
- Thoroughly remove all anti-corrosion agents from the connecting flange (use commercially available solvents)
- The drive-out elements should be rotated by hand. If there is a grinding noise, the cause must be rectified or the manufacturer contacted.

## 7.2 Overview of the mounting options

Torque motors are generally used as direct drives, i.e. without any intermediate gearbox or belts. The principle difference between mounting motors for conventional drives and for direct drives can be seen from the following diagram.

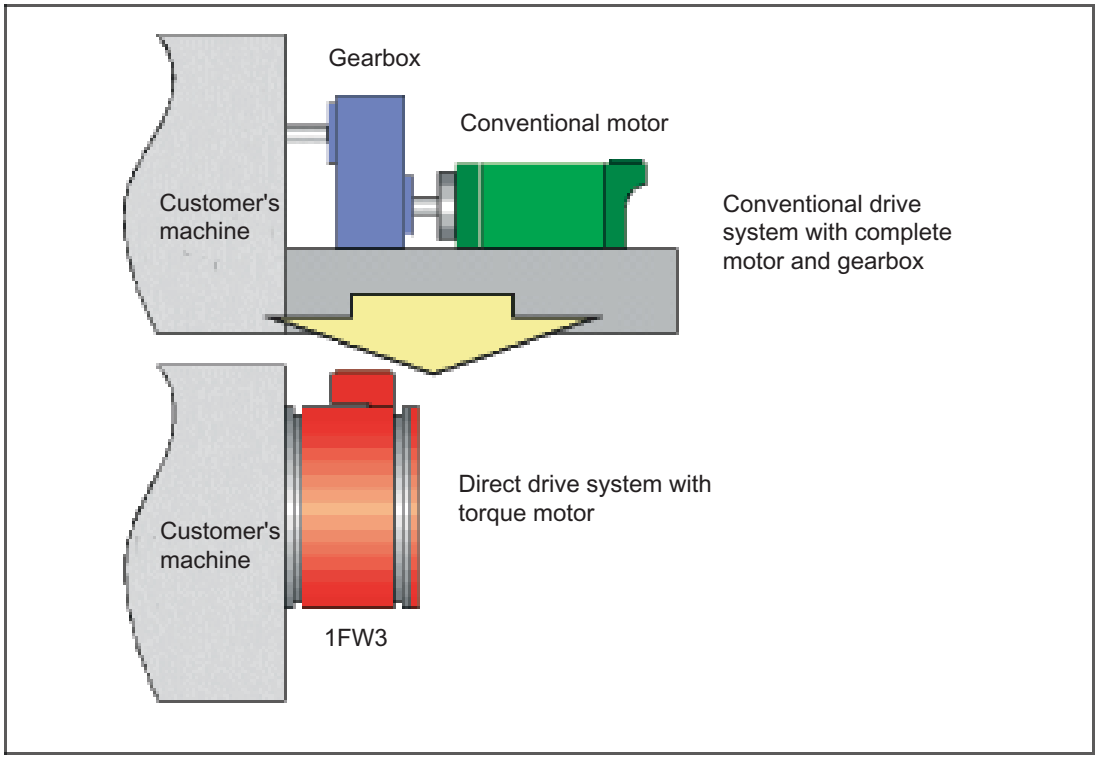



Figure 7-1 Comparison between conventional and direct drive systems

### The following must be observed when mounting

The torque motors are complete motors equipped with deep-groove ball bearings.

| NOTICE |
| --- |
| Under no circumstances may the max. permissible axial and radial forces be exceeded.<br>Under no circumstances may the bearings of the customer's machine over-determine the motor bearings. If the bearings are over-determined, this can result in immediate bearing damage or the bearing change interval will be significantly reduced. |

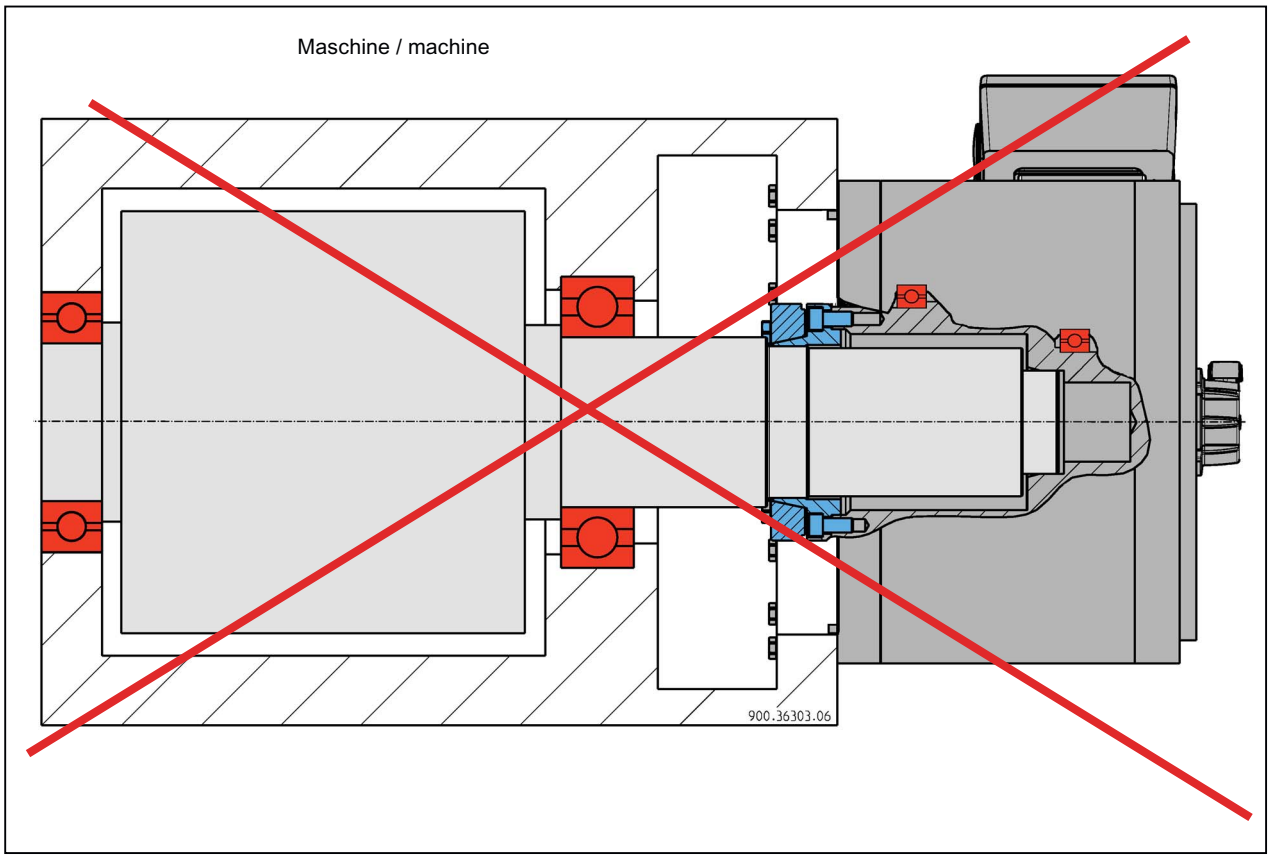



Figure 7-2 Over-determined bearings of a shaft (to be avoided)

## Mounting the motor frame to the machine on the customer's side

The following possibilities are available for mounting the motor frame of the complete torque motor 1FW3 to the machine on the customer's side:

1. Flange-mounting for 1FW3 motors (SH 150, SH 200, SH 280)
2. Foot and flange-mounting for 1FW3 motors (SH 280)

Table 7- 1 Types of construction

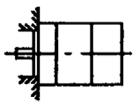
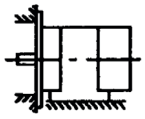
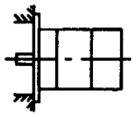
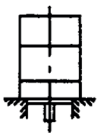
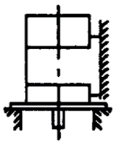
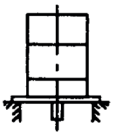
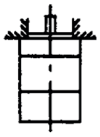
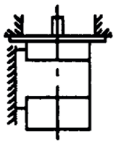
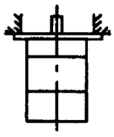
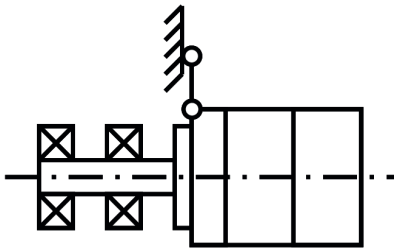
| Type of construction | Designation | Type of construction | Designation | Type of construction | Designation |
|---|---|---|---|---|---|
| 1FW315□ / 1FW320□ | | 1FW328□<br>Standard | | 1FW328□-□□□□5<br>Heavy Duty | |
|  | IM B14 |  | IM B35 |  | IM B5 |
|  | IM V18 |  | IM V15 |  | IM V1 |
|  | IM V19 |  | IM V35 |  | IM V3 |
| 1FW315 / 1FW320 / 1FW328 | | | | | |
|  | | Plug-on mounting with torque arm<br>(not standardized) | | | |

Table 7- 2 Mounting the motor frame

| Shaft height | Type of construction | Holes at the DE housing flange | Pitch circle diameter |
|---|---|---|---|
| 150 | IM B14, IM V18/19 | 12 x M10 | 295 mm |
| 200 | IM B14, IM V18/19 | 16 x M10 | 380 mm |
| 280 | IM B35, IM V15/35 | 24 x ∅ 13 mm | 532 mm |
| 280 | IM B5, IM V1/3 | 24 x ∅ 17.5 mm | 650 mm |

### Rotor connected to the drive shaft

The rotor of the 1FW3 motor can be connected as follows to the drive shaft on the customer's side:

Table 7- 3 Rotor connected to the drive shaft

| Shaft height | Threaded hole at the rotor DE (face side) | Tensioning elements in the inner diameter of the rotor |
|---|---|---|
| 150 | 12 x M12, 24 mm deep, pitch circle diameter 170 mm | Inside diameter, 153 mm H7 |
| 200 | 12 x M12, 24 mm deep, pitch circle diameter 170 mm | Inside diameter, 153 mm H7 |
| 280 | 24 x M16, 34 mm deep, pitch circle diameter 280 mm | Inside diameter, 250 mm H7 |

**NOTICE**

The permissible clamping range must be carefully observed! The permissible surface pressure must not be exceeded!

A stable foundation design and precise motor alignment are prerequisites for smooth, vibration-free operation.

The following mounting notes must be carefully observed:

- Especially for high-speed motors with flange mounting, it is important that the mounting is stiff in order to locate any resonant frequency as high as possible so that it remains above the maximum rotational frequency.
- Thin sheets (shims) can be placed under the motor mounting feet to align the motor and to avoid mechanically stressing the motor. The number of shims used should be kept to a minimum.
- In order to securely mount the motors and reliably and safely transfer the drive torque, bolts with property class 8.8 acc. to ISO 898-1 should be used.

## 7.3 Plug-on installation

**NOTICE**

**Installation using the plug-on principle**

When installing the motor using the plug-on principle (motor on the shaft, enclosure supported with a torque arm), the weight of the motor results in an additional load. This must be taken into account when designing the bearings and shaft. Information on the motor weight is provided in the data sheets or dimension drawings.

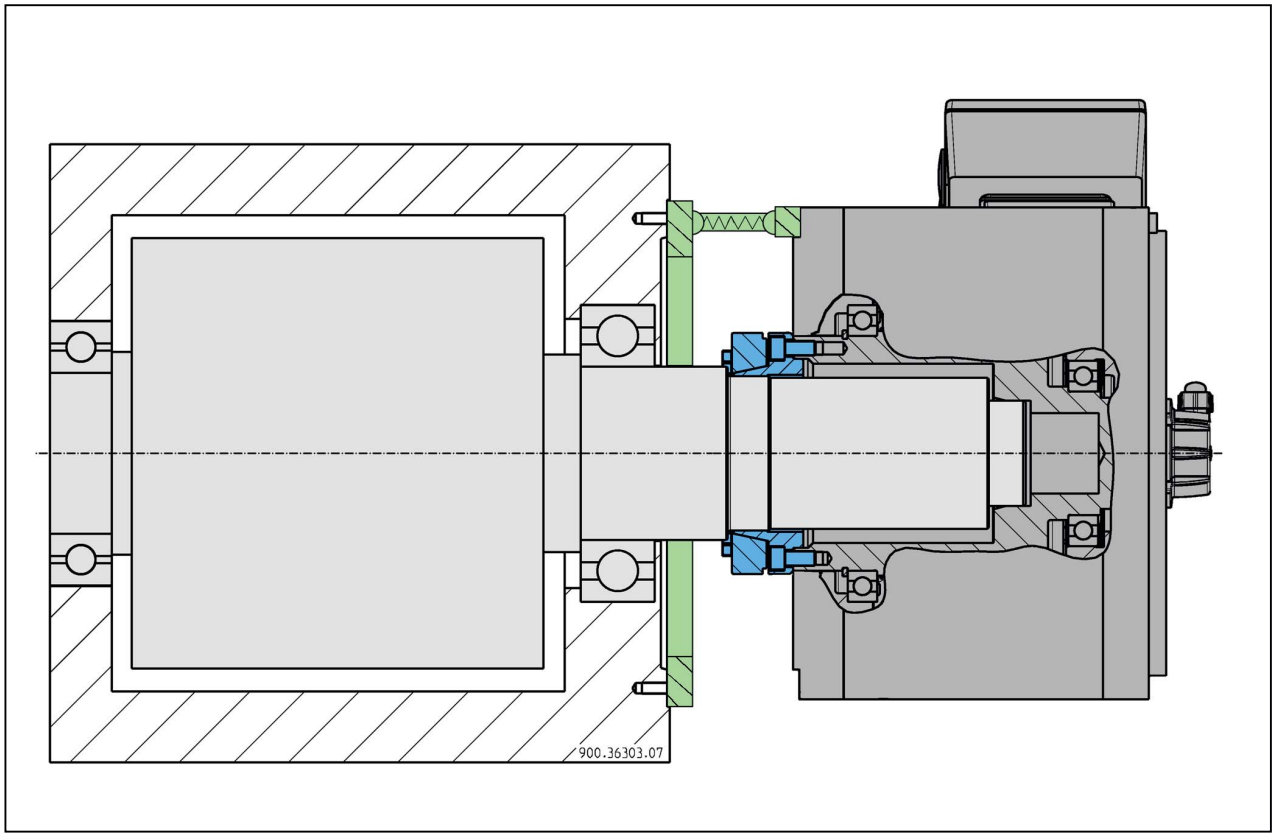



Figure 7-3 De-coupling the stator from the machine base using a torque arm (schematic representation)

- For the plug-on mounting, the motor weight is **solely** supported by the **shaft extension** of the driven machine. The mounting to the motor frame cannot accept any cantilever forces and therefore does not support the motor. This must be **taken into account when dimensioning the shaft extension and the machine bearings**.
- The natural bending frequency can be shifted as a result of the lower stiffness of the mounting to the motor frame. Operation at a rotational frequency in the range of the natural bending frequency should be avoided.

## 7.3.1 Siemens torque arm

### Option T32

In Chapter "Overview of the mounting options", it was explained that it is not permissible that the customer's machine bearings over-determine the bearing of a shaft.

One possible solution is the Siemens torque arm.

Advantage: Torque arms ensure a torsionally-rigid motor connection in a radial direction and balance axial tolerances and misalignments.

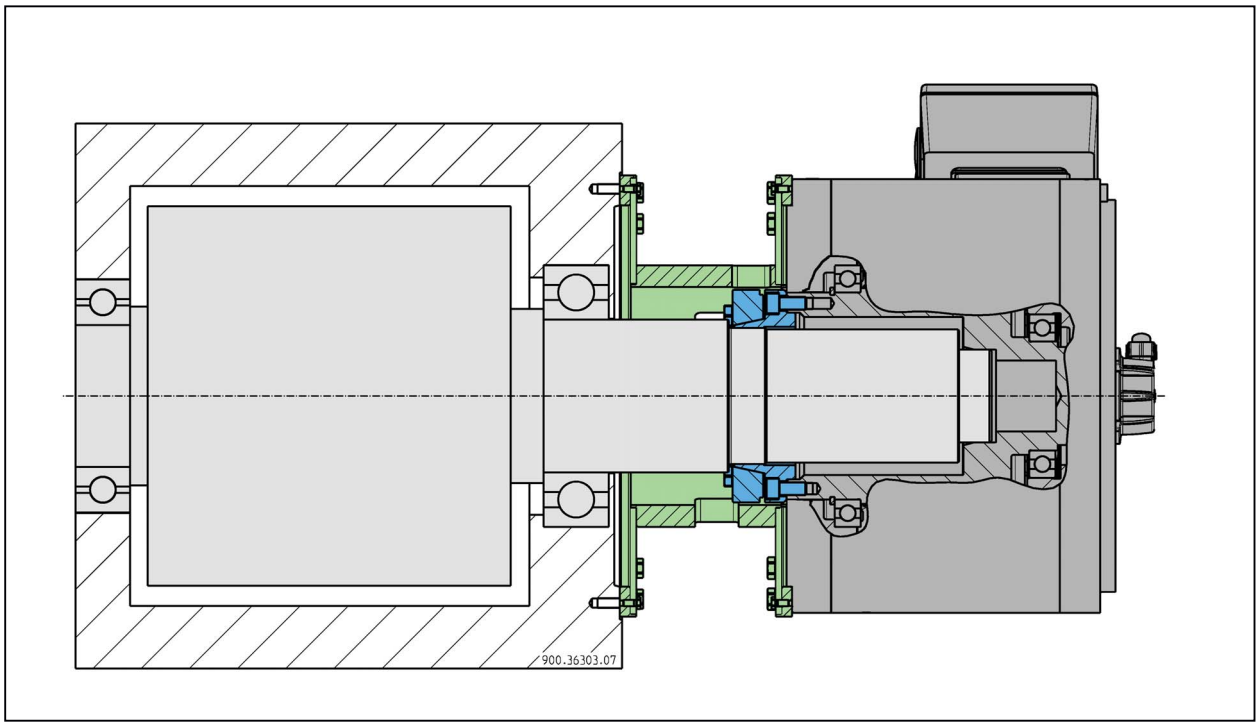



Figure 7-4 Schematic representation of the Siemens torque arm

When designing the mounting, it must be ensured that a possible (thermal) expansion of the shaft extension remains in a range less than 0.1 mm.

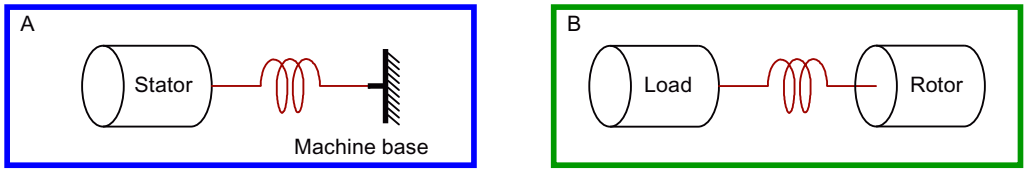
Further, before mounting, the motor should only be placed on supporting prisms. This rules out that the mounting flange of the Siemens torque arm is subject to inadmissibly high cantilever forces.

**Note**

The Siemens torque arm is available as standard for shaft height 200, and for shaft heights 150 and 280, is available on request.

## Influence of the torque arm on the speed control loop

By connecting the stator through a flexible element, with respect to the machine foundation, the stator represents an additional system that can oscillate (see Fig A), in addition to the two mass system comprising the load and rotor (see Fig. B).




The influence of the Siemens torque arm is shown qualitatively in the following diagram. The two-mass oscillating system comprising motor and load still dominates the system response; however, coupling the stator through the Siemens torque arm is manifested in the form of additional resonance effects, which must be dampened by the closed-loop control.

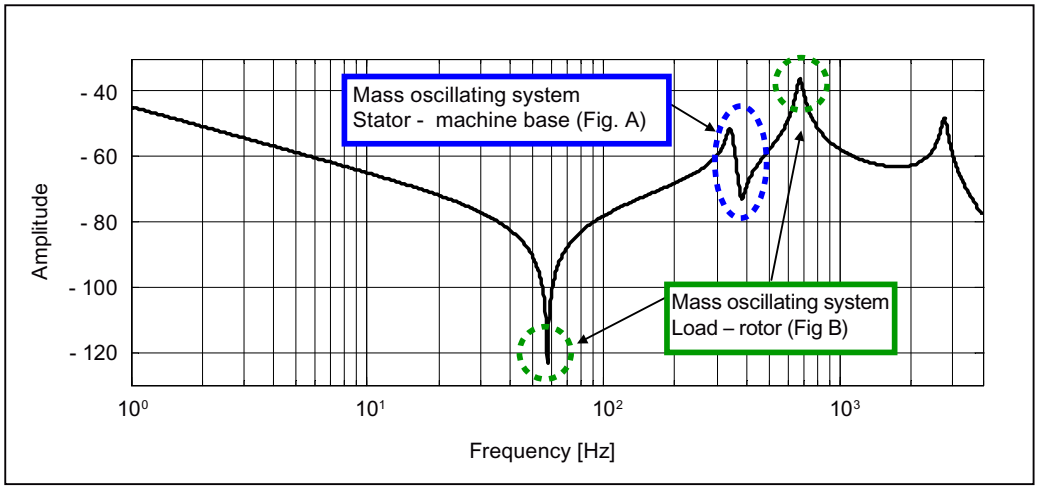



Figure 7-5 Speed control loop – influence of the Siemens torque arm

Table 7- 4 Resonant frequency, stator coupling

| Motor | Resonant frequency to be expected [Hz] | Note |
|---|---|---|
| 1FW3201 | 340 | Depending on the particular application, the resonant frequency can be up to 20% higher. |
| 1FW3202 | 310 | |
| 1FW3203 | 290 | |
| 1FW3204 | 260 | |
| 1FW3206 | 240 | |
| 1FW3208 | 220 | |

## Mounting sequence, Siemens torque arm with clamping element

1. Check the rotor and prepare the shaft seat:

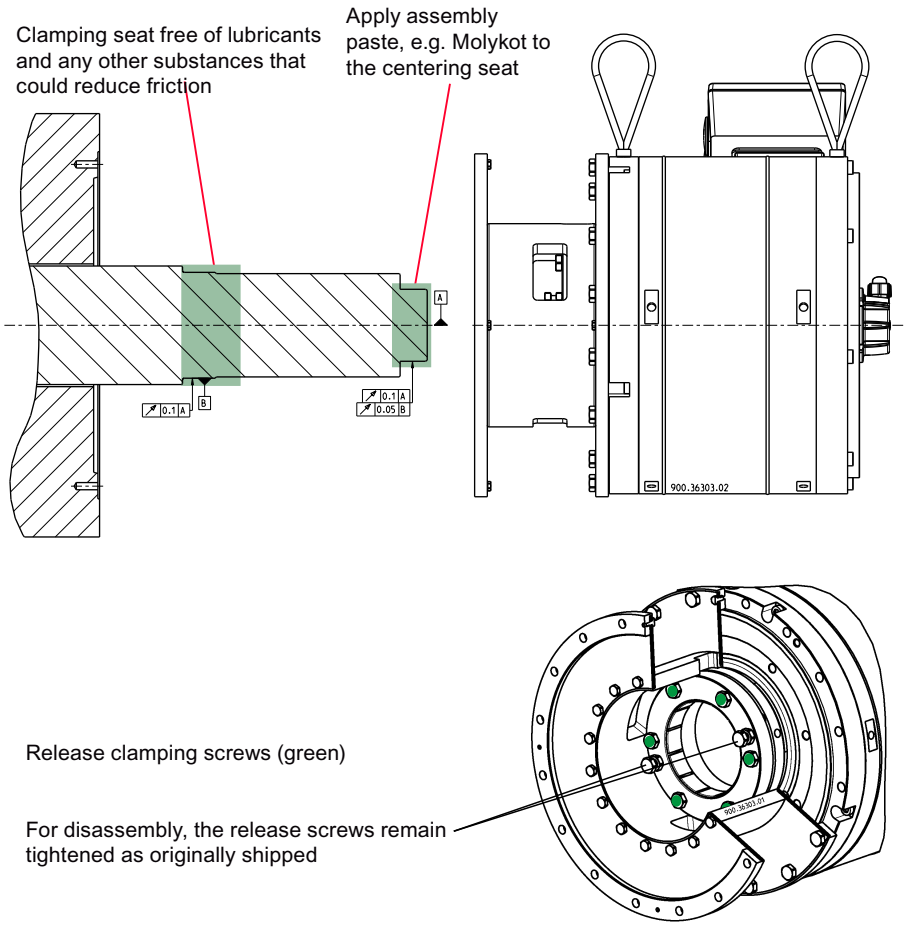



Figure 7-6 As delivered state and preparations for mounting

2. Axially slide the motor onto the customer's flange:

- The motor is slid onto the shaft extension and is in the correct axial position when the torque arm is located on the machine-side flange. The motor is **not** axially positioned on the shaft side.
- Tighten the clamping screws of the ring clamping element according to the mounting instructions "Mounting sequence, clamping elements, option +Q30" in Chapter "Shaft-side clamping element".
- You can rotate the motor using the shaft extension so that you can easily access the screws.

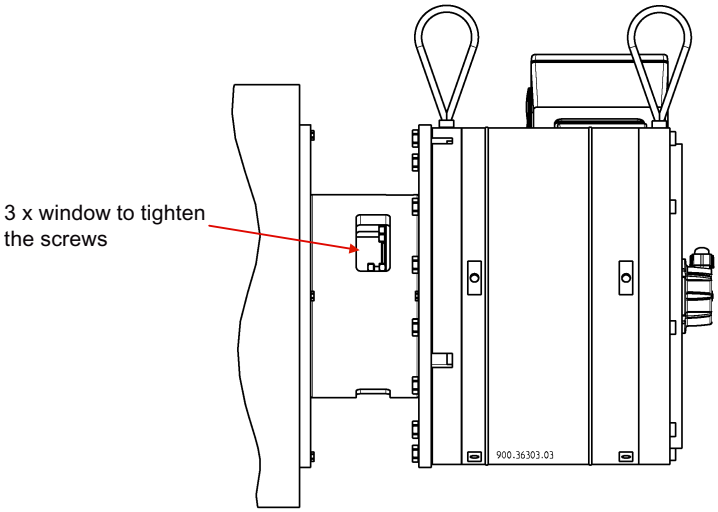



Figure 7-7 Pre-mounting

3. Check the gap in the clamping element, and if required, measure the motor alignment (run out):

- The gap between the two clamping element parts must be able to be identified around the complete circumference.
- In order to achieve a higher smooth running quality, you can check the alignment of the motor to the machine at the surface shown. If the deviation is too high, then alignment is possible by tightening the clamping screws.
- For further information on checking, see the mounting instructions "Mounting sequence, clamping elements of option +Q30" in Chapter "Shaft-side clamping element".

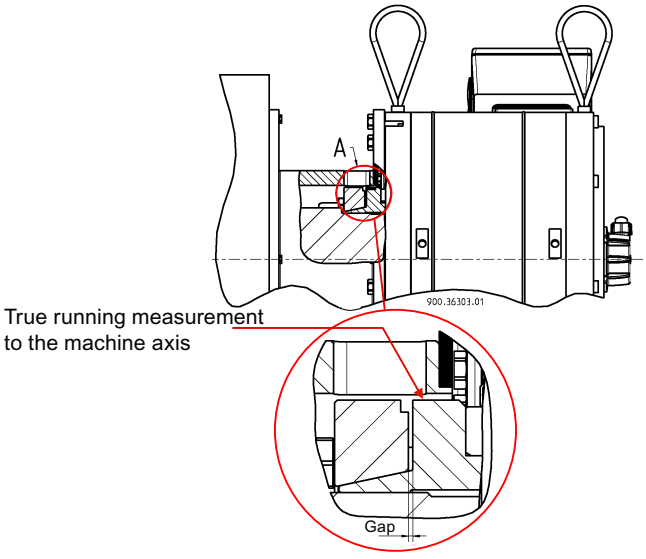



Figure 7-8 Check

4. Mounting the Siemens torque arm:

After successfully carrying out steps 1 – 3, screw the Siemens torque arm to the machine.

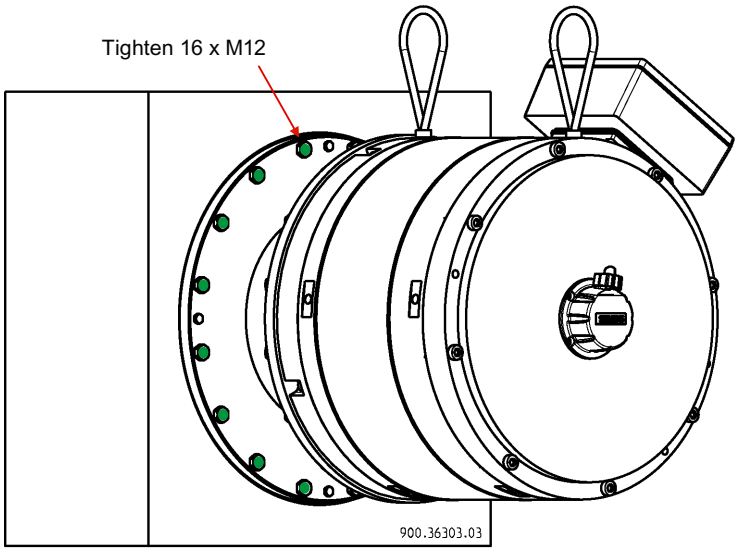



Figure 7-9 Final mounting

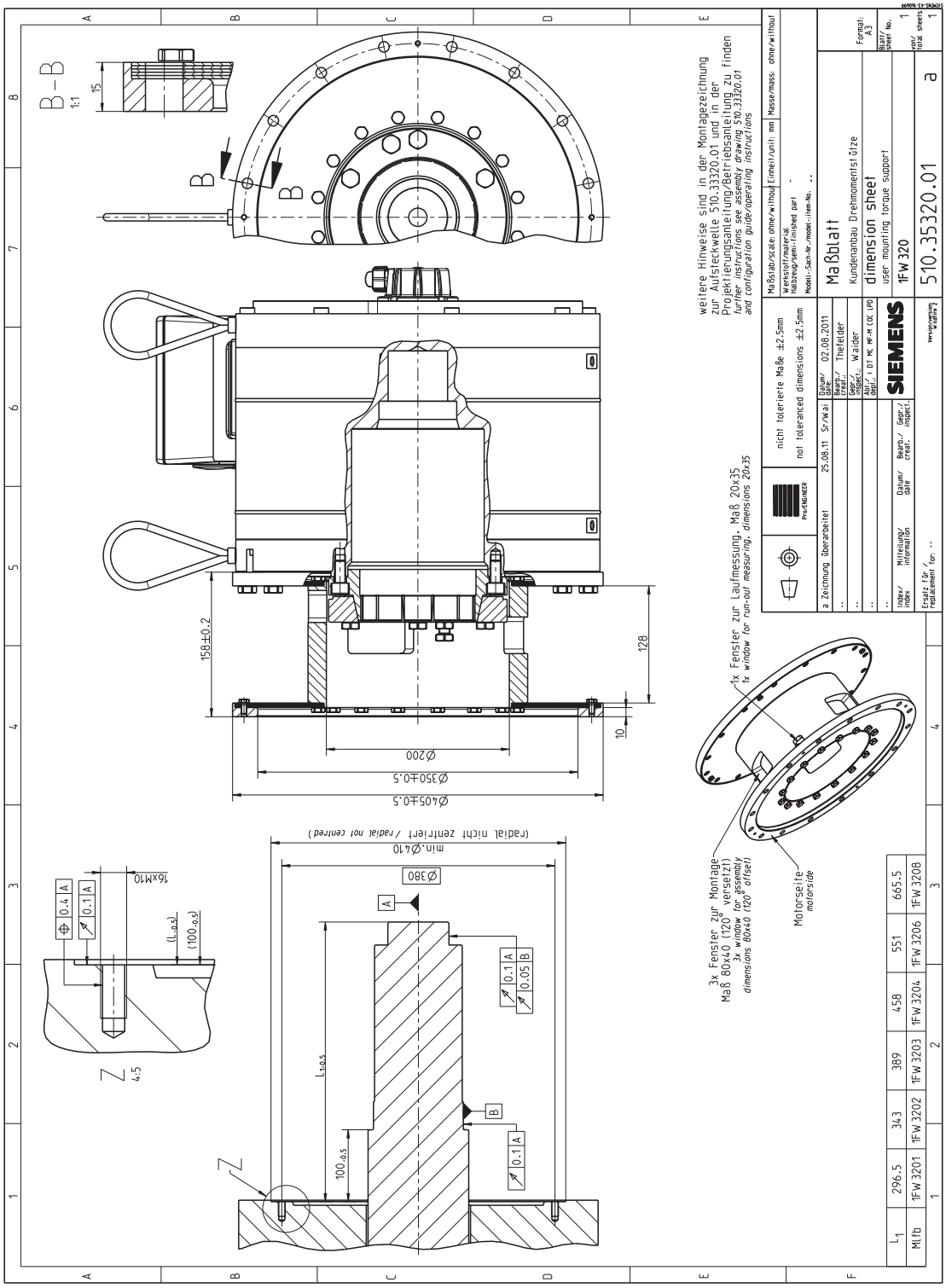



Figure 7-10 Siemens torque arm

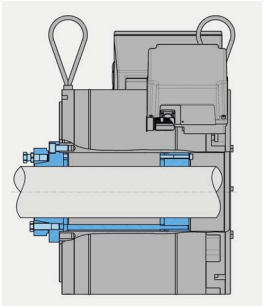
## 7.3.2 Shaft-side clamping element

Various mounting options using clamping elements are shown in this Chapter.

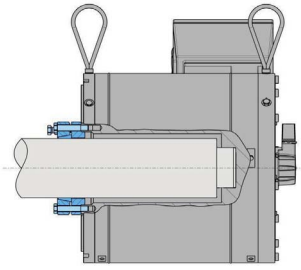
Siemens AG in cooperation with RINGSPANN GmbH has developed various clamping system solutions to ensure secure, friction-locked connection of torque motors to cylindrical machine shafts - with the following objectives.

- Safely and reliably transmitting the torque
- Precisely centering the torque motor on the machine shaft
- Avoid inadmissible deformation to the torque motor components
- No stress caused by different temperature changes in the torque motor and in the machine shaft
- Simple mounting
- Simple disassembly, even after longer periods of operation

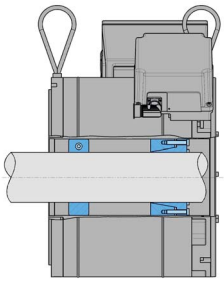
Mounting using suitable clamping elements is explained in the following.



Hollow shaft with option, clamping element and centering part
1FW3x-xxxxx-xxAx +Q30
See Chapter "Hollow shaft with option +Q30"

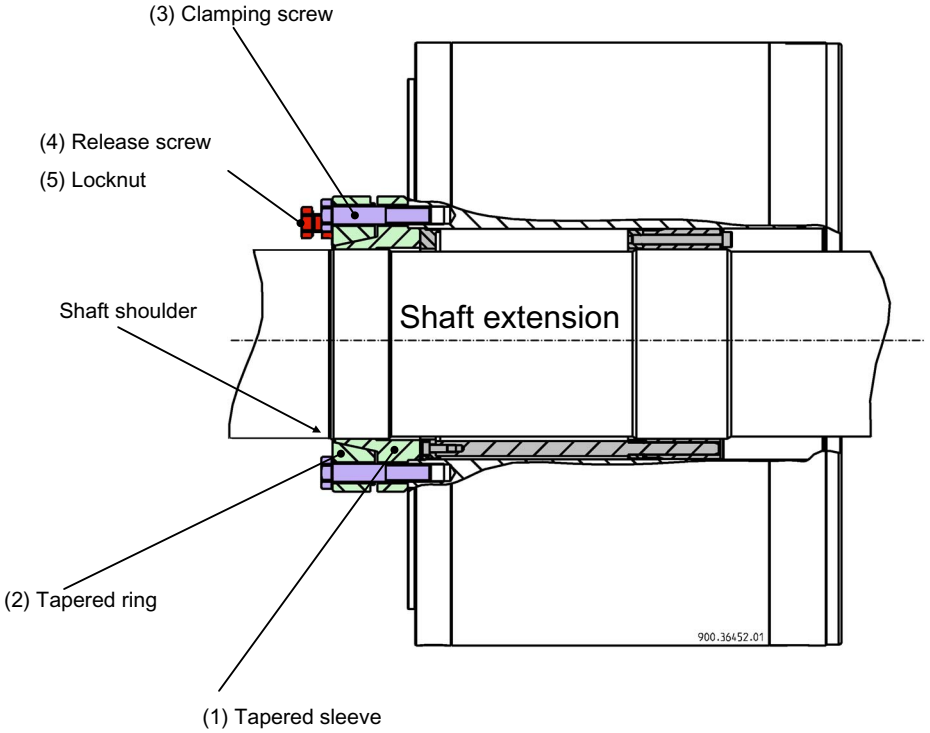


Plug-on shaft with clamping element
1FW3x-xxxxx-xxSx +Q30
See Chapter "Plug-on shaft with option +Q30"



Hollow shaft with inner clamping element from the Ringspann company
1FW315-xxxxx-xxCx
1FW320-xxxxx-xxCx
For details, see Chapter "Hollow shaft, inner clamping element"

## Mounting sequence, clamping elements of option +Q30




1. Using the clamping element (possibly with centering sleeve), mount the motor at the intended position on the shaft extension.
2. Using screws (3) clamp the tapered ring (2) onto the tapered sleeve (1). Initially tighten all screws diagonally so that they are hand tight (5 to 8 Nm).
3. Then tighten all of the screws (3) one after the other diagonally using a torque wrench. When doing this, the screw may only be tightened through a maximum of ¼ of a turn. With the torque wrench set to a torque of 127 Nm, repeat this procedure until none of the screws turns any further. Then check that the motor runs true.
4. Then check the gap between the tapered sleeve (1) and tapered ring (2) and between the tapered sleeve (1) and the release screw (4). There must be a minimum gap of 0.1 mm around the complete circumference. If this minimum gap does not exist, then there is the risk that the clamping element will not fulfill its function (excessively low joint interference).
   Causes could be: for hollow shaft extensions: excessively low wall thickness or excessively small diameter of the clamping seat.

### Options to optimize the smooth running characteristics of the mounting

The true running can be checked during procedures 2 and 3. The motor can be aligned by specifically tightening the screws (3). If the clamping screw (3) is over-proportionally tightened, then at this position the motor is lifted off from the shaft extension.

If, after tightening to the final torque, the true running check indicates an excessively high deviation, then all of the clamping screws (3) should be released and tightening procedures 2 and 3 should be repeated, checking the true running and specifically tightening the clamping screws (3).

### Disassembly

If, when disassembling the clamping element, after removing the clamping screws (3) the tapered ring (2) cannot be released, then proceed as follows:

1. Release the nut (5) and turn this until it comes into contact with the head of the release screw (4).
2. Rotate the release screws (4) in the tapered ring (2) until they are in contact with the tapered sleeve (1).
3. Screw in the release screws (4) one after the another through ¼ of a turn until the tapered ring is released.

If the motor cannot be released from the shaft extension, for an appropriate shaft extension design, using the release screws, it is possible to press the tapered ring until it comes into contact with the shaft shoulder. The motor is pressed from the shaft extension by turning the release screws further (4).

When re-using the clamping element, the release screws must be screwed back in and secured using the nuts (5).

### Support

If certain requirements exist, e.g.

- different diameter
- restricted mounting space
- thermal insulation
- electrical installation

regarding the shaft-side connection of the motor, RINGSPANN GmbH is more than willing to provide support when selecting a suitable clamping system for your particular application. Contact:

| | |
|---|---|
| RINGSPANN GmbH | Telephone: +49 (0) 6172 275 0 |
| Schaberberg 30-34 | Internet: http://www.ringspann.de |
| D-61348 Bad Homburg | |

### 7.3.2.1 Plug-on shaft with option +Q30

Available for the motors 1FW315x, 1FW320x and 1FW328x with plug-on shaft (15th position of the order number = S)

Support at the DE with the seat integrated in order to facilitate centered mounting.

When the shaft journal is implemented according to dimension drawings 510.31315.01/510.33320.01/510.31396.01, then it is also possible to disassemble using release screws.

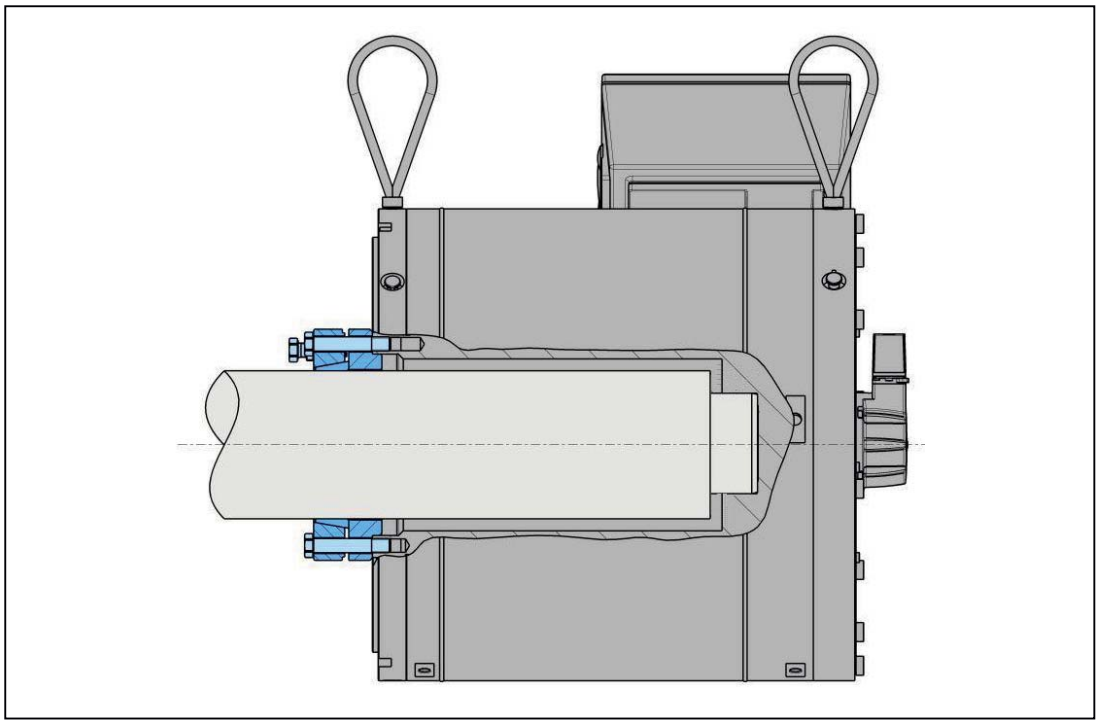


Figure 7-11 Plug-on shaft clamping element

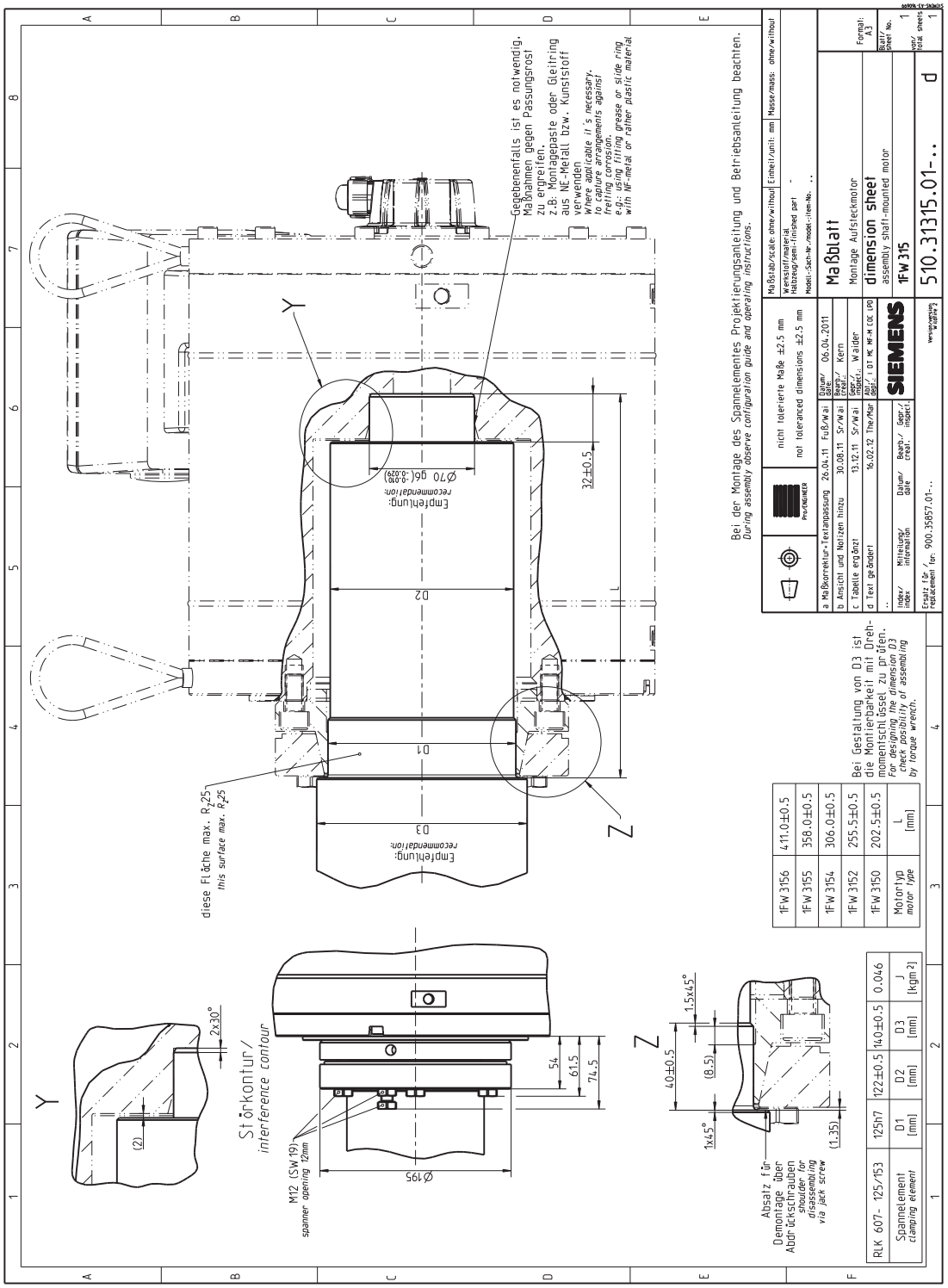



Figure 7-12 Dimension drawing, mounting plug-on motor 1FW315

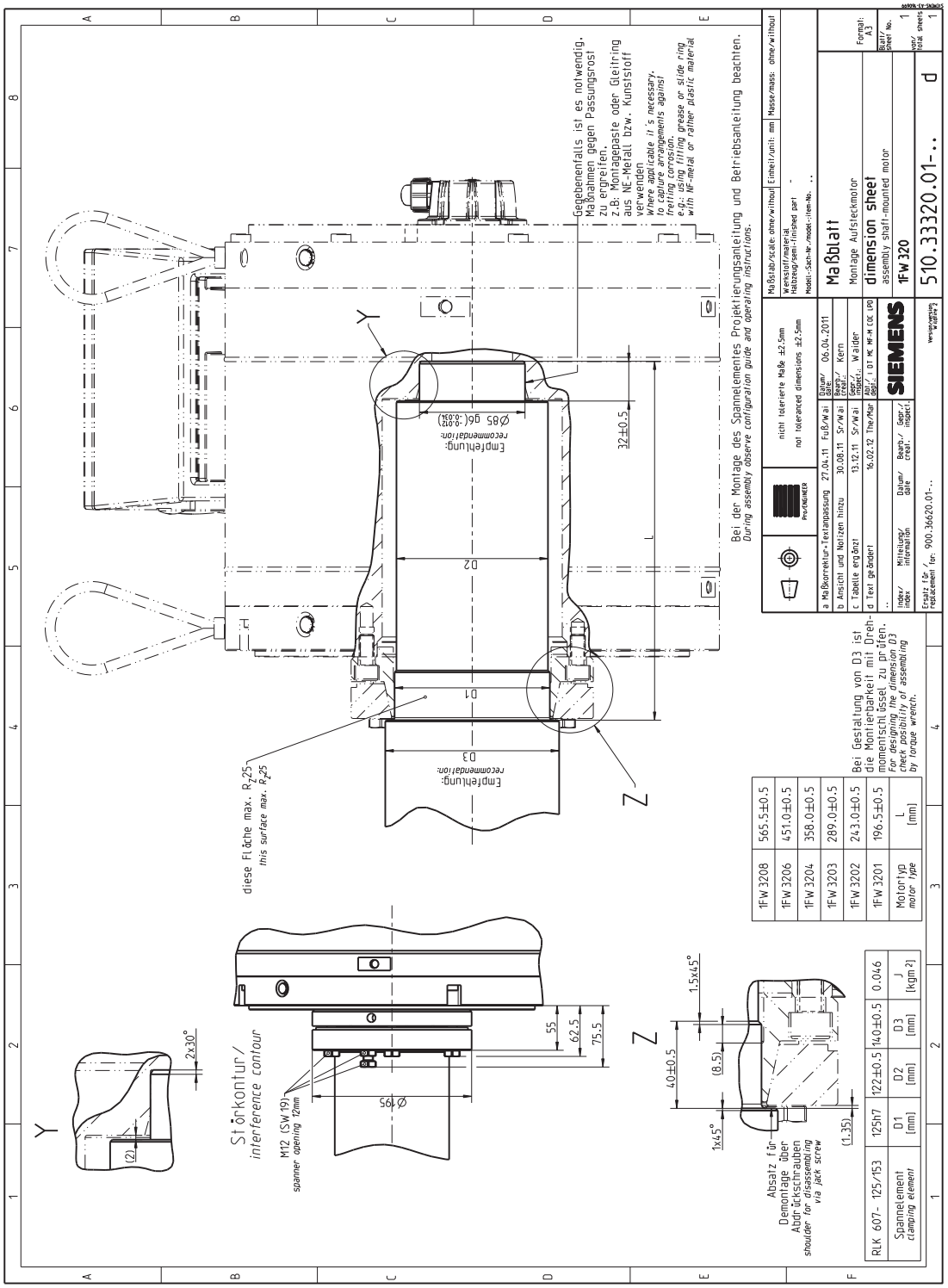



Figure 7-13 Dimension drawing, mounting plug-on motor 1FW320

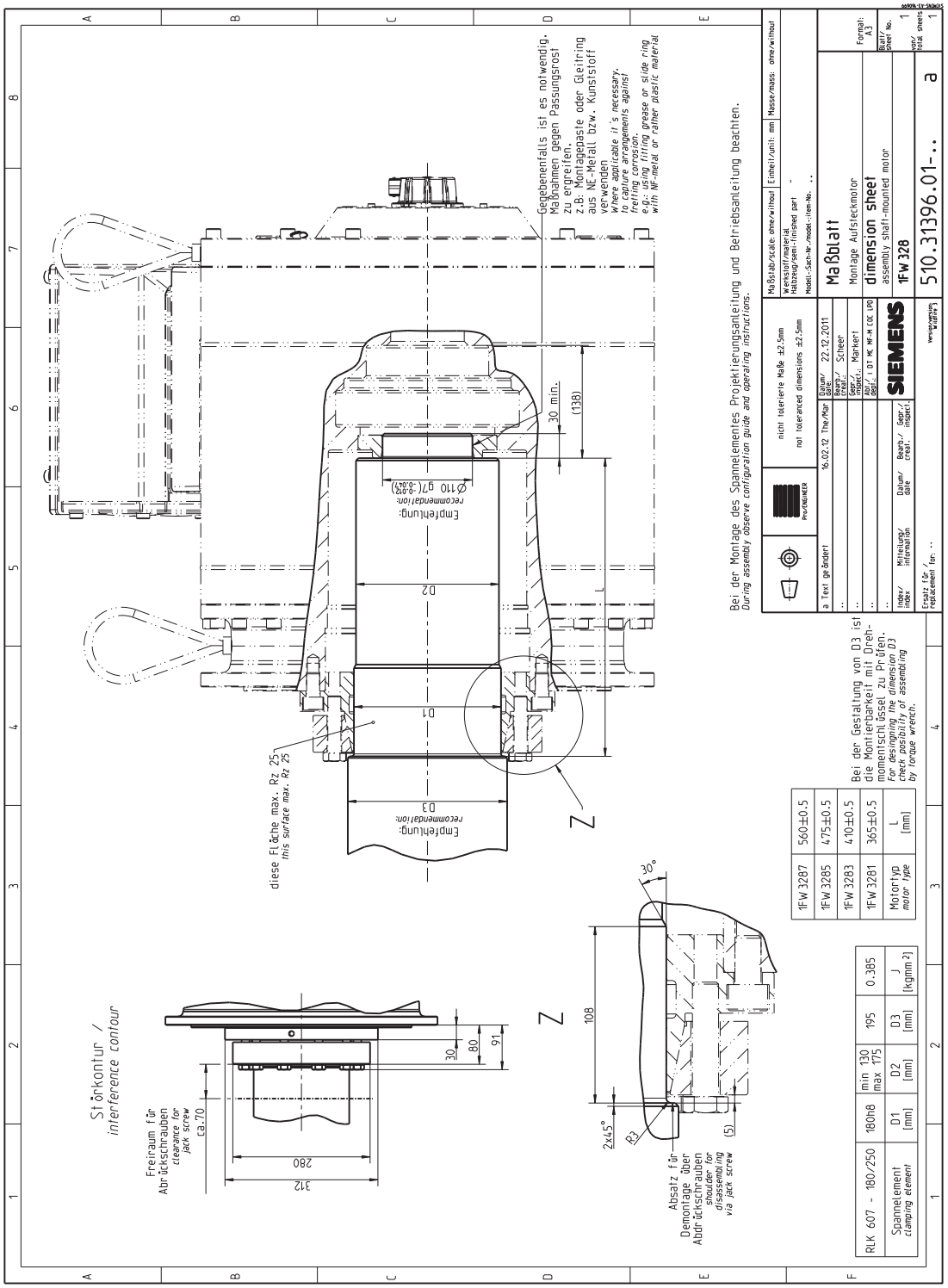



Figure 7-14 Dimension drawing, mounting plug-on motor 1FW328

### 7.3.2.2 Hollow shaft with option +Q30

1FW315x-xxxxx-xx**A**x
1FW320x-xxxxx-xx**A**x

- Harmonized clamping system
- For hollow shafts through which hot or cold media are routed
- Can be combined with a coaxially mounted encoder
- Axial mounting space is required at the DE
- Mounted only from the DE or alternatively, in two parts from DE/NDE
- Torque transmission to the customer shaft (h8 fit) via a flanged clamping element at the DE
- Supported at the NDE using an aluminum ring to guarantee centered mounting and to prevent any inadmissible wobbling motion.

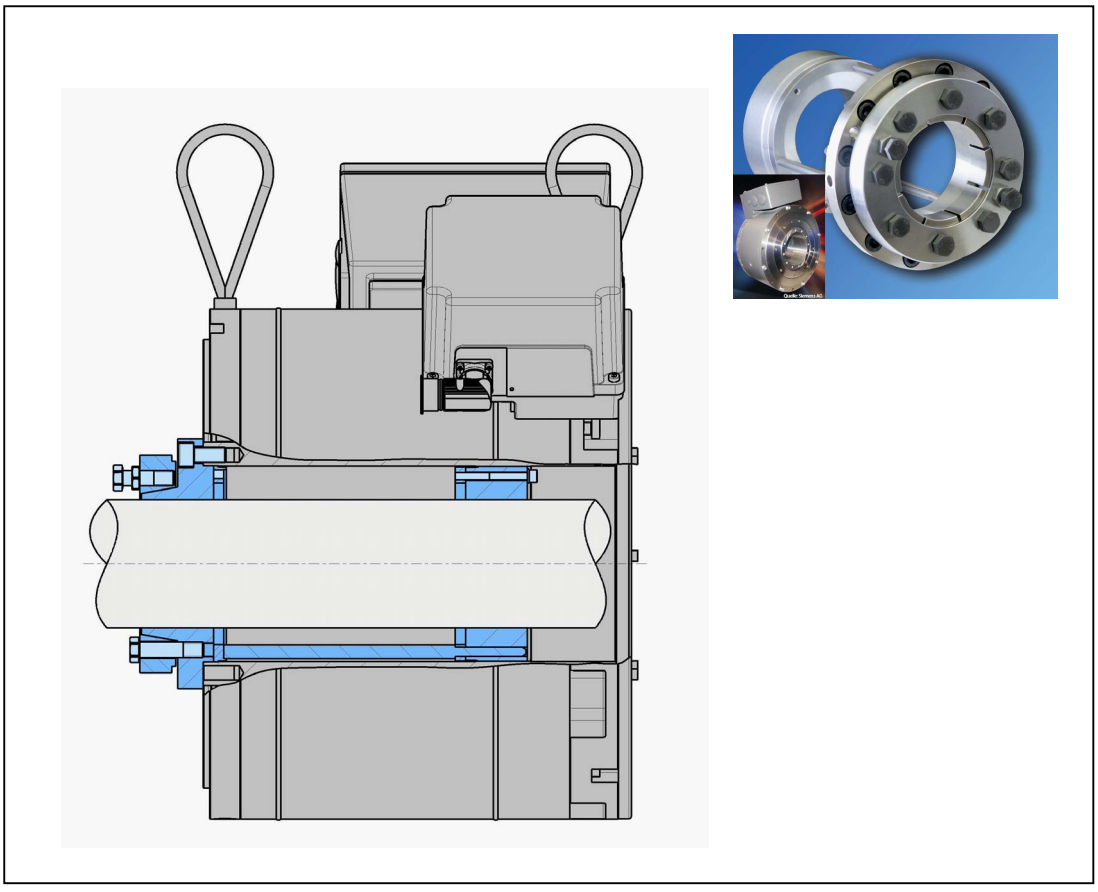
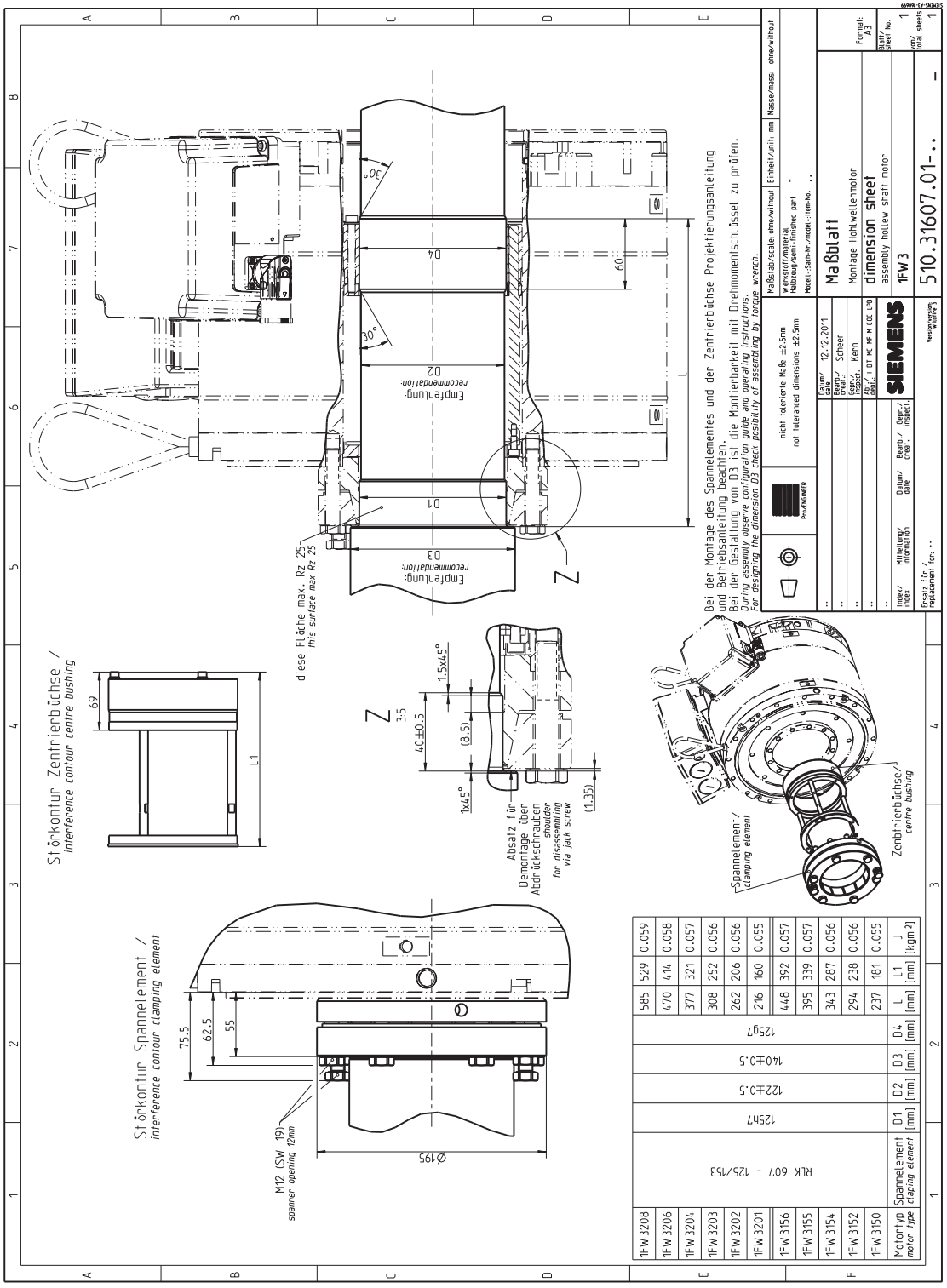


Figure 7-15 Outer clamping system




| Motortyp / motor type | Spannelement / clapping element | D1 [mm] | D2 [mm] | D3 [mm] | D4 [mm] | L [mm] | L1 [mm] | J [kgm 2] |
|---|---|---|---|---|---|---|---|---|
| 1FW 3208 | | | | | | 585 | 529 | 0.059 |
| 1FW 3206 | | | | | | 470 | 414 | 0.058 |
| 1FW 3204 | | | | | | 377 | 321 | 0.057 |
| 1FW 3203 | | | | | | 308 | 252 | 0.056 |
| 1FW 3202 | | | | | | 262 | 206 | 0.056 |
| 1FW 3201 | | | | | | 216 | 160 | 0.055 |
| 1FW 3156 | | | | | | 448 | 392 | 0.057 |
| 1FW 3155 | | | | | | 395 | 339 | 0.057 |
| 1FW 3154 | | | | | | 343 | 287 | 0.056 |
| 1FW 3152 | | | | | | 294 | 238 | 0.056 |
| 1FW 3150 | | | | | | 237 | 181 | 0.055 |

Figure 7-16 Dimension drawing hollow shaft with clamping element

### 7.3.2.3 Hollow shaft, inner clamping element

1FW315x-xxxxx-xx**C**x
1FW320x-xxxxx-xx**C**x

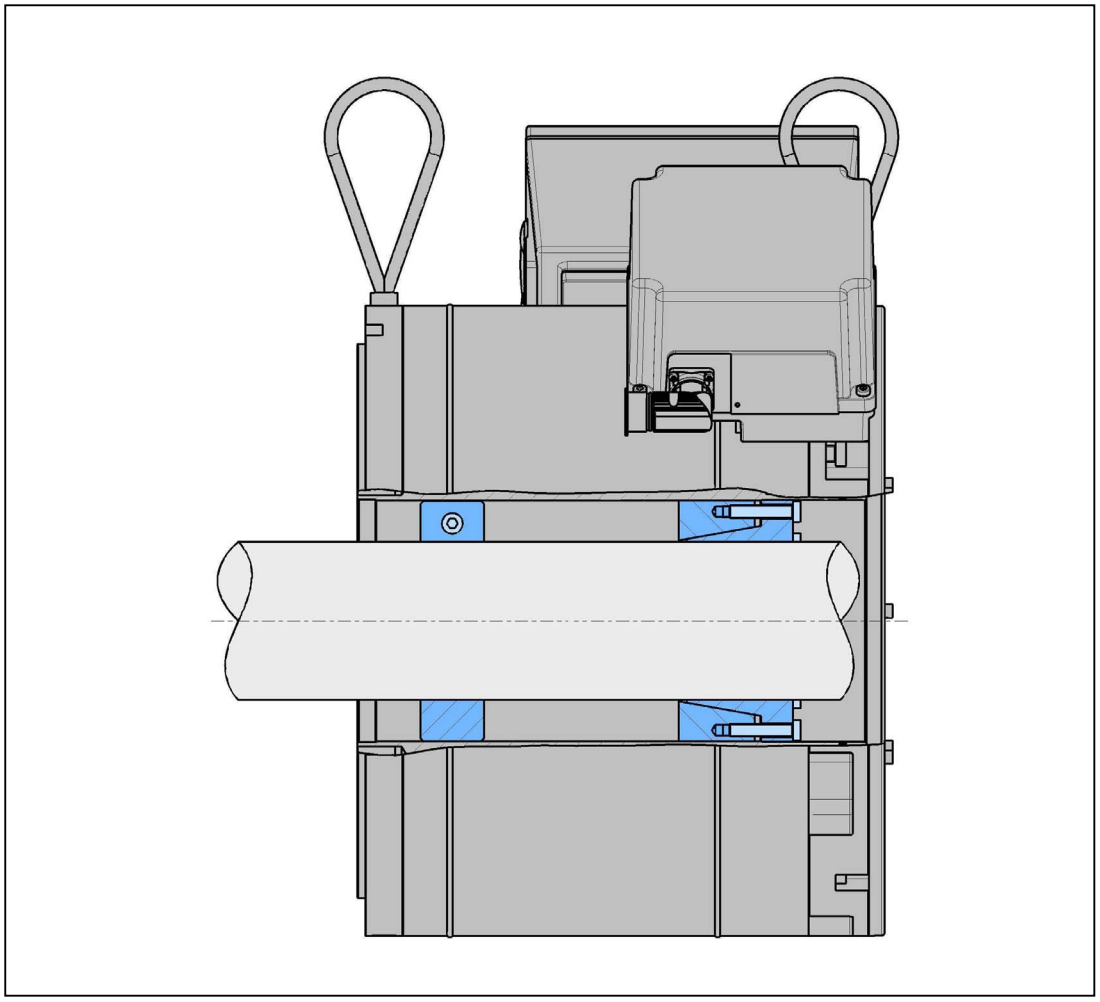


Figure 7-17 Inner clamping system

- Available for 1FW315x and 1FW320x with special shaft (15th position of the MLFB = C)
- RINGSPANN RTM 134.1
- Torque transmission to the customer shaft (h8 fit) via the clamping element located in the hollow shaft NDE
- Supported at the DE using an aluminum ring to guarantee centered mounting and to prevent any inadmissible wobbling motion

- Compact mounting at the machine is possible as no axial mounting space is required at the DE and the device is completely mounted from the NDE.
- Cannot be combined with a coaxially mounted encoder

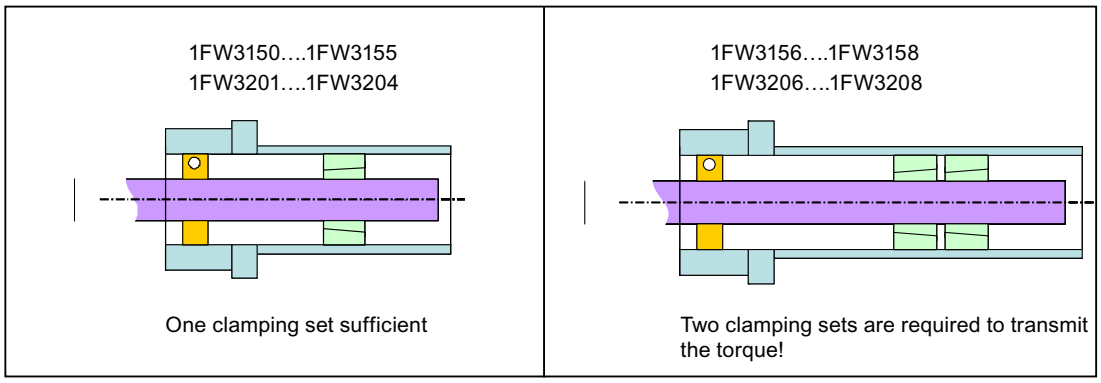



Figure 7-18 Clamping sets required to transmit the torque

## Technical Support RINGSPANN GmbH

RINGSPANN GmbH is more than welcome to support you when selecting a suitable clamping system for your application.

RINGSPANN GmbH
Schaberberg 30-34
D-61348 Bad Homburg

Telephone: +49 (0) 6172 275 0
Internet: http://www.ringspann.de

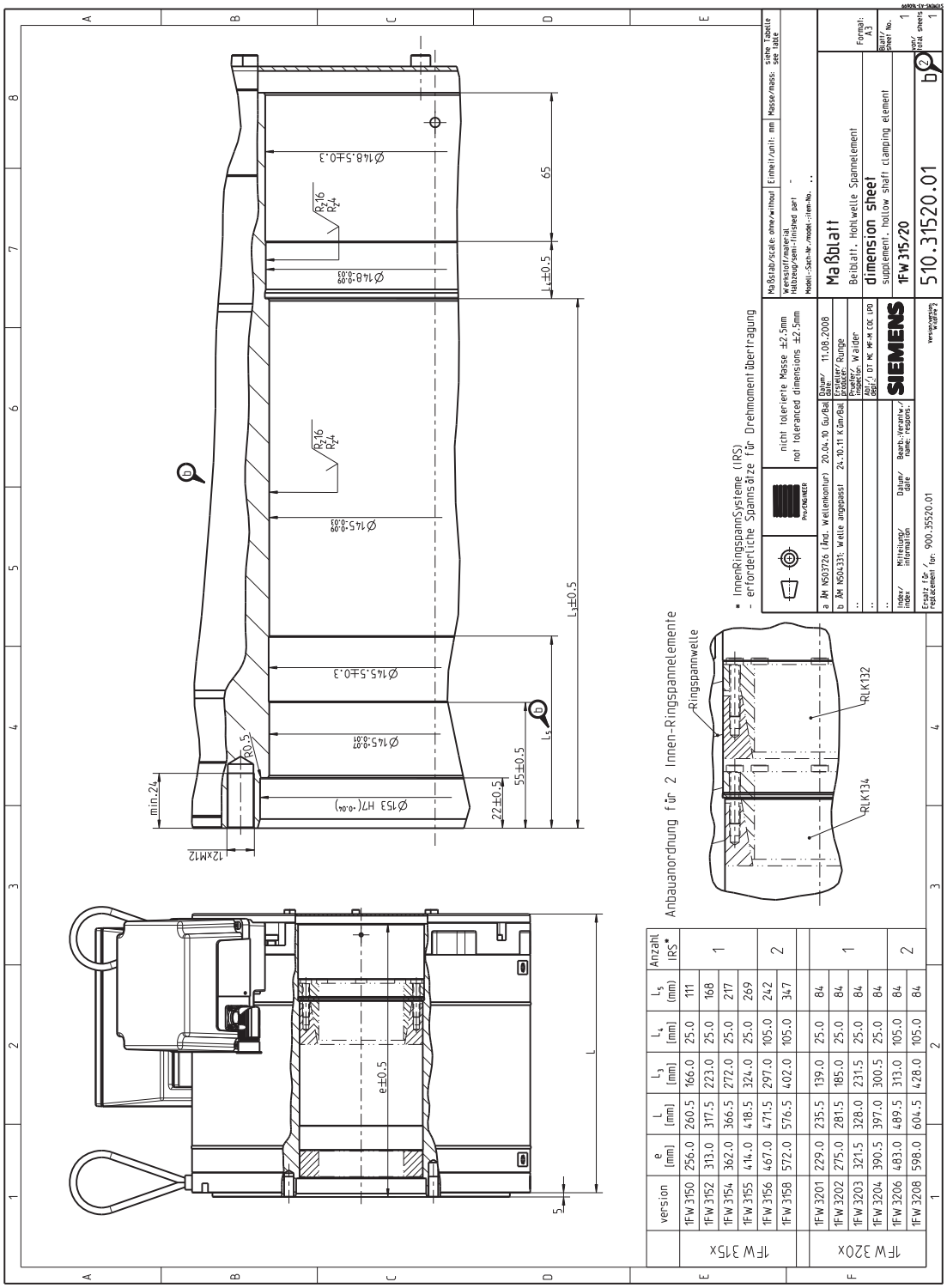



Figure 7-19 Dimension drawing hollow shaft clamping element

## 7.4 Coupling mounting

Advantage: Simple design, a standard motor can be used.

Disadvantage: As a result of its function, a coupling must be elastic and therefore has a negative impact on the positive characteristics and features of a directly driven load. The stiffness in the mechanical drive train is reduced.

**⚠ CAUTION**

If you use mechanical transmission elements which subject the shaft end to a radial force, the maximum limit values specified in the radial force diagrams must not be exceeded.

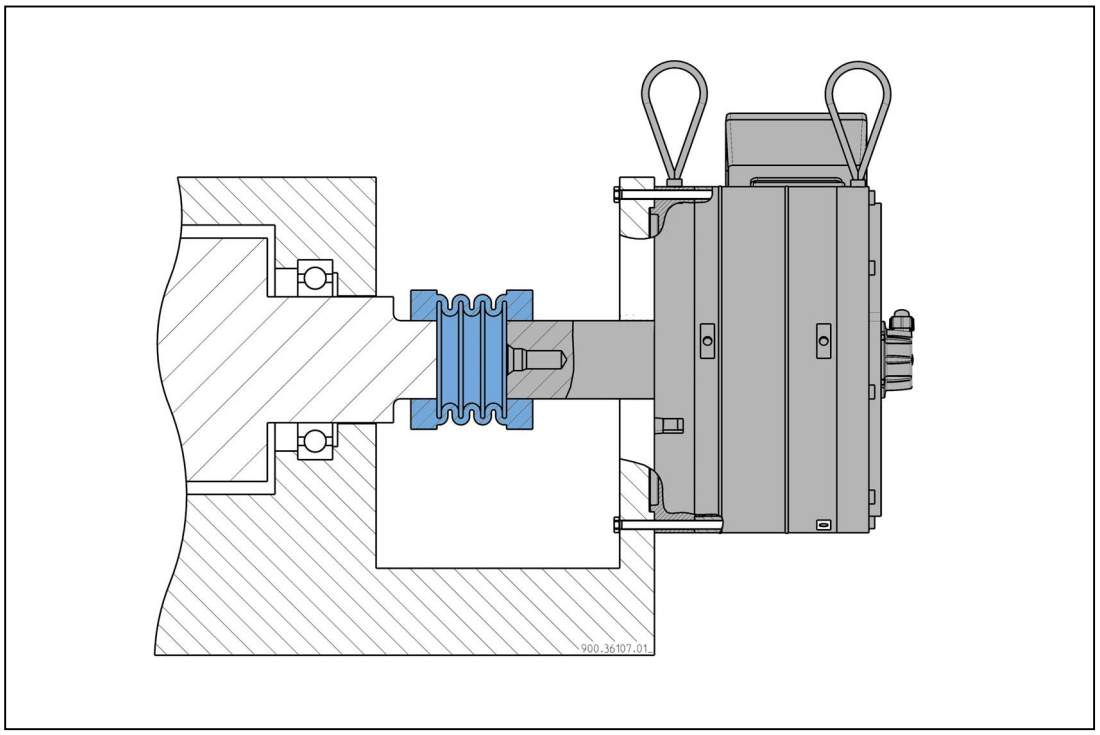



Figure 7-20 De-coupling the machine shaft from the motor shaft using a coupling

# 7.5 No bearings at the DE

1FW3xxx-xxxxx-xxx**3**

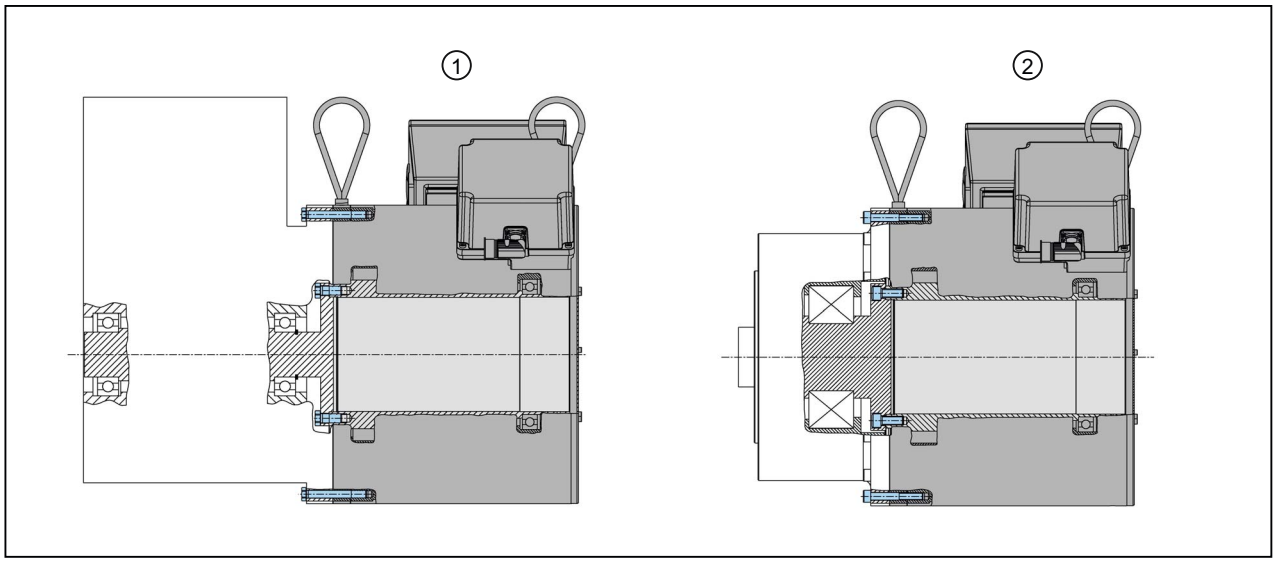
## Properties

- Stiff rotor and stator mounting for the hollow shaft version
- Only a few mounting components are required
- Provides a possibility of mounting bearing modules to absorb increased process forces
- Not available for plug-on and solid shaft versions (15th position of the MLFB) "M" and "S"

| NOTICE |
| --- |
| • Radial overdetermination of the remaining bearing at the NDE must be avoided; this must be verified by making the appropriate calculation<br>• Axial temperature expansion of the machine shaft must be limited as specified in dimension drawing 609.30284.01<br>• Installation conditions must be maintained, refer to the dimension drawing No. 609.30284.01, no bearings at the DE |

If you have any questions regarding the limitations and constraints, please contact the Siemens Service Center.

## Mounting examples




1 The manufacturer must be contacted (if necessary, over-determination)

2 For bearing module with increased radial/axial force load

Figure 7-21 Mounting examples for motors with no bearings at the DE

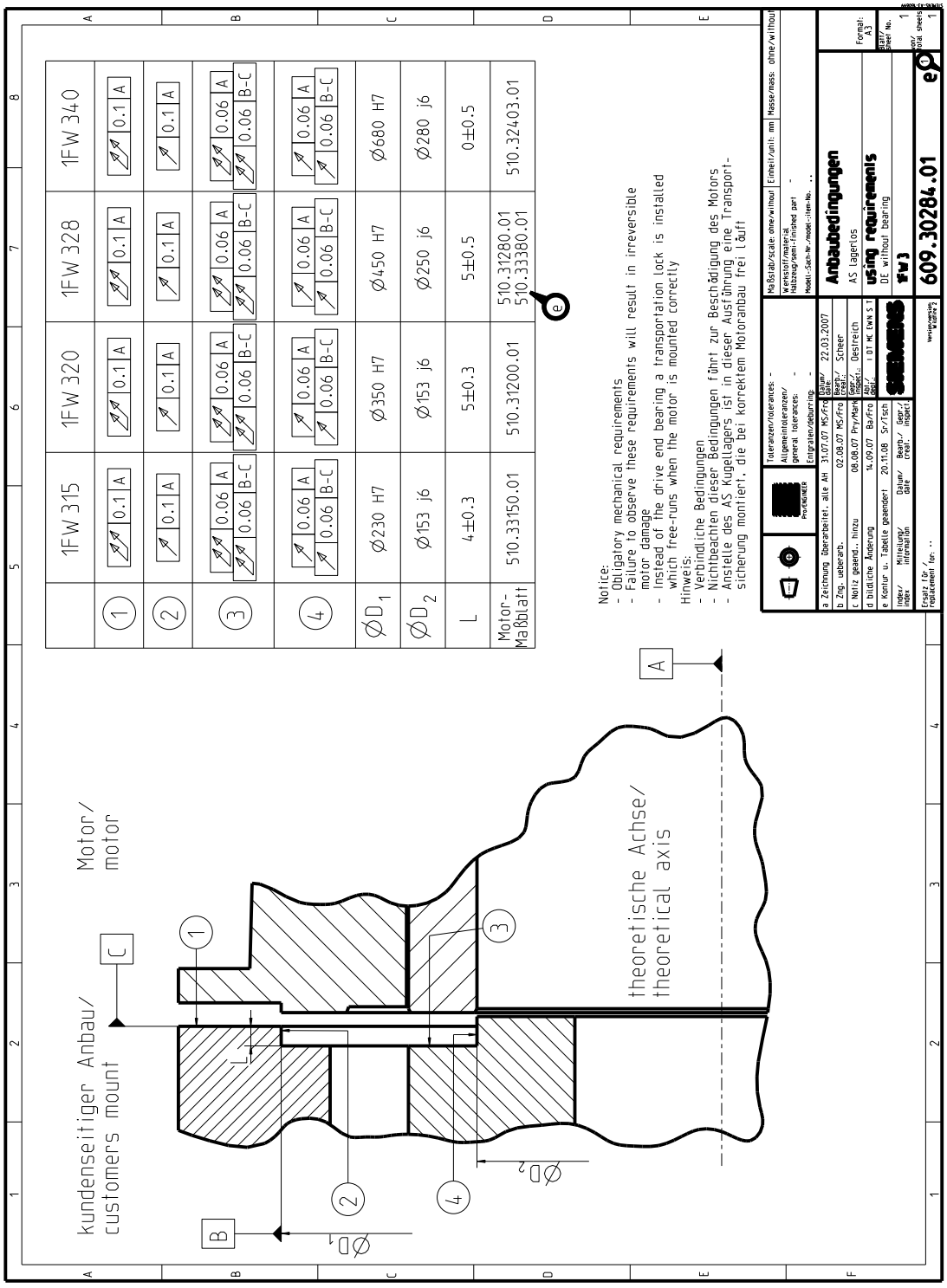



Figure 7-22 Dimension drawing, no bearings at the DE

## 7.6 Natural frequency when mounted

The motor is an oscillating system with a design-dependent natural frequency, which is higher than the specified maximum speed.

When the motor is mounted onto a machine, a new system, which is capable of vibration, is created with modified natural frequencies. These can lie within the motor speed range.

This can result in undesirable vibrations in the mechanical drive transmission.

| NOTICE |
| --- |
| Motors must be carefully mounted on adequately stiff foundations or bedplates. Additional elasticities of the foundation/bedplates can cause resonance effects of the natural frequency at the operating speed and, therefore, result in inadmissibly high vibration values. |

The magnitude of the natural frequency when the motor is mounted depends on various factors and can be influenced by the following points:

- Mechanical transmission elements (gearboxes, belts, couplings, pinions, etc.)
- Stiffness of the machine design to which the motor is mounted
- Stiffness of the motor in the area around the foot or customer flange
- Motor weight
- Machine weight and the weight of the mechanical system in the vicinity of the motor
- Damping properties of the motor and the driven machine
- Installation type/position (IM B14, IM V18/19, IM B35)
- Motor weight distribution, i.e. length, shaft height

## 7.7 Vibration resistance

The on-site system vibration behavior depends on factors such as the output elements, mounting situation, alignment, installation, and external vibration and can increase the level of vibration at the motor.

Under certain circumstances, the rotor may have to be completely balanced with the output element.

To ensure problem-free operation and a long service life, the vibration values specified to ISO 10816 must not be exceeded at the defined measuring points on the motor.

Table 7- 5 Max. permissible radial vibration values [1)]

| Vibration frequency | Vibration values |
|---|---|
| < 6.3 Hz | Vibration amplitude s ≤ 0.16 mm |
| 6.3 - 250 Hz | Vibration velocity $v_{rms}$ ≤ 4.5 mm/s |
| > 250 Hz | Vibration acceleration a ≤ 10 m/s$^2$ |

Table 7- 6 Max. permissible axial vibration values[1)]

| Vibration velocity | Vibration acceleration |
|---|---|
| $v_{rms}$ = 4.5 mm/s | $a_{peak}$ = 2.25 m/s$^2$ |

1) Both values must be maintained simultaneously

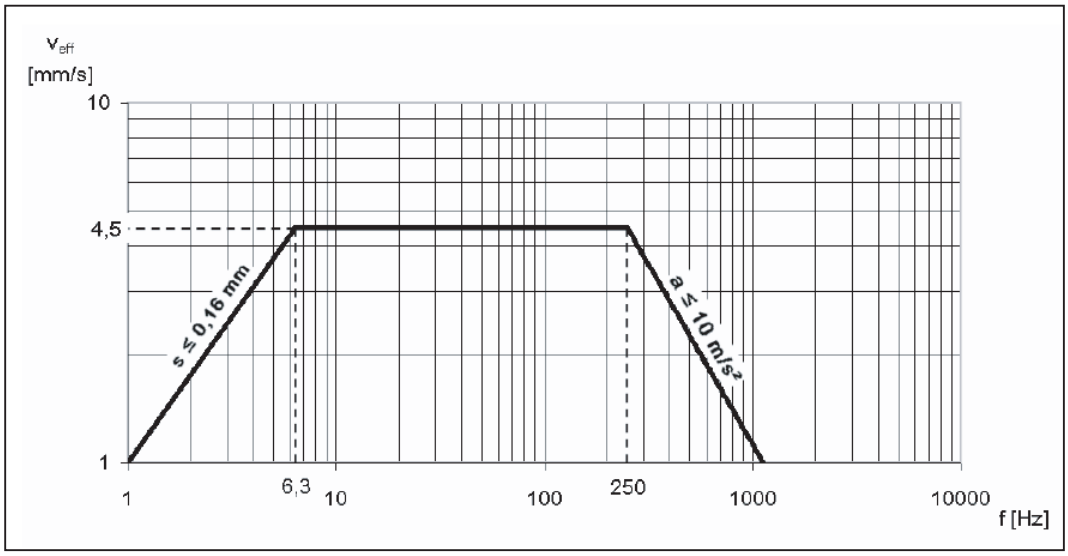



Figure 7-23 Max. permissible vibration velocity, taking into account the vibration displacement and vibration acceleration

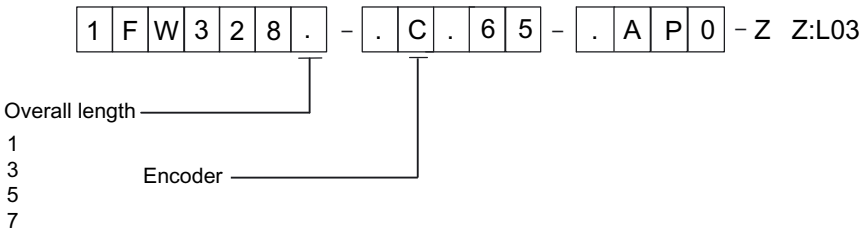
To measure the vibration velocity, the measuring equipment must fulfill the requirements of ISO 2954. The vibration acceleration must be measured as a peak value in the time range in a frequency band of 10 to 2000 Hz.

If appreciable vibration excitation in excess of 2000 Hz (e.g. gear teeth meshing frequencies) can be expected, the measurement range must be adapted accordingly. This does not alter the maximum permissible values.

# 7.8 Heavy Duty (Z option L03)

Heavy Duty is the version for increased shock loads.

## Valid for the following complete torque motors




Type of construction: IM B5

## Shock load

Table 7- 7 Shock load

| | Vibration acceleration $a_{peak}$ |
|---|---|
| Max. permissible radial shock load | 100 m/s$^2$ |
| Max. permissible axial shock load | 50 m/s$^2$ |

The vibration acceleration must be measured as a peak value in the time range in a frequency band of 0 to 2000 Hz. The measurement must be made at the DE flange (based on DIN ISO 10816). If vibration excitation exceeding 2000 Hz (e.g. gear meshing frequencies) can be expected, the measurement range must be adapted accordingly. This does not alter the maximum permissible values.

## Mounting

A flange is used for mounting.

Table 7- 8 Flange mounting

| | Description |
|---|---|
| Bolt ISO 898-1[1)] | M16 |
| Washer ISO 7092 | ISO 7092-16-300 HV (d2 = 30) |
| Tightening torque | 300 Nm |

1) Bolts of property class 10.9 or higher must be used

| NOTICE |
| --- |
| **Bolt locking**<br>Bolts must be locked as a result of vibration and shock loads. |

## Shaft adaptation

The motor must be precisely aligned in order to avoid distortion or over-determining the bearings. For the shaft adaptation, it must be ensured that in operation the motor shaft is not subject to any additional axial shock load. A rigid connection between the motor and customer shaft is not permitted. The shaft adaptation must be designed so that there are no axial forces (straight gearing with splined shaft) and the appropriate play.

## Connecting-up notes

There must be a good metallic connection between the motor and the customer's machine (enclosure and shaft) in order to avoid rotor-ground currents. You should contact the manufacturer if this cannot be guaranteed.

Shielded power and signal cables must be used.

## Bearing lifetime and regreasing interval

The bearings are equipped with a regreasing device. The values specified in the following table are valid for ambient conditions, according to Chapter "Bearing versions".

Fixed bearings at DE: 61864

Floating bearings at NDE: 6230

Table 7- 9 Regreasing intervals

| Motor type | $n_N$ [rpm] | Bearing lifetime with lubrication [h] | Regreasing interval [h] | Grease quantity 1) DE [g] | Grease quantity 1) NDE [g] |
| --- | --- | --- | --- | --- | --- |
| 1FW328x-2/3 | 150 / 250 / 400 / 600 | 20000 | 4000 | 80 | 120 |

1) Bearing grease designation: Klüberquiet BQH 72-102, Klüber Lubrication Munich KG, Internet: www.klueber.com

## Dimension drawing

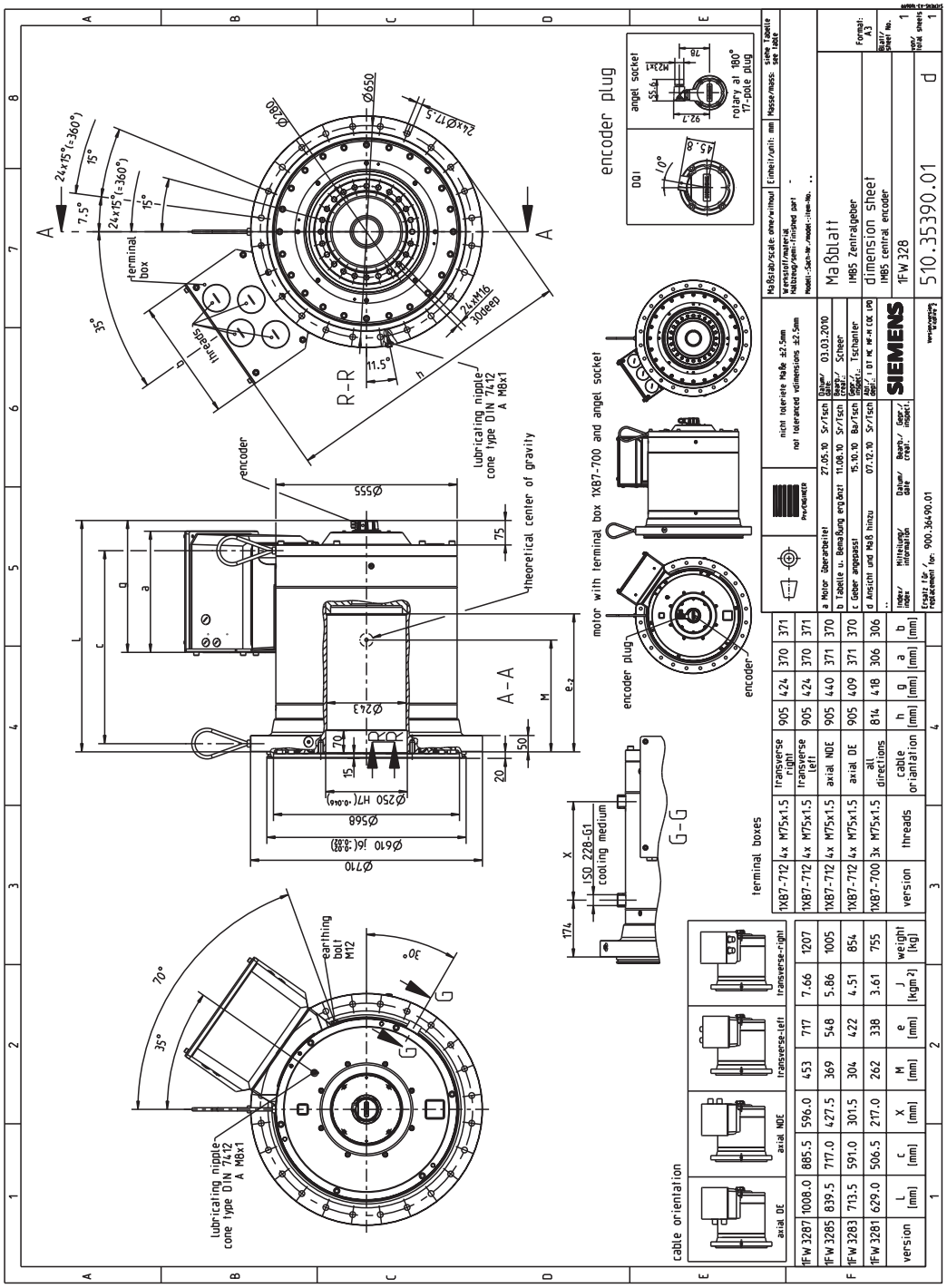



Figure 7-24 1FW3 Heavy Duty

# Appendix

# A

## A.1 Description of terms

### Braking resistance $R_{opt}$

$R_{opt}$ corresponds to the optimum resistance value per phase that is switched in series external to the motor winding for the armature short-circuit braking function.

### Braking torque $M_{br\ rms}$

$M_{br\ rms}$ corresponds to the average braking torque for armature short-circuit braking that is achieved through the upstream braking resistor $R_{opt}$.

### Cyclic inductance $L_D$

The cyclic inductance is the sum of the air gap inductance and leakage inductance relative to the single-strand equivalent circuit diagram. It consists of the self-inductance of a phase and the coupled inductance to other phases.

### DE

Drive end

### Efficiency $\eta_{opt}$

Maximum achievable efficiency along the S1 characteristic or below the S1 characteristic without field weakening current.

### Electrical time constant $T_{el}$

Quotient obtained from the rotating field inductance and winding resistance. $T_{el} = L_D/R_{ph}$

### Maximum current $I_{max,\ RMS}$

This current limit is only determined by the magnetic circuit. Even if this is briefly exceeded, it can result in an irreversible de-magnetization of the magnetic material. Specification of the RMS value of a sinusoidal current.

### Maximum permissible speed at converter $n_{max\ Inv}$

The maximum permissible speed during operation on a converter is $n_{max\ Inv}$. This is calculated by means of the voltage induced in the motor and the voltage strength of the converter.

### Maximum permissible speed (mechanical) $n_{max}$.

The maximum mechanically permissible speed is $n_{max\ mech}$. It is defined by the centrifugal forces and frictional forces in the bearing.

### Maximum speed $n_{max}$

The maximum permissible operating speed $n_{max}$ is the lesser of the maximum mechanically permissible speed and the maximum permissible speed at the converter.

### Maximum torque $M_{max}$

Torque that is generated at the maximum permissible current.

The maximum torque is briefly available for high-speed operations (dynamic response to quickly changing loads).

The maximum torque is limited by the closed-loop control parameters. If the current is increased, then the rotor will be de-magnetized.

### Mechanical time constant $T_{mech}$

The mechanical time constant is obtained from the tangent at a theoretical ramp-up function through the origin.

$T_{mech} = 3 \bullet R_{ph} \bullet J_{mot}/k_T^2$ [s]

$J_{mot}$ = Servomotor moment of inertia [kgm$^2$]

$R_{ph}$ = Phase resistance of the stator winding [Ohm]

$k_T$ = Torque constant [Nm/A]

### Moment of inertia $J_{mot}$

Moment of inertia of rotating motor parts.

### NDE

Non-drive end

### Number of poles 2p

Number of magnetic north and south poles on the rotor. p is the number of pole pairs.

### Rated current $I_N$

RMS motor phase current for generating the particular rated torque. Specification of the RMS value of a sinusoidal current.

### Rated speed $n_N$

The characteristic speed range for the motor is defined in the speed-torque diagram by the rated speed.

### Rated torque $M_N$

Thermally permissible continuous torque in S1 duty at the rated motor speed.

### Shaft torsional stiffness $c_T$

This specifies the shaft torsional stiffness from the center of the rotor laminated core to the center of the shaft end.

### Static current $I_0$

Motor phase current for generating the particular static torque. Specification of the RMS value of a sinusoidal current.

### Static torque $M_0$

Thermal limit torque at motor standstill corresponding to a utilization according to 100 K. At n = 0, this can be output for an unlimited length of time. $M_0$ is always greater than the rated torque $M_N$.

### Thermal time constant $T_{th}$

Defines the increase in the motor frame temperature when the motor load is suddenly increased (step function) to the permissible S1 torque. The motor has reached 63% of its final temperature after $T_{th}$.

### Torque constant $k_T$ (value for a 100 K average winding temperature rise)

Quotient obtained from the static torque and static current.

Calculation: $k_T = M_{0,\ 100K} / I_{0,\ 100K}$

**Note**

This constant is not applicable when configuring the necessary rated and acceleration currents (motor losses!).

The steady-state load and the frictional torques must also be included in the calculation.

### Voltage constant $k_E$ (value at 20 °C rotor temperature)

Value of the induced motor voltage at a speed of 1000 rpm and a rotor temperature of 20 °C.

The phase-to-phase RMS motor terminal voltage is specified.

### Winding resistance $R_{ph}$ at 20 °C winding temperature

The resistance of a phase at a winding temperature of 20 °C is specified. The winding has a star circuit configuration.

# A.2 Conformity certificates

SIEMENS

## EG-Konformitätserklärung
## *EC Declaration of Conformity*

**No. 664.20032.02**

| | |
|---|---|
| Hersteller:<br>*Manufacturer:* | **Siemens Aktiengesellschaft**<br>Industrie Sector<br>I DT MC MF-M |
| Anschrift:<br>*Address:* | Industriestraße 1<br>97615 Bad Neustadt a. d. Saale<br>Germany |
| Produktbezeichnung:<br>*Description of the product:* | **Drehstrom – Synchronmotor, Typ 1FW3...**<br>*Three-phase synchronous motor, type 1FW3…* |

Die bezeichneten Produkte stimmen in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinie überein:
*The products described above in the form as placed on the market are in conformity with the provisions of the following European Directive:*

2006/95/EG Richtlinie des Europäischen Parlaments und de Rates vom 12.Dezember 2006 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen.
*Directive of the European Parliament and the Council of 12. December 2006 on the approximation of the laws of the Member States related to electrical equipment designed for use within certain voltage limits.*

Die Konformität mit der Richtlinie wird nachgewiesen durch die Einhaltung folgender Normen:
*Conformity to the Directive is assured through the application of the following standards:*

EN 60034-1*): 2004 EN 60204-1 : 2006
***) mit allen relevanten Teilen / *with all relevant parts***

**Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.**
*The safety and manual documentation shall be considered in detail.*

Erste CE - Kennzeichnung: 2003 */ first CE - marking: 2003*

Die bezeichneten Produkte sind zum Einbau in andere Maschinen bestimmt. Die Inbetriebnahme ist solange untersagt, bis die Konformität des Endproduktes mit der Richtlinie 2006/42/EG festgestellt ist.
Alle Sicherheitshinweise der zugehörenden Produktdokumentation sind zu beachten sowie dem Endanwender zur Kenntnis zu geben.
*The products supplied are intended exclusively for installation in a machine. Commissioning is prohibited until it has been established that the end product conforms with the Directive 2006/42/EU. All safety instructions in the associated product documentation must be observed and given to the end user for his/her information.*

Bad Neustadt, den 28.6.2010
Siemens Aktiengesellschaft

i.V. .....
Michael Frank,
*Head of the electric motor factory Bad Neustadt*

i.V. .....
Dr. Jan Dainat,
*Head of product development department*

Diese Erklärung bescheinigt die Übereinstimmung mit der genannten Richtlinie, ist jedoch keine Beschaffenheits- oder Haltbarkeitsgarantie nach §443 BGB.
*This declaration certifies the conformity to the specified directive but does not imply any warranty for properties.*

Ersatz für / *Substitute for* 664.20031.02 Stand / *Status*: 12/2003

**Ausgabestand / *Status*: 06/2010**
**Erstausgabe / *first document*: 12/2003**

# A.3 References

## Overview of publications of planning manuals

An updated overview of publications is available in a number of languages on the Internet at:
www.siemens.com/motioncontrol
Select "Support" → "Technical Documentation" → "Ordering Documentation" → "Printed Documentation".

## Catalogs

| Order code | Catalog name |
|---|---|
| NC 61 | SINUMERIK & SINAMICS |
| NC 60 | SINUMERIK & SIMODRIVE |
| PM 21 | SIMOTION & SINAMICS |

## Electronic Documentation

| Order code | DOC ON CD |
|---|---|
| CD1 | The SINUMERIK System<br>(includes all SINUMERIK 840D/810D and SIMODRIVE 611D) |
| CD2 | The SINAMICS System |

# Index

## S



## T



## V



## W

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