



ac-motors

LARGE DRIVES

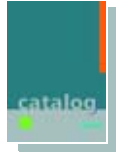
Three-phase synchronous motors
based on permanent
magnet technology
HT-direct 1FW4

SIEMENS

Related catalogs

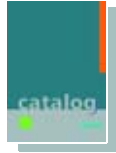
Low-Voltage Motors IEC Squirrel-Cage Motors D 81.1

Order No.:
German: E86060-K5581-A111-A1
English: E86060-K5581-A111-A1-7600



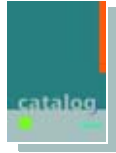
Asynchronous Motors Standardline N-compact 1LA8 H-compact 1LA4 D 86.1

Order No.:
German: E86060-K5586-A111-A1
English: E86060-K5586-A111-A1-7600



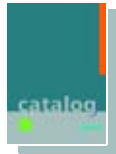
SINAMICS G130 Drive Converter Chassis Units SINAMICS G150 Drive Converter Cabinet Units 75 kW to 800 kW D 11

Order No.:
German: E86060-K5511-A101-A3
English: E86060-K5511-A101-A3-7600



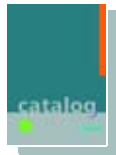
SINAMICS S120 Drive System 0.12 kW to 1200 kW D 21.1

Order No.:
German: E86060-K5521-A111-A2
English: E86060-K5521-A111-A2-7600



SINAMICS S150 Drive converter cabinet units 75 kW to 1200 kW D 21.3

Order No.:
German: E86060-K5521-A131-A1
English: E86060-K5521-A131-A1-7600



Catalog CA 01 CA 01

The Offline Mall of
Automation and Drives

Order No.:
CD E86060-D4001-A110-C5-7600
DVD: E86060-D4001-A510-C5-7600



A&D Mall

Internet:
<http://www.siemens.com/automation/mall>



Three-phase synchronous motors based on permanent magnet technology

HT-direct 1FW4

Catalog D 86.2 · 2007

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The products and systems described in this catalog are manufactured under application of a quality management system certified by DQS in accordance with EN ISO 9001 (Certificate Registration No. 002241 QM UM). The certificate is recognized in all IQ Net countries.



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Introduction

1

Selection
and
ordering

**HT-direct motors 1FW4
with water cooling**
(water-jacket cooling)

2

**HT-direct motors 1FW4
with air cooling**
(forced ventilation)

3

Configuring

4

Appendix

5

Siemens Automation and Drives. Welcome

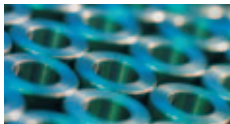
More than 60,000 people aiming for the same goal: increasing your competitiveness. That's Siemens Automation and Drives.

We offer you a comprehensive portfolio for sustained success in your sector, whether you're talking automation engineering, drives or electrical installation systems. Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) form the core of our offering. TIA and TIP are the basis of our integrated range of products and systems for the manufacturing and process industries as well as building automation. This portfolio is rounded off by innovative services over the entire life cycle of your plants.

Learn for yourself the potential our products and systems offer. And discover how you can permanently increase your productivity with us.

Your regional Siemens contact can provide more information. He or she will be glad to help.







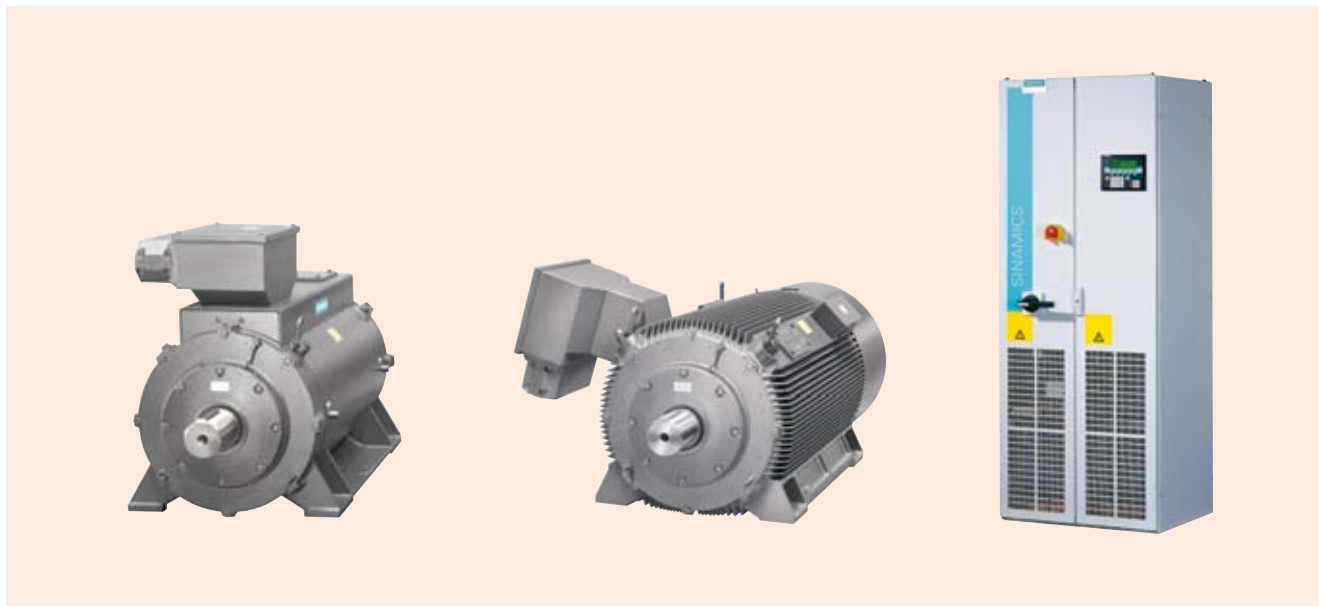
Introduction



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Overview

High-torque motors with SINAMICS frequency converters



HT-direct motors in combination with SINAMICS frequency converters form a variable-speed drive system for

- High torques
- Low speeds
- Low-maintenance operation

With

- Small space requirements
- High availability

With

- High efficiency
- Rugged design
- Low noise level

The HT-direct motors are a product range of extremely compact, low-voltage high-torque motors. In combination with a SINAMICS frequency converter, the HT-direct motor forms a perfectly matched drive system.

- Motor shaft heights of 400, 450 and 500 mm
- Motor torque range 5 – 40 kNm
- Motor rated voltage 400, 460 or 690 V
- Motor rated speed 200 to 800 rpm
- Type of construction of the motor IMB3
- Degree of protection of the motor IP55
- Motor cooling: Water-jacket cooled or forced ventilation
- Low-voltage converter with input voltages: 400 and 690 V/50 Hz, 460 V/60 Hz

SINAMICS frequency converters are designed for use in variable-speed drives in mechanical and plant engineering applications. They offer a low-cost drive solution which can be flexibly tailored from a wide spectrum of components and options to meet the requirements of individual customers.

HT-direct motors can be operated with converters of the SINAMICS S120/S150 and G130/G150 types. Closed-loop control software for permanent-magnet synchronous motors has also been developed.

SINAMICS S converters are used in the implementation of demanding drive-system tasks and satisfy stringent requirements on

- Dynamics and accuracy
- Integration of extensive technological functions in the drive control system.

SINAMICS G converters are designed for standard applications. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.

For a detailed description of the SINAMICS product series, see the following catalogs:

Siemens converter series	Catalog short code	Catalog Order No.
SINAMICS G130 (chassis units)	D 11	E86060-K5511-A101-A3
SINAMICS G150 (cabinet units)		
SINAMICS S120 (chassis and booksized units)	D 21.1	E86060-K5521-A111-A2
SINAMICS S150 (cabinet units)	D 21.3	E86060-K5521-A131-A1
SINAMICS S120 (cabinet modules)	D 21.3 CM	–

Benefits

The benefits of the HT-direct motors:

- With slow-running drives, the efficiency of the HT-direct motors is approximately 2 to 3% higher than for similar drive concepts. For a 1000 kW motor, this results in a saving of 33 kW, which is an annual saving of approximately 15000 € for an operating time of 8 hours per day.
- The multi-pole drive design ensures that the space requirement and mass of the motors are lower than for similar induction machines. The slow-running motors of the HT-direct series obviate the need for a gearbox in many cases (reduction in engineering, assembly and maintenance outlay, lower investment and lower operating costs).
- Efficient, optimally matched drive system, SINAMICS converter and HT-direct motor for operation without encoders.

- Thanks to their long service life (nominal bearing lifetime > 60000 hours), HT-direct motors are maintenance-low and have a high availability especially for applications in which a gearbox can be omitted.
- Environmentally friendly system (where applicable, no disposal of gearbox oil is necessary; energy-saving drive system).

Application

Permanent-magnet synchronous motors are used in combination with converters as slow-running direct drives, e.g. for paper machines, in the steel and plastics industries and in shipbuilding.

Order No. code

High-torque motors with permanent-magnet technology

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																				
	1	F	W	4	■	■	■	-	■	H	■	■	0	-	1	A	A	■	-	Z																
Positions 1 to 3 (digit, character, character)	Type																																			
Position 4 (digit)				Type series																																
Positions 5 to 7 (digits)				Frame size																																
Position 8 (digit)							Cooling method																													
Position 9 (character)										Number of poles																										
Position 10 (character)													Rated speed																							
Position 11 (digit)																Voltage																				
Position 12 (digit)																			Type of construction																	
Position 13 (digit)																						Rotor design														
Position 14 (character)																									(Not used at this time)											
Position 15 (character)																												Shaft version								
Position 16 (digit)																															Bearing design					
Special versions																																		Please specify additional order code and any plain text		

Ordering example

HT-direct motor, water-cooled

400 rpm; 40 kNm; 1676 kW; 690 VY →
 Frame size 508
 Temperature class 155 (F)
 Used acc. to 155 (F)
 IP55 degree of protection
 IM B3 type of construction
 Standard bearing design

Order No.	1 F W 4 5 0 8 - 1 ■ ■ ■ ■ ■ - ■ A ■ ■
Number of poles	- H
Rated speed	- C
Voltage	- 7
Type of construction	- 0
Rotor design	- 1
(Spare position)	- A
Shaft version	- A
Bearing design	- 0
Specify when ordering:	1 F W 4 5 0 8 - 1 H C 7 0 - 1 A A 0

Protection strategy

Reverse power

Due to the permanent magnets in the rotor, magnetic flux is continuously present in the motor and for each revolution of the rotor, a voltage is generated at the motor terminals, even when the feeding converter is switched off and disconnected from the supply system.

Power from feeding converter

Also, when the rotor is at a standstill, voltage can still be present at the motor terminals if the feeding converter has not yet been switched off or the DC link circuit of the converter is not yet discharged.

Notes on safety, application and design

If work is to be performed on the drive system (converter and/or motor), the following safety measures must be implemented:

- The converter must be isolated from the supply system by a switch (isolating switch or circuit-breaker).
- Prevent any rotary motion of the motor.
- A separate protective device must be used for plants, in which the rotor can be accelerated by an active load, for example a circuit breaker must be used.
- The field weakening range is limited to 120%. In case of an active load (rotor can be accelerated by the plant) the DC link must be protected against overspeed/overvoltage.

Safety precautions when working on		Maintenance or repair on the motor and/or the converter after commissioning of the drive system may only be carried out under the following preconditions.
Motor terminal box	Important! Only permissible when the rotor is at a standstill!	Before opening the motor terminal box it must be ensured that <ul style="list-style-type: none"> • the rotor is at a standstill, • the converter is disconnected from the supply and • the DC link of the converter is discharged.
Converter	On rotor standstill.	Before opening the converter it must be ensured that <ul style="list-style-type: none"> • the converter is disconnected from the supply, • the DC link of the converter is discharged and • the rotor is at a standstill.
	With a rotating rotor that is coupled depending on the plant.	Before opening the converter it must be ensured that <ul style="list-style-type: none"> • the converter is disconnected from the supply, • the DC link of the converter is discharged and • that the (coupled) motor is electrically isolated from the converter by means of a suitable switch (for SINAMICS S120 Cabinet Modules a corresponding circuit-breaker on the output side can be ordered with the converter option L34).

Converter-fed operation

Converters

SINAMICS S converters

The **SINAMICS S120 and S150 converters** allow regenerative feedback into the supply system. The motor can be operated, if required, with a rotor position encoder.

SINAMICS G converters

The **SINAMICS G130 and G150 converters** do not allow regenerative feedback into the supply system. These converters also do not support the use of a rotor position encoder. The motor can only be operated without encoder.

All converters must be operated at a pulse frequency of ≥ 2.5 kHz due to the eddy-current losses that arise in the magnets.

Encoderless speed control

Encoderless speed and torque control has been developed for the HT-direct motors.

The motors can be started up from a standstill without encoders. After a few revolutions, the converter can calculate the speed and position of the rotor from the voltage induced by the magnets in the motor winding. Motor operation down to standstill is possible. For highly dynamic torque control, an encoder is required at low speeds. For connection to a rotating machine (capture) in encoderless operation, a voltage measuring module is required. This module is offered as an option (K 51) for the converter and can be used instead of an encoder module.

Synchronized operation of multiple drives

The accuracy for speed or frequency for synchronized operation of several drives is 0.01% related to the maximum speed or frequency over a period of one second. A SINAMICS converter is required for each motor.

Approach

Start-up from standstill with full rated torque is possible for encoderless motors as well as for motors with speed encoders.

Creep operation

Water-jacket-cooled and forced-ventilated motors can be operated for 3 hours with 1/100 of the rated speed. At this operating point, the converter is only permitted to be operated at 50% of the rated current. A speed encoder is required for torque-controlled operation in this range.

In creep mode, if the torque is more than the applicable torque at 50% of rated current, a converter with a higher rating must be selected.

Operation in the field weakening range

The field weakening range for the HT-direct motors is limited to 20% of the rated speed. The magnets in the rotor do not allow conventional field weakening, so field weakening can only be achieved by the injection of a phase-displaced current by the converter. In the case of high field-weakening speeds, this would require an increase in converter frame size. The limited field-weakening range also ensures that the DC-link voltage of the converter does not exceed the maximum permissible value in case of pulse blocking due to the induced voltage of the motor.

Overload capability

The overload capability of the motor converter system is determined by the design of the converter and motor (see SINAMICS catalogs). The motor and converter can be temporarily overloaded by up to 50%. The basic load current of the converter that is available is reduced by overload requirements which may require selection of a larger converter. For higher overloads and more complex duty cycles, please submit an enquiry.

Cable lengths between the motor and converter

The maximum cable length for shielded motor connection cables is 300 m without any additional measures (see the section "Bearings and bearing currents").

Duty type

The standard duty type is S1. For other duty types, please specify the duty cycle.

Use according to temperature class 130 (previously temperature class B) available on request.

General technical data

Bearings and bearing currents

When operating multiphase AC machines by a converter, an electrical bearing stress results from a capacitive induced voltage via the bearing lubricating film, depending on the principle being used. The physical cause of this is the common-mode voltage at the converter output: The sum of the three phase-to-neutral voltages is not zero at all times, unlike with direct on-line operation. The high-frequency, pulse-shaped common-mode voltage brings about a residual current, which closes back to the converter's DC link via the machine's internal capacitances, the machine housing and the earthing circuit. The machine's internal capacitances include the main insulation winding capacitance, the geometric capacitance between the rotor and stator, the lubricating film capacitance and the capacitance of any bearing insulation that may be present. The current level via the internal capacitances is proportional to the common-mode voltage regulation ($i(t) = C \cdot du/dt$).

In order to apply currents to the motor which are sinusoidal as far as possible (smooth running, oscillation torques, stray losses), a high pulse frequency is required for the converter's output voltage. The related (very steep) switching edges of the converter output voltage (and also, therefore, of the common-mode voltage) cause correspondingly high capacitive currents and voltages on the machine's internal capacitances.

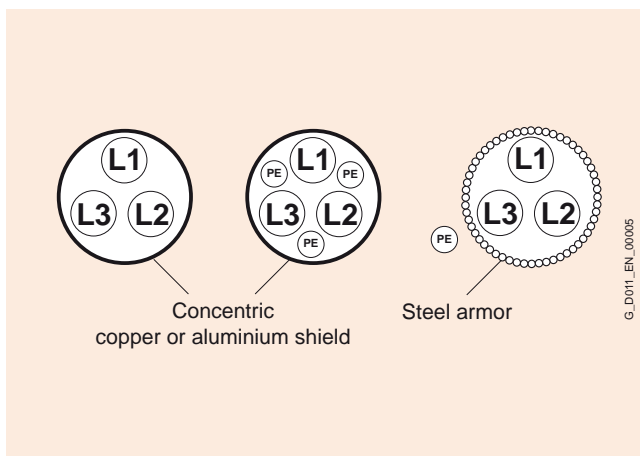
In the worst-case scenario, the capacitive voltage induced via the bearing can lead to random punctures of the bearing lubricating film, thus damaging the bearing/ causing premature wear. The current pulses caused by the puncture in the lubricating film are referred to as EDM (Electrostatic Discharge Machining) currents, although this is not primarily a question of an electrostatic effect, but more of (partial) punctures of insulating material, i.e., of partial discharges.

This physical effect, which occurs in isolated cases, has mostly been observed in connection with larger motors.

EMC-compliant installation of the drive system is a basic prerequisite for preventing premature bearing damage via bearing currents.

The most important measures for reducing bearing currents:

- Use of cables with a symmetrical cable cross-section (see Figure below)



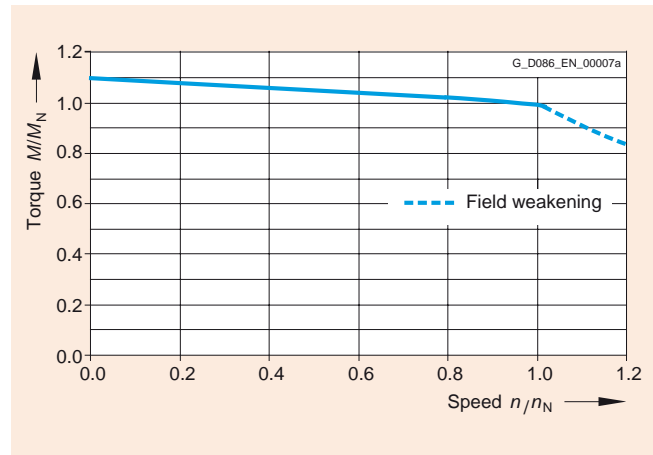
- Use of motor reactors (converter option L08)
- Preference given to a supply with insulated neutral point (IT system)
- Use of grounding cables with low impedance in a large frequency range (DC up to approximately 70 MHz): for example, plaited copper ribbon cables, HF litz wires
- Separate HF equipotential-bonding cable between motor housing and driven machine
- Separate HF equipotential-bonding cable between motor housing and converter PE busbar

- 360° HF contacting of the cable shield on the motor housing and the converter PE busbar. This can be achieved using EMC screwed glands on the motor end and EMC shield clips on the converter end, for example.
- Common-mode filters at the converter output
- The HT-direct motors are equipped with an electrically insulated bearing housing at NDE.

Thermal limit characteristic and field-weakening range

Due to the speed-independent cooling of the HT-direct motors, no torque reduction or only a relatively minor torque reduction (depending on their speed range) is required for operation at constant load torque and with wide speed ranges.

Guide values for the maximum load torques at various speeds can be obtained from the diagrams below:



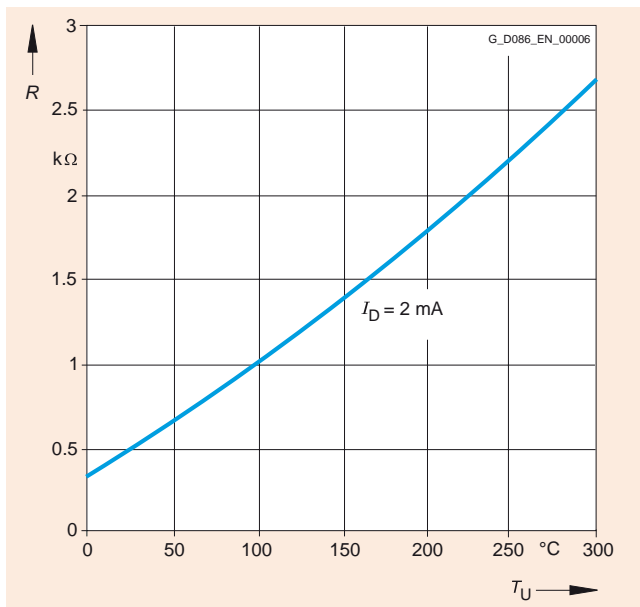
Motor protection

In addition to the current-dependent overload protection device located in the connecting leads, we recommend that you also monitor the temperature rise in the motor - and consequently the winding temperature - with the aid of the KTY 84-130 temperature sensors built into the stator winding as standard.

Winding temperature detection with KTY 84-130 temperature sensors (standard)

The KTY 84-130 sensor is a semiconductor sensor that changes its resistance depending on temperature in accordance with a defined, approximately linear characteristic. Two temperature sensors are built into the winding overhang as standard, whereby one sensor is used as a spare. The temperature is evaluated in the Siemens converter using the resistance of the temperature sensor. The required temperature for alarm and tripping can be set on the converter.

Two auxiliary terminals are provided for connection in the terminal box.



Optional winding temperature detection with PTC thermistors (thermistor motor protection)

Protection against thermal overloading of the motor is also provided by PTC thermistors installed in the winding overhang. When a limit temperature is reached (rated tripping temperature), the PTC thermistor undergoes a step change in resistance. This is evaluated by a tripping unit and can be used to open auxiliary circuits.

Two auxiliary terminals are provided in the terminal box for connecting three built-in temperature sensors for shutdown.

Optional winding temperature detection with PT100 resistance thermometers

PT100 resistance thermometers can also be installed in the winding overhang. An additional auxiliary terminal box is required for connection.

Changes in temperature are transferred to a display device in the form of changes in resistance. The indicator is not included in the scope of supply.

Bearing monitoring

Standard bearing vibration monitoring using SPM shock-pulse measurement

Measuring nipples for SPM shock-pulse measurement are screwed into the bearing housing at the drive end and non-drive end as standard.

Optional bearing temperature detection with PT100 resistance thermometers

As an option, bearing thermometers can be screwed into the bearing housings at the drive end and non-drive end. The wires are routed through an additional terminal box.

Changes in temperature are transferred to a display device in the form of changes in resistance. The indicator is not included in the scope of supply.

General technical data

Electrical design

Speeds

The rated motor speeds (rpm)

- 200
- 300
- 400
- 500
- 600
- 800

describe the transition speeds of the motor design.

Above the transition speed, a field weakening range of up to 20% is possible (e.g. a motor with a rated speed 500 rpm can be operated up to 600 rpm).

Voltages and frequencies

EN 60034-1 differentiates between Category A (combination of voltage deviation $\pm 5\%$ and frequency deviation $\pm 2\%$) and Category B (combination of voltage deviation $\pm 10\%$ and frequency deviation $+3/-5\%$) for voltage and frequency fluctuations.

The motors can supply their rated torque in both Category A and Category B. In Category A, the temperature rise is approx. 10 K higher than during normal operation. According to the standard, longer operation is not recommended for Category B.

The tolerance for HT-direct motors is in accordance with DIN EN 60034-1 in all cases. A rated voltage range is, therefore, not specified on the rating plate.

Line voltages	690 V, 50 Hz	400 V, 50 Hz	460 V, 60 Hz
Voltage code (11th position of the Order No.)	7	8	4

Windings and insulation

For the versions with windings of round wire, the well-proven DURIGNIT 2000 insulation system in temperature class 155 is used. Frame sizes ≥ 450 have shaped-coil windings whose insulation system is based on the same materials and whose winding design is adapted accordingly.

The components of the insulation system are

- Varnish or mica-insulated round or flat wires for the winding insulation
- Multi-layer flat insulation material for the slot and phase insulation
- Solvent-free impregnated resin

The high-quality materials offer resistance to continuous high temperatures approaching temperature class 180.

An impregnation technique optimized for the winding design is used that ensures a minimum resin fill level in the slot.

This ensures:

- The required mechanical stiffness of the winding in the vicinity of the slot and windings
- The quality of heat dissipation to the laminated core and the internal air circulation
- Protection of the winding from environmental effects such as humidity or corrosive chemicals.

Utilization

With the insulation system used under normal converter-fed operation, the motors are utilized according to temperature class 155 (previously: temperature class F).

Motor connection and connection boxes

Connecting cables

For motor currents that exceed the maximum current carrying capability of 1230 A of a terminal box, two galvanically isolated winding systems are equipped with two 1XB1 631 terminal boxes (for assignment, see the section "Selection and ordering data").

The connecting cables must be dimensioned acc. to DIN VDE 0298.

Characteristics of the 1XB1 631 terminal box

Number of terminals	Quantity	12
Contact screw thread	Size	M16
Max. rec. conductor cross-section	mm ²	240
Outer cable diameter (sealing range)	mm	56 ... 68.5
Cable entry holes	Size	4 x M80 x 2
Cable glands (option K57)	Size	4 x M80 x 2 Z58 – Z67



Terminal box 1XB1 631

The possible mounting positions for the terminal boxes on the water-cooled or air-cooled motors are described in Sections 2 and 3.

Characteristics of the optional auxiliary terminal box

Number of terminals	Quantity	24
Outer cable diameter	mm	11 ... 16
Cable entry holes	Size	2 x M20 x 1.5
Cable glands (option K57)	Size	2 x M20 x 1.5

Mechanical design

Rotor construction

The rotor is fitted with permanent magnets. The magnets are integrated in the rotor and potted in resin.

For rotors **installed** in motors, a magnetic field cannot be detected externally.

Danger:

The magnetic field from a **disassembled** rotor can cause injury or damage to health if inappropriate tools are used. Installation and disassembly of the rotor is therefore only permitted to be performed at the manufacturer site.

Bearings and lubrication

The HT-direct motors are equipped as standard with one deep-groove ball bearing at DE and NDE installed in the bearing housing.

The DE bearing is responsible for axial guiding of the rotor (so-called fixed bearing).

The NDE bearing is installed as a floating bearing with axial clearance in the electrically insulated bearing housing. Axial pressure springs that act on the outer ring of the deep-groove ball bearing ensure backlash-free and smooth running of the motor.

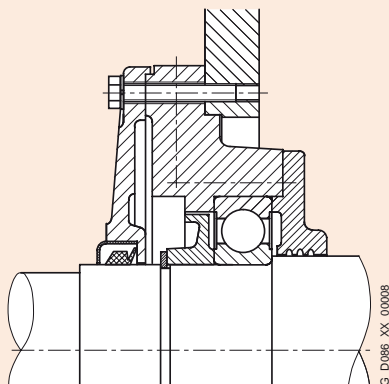
The roller bearings are greased and are equipped with a re-greasing device. The grease type, quantity and relubrication intervals are stated on the lubrication plate of the motor.

The calculated bearing lifetime is 60000 operating hours in S1 duty provided that the instructions for lubrication on the lubrication plate of the motor are complied with. In practice, however, the bearing lifetime is frequently longer than this.

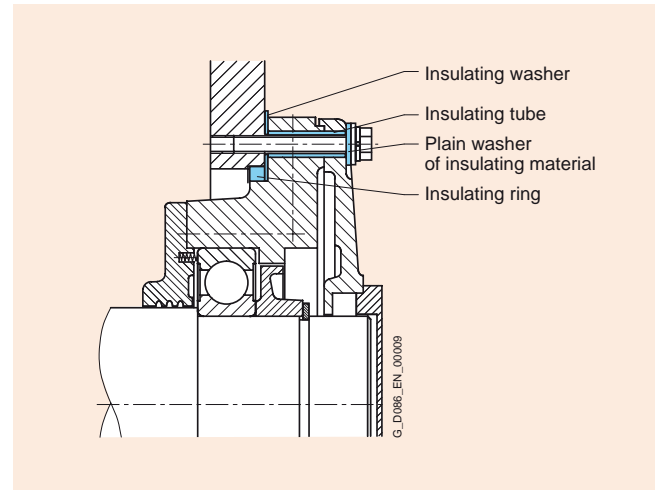
The compartment for storing the old grease must be sufficiently large to allow an operating time of > 60000 hours.

The requirements of the marine classification societies (Germanischer Lloyd, DNV, BV, LRS, ABS, CCS) are fulfilled, i.e. angular displacement is permitted in every direction up to 15° static and 22° dynamic. The requirement must be ordered with the appropriate E.. order code.

Measuring nipples are screwed into the bearing housing as standard for bearing monitoring based on the shock-pulse method.



Bearing at DE (fixed bearing)



Bearing at NDE (floating bearing):
Electrically insulated bearing cartridge, backlash-free adjusted deep-groove ball bearing

Standard bearing arrangement

Frame size	Drive end DE bearing	Non-drive end NDE bearing
40.	6232 C3	6228 C3
45.	6236 C3	6232 C3
50.	6240 C3	6236 C3

Changing the bearing

It is possible to change the bearings on site. Please contact your local Siemens sales representative regarding this.

Max. motor speed

The motors can be operated up to 20% above the rated speed.

General technical data

Balance and vibration severity

The rotors are dynamically balanced with half key. This corresponds to vibration severity grade A.

DIN EN 60034-14 is concerned with the mechanical vibrations of rotating electrical machines and specifies limits. "Half key balancing" is specified here based on DIN ISO 8821.

The balancing type is stamped on the face of the drive-end (DE) shaft extension.

- F = Balancing with full featherkey
- H = Balancing with half featherkey
- N = Balancing without featherkey

Full key balancing is possible, on request, by specifying code **L68** (additional charge).

Low-vibration versions can be supplied to fulfill stricter requirements on smooth running (additional charge).

For vibration severity level **B** (special vibration requirements), order code **K02** must be specified in the order.

Vibration severity grade	Limit values (rms values) for the maximum vibration level for the vibration speed in mm/s in a rigid configuration according to IEC/EN 60034-14
A	2.3
B	1.5

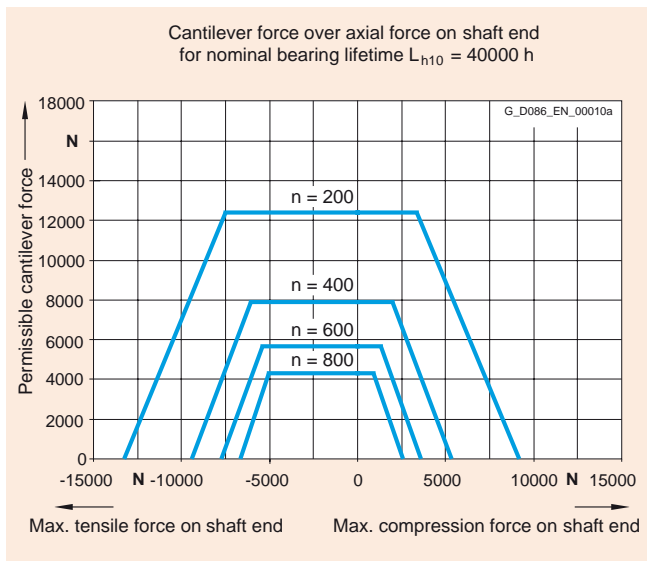
Note: The tolerance of the measuring instrument can be $\pm 10\%$.

Noise

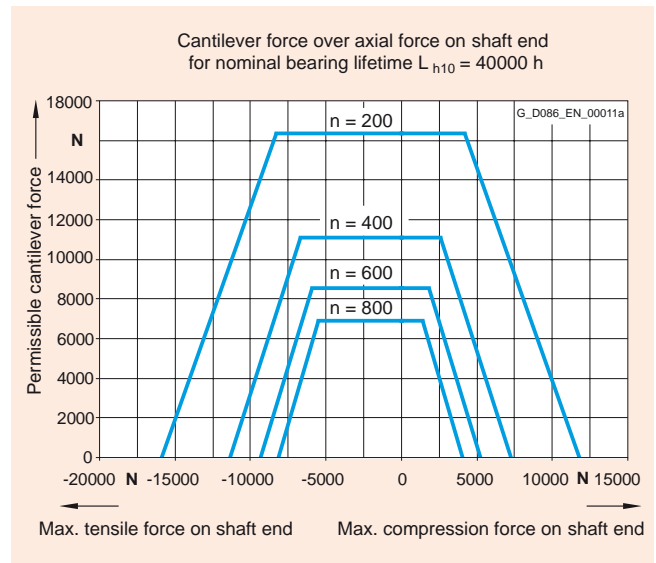
Noise is measured in a room with low reflection characteristics according to DIN EN ISO 1680, however at rated power. The noise level is specified as A-weighted measuring surface sound pressure level L_{pA} in dB (A). This value is the spatial average value of the sound pressure levels measured at the measuring surface. The measuring surface is a cube 1 m away from the surface of the motor.

The sound pressure level in converter-fed operation depend on the speed and torque of the drive application. In most cases, the values for water-cooled motors are below 82 dB(A) and for air-cooled motors they are below 85 dB(A).

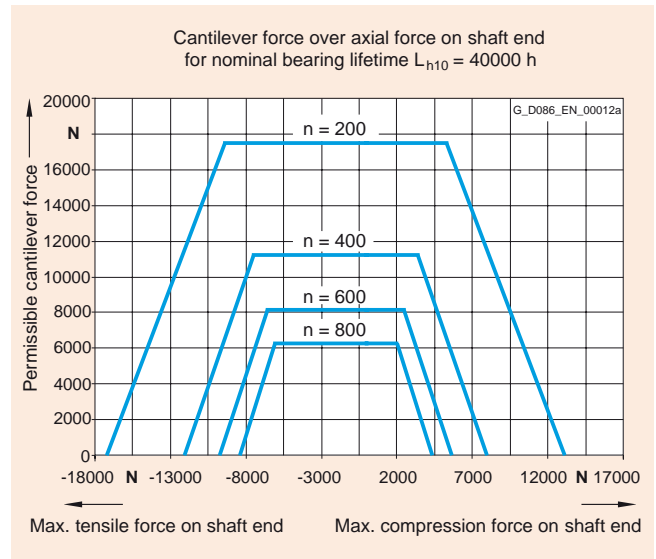
Permissible cantilever forces depending on the axial forces that occur



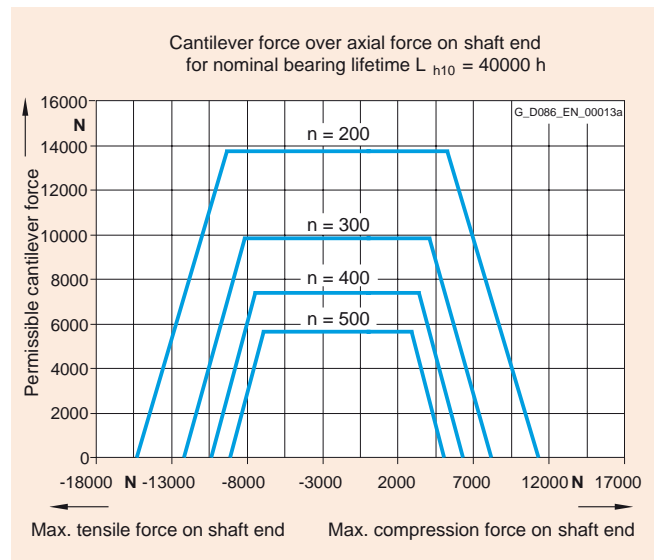
Frame size 400, 1FW4 40. IM B3



Frame size 450, 1FW4 45. IM B3



Frame size 503/505, 1FW4 503/505 IM B3



Frame size 507/508, 1FW4 507/508 IM B3

Paint finish

Design	Suitability of paint finish for climate group in accordance with DIN IEC 60 721, Part 2- 1	
Normal paint finish (layer thickness 60 to 90 μm)	Extended: Covers moderate outdoor climates, in particular, the "cold moderate climate", the "moderate climate", the "moderately dry climate" and the "warm dry climate". For indoors and outdoors under a roof <u>not</u> directly subjected to weather conditions The concentration of pollutants can be up to the applicable TRGS value (previously MAK value).	Short-term: Up to 120 °C Continu- ous: Up to 100 °C
Special paint finish (layer thickness 90 to 120 μm)	Global: Covers all statistical outdoor climates. For outdoor installations subjected to direct solar irradiation and/or weathering over a wide temperature and moisture range. Any aggressive pollutants must not exceed a concentration of three times the TRGS value.	Short-term: Up to 140 °C Continu- ous: Up to 120 °C

All motors can be repainted with commercially available paints.

All motors are painted with RAL 7030 if the color is not specified.

Special coatings with thicker layers are available on request.

Degrees of protection

HT-direct motors are designed to IP 55 degree of protection. They can be installed in dusty or humid environments. The motors can be suitable for operation in tropical climates as an option. Guide value 60% relative humidity at 40 °C ambient temperature. Other requirements on request.

The motors can be supplied in IP56 degree of protection on request (order code **K52**).

Explanation of the degrees of protection

- IP55: Protection against harmful dust deposits, protection against water jets.
- IP56: Protection against harmful dust deposits, protection against heavy water jets (non-heavy sea).

Condensation water drain hole:

If condensation water builds up in the motor it can drain through holes positioned at the lowest point in the motor housing. When the motors are delivered, these holes are sealed.

Rating plate (example for water-cooled motor)

SIEMENS		3
2		
1	3-MOT. 1FW4 508-1HC70-1AA0 NoN - U81176625010001 / 2006 IM B3 Th.Cl.F	
6	V	10
7	Hz	11
8	A	12
9	kW	13
	cos ϕ	14
	1/min	15
	Nm	16
	IP	17
14	Rotor Permanent Magnet EN/IEC 60034-1 Gew/Wt 7,4 t	
16	Max. Wasserdruck / max. water pressure 5 bar	
17	Kühlwasser / cooling water 80 l/min bei / at 25 °C max	
18	S1	19
	n_{max}	
Betrieb mit SINAMICS-Umrichter / Operation with SINAMICS Drive		
	MADE IN GERMANY D-90441 Nuremberg	
	CE	

- | | |
|-------------------------|--|
| 1 Motor type | 11 Rated torque [Nm] |
| 2 Order No. | 12 Rated speed [rpm] |
| 3 ID No. (factory No.) | 13 Power factor |
| 4 Type of construction | 14 Rotor |
| 5 Temperature class | 15 Motor weight [t] |
| 6 Rated voltage [V] | 16 Max. water pressure [bar] |
| 7 Rated frequency [Hz] | 17 Required cooling water flowrate [l/min]
at max. cooling water temperature [°C] |
| 8 Rated current [A] | 18 Duty type |
| 9 Rated power [kW] | 19 Max. operating speed [rpm] |
| 10 Degree of protection | |

G_D086_EN_00014a

General technical data

Anti-condensation heating (optional)

Motors whose windings are at risk of condensation due to the climatic conditions, e.g. inactive motors in humid atmospheres or motors that are subjected to widely fluctuating temperatures can be equipped with anti-condensation heaters as an option.

Anti-condensation heating must not be switched on during operation. For this purpose, an appropriate interlocking circuit with the main switch of the machine must be installed when erecting the electrical system.

For additional protection against the build-up of condensation, it is recommended that the cooling circuit of a water-cooled machine is shut down during long periods of inactivity.

The anti-condensation heating available as an option must principally be switched on 1 hour after shutdown of the machine to prevent damage to the winding insulation.

For the connection of auxiliary leads, separate auxiliary terminal boxes can be mounted as an option (option M52).

Additional order codes for anti-condensation heating

Supply voltage	Order code	
230 V (~)	K45	
400 V (~)	L08	
500 V (~)	L09	
115 V (~)	K46	
460 V (~)	Y83	With additional plain text: "For 460 V supply voltage"

Marine version (optional)

Motors for operation in a marine climate (saline sea air containing up to 1 mg salt/m³ of air and 96% air humidity) can be supplied in a "Marine version" as an option. To prevent corrosion at the bearing seal, the shaft section under the bearing seal is coated.

For installation on deck, forced-ventilated motors must be protected against flooding. The motors must also be protected against ice formation at temperatures below 0 °C (precautions must be taken against the external fan freezing solid or against freezing of the cooling water).

Standards and regulations

The motors comply with the appropriate standards and regulations, especially those listed in the table below.

Title	IEC	DIN/EN/ISO
General specifications for rotating electrical machines	IEC 60034-1 IEC 60085	DIN EN 60034-1
Starting characteristics for rotating electrical machines	IEC 60034-12	DIN EN 60034-12
Terminal designations and direction of rotation for rotating electrical machines	IEC 60034-8	DIN EN 60034-8
Designation for type of construction, installation and terminal box position	IEC 60034-7	DIN EN 60034-7
Entry to terminal box	–	DIN 42925
Built-in thermal protection	IEC 60034-11	DIN EN 60034-11
Noise limit values for rotating electrical machines	IEC 60034-9	DIN EN 60034-9
IEC standard voltages	IEC 60038	DIN IEC 60038
Cooling methods for rotating electrical machines	IEC 60034-6	DIN EN 60034-6
Vibration severity of rotating electrical machines	IEC 60034-14	DIN EN 60034-14
Vibration limits	–	DIN ISO 10816
Degrees of protection for rotating electrical machines	IEC 60034-5	DIN EN 60034-5
Technique for measuring the emitted sound from rotating electrical machines	–	DIN EN ISO 1680

Selection and ordering HT-direct motors 1FW4 water-cooled

2



2/2	Overview
2/2	Benefits
2/3	Selection and ordering data
2/5	Special versions
2/8	Dimension drawings
2/9	Additional information

Selection and ordering

HT-direct motors 1FW4 water-cooled

Overview



The motors are designed for the following rated voltages:

- 690 V $\sqrt{3}$ /50 Hz
- 400 V $\sqrt{3}$ /50 Hz
- 460 V $\sqrt{3}$ /60 Hz

Ambient temperature: $-20\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$; when operated below $0\text{ }^{\circ}\text{C}$, use anti-freeze in cooling water. Motors can optionally be ordered for higher ambient temperatures (see Page 2/6).

Cooling water inlet temperature: max. $25\text{ }^{\circ}\text{C}$; at higher coolant inlet temperatures up to $45\text{ }^{\circ}\text{C}$, a motor Order No. must be selected in accordance with the derating factors (see Page 2/10). The order code for the higher cooling water inlet temperature (see Page 2/6) must also be specified in the order.

Degree of protection: IP55

Cooling method: IC71W

Type of construction: IM B3

Overview of torques and outputs
in accordance with the rated speed

Rated speed rpm	Max. rated torque Nm	Max. rated output kW
200	42000	879
300	41000	1288
400	40000	1675
500	34235	1792
600	33000	2073
800	19000	1591

Benefits

When high torques and low speeds are required for electrical drives in combination with compact dimensions and a low-noise design, the HT-direct motor with water-jacket cooling provides the ideal customer solution. Depending on the ambient conditions, water-jacket cooling generally provides maximum cooling performance – with minimal heating of the immediate environment.

Selection and ordering HT-direct motors 1FW4 water-cooled

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Selection and ordering data

Rated torque Nm	Rated output ¹⁾ kW	Frame size	Efficiency at 690 V		Rated current at			Norm. max. torque at 690 V ²⁾ T_{max}/T_{rated}	Moment of inertia J kgm ²	Version with two galvanically isolated winding systems ³⁾			Order No.	Weight, approx. kg	
			4/4-load %	4/4-load cos φ	690 V Y A	400 V Y A	460 V Y A			690 V Y	400 V Y	460 V Y			
200 rpm, IP55 degree of protection, IMB3 type of construction															
9375	196	401	94.4	0.89	205	335	305	1.5	19.4	-	-	-	1FW4401-1HA	0-1AA0	3040
11250	235	403	94.4	0.88	245	410	370	1.5	22.4	-	-	-	1FW4403-1HA	0-1AA0	3310
13125	274	405	94.7	0.89	280	485	425	1.5	26.1	-	-	-	1FW4405-1HA	0-1AA0	3650
15000	314	407	95.0	0.90	315	530	465	1.5	30.9	-	-	-	1FW4407-1HA	0-1AA0	4100
16215	339	451	93.1	0.79	400	740	650	1.5	37.9	-	-	-	1FW4451-1HA	0-1AA0	4010
18975	397	453	93.9	0.80	460	840	720	1.5	44.9	-	-	-	1FW4453-1HA	0-1AA0	4350
21850	457	455	94.3	0.81	550	900	830	1.5	51.5	-	-	-	1FW4455-1HA	0-1AA0	4680
27600	578	503	95.0	0.80	660	1190	990	1.5	89.3	-	-	-	1FW4503-1HA	0-1AA0	5610
32775	686	505	94.8	0.79	870	1350	1210	1.5	102.6	-	✓	-	1FW4505-1HA	0-1AA0	6110
37950	794	507	95.2	0.80	930	1720	1340	1.5	118.4	-	✓	✓	1FW4507-1HA	0-1AA0	6680
42000	879	508	95.6	0.82	930	1600	1400	1.5	139.3	-	✓	✓	1FW4508-1HA	0-1AA0	7440
300 rpm, IP55 degree of protection, IMB3 type of construction															
9060	284	401	95.7	0.90	275	475	420	1.5	19.4	-	-	-	1FW4401-1HB	0-1AA0	3040
10875	341	403	95.8	0.89	340	550	510	1.5	22.4	-	-	-	1FW4403-1HB	0-1AA0	3310
12690	398	405	96.1	0.89	390	640	580	1.5	26.1	-	-	-	1FW4405-1HB	0-1AA0	3650
14500	455	407	96.3	0.90	450	750	670	1.5	30.9	-	-	-	1FW4407-1HB	0-1AA0	4100
15860	498	451	95.3	0.79	560	1010	840	1.5	37.9	-	-	-	1FW4451-1HB	0-1AA0	4010
18560	583	453	95.6	0.81	700	1100	990	1.5	44.9	-	-	-	1FW4453-1HB	0-1AA0	4350
21375	671	455	95.8	0.81	890	1390	1220	1.5	51.5	-	✓	-	1FW4455-1HB	0-1AA0	4680
26700	838	503	96.2	0.81	960	1640	1440	1.5	89.3	-	✓	✓	1FW4503-1HB	0-1AA0	5610
31705	996	505	96.3	0.80	1170	1960	1680	1.5	102.6	-	✓	✓	1FW4505-1HB	0-1AA0	6110
36710	1153	507	96.5	0.80	1290	2330	1940	1.5	118.4	✓	✓	✓	1FW4507-1HB	0-1AA0	6680
41000	1288	508	96.7	0.82	1360	2220	2190	1.5	139.3	✓	✓	✓	1FW4508-1HB	0-1AA0	7440
400 rpm, IP55 degree of protection, IMB3 type of construction															
8750	366	401	96.4	0.90	360	580	530	1.5	19.4	-	-	-	1FW4401-1HC	0-1AA0	3040
10500	439	403	96.5	0.90	435	700	630	1.5	22.4	-	-	-	1FW4403-1HC	0-1AA0	3310
12250	513	405	96.7	0.91	485	850	750	1.5	26.1	-	-	-	1FW4405-1HC	0-1AA0	3650
14000	586	407	96.9	0.93	540	930	810	1.5	30.9	-	-	-	1FW4407-1HC	0-1AA0	4100
15510	649	451	96.0	0.80	710	1240	1100	1.5	37.9	-	✓	-	1FW4451-1HC	0-1AA0	4010
18150	760	453	96.4	0.82	800	1380	1210	1.5	44.9	-	✓	-	1FW4453-1HC	0-1AA0	4350
20900	875	455	96.5	0.81	950	1590	1370	1.5	51.5	-	✓	✓	1FW4455-1HC	0-1AA0	4680
25800	1080	503	96.8	0.83	1110	1880	1620	1.5	89.3	-	✓	✓	1FW4503-1HC	0-1AA0	5610
30635	1283	505	96.8	0.81	1420	2290	2270	1.5	102.6	✓	✓	✓	1FW4505-1HC	0-1AA0	6110
35475	1485	507	97.0	0.81	1610	4)	2270	1.5	118.4	✓	4)	✓	1FW4507-1HC	0-1AA0	6680
40000	1675	508	97.2	0.83	1780	4)	4)	1.5	139.3	✓	4)	4)	1FW4508-1HC	0-1AA0	7440
Rated voltage															
• 460 V Y														4	
• 690 V Y														7	
• 400 V Y														8	
Special voltage														9	
Other rated speed with additional plain text														-Z	

1) Temperature class 155 (temperature class F), used according to temperature class 155 (temperature class F)
 2) Maximum torque T_{max} = Overload torque for 120 s (higher overload torques on request)

3) In the version with two galvanically isolated winding systems, two main terminal boxes 1XB1 631 are required.
 - Not applicable
 ✓ Applicable
 4) Cannot be implemented

Selection and ordering

HT-direct motors 1FW4 water-cooled

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Rated torque Nm	Rated output ¹⁾ kW	Frame size	Efficiency at 690 V		Rated current at			Norm. max. torque at 690 V ²⁾ T_{max}/T_{rated}	Moment of inertia J kgm ²	Version with two galvanically isolated winding systems ³⁾			Order No.	Weight, approx. kg
			4/4-load %	4/4-load cos φ	690 V √	400 V √	460 V √			690 V √	400 V √	460 V √		
500 rpm, IP55 degree of protection, IMB3 type of construction														
8440	441	401	96.8	0.91	415	680	610	1.5	19.4	-	-	-	1FW4401-1HD ■ 0-1AA0	3040
10125	530	403	96.9	0.90	510	840	740	1.5	22.4	-	-	-	1FW4403-1HD ■ 0-1AA0	3310
11810	618	405	97.0	0.90	590	960	830	1.5	26.1	-	-	-	1FW4405-1HD ■ 0-1AA0	3650
13500	706	407	97.2	0.95	630	1080	930	1.5	30.9	-	-	-	1FW4407-1HD ■ 0-1AA0	4100
15160	793	451	96.6	0.80	880	1400	1390	1.5	37.9	-	✓	✓	1FW4451-1HD ■ 0-1AA0	4010
17740	928	453	96.8	0.81	1050	1600	1580	1.5	44.9	-	✓	✓	1FW4453-1HD ■ 0-1AA0	4350
20425	1069	455	96.9	0.82	1170	1880	1580	1.5	51.5	-	✓	✓	1FW4455-1HD ■ 0-1AA0	4680
24900	1303	503	97.0	0.83	1340	2200	2150	1.5	89.3	✓	✓	✓	1FW4503-1HD ■ 0-1AA0	5610
29565	1548	505	97.2	0.84	1570	4)	4)	1.5	102.6	✓	4)	4)	1FW4505-1HD ■ 0-1AA0	6110
34235	1792	507	97.3	0.84	1820	4)	4)	1.5	118.4	✓	4)	4)	1FW4507-1HD ■ 0-1AA0	6680
600 rpm, IP55 degree of protection, IMB3 type of construction														
8125	510	401	97.0	0.90	490	800	710	1.5	19.4	-	-	-	1FW4401-1HE ■ 0-1AA0	3040
9750	612	403	97.1	0.90	580	940	820	1.5	22.4	-	-	-	1FW4403-1HE ■ 0-1AA0	3310
11375	714	405	97.2	0.90	700	1090	940	1.5	26.1	-	-	-	1FW4405-1HE ■ 0-1AA0	3650
13000	816	407	97.3	0.93	750	1250	1070	1.5	30.9	-	✓	-	1FW4407-1HE ■ 0-1AA0	4100
14805	930	451	96.9	0.81	1050	1610	1580	1.5	37.9	-	✓	✓	1FW4451-1HE ■ 0-1AA0	4010
17325	1088	453	97.0	0.82	1160	1870	1850	1.5	44.9	-	✓	✓	1FW4453-1HE ■ 0-1AA0	4350
19950	1253	455	97.0	0.83	1300	2280	1850	1.5	51.5	✓	✓	✓	1FW4455-1HE ■ 0-1AA0	4680
24000	1507	503	97.4	0.87	1490	4)	2160	1.5	89.3	✓	4)	✓	1FW4503-1HE ■ 0-1AA0	5610
28500	1790	505	97.4	0.86	1780	4)	4)	1.5	102.6	✓	4)	4)	1FW4505-1HE ■ 0-1AA0	6110
33000	2073	507	97.5	0.84	2100	4)	4)	1.5	118.4	✓	4)	4)	1FW4507-1HE ■ 0-1AA0	6680
800 rpm, IP55 degree of protection, IMB3 type of construction														
7500	628	401	97.2	0.91	590	990	850	1.5	19.4	-	-	-	1FW4401-1HF ■ 0-1AA0	3040
9000	753	403	97.2	0.91	740	1190	1010	1.5	22.4	-	-	-	1FW4403-1HF ■ 0-1AA0	3310
10500	879	405	97.3	0.92	830	1460	1180	1.5	26.1	-	✓	-	1FW4405-1HF ■ 0-1AA0	3650
12000	1005	407	97.3	0.92	930	1500	1400	1.5	30.9	-	✓	✓	1FW4407-1HF ■ 0-1AA0	4100
14100	1181	451	96.9	0.82	1290	2260	1810	1.5	37.9	✓	✓	✓	1FW4451-1HF ■ 0-1AA0	4010
16500	1382	453	97.3	0.83	1470	2290	2210	1.5	44.9	✓	✓	✓	1FW4453-1HF ■ 0-1AA0	4350
19000	1591	455	97.4	0.90	1510	4)	2270	1.5	51.5	✓	4)	✓	1FW4455-1HF ■ 0-1AA0	4680
Rated voltage													4 7 8 9	-Z
• 460 V √														
• 690 V √														
• 400 V √														
Special voltage														
Other rated speed with additional plain text														

Notes for current-calculation:

The stator current from permanent-excited motors can not be calculated as usual with the rated output, converter output voltage, power factor and efficiency. The reason is that the induced voltage at the rated point does not comply with the converter output voltage automatically. The real terminal voltage is depending on the speed, the torque and the integer number of turns.

The stator current of the 1FW4-motor series is proportional to the speed. With it the required stator current for a torque differing from the rated torque can be calculated. The stator current should be calculated exactly with the project tool „SINAMICS MICROMASTER SIZER“.

1) Temperature class 155 (temperature class F), used according to temperature class 155 (temperature class F)
 2) Maximum torque T_{max} = Overload torque for 120 s (higher overload torques on request)

3) In the version with two galvanically isolated winding systems, two main terminal boxes 1XB1 631 are required.
 - Not applicable
 ✓ Applicable
 4) Cannot be implemented

Special versions

Special versions	Order code	Comments
Motor protection		
Motor temperature monitoring using built-in temperature sensor 1 x KTY 84-130	A23	
Motor temperature monitoring using built-in temperature sensor 2 x KTY 84-130	A25	
2 PT100 resistance thermometers or 3-wire for 4-wire circuit from terminals, without evaluation unit for rolling-contact bearings	A40	
2 PT100 dual resistance thermometers for 3-wire or 4-wire circuit from terminals, without evaluation unit for rolling-contact bearings	A42	
6 PT100 resistance thermometers for winding temperature monitoring for 3-wire or 4-wire circuit from terminals	A65	
Rolling-contact bearing monitor based on SPM shock pulse method, complete alarm box	H07	
Motor connection and connection boxes		
Two-part plate on connection box	K06	
Cable entry DIN 89280, maximum configuration	K57	
Rotation of the terminal box through 90°, entry from DE (This option is only possible when the motor can only be implemented with one terminal box).	K83	
Rotation of the terminal box through 90°, entry from NDE. (This option is only possible when the motor can only be implemented with one terminal box).	K84	
Rotation of connection box through 180°	K85	
Undrilled cable entry plate	L01	
Auxiliary terminal box with cast-iron housing	M50	
Auxiliary terminal box with stainless-steel housing	M51	
Separate auxiliary terminal box with cable entry for heater	M52	
Auxiliary terminal box with aluminium housing	M88	
Shaft and rotor		
Standard cylindrical shaft end, but without keyway	K42	
Non-standard cylindrical shaft end (only when technically possible); additional plain text stating the dimensions of the non-standard shaft end is required (in mm)	Y55	
Coupling		
Thrust ring for coupling guard	L15	
Mounting of supplied coupling	L17	
Heating		
Anti-condensation heating for 230 V supply voltage	K45	
Anti-condensation heating for 115 V supply voltage	K46	
Anti-condensation heating for 400 V supply voltage	L08	
Anti-condensation heating for 500 V supply voltage	L09	
Anti-condensation heating for other supply voltages (with plain text for voltage)	Y83	
Colors and paint finish		
Unpainted (primed)	K23	
Special paint finish in standard color	K26	
Normal paint finish not in standard color	Y53	
Special paint finish not in standard color	Y54	
Special mounting technology		
Mounting of absolute encoder EQN 425 EnDat 2.1 2048	H81	
Mounting of absolute encoder HMG111 HTL + SSI	H82	
Mounting of incremental encoder HOG10 DN 2048	H83	
Mounting of incremental encoder HOG11 DN 2048	H84	
Mounting of incremental encoder LL861 (2048 pulses)	H85	
Mounting of a rotary pulse encoder in special design (with plain text for encoder designation)	Y70	
Balance and vibration severity		
Vibration severity grade B	K02	
Full-key balancing	L68	

Selection and ordering

HT-direct motors 1FW4 water-cooled

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Special versions	Order code	Comments
Mechanical design and degrees of protection		
Bearing design for increased cantilever forces	K20	
IP56 degree of protection (non-heavy-sea)	K52	
Bolts for fixing machine to steel foundation	L31	
T-head bolts, anchor sleeves and soleplates for mounting on a concrete foundation	L33	
External screws made of stainless steel	P45	
Anormal stator winding		
Anormal stator winding for speeds below 170 rpm	L1Y	
Cooling water inlet temperature and ambient temperature		
Cooling water inlet temperature up to 30 °C (ambient temperature up to 45 °C), torque reduction 3%	D15	
Cooling water inlet temperature up to 35 °C (ambient temperature up to 50 °C), torque reduction 5%	D16	
Cooling water inlet temperature up to 40 °C (ambient temperature up to 55 °C), torque reduction 8%	D17	
Cooling water inlet temperature up to 45 °C (ambient temperature up to 60 °C), torque reduction 11%	D18	
Marine version - Acceptance/certification		
Individual acceptance by classification authority with witness-testing and acceptance inspection certificate 3.1.C	E09	
Individual acceptance by classification authority	E10	
Marine design to GL, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E11	
Marine design to LR, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E21	
Marine design to BV, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E31	
Marine design to DNV, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E51	
Marine design to ABS, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E61	
Marine design to CCS, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E71	
Marine design, higher ambient temperature and/or temperature class 155 used according to 130 (F according to B), with plain text for ambient temperature, utilization and classification society	E80	
Rating plate and additional plates		
Second rating plate, separately packed	K31	
Rating plate with different data	Y80	
Additional plate with ordering data (customer information in plain text)	Y82	
Packaging, safety notes, documentation and test certificates		
Acceptance test certificate 3.1 according to EN 10204	B02	
Documentation on CD	B21	
Document - EU manufacturer's declaration	B30	
Document - Electrical data sheet	B31	
Document - Order dimension drawing	B32	
Document - Routine test certificate	B33	
Documentation in German	D00	(Documentation in English standard)
Documentation in Russian	D56	
Documentation in Italian	D72	
Documentation in French	D77	
Documentation in Spanish	D78	
Documentation in Portuguese	D79	
Documentation in Swedish	D83	
Standard test (routine test), witnessed	F01	
Visual acceptance and report handover, witnessed	F03	
Heating test at rated operating point at converter, unwitnessed	F04	
Heating test at rated operating point at converter, witnessed	F05	

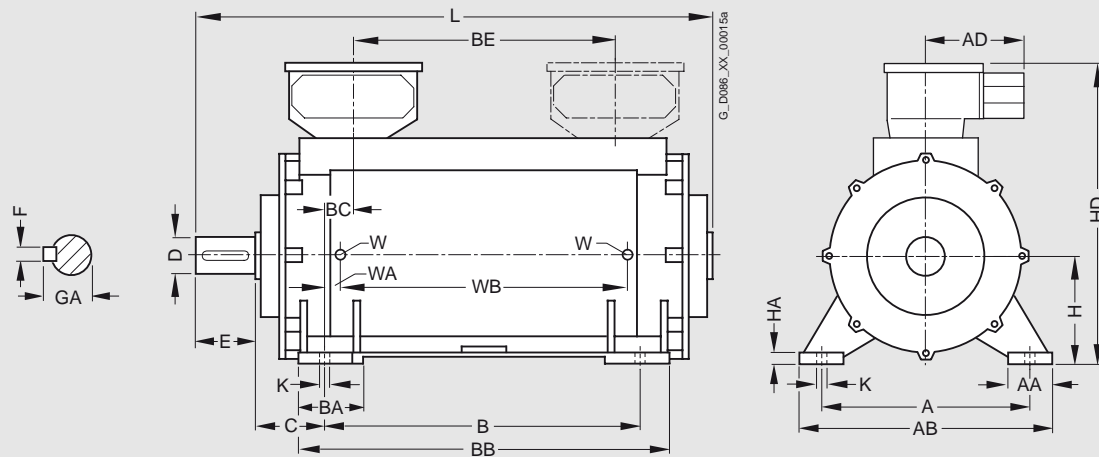
Selection and ordering HT-direct motors 1FW4 water-cooled

Special versions	Order code	Comments
Packaging, safety notes, documentation and test certificates (continued)		
Recording of continuous short-circuit characteristic and calculation of losses, unwitnessed	F16	
Recording of continuous short-circuit characteristic and calculation of losses, witnessed	F17	
Recording of load characteristic (T-n-characteristic curve) on converter, unwitnessed	F18	
Recording of load characteristic (T-n-characteristic curve) on converter, witnessed	F19	
Noise measurement in no-load operation, no noise analysis, unwitnessed	F28	
Noise measurement in no-load operation, no noise analysis, witnessed	F29	
Noise measurement in no-load operation, with noise analysis, unwitnessed	F62	
Noise measurement in no-load operation, with noise analysis, witnessed	F63	
Type test with heat run for horizontal motors, unwitnessed	F82	
Type test with heat run for horizontal motors, witnessed	F83	
Customized acceptance on customer converter, additional information required	F99	

Selection and ordering

HT-direct motors 1FW4 water-cooled

Dimension drawings



Type	Dimensions															
	A	AA	AB	AD ¹⁾	B	BA	BB	BC	BE	C	H	HA	HD	K	L	
1FW4401	750	150	900	400	1120	260	1365	155	880	254	400	30	1180	35	1880	
1FW4403																
1FW4405																
1FW4407																
1FW4451	850	180	1030	400	1250	265	1515	165	975	280	450	30	1280	42	2090	
1FW4453																
1FW4455																
1FW4503	950	180	1130	400	1400	300	1624	250	935	280	500	40	1385	42	2265	
1FW4505																
1FW4507	950	180	1130	400	1500	300	1782	135	628	315	500	40	1385	42	2415	
1FW4508																

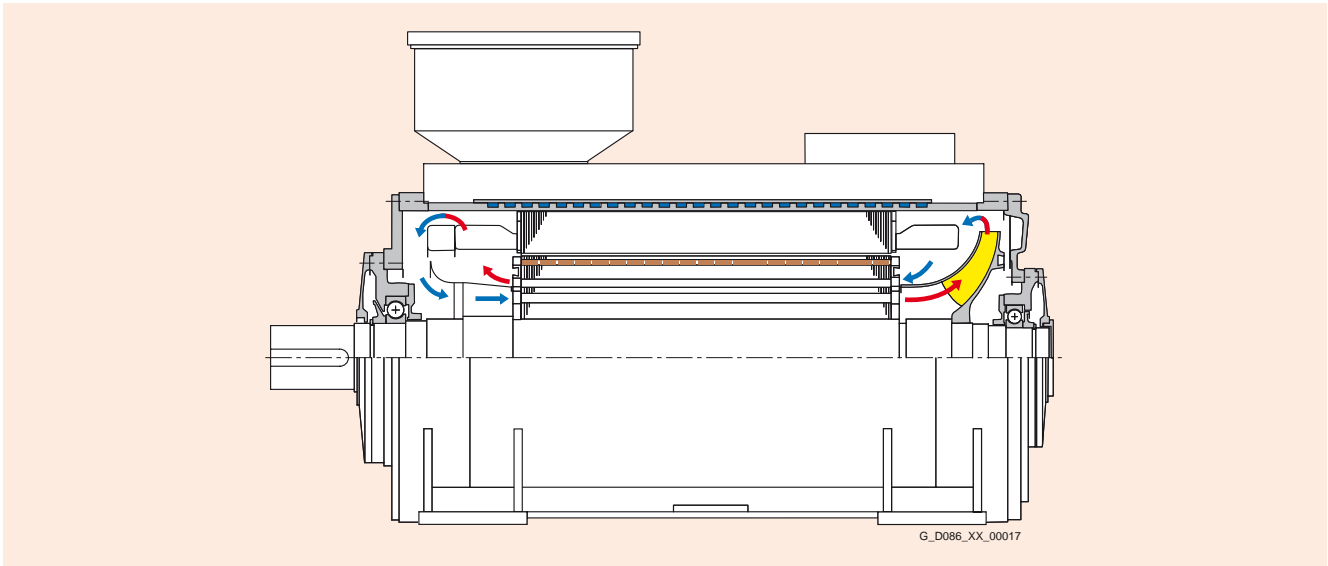
Type	Dimensions for shaft extension according to DIN 748 "short"				Dimensions of cooling water connection ²⁾		
	D	E	F	GA	W	WA	WB
1FW4401	150	200	36	158	G3/4"	50	780
1FW4403							
1FW4405							
1FW4407							
1FW4451	170	240	40	179	G1"	63	1175
1FW4453							
1FW4455							
1FW4503	190	280	45	200	G1 1/2"	85	1260
1FW4505							
1FW4507	190	280	45	200	G1 1/2"	40	1440
1FW4508							

¹⁾ For 1XB1 631 terminal box.

²⁾ The cooling water connection is available on both sides (RHS and LHS of motor).

Further information

Structure



Basic structure of the water-cooled HT-direct motor 1FW4

HT-direct motors have two cooling circuits that can be used to achieve intensive and effective cooling:

- The aluminium fan within the motor provides air circulation between DE and NDE. This cools, in particular, the stator winding overhang, the magnetic rotor and the bearings.
- The heat from the internal air is transferred to the cooling water through the motor housing.

Frame design

A welded steel stator housing. The condensation water drainage holes are present and they are sealed during transport. For certain applications (e.g. in shipbuilding and the chemicals industry), external components made from aluminium are not permitted in the case of some customers. In these cases, aluminium components (e.g. terminal boxes) are replaced with other materials.

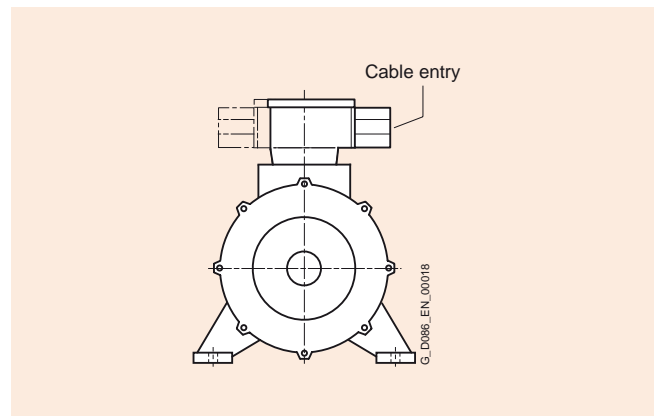
If external components are not permitted to be made from aluminium, this must be specified in plain text in the order.

Position of the terminal box and cable entry

The terminal box is mounted **on the top**, in the **basic version at DE with cable entry from the right** (with view onto DE shaft extension). If a second terminal box is required, this is mounted behind it at NDE.

As an option, cable entry from the LHS is possible (order code **K85**).

When **only one** terminal box is mounted, cable entry is also possible from **DE** (order code **K83**) or **NDE** (order code **K84**).



Position of the terminal box and cable entry

Selection and ordering

HT-direct motors 1FW4 water-cooled

Additional information

Packing weights and packing dimensions

Packing weights, tare

Type 1FW4 ...	Land transport on battens	Sea transport in wooden cases
	Type of construction IM B3	Type of construction IM B3
	kg	kg
... 401/403/405/407	70	280
... 451/453/455	75	340
... 503/505	80	390
... 507/508	85	410

Packing dimension = Largest motor dimension + Supplement

Dimensions	Supplements for	
	Land transport on battens	Sea transport in wooden cases
	Type of construction IM B3	Type of construction IM B3
	mm	mm
Length	+250	+250
Width	+200	+200
Height	+200	+500

Water-jacket cooling

To achieve a high power density, the motor housing is designed with water-jacket cooling.

The cooling water flows through a channel that runs in a spiral in the cooling jacket (from DE to NDE).

The cooling water inlet is at the drive end, on the LHS or RHS of the motor housing as required. The cooling water outlet is at the non-drive end, on the LHS or RHS of the motor housing as required (see dimension drawing). During transportation, the water inlet and outlet holes are sealed.

Cooling water flowrate and water pressure:

Type 1FW4 ...	Cooling water flow rate l/min	Maximum permissi- ble water pressure bar
... 401/403/405/407	30	5
... 451/453/455	50	5
... 503/505	65	5
... 507/508	80	5

The water quality must be taken into account:

- The cooling water should be chemically neutral, it should be clean, particles should have been filtered out and the following values must not be exceeded:
 - ph value 6.0 to 8.0
 - Overall hardness < 170 ppm
 - Chloride < 40 ppm
 - Sulfate < 50 ppm
 - Nitrate < 10 ppm
 - Iron < 0.2 ppm
 - Ammonium < 10 ppm
 - Loose material < 340 ppm
 - Conductance < 500 μ S/cm
- Max. size of any particles carried \leq 0.1 mm
- No saltwater (sea water)
- If there is a danger of frost, then the appropriate anti-freeze measures are required for operation, storage and transport. For example, emptying and blowing-out with air, supplementary heating system for the cooling ducts.

- Additives must be mixed with the cooling water in appropriate quantities to protect against corrosion and the growth of algae. The type and quantity of additive should be taken from the manufacturer's specifications for these additives and the particular ambient conditions.

Materials used in the cooling circuit

Only steel is used in the cooling circuit. The heatsink material is not resistant to seawater. It is not permissible to directly cool the motors using seawater.

Different cooling water inlet temperature and site altitude

Cooling water inlet temperature
(according to EN 60034-1 and IEC 60034-1)

The motors are designed for operation up to a cooling water inlet temperature of 25 °C, but still maintaining all of the specified motor data.

If the HT-direct motors are operated with higher cooling water inlet temperatures, the derating factors in the following table must be taken into account.

Derating factors for cooling water inlet temperatures >25 °C

Cooling water inlet temperature up to (ambient temperature up to)	25 °C (40 °C)	30 °C (45 °C)	35 °C (50 °C)	40 °C (55 °C)	45 °C (60 °C)
Derating factor k_T	1.0	0.97	0.95	0.92	0.89

This results in a maximum torque of the motor of:

$$T_{\max} = T_{\text{rated}} \cdot k_T$$

T_{\max} = Maximum torque in Nm

T_{rated} = Rated torque in Nm

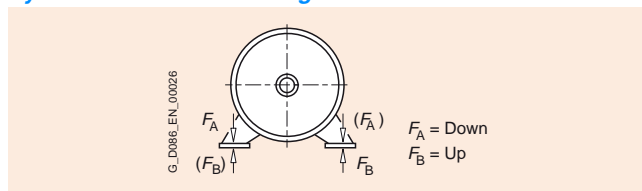
k_T = Factor for different cooling water inlet temperature

If the maximum torque is no longer adequate for the drive, it should be checked whether the motor with the next higher rated torque fulfills the requirements.

Site altitude (according to EN 60034-1 and IEC 60034-1)

For site altitudes >1000 m above sea level, derating factors do not have to be taken into account for water-cooled HT-direct motors. They may, however, affect the dimensioning of the converter.

Dynamic foundation loading



Type	F_A ¹⁾ kN	F_B ¹⁾ kN
1FW4401-1 ...	53	22
1FW4403-1 ...	62	29
1FW4405-1 ...	72	35
1FW4407-1 ...	85	44
1FW4451-1 ...	91	51
1FW4453-1 ...	111	68
1FW4455-1 ...	136	90
1FW4503-1 ...	125	69
1FW4505-1 ...	148	88
1FW4507-1 ...	176	110
1FW4508-1 ...	205	132

¹⁾ Load at one motor long side (that is for two feet).

Selection and ordering HT-direct motors 1FW4 air-cooled

3



3/2	Overview
3/2	Benefits
3/3	Selection and ordering data
3/5	Special versions
3/8	Dimension drawings
3/9	Additional information

Selection and ordering

HT-direct motors 1FW4 air-cooled

Overview



The motors are designed for the following rated voltages:

- 690 V $\sqrt{3}$ /50 Hz
- 400 V $\sqrt{3}$ /50 Hz
- 460 V $\sqrt{3}$ /60 Hz

Ambient temperature: -20 °C to +40 °C

Site altitude: Up to 1000 m above sea level

At higher ambient temperatures and site altitudes above 1000 m, a motor Order No. must be selected in accordance with the derating factors (see Page 3/12). The order codes for the cooling-water inlet temperature (see Page 3/6) and site altitude over 1000 m (see Page 3/6) must also be specified in the order.

Degree of protection: IP55

Cooling method: IC416

Type of construction: IM B3

Overview of torques and outputs
in accordance with the rated speed

Rated speed rpm	Max. rated torque Nm	Max. rated output kW
200	23000	481
300	22250	699
400	21500	900
500	20750	1086
600	20000	1256
800	14100	1181

Benefits

The well-proven cooling principle of the H-compact motors forms the basis for the air-cooled HT-direct motors. The constant cooling air flow independent of the motor speed from the external fan assembly mounted axially at the non-drive end ensures intensive, even motor cooling which is the basis of a long lifetime.

Selection and ordering HT-direct motors 1FW4 air-cooled

Selection and ordering data

Rated torque Nm	Rated output ¹⁾ kW	Frame size	Efficiency at 690 V		Rated current at			Norm. max. torque at 690 V ²⁾ T_{max}/T_{rated}	Moment of inertia J kgm ²	Version with two galvanically isolated winding systems ³⁾			Order No.	Weight, approx. kg	
			4/4-load %	4/4-load cos φ	690 V Y A	400 V Y A	460 V Y A			690 V Y	400 V Y	460 V Y			
200 rpm, IP55 degree of protection, IMB3 type of construction															
7200	150	401	95.4	0.94	140	255	215	1.5	19.4	-	-	-	1FW4401-3HA	0-1AA0	3950
8520	178	403	95.6	0.92	174	280	250	1.5	22.4	-	-	-	1FW4403-3HA	0-1AA0	4150
9840	206	405	95.8	0.93	192	335	300	1.5	26.1	-	-	-	1FW4405-3HA	0-1AA0	4400
11520	241	407	96.0	0.94	220	380	355	1.5	30.9	-	-	-	1FW4407-3HA	0-1AA0	4720
12510	262	451	94.7	0.85	285	495	440	1.5	37.9	-	-	-	1FW4451-3HA	0-1AA0	4970
14395	301	453	95.1	0.86	315	540	475	1.5	44.9	-	-	-	1FW4453-3HA	0-1AA0	5180
16640	348	455	95.4	0.86	375	630	540	1.5	51.5	-	-	-	1FW4455-3HA	0-1AA0	5450
19780	414	503	96.1	0.87	420	700	600	1.5	89.3	-	-	-	1FW4503-3HA	0-1AA0	6610
23000	481	505	96.3	0.89	470	840	700	1.5	102.6	-	-	-	1FW4505-3HA	0-1AA0	7070
300 rpm, IP55 degree of protection, IMB3 type of construction															
7000	219	401	96.5	0.96	198	345	320	1.5	19.4	-	-	-	1FW4401-3HB	0-1AA0	3950
8280	260	403	96.5	0.97	230	415	360	1.5	22.4	-	-	-	1FW4403-3HB	0-1AA0	4150
9565	300	405	96.7	0.97	265	475	435	1.5	26.1	-	-	-	1FW4405-3HB	0-1AA0	4400
11200	351	407	96.8	0.94	320	570	475	1.5	30.9	-	-	-	1FW4407-3HB	0-1AA0	4720
12190	382	451	96.1	0.86	385	700	560	1.5	37.9	-	-	-	1FW4451-3HB	0-1AA0	4970
14030	440	453	96.4	0.86	465	830	680	1.5	44.9	-	-	-	1FW4453-3HB	0-1AA0	5180
16215	509	455	96.5	0.87	520	920	820	1.5	51.5	-	-	-	1FW4455-3HB	0-1AA0	5450
19135	601	503	97.0	0.88	580	1020	910	1.5	89.3	-	-	-	1FW4503-3HB	0-1AA0	6610
22250	699	505	97.1	0.88	680	1170	1020	1.5	102.6	-	-	-	1FW4505-3HB	0-1AA0	7070
400 rpm, IP55 degree of protection, IMB3 type of construction															
6800	284	401	96.9	0.98	250	445	410	1.5	19.4	-	-	-	1FW4401-3HC	0-1AA0	3950
8050	337	403	97.1	0.97	295	530	480	1.5	22.4	-	-	-	1FW4403-3HC	0-1AA0	4150
9290	389	405	97.1	0.94	365	640	510	1.5	26.1	-	-	-	1FW4405-3HC	0-1AA0	4400
10880	455	407	97.2	0.94	420	720	630	1.5	30.9	-	-	-	1FW4407-3HC	0-1AA0	4720
11870	497	451	96.7	0.86	540	840	750	1.5	37.9	-	-	-	1FW4451-3HC	0-1AA0	4970
13665	572	453	96.9	0.87	600	1040	910	1.5	44.9	-	-	-	1FW4453-3HC	0-1AA0	5180
15790	661	455	97.1	0.87	650	1200	1030	1.5	51.5	-	-	-	1FW4455-3HC	0-1AA0	5450
18490	774	503	97.4	0.91	720	1320	1130	1.5	89.3	-	✓	-	1FW4503-3HC	0-1AA0	6610
21500	900	505	97.5	0.88	880	1580	1320	1.5	102.6	-	✓	✓	1FW4505-3HC	0-1AA0	7070
Rated voltage															
• 460 V Y													4		
• 690 V Y													7		
• 400 V Y													8		
Special voltage													9		
Other rated speed with additional plain text														-Z	

¹⁾ Temperature class 155 (temperature class F), used according to temperature class 155 (temperature class F)

²⁾ Maximum torque T_{max} = Overload torque for 120 s (higher overload torques on request)

³⁾ In the version with two galvanically isolated winding systems, two main terminal boxes 1XB1 631 are required.

- Not applicable
✓ Applicable

Selection and ordering

HT-direct motors 1FW4 air-cooled

Rated torque Nm	Rated output ¹⁾ kW	Frame size	Efficiency at 690 V		Rated current at			Norm. max. torque at 690 V ²⁾ T_{max}/T_{rated}	Moment of inertia J kgm ²	Version with two galvanically isolated winding systems ³⁾			Order No.	Weight, approx. kg
			4/4-load %	4/4-load cos φ	690 V √	400 V √	460 V √			690 V √	400 V √	460 V √		
500 rpm, IP55 degree of protection, IMB3 type of construction														
6600	345	401	97.2	0.99	300	520	470	1.5	19.4	-	-	-	1FW4401-3HD ■ 0-1AA0	3950
7810	408	403	97.3	0.95	365	640	570	1.5	22.4	-	-	-	1FW4403-3HD ■ 0-1AA0	4150
9020	472	405	97.3	0.97	415	720	620	1.5	26.1	-	-	-	1FW4405-3HD ■ 0-1AA0	4400
10560	552	407	97.4	0.96	490	830	720	1.5	30.9	-	-	-	1FW4407-3HD ■ 0-1AA0	4720
11555	605	451	97.1	0.86	610	1050	920	1.5	37.9	-	-	-	1FW4451-3HD ■ 0-1AA0	4970
13300	696	453	97.3	0.87	710	1180	1010	1.5	44.9	-	-	-	1FW4453-3HD ■ 0-1AA0	5180
15370	804	455	97.4	0.88	780	1400	1170	1.5	51.5	-	✓	-	1FW4455-3HD ■ 0-1AA0	5450
17845	934	503	97.6	0.93	860	1530	1290	1.5	89.3	-	✓	✓	1FW4503-3HD ■ 0-1AA0	6610
20750	1086	505	97.6	0.89	1090	1650	1530	1.5	102.6	-	✓	✓	1FW4505-3HD ■ 0-1AA0	7070
600 rpm, IP55 degree of protection, IMB3 type of construction														
6400	402	401	97.3	0.96	360	630	560	1.5	19.4	-	-	-	1FW4401-3HE ■ 0-1AA0	3950
7570	475	403	97.3	0.97	420	720	630	1.5	22.4	-	-	-	1FW4403-3HE ■ 0-1AA0	4150
8750	549	405	97.4	0.97	485	820	710	1.5	26.1	-	-	-	1FW4405-3HE ■ 0-1AA0	4400
10240	643	407	97.5	0.99	550	970	830	1.5	30.9	-	-	-	1FW4407-3HE ■ 0-1AA0	4720
11235	705	451	97.3	0.87	720	1200	1030	1.5	37.9	-	-	-	1FW4451-3HE ■ 0-1AA0	4970
12930	812	453	97.5	0.90	770	1380	1150	1.5	44.9	-	✓	-	1FW4453-3HE ■ 0-1AA0	5180
14950	939	455	97.5	0.93	860	1450	1360	1.5	51.5	-	✓	✓	1FW4455-3HE ■ 0-1AA0	5450
17200	1080	503	97.6	0.88	1050	1850	1490	1.5	89.3	-	✓	✓	1FW4503-3HE ■ 0-1AA0	6610
20000	1256	505	97.7	0.88	1230	1930	1640	1.5	102.6	✓	✓	✓	1FW4505-3HE ■ 0-1AA0	7070
800 rpm, IP55 degree of protection, IMB3 type of construction														
6000	502	401	97.3	0.98	440	790	670	1.5	19.4	-	-	-	1FW4401-3HF ■ 0-1AA0	3950
7100	594	403	97.3	0.97	520	940	790	1.5	22.4	-	-	-	1FW4403-3HF ■ 0-1AA0	4150
8200	686	405	97.4	0.99	590	1010	910	1.5	26.1	-	-	-	1FW4405-3HF ■ 0-1AA0	4400
9600	804	407	97.4	1.00	690	1190	1030	1.5	30.9	-	-	-	1FW4407-3HF ■ 0-1AA0	4720
10600	888	451	97.4	0.90	850	1390	1190	1.5	37.9	-	✓	-	1FW4451-3HF ■ 0-1AA0	4970
12200	1022	453	97.4	0.93	940	1640	1360	1.5	44.9	-	✓	✓	1FW4453-3HF ■ 0-1AA0	5180
14100	1181	455	97.6	0.93	1080	1780	1630	1.5	51.5	-	✓	✓	1FW4455-3HF ■ 0-1AA0	5450
Rated voltage														
• 460 V √												4		
• 690 V √												7		
• 400 V √												8		
Special voltage												9		
Other rated speed with additional plain text													-Z	

Notes for current-calculation:

The stator current from permanent-excited motors can not be calculated as usual with the rated output, converter output voltage, power factor and efficiency. The reason is that the induced voltage at the rated point does not comply with the converter output voltage automatically. The real terminal voltage is depending on the speed, the torque and the integer number of turns.

The stator current of the 1FW4-motor series is proportional to the speed. With it the required stator current for a torque differing from the rated torque can be calculated. The stator current should be calculated exactly with the project tool „SINAMICS MICROMASTER SIZER“.

¹⁾ Temperature class 155 (temperature class F), used according to temperature class 155 (temperature class F)
²⁾ Maximum torque T_{max} = Overload torque for 120 s (higher overload torques on request)

³⁾ In the version with two galvanically isolated winding systems, two main terminal boxes 1XB1 631 are required.
 - Not applicable
 ✓ Applicable

Special versions

Special versions	Order code	Comments
Motor protection		
Motor temperature monitoring using built-in temperature sensor 1 x KTY 84-130	A23	
Motor temperature monitoring using built-in temperature sensor 2 x KTY 84-130	A25	
2 PT100 resistance thermometers or 3-wire for 4-wire circuit from terminals, without evaluation unit for rolling-contact bearings	A40	
2 PT100 dual resistance thermometers for 3-wire or 4-wire circuit from terminals, without evaluation unit for rolling-contact bearings	A42	
6 PT100 resistance thermometers for winding temperature monitoring for 3-wire or 4-wire circuit from terminals	A65	
Rolling-contact bearing monitor based on SPM shock pulse method, complete alarm box	H07	
Motor connection and connection boxes		
Two-part plate on connection box	K06	
Terminal box on LHS (view onto DE)	K10	
Cable entry DIN 89280, maximum configuration	K57	
Rotation of the terminal box through 90°, entry from DE (This option is only possible when the motor can only be implemented with one terminal box).	K83	
Rotation of the terminal box through 90°, entry from NDE. (This option is only possible when the motor can only be implemented with one terminal box).	K84	
Rotation of connection box through 180°	K85	
Undrilled cable entry plate.	L01	
Auxiliary terminal box with cast-iron housing	M50	
Auxiliary terminal box with stainless-steel housing	M51	
Separate auxiliary terminal box with cable entry for heater	M52	
Auxiliary terminal box with aluminium housing	M88	
Shaft and rotor		
Standard cylindrical shaft end, but without keyway	K42	
Non-standard cylindrical shaft end (only when technically possible); additional plain text stating the dimensions of the non-standard shaft end is required (in mm)	Y55	
Coupling		
Thrust ring for coupling guard	L15	
Mounting of supplied coupling	L17	
Heating		
Anti-condensation heating for 230 V supply voltage	K45	
Anti-condensation heating for 115 V supply voltage	K46	
Anti-condensation heating for 400 V supply voltage	L08	
Anti-condensation heating for 500 V supply voltage	L09	
Anti-condensation heating for other supply voltages (with plain text for voltage)	Y83	
Colors and paint finish		
Unpainted (primed)	K23	
Special paint finish in standard color	K26	
Normal paint finish not in standard color	Y53	
Special paint finish not in standard color	Y54	
Special mounting technology		
Mounting of absolute encoder EQN 425 EnDat 2.1 2048	H81	
Mounting of absolute encoder HMG111 HTL + SSI	H82	
Mounting of incremental encoder HOG10 DN 2048	H83	
Mounting of incremental encoder HOG11 DN 2048	H84	
Mounting of incremental encoder LL861 (2048 pulses)	H85	
Mounting of a rotary pulse encoder in special design (with plain text for encoder designation)	Y70	
Balance and vibration severity		
Vibration severity grade B	K02	
Full-key balancing	L68	

Selection and ordering

HT-direct motors 1FW4 air-cooled

Special versions	Order code	Comments
Mechanical design and degrees of protection		
Bearing design for increased cantilever forces	K20	
IP56 degree of protection (non-heavy-sea)	K52	
Bolts for fixing machine to steel foundation	L31	
T-head bolts, anchor sleeves and soleplates for mounting on a concrete foundation	L33	
External screws made of stainless steel	P45	
Anormal stator winding		
Anormal stator winding for speeds below 170 rpm	L1Y	
Ambient temperature and site altitude		
Coolant temperature -50 to +40 °C	D02	
Coolant temperature -40 to +40 °C	D03	
Coolant temperature -30 to +40 °C	D04	
Site altitude up to 1500 m	D06	
Site altitude up to 2000 m	D07	
Site altitude up to 2500 m	D08	
Site altitude up to 3000 m	D09	
Coolant temperature up to 45 °C, torque reduction of 4%	D11	
Coolant temperature up to 50 °C, torque reduction of 8%	D12	
Coolant temperature up to 55 °C, torque reduction of 13%	D13	
Coolant temperature up to 60 °C, torque reduction of 18%	D14	
Marine version - Acceptance/certification		
Individual acceptance by classification authority with witness-testing and acceptance inspection certificate 3.1.C	E09	
Individual acceptance by classification authority	E10	
Marine design to GL, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E11	
Marine design to LR, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E21	
Marine design to BV, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E31	
Marine design to DNV, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E51	
Marine design to ABS, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E61	
Marine design to CCS, CT 45 °C, temperature class 155 used according to 155 (F according to F)	E71	
Marine design, higher ambient temperature and/or temperature class 155 used according to 130 (F according to B), with plain text for ambient temperature, utilization and classification society	E80	
Rating plate and additional plates		
Second rating plate, separately packed	K31	
Rating plate with different data	Y80	
Additional plate with ordering data (customer information in plain text)	Y82	
Packaging, safety notes, documentation and test certificates		
Acceptance test certificate 3.1 according to EN 10204	B02	
Documentation on CD	B21	
Document - EU manufacturer's declaration	B30	
Document - Electrical data sheet	B31	
Document - Order dimension drawing	B32	
Document - Routine test certificate	B33	
Documentation in German	D00	(Documentation in English standard)
Documentation in Russian	D56	
Documentation in Italian	D72	
Documentation in French	D77	
Documentation in Spanish	D78	
Documentation in Portuguese	D79	
Documentation in Swedish	D83	

Selection and ordering

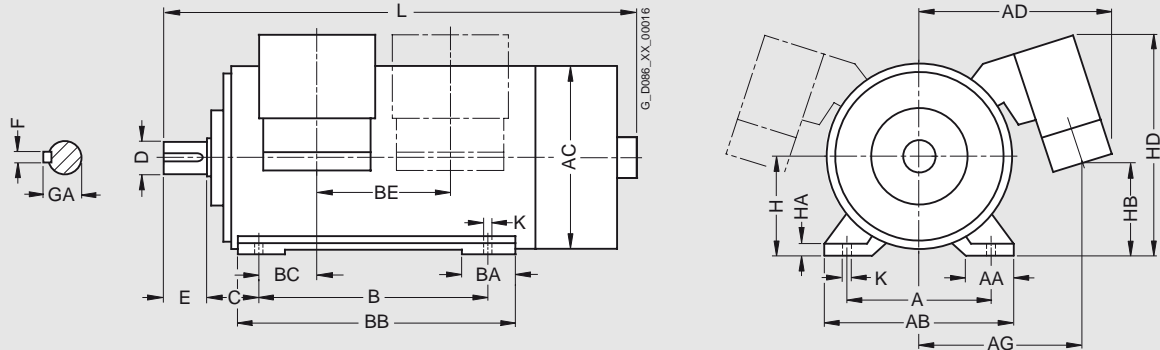
HT-direct motors 1FW4 air-cooled

Special versions	Order code	Comments
Packaging, safety notes, documentation and test certificates (continued)		
Standard test (routine test), witnessed	F01	
Visual acceptance and report handover, witnessed	F03	
Temperature-rise test, unwitnessed	F04	
Temperature-rise test, witnessed	F05	
Recording of continuous short-circuit characteristic and calculation of losses, unwitnessed	F16	
Recording of continuous short-circuit characteristic and calculation of losses, witnessed	F17	
Recording of load characteristic (T-n-characteristic curve) on converter, unwitnessed	F18	
Recording of load characteristic (T-n-characteristic curve) on converter, witnessed	F19	
Noise measurement in no-load operation, no noise analysis, unwitnessed	F28	
Noise measurement in no-load operation, no noise analysis, witnessed	F29	
Noise measurement in no-load operation, with noise analysis, unwitnessed	F62	
Noise measurement in no-load operation, with noise analysis, witnessed	F63	
Type test with heat run for horizontal motors, unwitnessed	F82	
Type test with heat run for horizontal motors, witnessed	F83	
Customized acceptance on customer converter, additional information required	F99	

Selection and ordering

HT-direct motors 1FW4 air-cooled

Dimension drawings



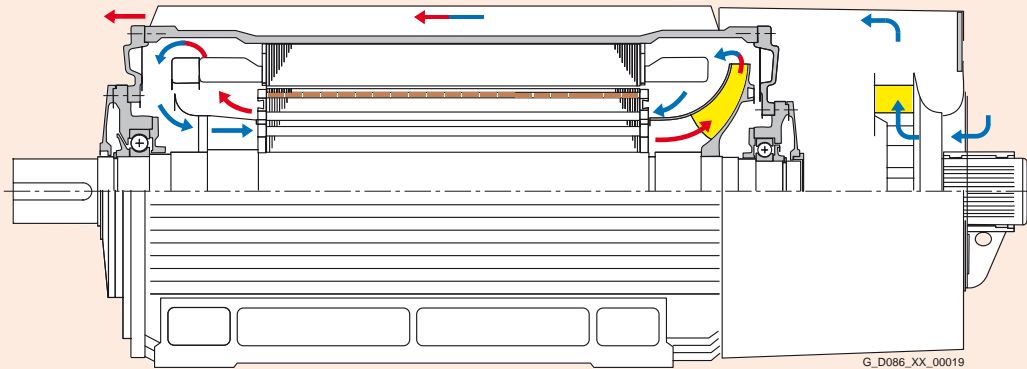
Type	Dimensions																		
	A	AA	AB	AC	AD ¹⁾	AG ¹⁾	B	BA	BB	BC	BE	C	H	HA	HB ¹⁾	HD	K	L	
1FW4401	750	150	900	855	865	775	1120	220	1320	201	745	254	400	35	440	1020	35	2470	
1FW4403																			
1FW4405																			
1FW4407																			
1FW4451	850	180	1030	955	910	820	1250	260	1490	220	865	280	450	42	530	1110	42	2880	
1FW4453																			
1FW4455																			
1FW4503	950	180	1130	1075	960	870	1320	260	1560	220	880	315	500	42	630	1210	42	3120	
1FW4505																			

Type	Dimensions for shaft extension according to DIN 748 "short"			
	D	E	F	GA
1FW4401	150	200	36	158
1FW4403				
1FW4405				
1FW4407				
1FW4451	170	240	40	179
1FW4453				
1FW4455				
1FW4503	190	280	45	200
1FW4505				

¹⁾ For 1XB1 631 terminal box.

Additional information

Structure



Basic structure of the air-cooled HT-direct motor 1FW4

HT-direct motors have two cooling circuits that can be used to achieve intensive and effective cooling:

- The aluminium fan within the motor provides air circulation between DE and NDE. This cools, in particular, the stator winding overhang, the magnetic rotor and the bearings.
- The heat from the internal air is dissipated across the surface of the motor housing. The external fan provides an even cooling air-flow over the complete speed range of the HT-direct motor.

Frame design

The housings are the same as the well-proven cast-iron housings of the 1LA4 series (H-compact motors). The condensation water drainage holes are present and they are sealed during transport. For certain applications (e.g. in shipbuilding and the chemicals industry), external components made from aluminium are not permitted.

In these cases, aluminium components (e.g. terminal boxes) are replaced with other materials.

Forced ventilation

Forced ventilation is necessary to achieve even, intensive cooling so that even at low speeds a high torque density can be achieved.

Data of the external fan unit

External fan unit for motor type 1FW4 . . .	Fre- quency	Voltage	Cur- rent	Input kW	Air flow rate m ³ /s
	Hz	V	A		
. . . 401/403/405/407	50	230 Δ	11.1	1.6	1.7
		400 Y	6.4		
. . . 451/453/455	60	460 Y	6.2	2.8	2.02
		690 Y	4.7		
. . . 503/505	50	400 Δ	11.4	3.6	2.75
		690 Y	6.6		
. . . 503/505	60	460 Δ	10.9	6.3	3.3
		690 Y	6.6		

Selection and ordering

HT-direct motors 1FW4 air-cooled

Additional information

Mounting position of the terminal box and position of the cable entry

If a terminal box or cable entry position other than specified for the standard version is required, this must be specified using order codes or plain text.

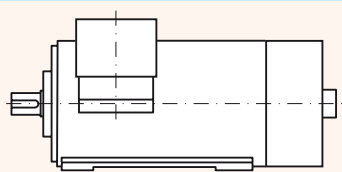
Mounting location

In the standard version, the terminal box is mounted on the **RHS of the motor (as viewed onto the DE shaft end)**. If a second terminal box is required, this is mounted alongside it on the same side (at NDE)

The terminal box can be mounted on the LHS of the motor as a special version.

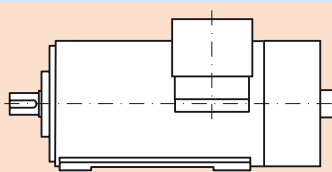
Basic version

Special versions



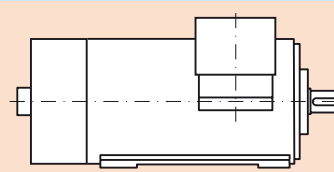
G_D086_XX_00020

Mounting position RHS, DE
Order code: –



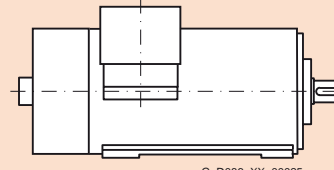
G_D086_XX_00022

Mounting position RHS, NDE
Order code: **Plain text**



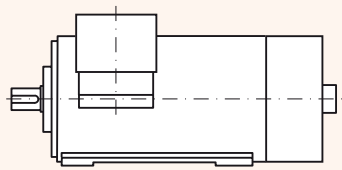
G_D086_XX_00023

Mounting position LHS, DE
Order code: **K10**



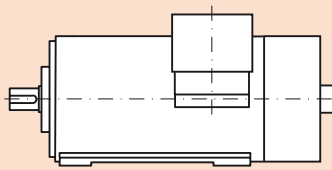
G_D086_XX_00025

Mounting position LHS, NDE
Order code: **K10 and plain text**



G_D086_XX_00020

Mounting position RHS and LHS, DE,
when two terminal boxes are required.
Order code: –



G_D086_XX_00022

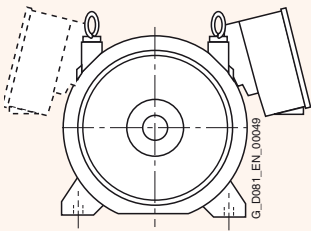
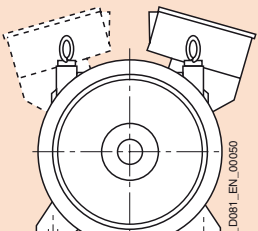
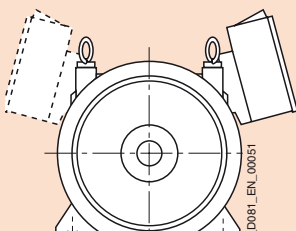
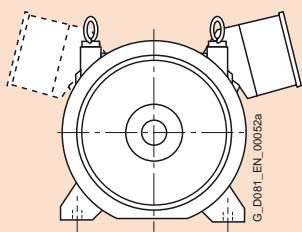
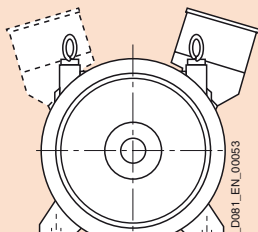
Mounting position RHS and LHS, NDE,
when two terminal boxes are required.
Order code: **Plain text**

Selection and ordering HT-direct motors 1FW4 air-cooled

Cable entry

In the basic version, cable entry is from below.

Further cable entry directions are possible as special versions. In this case, the terminal box and if necessary also the console will have to be rotated.

Basic version	Special versions	
 <p data-bbox="193 629 387 689">Cable entry: bottom Console: 0 degrees Order code: -</p>	 <p data-bbox="507 646 719 706">Cable entry: top Console: 180 degrees Order code: K85</p> <p data-bbox="507 725 730 768">Not possible with two opposed terminal boxes</p>	 <p data-bbox="863 655 1054 715">Cable entry: top Console: 0 degrees Order code: plain text</p> <p data-bbox="1145 625 1430 710">With cable entry from above, protection against rain and other adverse weather conditions must be provided.</p>
	 <p data-bbox="531 1034 724 1093">Cable entry: DE / NDE Console: 0 degrees Order code: K83/K84</p>	 <p data-bbox="845 1051 1054 1110">Cable entry: DE / NDE Console: 180 degrees Order code: plain text</p>

Selection and ordering HT-direct motors 1FW4 air-cooled

Additional information

Packing weights and packing dimensions

Packing weights, tare

Type 1FW4 ...	Land transport on battens	Sea transport in wooden cases
	Type of construction IM B3	Type of construction IM B3
	kg	kg
... 401/403/405/407	90	395
... 451/453/455	95	470
... 501/503/505	100	550

Packing dimension = Largest motor dimension + Supplement

Dimensions	Supplements for	
	Land transport on battens	Sea transport in wooden cases
	Type of construction IM B3	Type of construction IM B3
	mm	mm
Length	+250	+250
Width	+200	+200
Height	+200	+500

Cooling

The motors are designed in accordance with EN 60034-1 for operation up to 40 °C ambient temperature, maintaining all of the motor data.

When the HT-direct motors are operated at higher ambient temperatures, derating factors must be taken into account.

The motors are forced-ventilated as standard. Installation or building in of the motor must not affect the air inlet.

Different ambient temperature and site altitude

Forced-ventilated HT-direct motors are designed for ambient temperatures from -20 °C to +40 °C.

The motors are suitable for site altitudes up to 1000 m above sea level.

For higher ambient temperatures and/or site altitudes higher than 1000 m above sea level, the specified motor rated torque must be reduced using the factor k_{HT} .

Depending on the frame size of the motor, special windings may be added to the motors for the different operating conditions.

This results in a maximum torque of the motor of:

$$T_{max} = T_{rated} \cdot k_{HT}$$

T_{max} = Maximum torque in Nm

T_{rated} = Rated torque in Nm

k_{HT} = Factor for different ambient temperature and site altitude

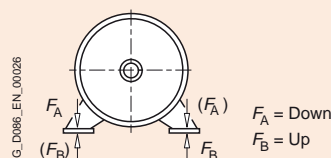
If the maximum torque is no longer adequate for the drive, it should be checked whether the motor with the next higher rated torque fulfills the requirements.

Factor k_{HT} for different ambient temperature and site altitude

Ambient temperature °C	Factor k_{HT} for site altitude above sea level				
	1000 m	1500 m	2000 m	2500 m	3000 m
30	1.07	1.04	1.02	0.98	0.95
35	1.03	1.02	0.98	0.94	0.92
40	1	0.97	0.93	0.90	0.87
45	0.95	0.93	0.88	0.86	0.83
50	0.91	0.88	0.83	0.81	O. R.
55	0.85	0.83	O. R.	O. R.	O. R.
60	0.8	O. R.	O. R.	O. R.	O. R.

Ambient temperature and site altitude are rounded off to 5 °C or 500 m.

Dynamic foundation loading



Type	F_A ¹⁾ kN	F_B ¹⁾ kN
1FW4401-3 ...	44	10
1FW4403-3 ...	50	15
1FW4405-3 ...	57	18
1FW4407-3 ...	67	25
1FW4451-3 ...	71	24
1FW4453-3 ...	77	27
1FW4455-3 ...	88	34
1FW4501-3 ...	93	33
1FW4503-3 ...	113	48
1FW4505-3 ...	136	66

¹⁾ Load at one motor long side (that is for two feet).

Configuring



4/2 Configuration

Configuration




HT-direct motors can only be operated in combination with SINAMICS converters. The drive system can be completely configured using the "SINAMICS MICROMASTER SIZER" configuration tool.

These motors cannot be used as line-fed machines (no self-starting capability).

Guideline for drive selection

These "guideline for drive selection" guide you step-by-step to the required HT-direct motor and SINAMICS converter:

Step 1	Technical requirements for the motor (example)		Further notes and alternatives
Determine the required product profile Required is, for example:	Torque in continuous operation ($T_{cont.}$)	16000 Nm	$T = P_{mech} [kW] \times 9550 / n [rpm] = 1282 \times 9550 / 765$ $T = 16000 \text{ Nm}$
	Short-term overload torque ($T_{overload}$)	18000 Nm	$T_{overload}/T_{cont.} < 1.5$: Rated torque = $T_{cont.}$ $T_{overload}/T_{cont.} > 1.5$: Rated torque = $T_{overload}/1.5$ Higher overloads on request.
	Duty type	S1	When, instead of S1 duty, duty cycles must be taken into account: Average torque is calculated from the root of the square of the required torques multiplied by the time divided by the total time: e.g. 140%, 10 seconds, then 80%, 30 seconds, results in an average 98.5% of the rated torque: $\sqrt{\left[(1,40^2 \times 10 + 0,80^2 \times 30) / 40 \right]} = 0,985$
	Utilization	Temperature class 155 (previously temperature class F)	In case of use according to temperature class 130 (previously temperature class B), the motor must be designed for a torque 20% higher: e.g. $T_{cont.} = 1.2 \times 16000 = 19200 \text{ Nm}$
	Rated voltage	690 V	Alternatively 400 V or 460 V
	Max. speed in continuous operation	765 rpm	Rated speed acc. to catalog 800 rpm, max. perm. speed 20% higher ($800 \times 1.2 = 960 \text{ rpm}$) For speeds below 170 rpm the option L1Y must be selected (anormal stator winding).
	Cooling medium	Water with max. inlet temperature 25 °C	Higher cooling-water inlet temperatures must be accounted for with derating factors when the rated torque is determined: e.g. for 35 °C: $16000/0.95 = 16840 \text{ Nm}$ For derating factors, see Page 2/10.
	Type of construction	IM B3	
Step 2	Environmental requirements for the motor		Further notes and alternatives
Determine the installation conditions	Ambient temperature	-20 to +40 °C	At ambient temperatures up to +40 °C, derating factors are not required for water-cooled motors. At higher ambient temperatures in combination with cooling-water inlet temperatures above 25 °C, the derating factors on Page 2/10 are applicable. For air-cooled motors, derating factors must be used in accordance to Page 3/12.
	Site altitude	< 1000 m	For water-cooled motors, the site altitude does not have to be taken into account for the derating factor. For site altitudes > 1000 m above sea level, the conditions of the converter must however be taken into account. For air-cooled motors, derating factors must be used in accordance to Page 3/12.
Step 3	Selecting the motor		Further notes and alternatives
Determining the motor Order No.	1FW4453-1HF70-1AA0		See "Selection and ordering data" (Section 2). Due to the current-carrying capability of the motor terminal box (max. 1230 A), the motor is designed with two terminal boxes and two galvanically isolated winding systems.

Step 4	Choosing the options		Further notes and alternatives
Completing the motor Order No. 	Specifying options for special versions and tests.		See "Special versions" (Section 2).
Step 5	Determining the motor currents		Further notes and alternatives
Motor currents 	Motor rated current for torque of 16000 Nm in continuous operation at 690 V	1425 A	See "Selection and ordering data" (Page 2/4). $(16000/16500) \times 1470 = 1425 \text{ A}$
	Required motor current for max. torque of 18000 Nm (temporary overload torque)	1603 A	$(18000/16000) \times 1425 = 1603 \text{ A}$
Step 6	Selection of the converter or the motor module		Further notes and alternatives
SINAMICS S120 	Rated output current I_{rated}	1603 A	
	Due to the current level of 1593 A, distribution over two motor modules is necessary.	802 A per motor module	$1603/2 = 802 \text{ A}$
	Derating factor due to two parallel motor modules	0.95	
	Current required per motor module	844 A	$802/0.95 = 844 \text{ A}$
	Intermediate result for motor module selection	910 A, 900 kW	
	Derating factor for increasing the pulse frequency to 2.5 kHz for 900 kW motor module	0.87	Derating factors must be taken into account in general when pulse frequencies are increased. They are dependent on the converter type and converter rating. Derating factors are provided in the configuration manuals or should be requested.
	Max. output current of both motor modules	1504 A (too low, because 1603 A are necessary!)	$2 \times 910 \text{ A} \times 0.95 \times 0.87 = 1504 \text{ A}$
	Selection of the next largest motor module	1025 A, 1000 kW	
	Derating factor for increasing the pulse frequency to 2.5 kHz for 1000 kW motor module	0.86	
	Max. output current of both motor modules	1675 A (sufficient)	$2 \times 1025 \text{ A} \times 0.95 \times 0.86 = 1675 \text{ A}$
	SINAMICS S120 Vector Control: 2 Single Motor Modules Order No. 6SL3320-1TH41-0AA0		The appropriate infeed must also be selected in accordance with the SINAMICS catalog.
	SINAMICS S120 Cabinet Modules: 2 Motor Modules Order No. 6SL3720-1TH41-0AA0		The appropriate infeed must also be selected in accordance with the SINAMICS catalog.
Step 7	Specification of the protection concept		Further notes and alternatives
A protection concept must be specified when work has to be carried out on the converter and/or cables after switch-off when the rotor is still revolving.	The protection concept depends on the operating conditions and application. To specify any necessary protective measures, please contact your Siemens sales representative.		See page 1/4 "Protection strategy"

Configuring

Notes

4



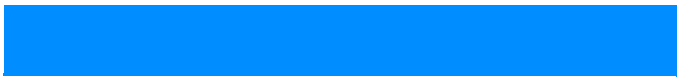
Appendix



- 5/2 Siemens contact partners worldwide
- 5/3 A&D online services
- 5/4 Customer support
- 5/6 Conditions of sale and delivery
- 5/6 Export regulations

Appendix

Siemens Contacts Worldwide



At

<http://www.siemens.com/automation/partner>

you can find details of Siemens contact partners worldwide responsible for particular technologies.

You can obtain in most cases a contact partner for

- Technical Support,
- Spare parts/repairs,
- Service,
- Training,
- Sales or
- Consultation/engineering.

You start by selecting a

- Country,
- Product or
- Sector.

By further specifying the remaining criteria you will find exactly the right contact partner with his/her respective expertise.



5

A&D in the WWW



A detailed knowledge of the range of products and services available is essential when planning and configuring automation systems. It goes without saying that this information must always be fully up-to-date.

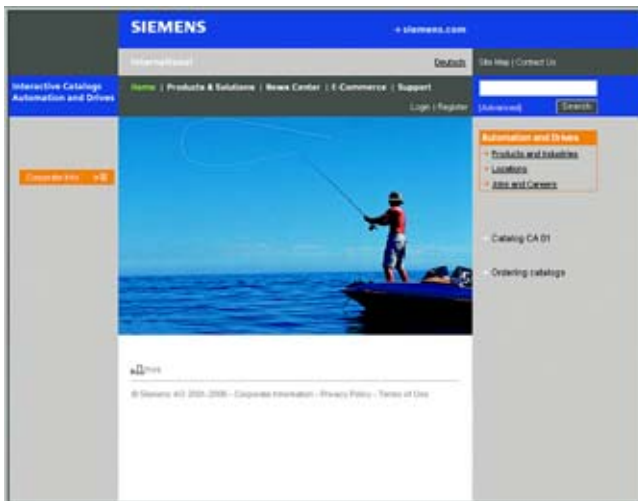
The Siemens Automation and Drives Group (A&D) has therefore built up a comprehensive range of information in the World Wide Web, which offers quick and easy access to all data required.

Under the address

<http://www.siemens.com/automation>

you will find everything you need to know about products, systems and services.

Product Selection Using the Offline Mall of Automation and Drives



Detailed information together with convenient interactive functions:

The Offline Mall CA 01 covers more than 80,000 products and thus provides a full summary of the Siemens Automation and Drives product base.

Here you will find everything that you need to solve tasks in the fields of automation, switchgear, installation and drives. All information is linked into a user interface which is easy to work with and intuitive.

After selecting the product of your choice you can order at the press of a button, by fax or by online link.

Information on the Offline Mall CA 01 can be found in the Internet under

<http://www.siemens.com/automation/ca01>

or on CD-ROM or DVD.

Easy Shopping with the A&D Mall



The A&D Mall is the virtual department store of Siemens AG in the Internet. Here you have access to a huge range of products presented in electronic catalogs in an informative and attractive way.

Data transfer via EDIFACT allows the whole procedure from selection through ordering to tracking of the order to be carried out online via the Internet.

Numerous functions are available to support you.

For example, powerful search functions make it easy to find the required products, which can be immediately checked for availability. Customer-specific discounts and preparation of quotes can be carried out online as well as order tracking and tracing.

Please visit the A&D Mall on the Internet under:

<http://www.siemens.com/automation/mall>

Appendix Customer Support

Our Services for Every Phase of Your Project



In the face of harsh competition you need optimum conditions to keep ahead all the time:

A strong starting position. A sophisticated strategy and team for the necessary support - in every phase.

Service & Support from Siemens provides this support with a complete range of different services for automation and drives.

In every phase: from planning and startup to maintenance and upgrading.

Our specialists know when and where to act to keep the productivity and cost-effectiveness of your system running in top form.

Configuration and Software Engineering



Support in configuring and developing with customer-oriented services from actual configuration to implementation of the automation project. ¹⁾

Service On Site



With Service On Site we offer services for startup and maintenance, essential for ensuring system availability.

In Germany
0180 50 50 444 ¹⁾

Online Support



The comprehensive information system available round the clock via Internet ranging from Product Support and Service & Support services to Support Tools in the Shop.

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

Repairs and Spare Parts



In the operating phase of a machine or automation system we provide a comprehensive repair and spare parts service ensuring the highest degree of operating safety and reliability.

In Germany
0180 50 50 446 ¹⁾

Technical Support



Competent consulting in technical questions covering a wide range of customer-oriented services for all our products and systems.

Tel.: +49 (0)180 50 50 222
Fax: +49 (0)180 50 50 223
<http://www.siemens.com/automation/support-request>

Optimization and Upgrading



To enhance productivity and save costs in your project we offer high-quality services in optimization and upgrading. ¹⁾

Technical Consulting



Support in the planning and designing of your project from detailed actual-state analysis, target definition and consulting on product and system questions right to the creation of the automation solution. ¹⁾

¹⁾ For country-specific telephone numbers go to our Internet site at: <http://www.siemens.com/automation/service&support>

Knowledge Base on CD-ROM



For locations without online connections to the Internet there are excerpts of the free part of the information sources available on CD-ROM (Service & Support Knowledge Base). This CD-ROM contains all the latest product information at the time of production (FAQs, Downloads, Tips and Tricks, Updates) as well as general information on Service and Technical Support.

The CD-ROM also includes a full-text search and our Knowledge Manager for targeted searches for solutions. The CD-ROM will be updated every 4 months.

Just the same as our online offer in the Internet, the Service & Support Knowledge Base on CD comes complete in 5 languages (German, English, French, Italian, Spanish).

You can order the **Service & Support Knowledge Base CD** from your Siemens contact.

Order no. **6ZB5310-0EP30-0BA2**

Orders via the Internet
(with Automation Value Card or credit card) at:

<http://www.siemens.com/automation/service&support>
in the Shop domain.

Automation Value Card



Small card - great support

The Automation Value Card is an integral component of the comprehensive service concept with which Siemens Automation and Drives will accompany you in each phase of your automation project.

It doesn't matter whether you want just specific services from our Technical Support or want to purchase high-quality Support Tools in our Online Shop, you can always pay with your Automation Value Card. No invoicing, transparent and safe. With your personal card number and associated PIN you can view the state of your account and all transactions at any time.

Services on card. This is how it's done.

Card number and PIN are on the back of the Automation Value Card. When delivered, the PIN is covered by a scratch field, guaranteeing that the full credit is on the card.

By entering the card number and PIN you have full access to the Service & Support services being offered. The charge for the services procured is debited from the credits on your Automation Value Card.

All the services offered are marked in currency-neutral credits, so you can use the Automation Value Card worldwide.

Automation Value Card order numbers

Credits	Order no.
200	6ES7 997-0BA00-0XA0
500	6ES7 997-0BB00-0XA0
1000	6ES7 997-0BC00-0XA0
10000	6ES7 997-0BG00-0XA0

Detailed information on the services offered is available on our Internet site at:

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

Service & Support à la Card: Examples

Technical Support

"Priority"	Priority processing for urgent cases
"24 h"	Availability round the clock
"Extended"	Technical consulting for complex questions

Support Tools in the Support Shop

"System Utilities"	Tools that can be used directly for configuration, analysis and testing
"Applications"	Complete topic solutions including ready-tested software
"Functions & Samples"	Adaptable blocks for accelerating your developments

Additional information

- H-compact on the Internet: www.siemens.com/h-compact
- N-compact Catalog D81.1 on the Internet: www.siemens.com/n-compact
Online Catalog CA01 www.siemens.com/automation/ca01

- SINAMICS G150 Catalog D11 on the Internet: www.siemens.com/sinamics-g150
Order No. E86060-K5511-A101-A2

Conditions of sale and delivery

Terms and Conditions of Sale and Delivery

By using this catalog you can acquire hardware and software products described therein from Siemens AG subject to the following terms. Please note! The scope, the quality and the conditions for supplies and services, including software products, by any Siemens entity having a registered office outside of Germany, shall be subject exclusively to the General Terms and Conditions of the respective Siemens entity. The following terms apply exclusively for orders placed with Siemens AG.

For customers with a seat or registered office in Germany

The "General Terms of Payment" as well as the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry" shall apply.

For software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or registered Office in Germany" shall apply.

For customers with a seat or registered office outside of Germany

The "General Terms of Payment" as well as the "General Conditions for Supplies of Siemens. Automation and Drives for Customers with a Seat or registered Office outside of Germany" shall apply.

For software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or registered Office outside of Germany" shall apply.

General

The dimensions are in mm. In Germany, according to the German law on units in measuring technology, data in inches only apply to devices for export.

Illustrations are not binding.

Insofar as there are no remarks on the corresponding pages, - especially with regard to data, dimensions and weights given - these are subject to change without prior notice.

The prices are in € (Euro) ex works, exclusive packaging.

The sales tax (value added tax) is not included in the prices. It shall be debited separately at the respective rate according to the applicable legal regulations.

Prices are subject to change without prior notice. We will debit the prices valid at the time of delivery.

Surcharges will be added to the prices of products that contain silver, copper, aluminum, lead and/or gold if the respective basic official prices for these metals are exceeded. These surcharges will be determined based on the official price and the metal factor of the respective product.

The surcharge will be calculated on the basis of the official price on the day prior to receipt of the order or prior to the release order.

The metal factor determines the official price as of which the metal surcharges are charged and the calculation method used. The metal factor, provided it is relevant, is included with the price information of the respective products.

An exact explanation of the metal factor and the text of the Comprehensive Terms and Conditions of Sale and Delivery are available free of charge from your local Siemens business office under the following Order Nos.:

- 6ZB5310-0KR30-0BA1
(for customers based in Germany)
- 6ZB5310-0KS53-0BA1
(for customers based outside Germany)

or download them from the Internet

<http://www.siemens.com/automation/mall>

(Germany: A&D Mall Online-Help System)

Export regulations

The products listed in this catalog/price list may be subject to European/German and/or US export regulations.

Therefore, any export requiring a license is subject to approval by the competent authorities.

According to current provisions, the following export regulations must be observed with respect to the products featured in this catalog/price list:

AL	Number of the <u>German Export List</u> Products marked other than "N" require an export license. In the case of software products, the export designations of the relevant data medium must also be generally adhered to. Goods labeled with an " <u>AL</u> " not equal to "N" are subject to a European or German export authorization when being exported out of the EU.
ECCN	<u>Export Control Classification Number</u> Products marked other than "N" are subject to a reexport license to specific countries. In the case of software products, the export designations of the relevant data medium must also be generally adhered to. Goods labeled with an " <u>ECCN</u> " not equal to "N" are subject to a US re-export authorization.

Even without a label or with an "AL: N" or "ECCN: N", authorization may be required due to the final destination and purpose for which the goods are to be used.

The deciding factors are the AL or ECCN export authorization indicated on order confirmations, delivery notes and invoices.

Errors excepted and subject to change without prior notice.

A&D/VuL_ohne MZ/En 05.09.06

Further information can be obtained from our branch offices listed in the appendix or at www.siemens.com/automation/partner

Automation and Drives Interactive catalog on CD-ROM and on DVD <ul style="list-style-type: none"> The Offline Mall of Automation and Drives 	<i>Catalog</i>	CA 01	Industrial Communication for Automation and Drives	<i>Catalog</i>	IK PI
Automation Systems for Machine Tools SINUMERIK & SIMODRIVE SINUMERIK & SINAMICS		NC 60 NC 61	Low-Voltage Controls and Distribution – SIRIUS, SENTRON, SIVACON Controls and Distribution – Technical Information SIRIUS, SENTRON, SIVACON SIDAC Reactors and Filters SIVENT Fans SIVACON 8PS Busbar Trunking Systems		LV 1 LV 1 T LV 60 LV 65 LV 70
Drive Systems <u>Variable-Speed Drives</u> SINAMICS G130 Drive Converter Chassis Units, SINAMICS G150 Drive Converter Cabinet Units SINAMICS G110 Inverter Chassis Units SINAMICS GM150/SINAMICS SM150 Medium-Voltage Converters SINAMICS S120 Drive Converter Systems SINAMICS S150 Drive Converter Cabinet Units Asynchronous Motors Standardline Synchronous Motors with Permanent-Magnet Technology, HT-direct DC Motors SIMOREG DC MASTER 6RA70 Digital Chassis Converters SIMOREG K 6RA22 Analog Chassis Converters SIMOREG DC MASTER 6RM70 Digital Converter Cabinet Units SIMOVERT PM Modular Converter Systems SIEMOSYN Motors MICROMASTER 410/420/430/440 Inverters MICROMASTER 411/COMBIMASTER 411 SIMOVERT MASTERDRIVES Vector Control SIMOVERT MASTERDRIVES Motion Control Synchronous and asynchronous servomotors for SIMOVERT MASTERDRIVES SIMODRIVE 611 universal and POSMO <u>Low-Voltage Three-Phase-Motors</u> IEC Squirrel-Cage Motors <u>Automation Systems for Machine Tools SIMODRIVE</u> <ul style="list-style-type: none"> Main Spindle/Feed Motors Converter Systems SIMODRIVE 611/POSMO <u>Automation Systems for Machine Tools SINAMICS</u> <ul style="list-style-type: none"> Main Spindle/Feed Motors Drive System SINAMICS S120 <u>Drive and Control Components for Hoisting Equipment</u>		D 11 D 11.1 D 12 D 21.1 D 21.3 D 86.1 D 86.2 DA 12 DA 21.1 DA 21.2 DA 22 DA 45 DA 48 DA 51.2 DA 51.3 DA 65.10 DA 65.11 DA 65.3 DA 65.4	Motion Control System SIMOTION Process Instrumentation and Analytics Field Instruments for Process Automation Measuring Instruments for Pressure, Differential Pressure, Flow, Level and Temperature, Positioners and Liquid Meters <i>PDF: Indicators for panel mounting</i> SIREC Recorders and Accessories SIPART, Controllers and Software SIWAREX Weighing Systems Continuous Weighing and Process Protection Process Analytical Instruments <i>PDF: Process Analytics, Components for the System Integration</i>		PM 10 FI 01 MP 12 MP 20 MP 31 WT 01 WT 02 PA 01 PA 11
Electrical Installation Technology <i>PDF: ALPHA Small Distribution Boards and Distribution Boards, Terminal Blocks</i> <i>PDF: ALPHA 8HP Molded-Plastic Distribution System</i> <i>PDF: BETA Low-Voltage Circuit Protection</i> <i>PDF: DELTA Switches and Socket Outlets</i> GAMMA Building Controls		ET A1 ET A3 ET B1 ET D1 ET G1	SIMATIC Industrial Automation Systems SIMATIC PCS Process Control System Products for Totally Integrated Automation and Micro Automation SIMATIC PCS 7 Process Control System Add-ons for the SIMATIC PCS 7 Process Control System Migration solutions with the SIMATIC PCS 7 Process Control System pc-based Automation SIMATIC Control Systems		ST 45 ST 70 ST PCS 7 ST PCS 7.1 ST PCS 7.2 ST PC ST DA
Human Machine Interface Systems SIMATIC HMI		ST 80	SIMATIC Sensors SIPOS Electric Actuators Electric Rotary, Linear and Part-turn Actuators Electric Rotary Actuators for Nuclear Plants		FS 10 MP 35 MP 35.1/2
			Systems Engineering Power supplies SITOP power System cabling SIMATIC TOP connect		KT 10.1 KT 10.2
			System Solutions Applications and Products for Industry are part of the interactive catalog CA 01		
			TELEPERM M Process Control System <i>PDF: AS 488/TM automation systems</i>		PLT 112

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