Planning Guide 09/2003 Edition

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SINAMICS
SIMOVERT MASTERDRIVES
MICROMASTER
1FU8 Motors

SIEMENS

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SIMOVERT MASTERDRIVES
MICROMASTER

SIEMOSYN Motors
1FU8

Planning Guide

09.2003 Edition

Printing history

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the “Remarks” column.

Status code in the “Remarks” column:

A . . . . . New documentation
B . . . . . Unrevised reprint with new Order No.
C . . . . . Revised edition with new status

If factual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on that page.

Edition	Order No.	Remark
09.03	6SN1197-0AC80-0BP0	**A**

This Manual is included in the documentation available on CD-ROM **(DOCONCD)**

Edition	Order No.	Remark
11.03	6FC5 298-6CA00-0BG4	**C**

More information is available on the Internet at:
http://www.ad.siemens.de/mc

This publication was produced with Interleaf V 7.

Other functions not described in this documentation might be executable in the control. The customer is not, however, entitled to these functions in the event of the system being replaced or serviced.

We have checked that the contents of this document correspond to the hardware and software described. Nevertheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information given in this publication is reviewed at regular intervals and any corrections that might be necessary are made in subsequent editions. We welcome any suggestions for improvement.

We reserve the right to make technical changes.

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Preface

Information on SIMOVERT MASTERDRIVES, MICROMASTER, SINAMICS, SIEMOSYN documentation

This document is part of the Technical Customer Documentation which has been developed for SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS/SIEMOSYN. All of the documents are available individually. You can obtain the complete list of documentation encompassing all Advertising Brochures, Catalogs, Overviews, Short Descriptions, Operating Instructions and Technical Descriptions with Order No., ordering address and price from your local Siemens office.

For reasons of transparency, this document does not include detailed information about all of the product types. Further, it cannot take into account every conceivable installation, operation or service/maintenance situation.

We would also like to point-out that the contents of this document are neither part of nor modify any prior or existing agreement, commitment or contractual relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein neither create new warranties nor modify the existing warranty.

Hotline

If you have any questions, please contact the following Hotline:

A&D Technical Support Tel.: +49 (180) 5050-222
Fax: +49 (180) 5050-223
eMail: adsupport@siemens.com

If you have any questions regarding the documentation (suggestions, corrections) then please send a fax to the following number:
+49 (9131) 98-2176

Fax form: Refer to the feedback sheet at the end of the document

Definition of qualified personnel

For the purpose of this document and warning information on the product itself, “Qualified personnel” are those who are familiar with the installation, mounting, start-up and operation of the equipment and are appropriately qualified and trained for the function which they perform.

- Trained and authorized to energize/de-energize, circuits and equipment in accordance with established safety procedures.
- Trained in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

Explanation of the symbols

The following danger and warning concept is used in this document:

Danger

Indicates an imminently hazardous situation which, if not avoided, **will** result in death or serious injury or in substantial property damage.

Warning

Indicates a potentially hazardous situation which, if not avoided, **could** result in death or serious injury or in substantial property damage.

Caution

Used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in minor or moderate injury or in property damage.

Caution

Used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in property damage.

Notice

Used without the safety alert symbol indicates a potential situation which, if not avoided, **may** result in an undesirable result or state.

Note

In the sense of this document there is a possible advantage/benefit if the note text is observed.

Danger and warning information

Danger

- **Personnel with pacemakers are in danger when they are close to disassembled rotors.**
- Data saved on electronic data mediums can be destroyed.
- It is not permissible to commission the equipment until it has been clearly identified that the machine, in which the described components are to be installed, is in full compliance with the specifications in Directive 98/37/EC.
- Only appropriately qualified and trained personnel may commission SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive units and the SIEMOSYN AC motors.
- This personnel must take into account the technical customer documentation belonging to the product and be knowledgeable and observe the specified information and instructions on the hazard and warning labels.
- When electrical equipment and motors are operated, the associated electrical circuits are at hazardous voltage levels.
- When the machine or syst. is operated, hazardous axis movements can occur.
- All of the work carried-out in the electrical machine or system must be carried-out with it in a no-voltage condition.
- SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive units have been designed for operation on low-ohmic grounded line supplies (TN line supplies).

Warning

- The successful and safe operation of this equipment and motors is dependent on proper transport, storage, installation and mounting as well as careful operator control, service and maintenance.
- For special versions of the drive units and motors, information and data in the catalogs and quotations additionally apply.
- In addition to the information and instructions on hazards and warnings in the technical customer documentation supplied, the applicable national, local and machine/system specific regulations and requirements must be carefully taken into consideration.

Caution

- The motors can have surface temperatures of over +100° C.
- This is the reason that it is not permissible that temperature-sensitive parts and components – e.g. cables or electrical components – are in contact with the motor or fastened to the motor.
- When connecting and routing connecting cables, the following must be carefully observed:
  - they may not be damaged
  - they may not be strained, and
  - they may not be able to be touched by rotating components.

Caution

- SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive units with AC motors are subject to a voltage test in compliance with EN 50178 as part of the routine test. According to EN 60204-1, Section 19.4, while electrical equipment of industrial machines are being subject to a voltage test, all of the SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive unit connections must be disconnected/withdrawn in order to avoid damaging the SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive units.
- Motors should be connected-up according to the circuit diagram supplied. It is not always permissible that the motors are directly connected to the line supply. Motors which are not suitable for direct online operation will be destroyed. It is extremely important that the rating plate data is carefully observed (frequency converter operation).

Note

- SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive units with AC motors fulfill, in the operational state and in dry operating areas, the Low-Voltage Directive 73/23/EEC.
- SIMOVERT MASTERDRIVES/MICROMASTER/SINAMICS drive units with AC motors fulfill, in the configurations which are specified in the associated EC Declaration of Conformance, the EMC Directive 89/336/EEC.

ESDS information and instructions

Caution

Electro**S**tatic **D**ischarge **S**ensitive devices (ESDS) are individual components, integrated circuits or modules which could be damaged as a result of electrostatic fields or electrostatic discharge.

Handling ESDS boards:

- The human body, working area and packaging should be well grounded when handling ESDS components!
- Electronic components may only be touched by people in ESDS areas with conductive flooring if
  - they are grounded through an ESDS wrist strap
  - they are wearing ESDS shoes or ESDS shoe grounding strips.
- Electronic boards should only be touched when absolutely necessary.
- Electronic boards may not come into contact with synthetic materials and clothing manufactured out of man-made fibers.
- Electronic boards may only be placed down on conductive surfaces (table with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).
- Electronic boards may not be brought close to data terminals, monitors or television sets (minimum clearance to screen > 10 cm).
- Measuring work may only be carried out on the electronic boards if
  - the measuring device is grounded (e.g. via the protective conductor) or
  - for floating measuring equipment, the probe is briefly discharged before making measurements (e.g. a bare control housing is touched).

Notes

Contents

■

Motor Description

1

1.1 Applications and features

Overview

The SIEMOSYN 1FU8 motors are permanent-magnet synchronous motors with short-circuit cage so that they can synchronously start by themselves. These motors can be connected to the line supply as constant-speed drives or connected to a drive converter as variable-speed single-motor drive or group drive.

SIEMOSYN 1FU8 motors are preferably supplied from SIMOVERT MASTERDRIVES, MICROMASTER or SINAMICS drive converters.

The mechanical design (shaft height, frame, bearing end shields, shaft dimensions etc.) is identical with the standard 1LA7 AC motors (IEC Standard).

The motors are available as standard up to a speed of 15,000 [RPM]. They provide a constant drive-out torque over a wide frequency/speed range.

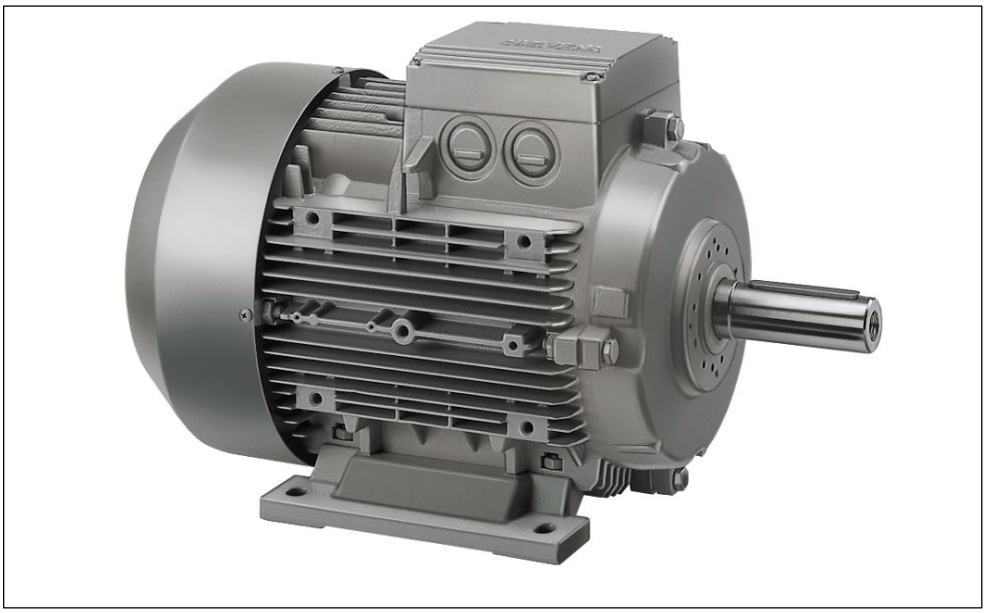


Fig. 1-1 SIEMOSYN 1FU8 motor

Advantages

- The motors do not require a speed encoder. This means that a speed encoder feedback is not required and therefore fewer components, installation, mounting and cabling costs
- The speed accuracy of single-motor and group drives is directly proportional to the frequency of the line supply or the drive converter
- In group drives, the motors run in synchronism without requiring any other electronic equipment
- The motors have intrinsically low rotor and excitation losses. This means that they have a higher efficiency than other motors thus reducing operating and energy costs
- Constant torque over a defined frequency range
- The speed is independent of the load over the frequency range
- Electrical braking – a holding torque can be provided at standstill with DC
- The motor has been designed so that it cannot be de-magnetized
- High degree of protection

Applications

1FU8 motors provide a high speed stability and synchronous operation even if several motors are used in a group (group drive).

These 1FU8 motors are suitable for applications where speeds are required independent of the load or synchronous operation. They are also admirably suited where defined speed ratios have to be maintained over a wide frequency range – both as single-motor and group drives. These include, for example:

- Man-made fiber industry (spinning pumps, godets, driving rolls)
- Texturing systems (stretching godets)
- Rolling mills (roller table motors)
- Transport systems (conveyor belts)
- Glass industry (conveyor belts)

1.2 Technical features and versions

Table 1-1 Features of the 1FU8 series

Technical features	Version
Motor type	Self-starting permanent-magnet synchronous motors
Magnetic material	Rare earth/ferrite magnetic material
Stator winding insulation acc. to EN60034-1 (IEC 60034-1)	Temperature Class F for a winding temperature rise of max. 105 K at an ambient temperature of 40 °C
Operating voltage	Unrestricted operation when connected to the line supply or frequency converter according to the rating plate
Standards and regulations	The motors are in compliance with the relevant Standards and Regulations, especially IEC 60 034
Type of construction	Acc. to EN 60034-7 (IEC 60034-7) – refer to the types of construction
Terminal box arrangement (when viewing the drive end)	Top-mounted
Terminal box connection type	Terminals are provided in the terminal box to connect the motor and PTC thermistor
Degrees of protection acc. to EN 60034-5 (IEC 60034-5)	IP54 for 2-pole motors IP55 for 4 and 6-pole motors
Permissible ambient temperature	–20 °C to + 40 °C
Cooling	Self-ventilated
Temperature monitoring	Motor protection using PTC thermistors with 3 integrated temperature sensors for trip
Paint finish	RAL 7030, stone-gray
Drive shaft end acc. to DIN 748-3 (IEC 60072-1)	Drive shaft end with key and keyway (half key balancing)
Radial eccentricity, concentricity and axial eccentricity acc. to DIN 42955 (IEC 60072-1)	Tolerance N (normal)
Vibration severity acc. to EN 60034-14 (IEC 60034-14)	Grade N (normal)
Options	Vibration severity Grade R or S Reduced radial eccentricity – Grade R Cast iron housing Locating bearings at the drive or non-drive end Radial shaft sealing ring for gearbox mounting Metal fan Textile fan shroud Drive-end bearings for increased cantilever forces Regreasing device Forced ventilation Terminal box mounted to the left or right Modular built-on brake Gearbox mounting Mounted modular frequency converter with/or without gear

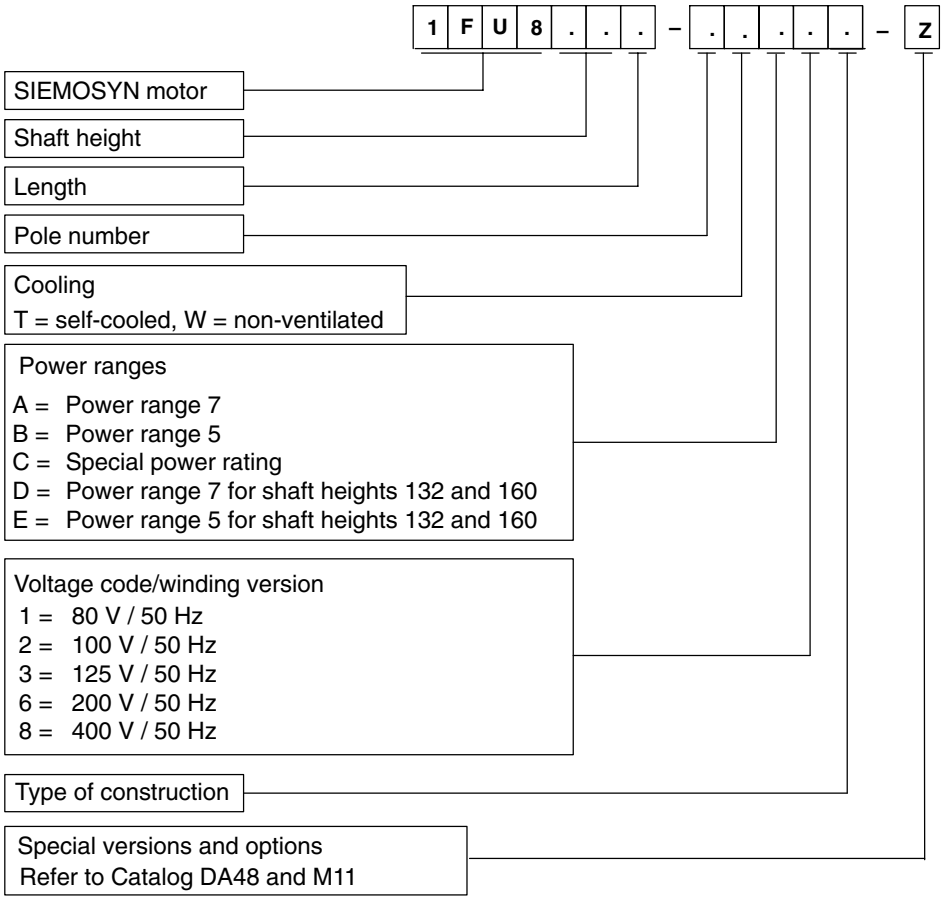
1.3 Order designation

Structure of the order designation

The order designation comprises a combination of digits and letters. It is sub-divided into three hyphenated blocks.

The motor is defined in the 1st block. Additional features are defined in the 2nd and 3rd blocks.

Explanation of the order designation



1.3.1 Special versions

The order codes are assigned to the individual motor series in the selection and ordering data.

Table 1-2 Special versions

Order code	Special versions
Winding and motor protection	
Standard	PTC thermistor motor protection using 3 integrated temperature sensors for shutdown
A12	PTC thermistor motor protection using 6 integrated temperature sensors for alarm and shutdown
“9”	Non-standard winding (plain text, refer to Table 2-1)
A23	Motor temperature sensing using the integrated temperature sensor KTY 84–130
A25	Motor temperature sensing using the integrated temperature sensor 2 x KTY 84–130
Paint finish	
Standard	Special paint finish in RAL 7030 stone gray
K23	Without paint finish (cast iron with primer)
K24	No paint finish, however with primer
K27	Special paint finish in RAL 6011, reseda green
K28	Special paint finish in RAL 7031, blue-gray
L42	Special paint finish in RAL 7032, pebble gray
L43	Special paint finish in RAL 9005, jet black
M16	Special paint finish in RAL 1002, sand yellow
M17	Special paint finish in RAL 1013, pearl white
M18	Special paint finish in RAL 3000, flame red
M19	Special paint finish in RAL 6021, pale green
M20	Special paint finish in RAL 7001, silver gray
M21	Special paint finish in RAL 7035, light gray
M22	Special paint finish in RAL 9001, cream
M23	Special paint finish in RAL 9002, gray-white
Y54	Special paint finish in other colors: RAL ....
Modular technology	
C00	Brake supply voltage, 24 V DC
C01	Brake supply voltage, 2-ph. 400 V AC, 50 Hz
G26	Mounted brake, 1-ph. 230 V AC, 50/60 Hz
K82	Mechanical manual brake release with lever
G17	Mounted separately-driven fan

Table 1-2 Special versions, continued

Order code	Special versions
Converter mounting	
H96	Prepared for mounting a MICROMASTER 411 to 1FU8
Mechanical design	
K01	Vibration severity grade R
K02	Vibration severity grade S
K04	Reduced radial eccentricity L = 0.025 mm
K09	Terminal box mounted on the righthand side (when viewing the drive end)
K10	Terminal box mounted on the lefthand side (when viewing the drive end)
K16	Second standard shaft end
K17	Radial shaft sealing ring with hardened shaft
K20	Bearing for increased cantilever forces from shaft height 112 onwards
K35	Version with metal fan
K40	Re-greasing device from shaft height 112 onwards
K83	Terminal box rotated through 90°, cable entry from the drive end
K84	Terminal box rotated through 90°, cable entry from the non-drive end
K85	Terminal box rotated through 180°
K94	Locating bearings, drive end
L04	Locating bearings, non-drive end
L13	External grounding (earthing)
L68	Full-key balancing
L71	Cast iron drive-end bearing end shield
L99	Wire lattice pallet
M07	Cast iron non-drive end bearing end shield
M28	Cast iron frame, shaft heights 112 to 160
Y58	Non-standard shaft end: Plain text + drawing (drive shaft end)
Y82	Supplementary rating plate
Safety and Start-up Guide/certification	
B00	Without Safety and Start-up Guide. The customer must provide a waiver
B01	With one Safety and Start-up Guide for each wire lattice pallet
B02	Factory test certificate 2.3 according to EN 10 204

1.3.2 Ordering example

Customer requirement (example)

The following 1FU8 motor is to be ordered:

- Three-phase motor, with IP55 degree of protection
  - Speed control range 600 – 4800 [RPM]
  - M = const. = 5 Nm across the speed control range
- IM B5 type of construction
- Special design:
  - PTC thermistor for alarm and shutdown (trip)
  - Radial shaft sealing ring for gearbox mounting

Order No. according to the selection table: **1FU8 083–4TA3□**

Note:
The PTC thermistor for shutdown is already included in the Standard (A11).

Order designation for a special version

• Type of construction B5	.1
• Special versions	–Z
– PTC thermistor for alarm and shutdown	A12
– Radial shaft sealing ring, .	K17

When ordering, specify: **1FU8 083–4TA31–Z**
A12 + K17

1.4 Rating plate data

The motors are designed for a constant torque range within a defined frequency range.

The rating plate can specify the following frequency ranges depending on the motor design and how it was ordered:

- M = const. for 13.3 Hz up to f_{max} for 4-pole motors or
- M = const. for 20 Hz up to f_{max} for 2, 4 and 6-pole motors

(The frequency range 13.3 Hz up to f_{max} has been conceived as replacement for the old 6-pole motor series.)

The following example involves the same motor, however, stamped for the specified frequency ranges with different constant torques for the speed range.

A voltage boost at low frequencies has already been taken into account in the data stamped on the rating plate.

Table rating plate for 13 Hz

1FU8080-4TA6 with f_{min} = 13 Hz to f_{max} = 100 Hz

SIEMENS 3~mot. 1) 1FU8080-4TA60 2) H 3)
E 0107/471101 14 002 4) IEC/EN 60034 5)
D-91056 Erlangen 10kg 6) IM B3 7) 80M 8) IP55 9) Th.Cl.F 10)

Hz 13)	V 12)	kW 11)	A 11)	cos φ 11)	/min 11)	Nm 11)
13	72 Y	0.1	1.85	0.83	390	2.5
50	200 Y	0.38	1.75	0.80	1500	2.5
100	400 Y	0.78	1.82	0.73	3000	2.5

6004/6004 14)

1) Motor type: Three-phase motor
2) Order No. (MLFB)
3) Half-key balancing
4) Serial number
5) Standard
6) Weight
7) Type of construction
8) Frame size
9) Degree of protection
10) Temperature class
11) Motor data
12) Voltage
13) Frequency
14) Bearing size DE/NDE

Table rating plate for 20 Hz

1FU8080-4TA6 with f_{min} = 20 Hz to f_{max} = 100 Hz

SIEMENS 3~mot. 1) 1FU8080-4TA60 2) H 3)
E 0107/471215 14 001 4) IEC/EN 60034 5)
D-91056 Erlangen 10 kg 6) IM B3 7) 80M 8) IP55 9) Th.Cl.F 10)

	Hz 13)	V 12)	kW 11)	A 11)	cos φ 11)	/min 11)	Nm 11)
◯	20	110 Y	0.22	2.24	0.82	600	3.5
	50	200 Y	0.55	2.22	0.89	1500	3.5
	100	400 Y	1.1	2.21	0.83	3000	3.5

6004/6004 12)

1) Motor type: Three-phase motor
2) Order No. (MLFB)
3) Half-key balancing
4) Serial number
5) Standard
6) Weight
7) Type of construction
8) Frame size
9) Degree of protection
10) Temperature class
11) Motor data
12) Voltage
13) Frequency
14) Bearing size DE/NDE

■

Notes

Electrical Design

2

2.1 Rated values

A rated value (e.g. current, voltage, torque, power) is that value which can be output or drawn at the specified voltage and frequency in continuous operation, utilized to temperature Class F, and installation altitude up to max. 1000 m above sea level as well as a 40 °C ambient temperature.

2.2 Voltages, currents, frequencies

SIEMOSYN motors have windings up to 350 Hz.

For the motors listed in the Technical Data, various voltages, referred to 50 Hz are obtained depending on the max. output frequency at 400 V.

The motor windings have been designed so that for a constant V/f ratio (M = const.), 400 V is connected as maximum voltage.

The winding versions available are specified at the 11th position of the Order No. – refer to Table 2-1.

Table 2-1 Winding versions

Max. output-frequency at 400 V	Rated-voltage at 50 Hz	11th position of the Order No.	V/f-ratio
f_{max}(HZ)	U_{N50Hz}	1FU8□□□–□□□□ ⇓	(V/Hz)
50	400	8	8
100	200	6	4
160	125	3	2.5
200	100	2	2
250	80	1	1.6
Non-standard	Non-standard	9	Non-standard

In order to optimally dimension SIEMOSYN 1FU8 motors, the winding can be adapted to the customer's application (11th position of the Order No.: "9", the voltage and frequency is specified in plain text).

The motor is generally operated in the star circuit configuration and the specified voltages are present at the windings. If long motor feeder cables are used, then a possible voltage drop should be taken into account.

For V/f = constant, for a constant torque, the motor current remains approximately constant over the frequency range.

The motor current slightly increases at higher frequencies. The load currents for the 50 Hz and f_{max} operating points are listed in the Chapter, Technical Data.

If the motor is connected to a power source, e.g. the motor is connected to a group of motors which is already running, then the motor starting torque can be a multiple of the rated current. The starting currents for the 50 Hz and f_{max} operating points are listed in the selection tables.

At low frequencies, the no-load current can be greater than the rated current. The approximate current characteristic is shown in Fig. 2-1.

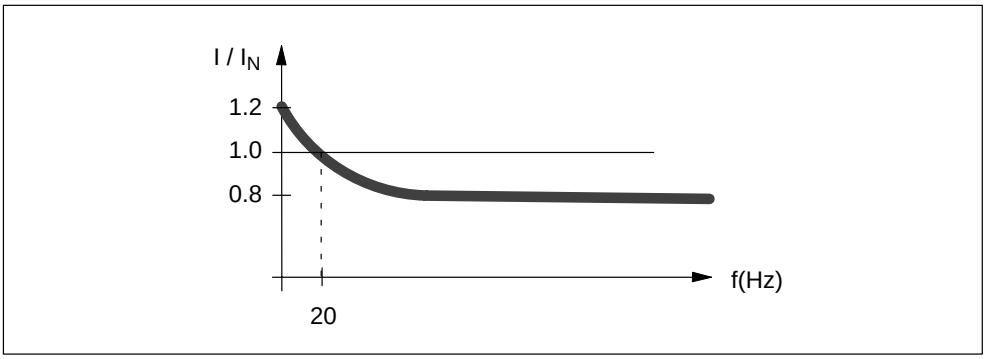


Fig. 2-1 No-load current characteristic at low frequencies

2.3 DURIGNIT® IR 2000 insulating system

The DURIGNIT® IR 2000 insulating system is made up of high-quality enamel wires and insulating materials in conjunction with a resin impregnation which does not contain any solvents.

This guarantees a high mechanical and electrical strength, high quality and a long motor lifetime.

The insulating system protects the winding against aggressive gases, vapors, dust, oil and increased air humidity. It can withstand the usual vibration stressing.

The insulation is suitable up to an absolute air humidity of 30 g water per m^3. Moisture condensation should be prevented from forming on the winding. The insulation is tropics-proof. If you have any higher requirements, please contact your local Siemens office.

All of the motors have an insulation according to temperature Class F and the motors are utilized, at the rated power (when fed directly from the line supply or frequency converter) to temperature Class F.

2.4 Motor torque

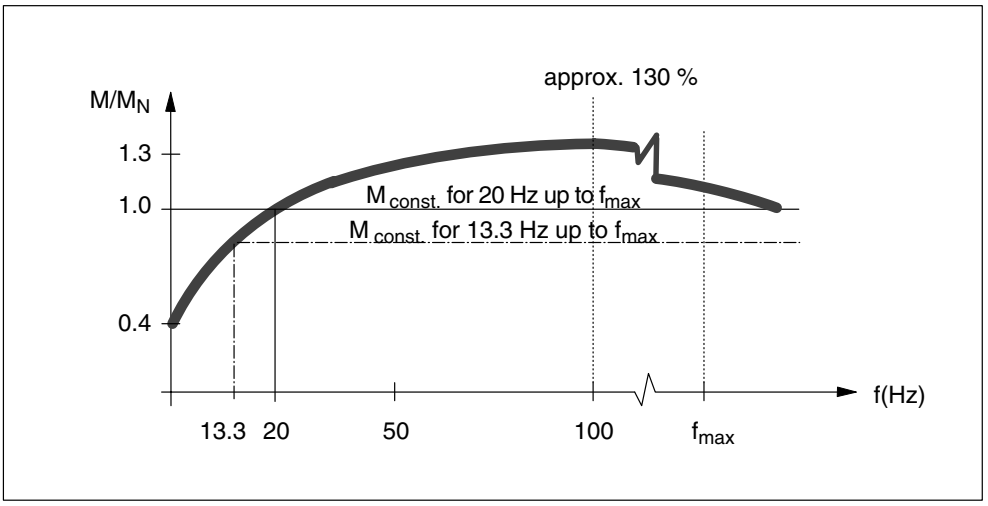


Fig. 2-2 Principle frequency (speed)/torque characteristic for 4 and 6-pole 1FU8 motors

For 2-pole motors, the actual torque characteristic approximately corresponds to the constant torque specified in the catalogs. The torque reduction at low frequencies is the same as for 4 and 6-pole motors.

The actual torque characteristics of 4 and 6-pole motors are shown in Fig. 2-2.

In the Chapter, Technical Data, the motors are assigned a constant torque in a defined speed/frequency range (13.3 or 20 Hz up to the max. frequency). The requirement $M_K \times 1.35\ M_N$ is maintained within this range.

M_K = Stall torque
M_N = Rated torque

At lower frequencies, the rated torque or stall torque is briefly available; for longer periods/continuous duty, then the characteristic should be applied (0 Hz/approx. 0.4 M_N).

If a higher torque is demanded at low speeds, the motors can be equipped with forced ventilation.

If a higher torque is demanded over the speed/frequency range, then the motor can be optimally adapted to the application according to the actual torque characteristic. In this case, the frequency converter must be dimensioned corresponding to the higher load current.

For single-motor drives, the motor is accelerated along a ramp from standstill up to the required operating speed. The motor is accelerated with a constant torque (max. torque M_k) as a result of the specified characteristic V/f = const. (voltage boost at low frequencies).

For group drives, the motor group runs-up (accelerates from standstill up to the operating speed) essentially the same as when a single-motor drive runs-up.

If individual motors are connected to a group of motors which is already running (operating voltage, frequency), the motor runs-up corresponding to the non-synchronous torque characteristic (short-circuit cage in the rotor) and is then synchronized to the operating frequency.

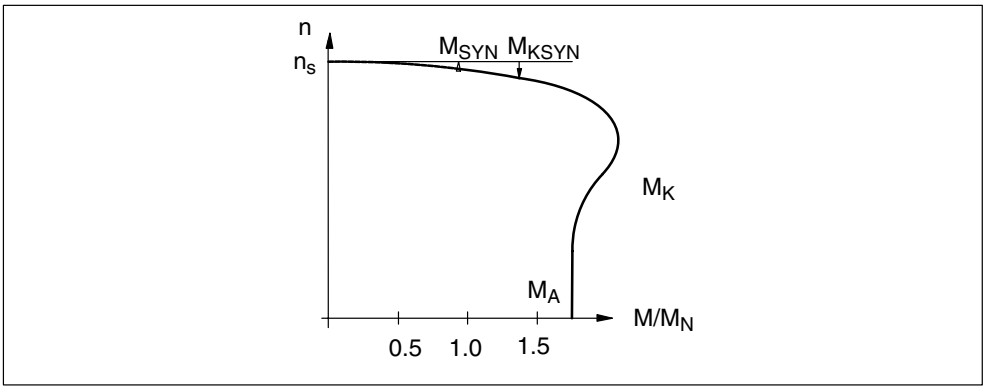


Fig. 2-3 Schematic torque characteristic

When the motor accelerates non-synchronously, a high external moment of inertia, which is a multiple of the intrinsic (motor) moment of inertia, can be synchronized.

The starting current when a motor is connected to a power source is a multiple of the rated motor current. This should be taken into consideration when dimensioning the frequency converter.

If a constant torque is not demanded over the speed/frequency range, then the motor can be optimally adapted to the application according to Fig. 2-2. The frequency converter must also be appropriately dimensioned for the current required for the torque taking into account $M_K < 1.35 \bullet M_N$.

Field weakening

As standard, field weakening is possible up to 150% speed according to the tables in the Technical Data. However, at higher speeds it must be ensured that the mechanical speed limit is not exceeded. It may be necessary to provide a modified fan and special bearings.

The power remains constant in the field-weakening range and the torque decreases proportionally with the speed. At higher frequencies, the current doesn't noticeably increase.

2.5 Frequency converter operation

SIEMOSYN 1FU8 motors can be connected to the line supply as constant-speed drives. They can also be connected to frequency converters as variable-speed drive.

When connected to a frequency converter, the SIEMOSYN 1FU8 motors are operated using open-loop frequency control along the V/f characteristic without using a speed encoder. A voltage boost must taken into consideration at low speeds/frequencies.

The frequency converter should be dimensioned so that the motor has the required short-term and continuous load current available taking into account inrush currents.

At low frequencies, the no-load current can exceed the load current.

2.6 Motor protection using PTC thermistors

SIEMOSYN 1FU8 motors are protected, as standard using semiconductor temperature sensors that are integrated in the winding (3 PTC thermistor temperature sensors in series). These temperature sensors can shut down (trip) the drive using a tripping device.

Two sets of three temperature sensors are used if a warning is required before the motor is shut down (tripped) (code **A12**: For alarm and shutdown). An alarm is output at 10 K below the shutdown (trip) temperature (155 °C winding temperature).

The 3RN1 tripping unit, which belongs to the protective equipment, must be separately ordered (refer to Catalog NS K).

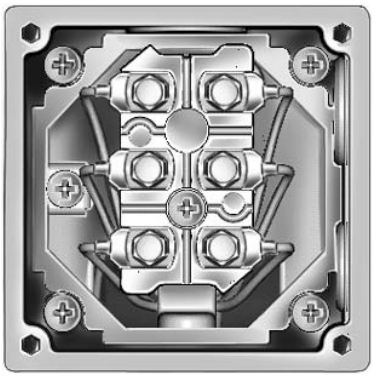
2.7 Electrical connection

Terminal boxes

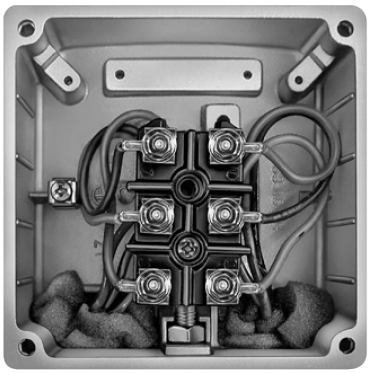
SIEMOSYN motors are connected through terminal boxes:

Shaft heights 71 to 90: With upper terminal box section

Shaft heights 112 to 160: The terminal box is integrated in the motor frame. Two knock-outs are provided at each side for cable glands. The nuts for the cable glands are provided in the terminal box.



Type gk030



Type gk130, 230, 330

Fig. 2-4 Terminal boxes

Table 2-2 Cable glands

Frame size	Number of cable glands	Terminal box material	Connecting the line feeder cables
71 to 90	2 cable glands incl. plugs	Aluminum allow	With or without cable lug
112 to 160	2 cable entries offset through 180°, 4 knock-outs closed with a thin cast membrane (2 at the left, 2 at the right), the terminal box is cast		

Table 2-3 Possible terminal box position when viewing the drive end

Frame size	Possible terminal box position			Rotating the terminal box		
	top (standard)	at the side, right or left (option)	can be subse-quently changed	90	180	can be subse-quently changed
71 to 90	●	●	No	●	●	No
112 to 160	●	●	No	–	●	No

Table 2-4 Terminal boxes for 1FU8 motors

Frame-size	Type	Number of terminals	Thread for the contact-stud	Max. conductor/cable size which can be connected [mm²]	Sealing area acc. to DIN 46319 [mm]	Cable entry (Size) 1)
71, 80, 90	gk030	6	M4	2.5	9 – 17 4.5 – 10	M25 x 1.5 M16 x 1.5
112	gk130	6	M4	4	11 – 21	M32 x 1.5
132	gk230	6	M4	6	11 – 21	M32 x 1.5
160	gk330	6	M5	16	19 – 28	M40 x 1.5

1) For motors with an upper terminal box section and auxiliary terminals (e.g. A11) an M16 x 1.5 or M20 x 1.5 cable gland with plugs is additionally available.

Power connection

The protective conductor must be connected at the “Ground” terminal.

The motors always have a star circuit configuration.

The semiconductor temperature sensors are connected through lamp-wire connectors in the terminal box; max. conductor cross-section which can be connected is 2.5 mm².

Labeled terminals are provided to connect the protective conductor.

A grounding terminal is provided on the outside of the motor frame (special version, Code **L13**).

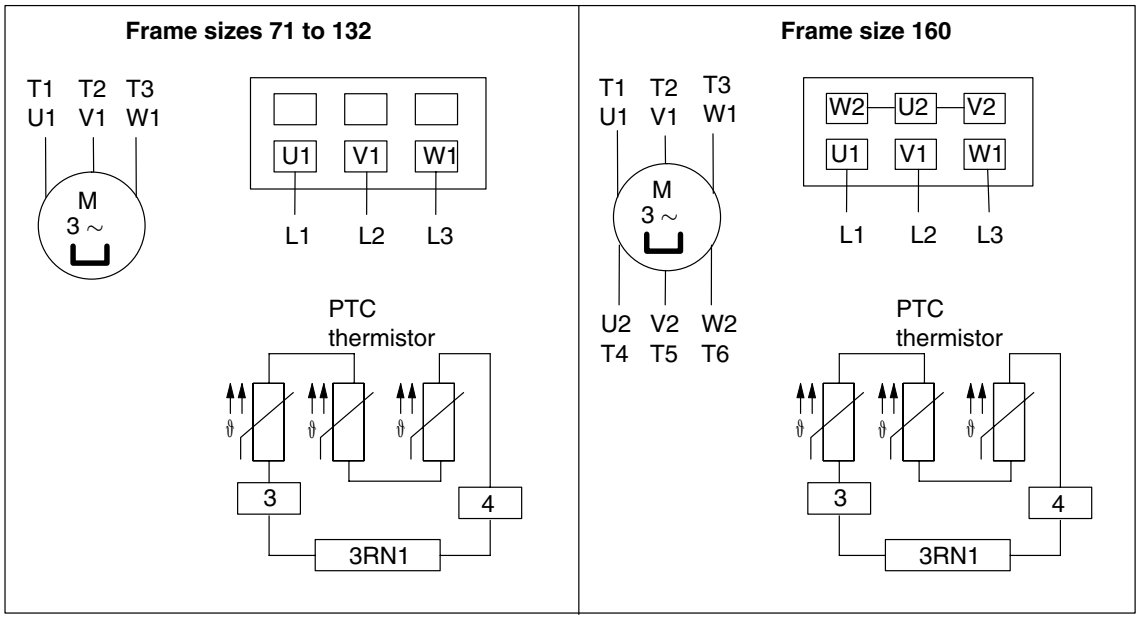


Fig. 2-5 Power/PTC thermistor connection

Clockwise-/counter-clockwise direction

The motors are suitable for clockwise and counter-clockwise rotation. The motors rotate in the clockwise direction when viewing the drive end (DE) when they are connected-up according to the circuit diagram.

Wiring for clockwise rotation (standard):

- U1 = orange (OG)
- V1 = black (BK)
- W1 = red (RD)

Counter-clockwise rotation can be selected by interchanging two phases.

Line feeder cables

The line feeder cables must be dimensioned acc. to DIN VDE 0298. The number of required feeder cables, if necessary in parallel, is defined by:

- The max. cable cross-section which can be connected
- The cable type and cable routing
- The ambient temperature
- The permissible current acc. to DIN VDE 0298.

■

Mechanical Design

3

3.1 Frame design

A code is cast into the motor close to the retaining holes to identify the frame size.

SIEMOSYN 1FU8 motors have aluminum frames.
Cast iron frames are possible up to shaft height 112.

The bearing end shields at the drive end and non-drive end of SIEMOSYN 1FU8 motors are, in some cases, manufactured out of aluminum and in some cases out of cast iron; refer to Table 3-1.
Instead of aluminum bearing end shields, cast iron end shields can be supplied.

Foot-mounted versions of the motors have, in some cases, two retaining holes at the non-drive end, refer to Chapter 6.

For shaft heights 71 to 90, the frame feet are cast.
For shaft heights 112 to 160, the feet are bolted on.

Table 3-1 Frame versions

	400 V/50Hz	200 V/50Hz	125 V/50Hz	100 V/50Hz	80 V/50Hz
11th position of the Order No. [MLFB]	**8**	**6**	**3**	**2**	**1**
1FU8080–2TA□	X	X	AL/cast iron	AL/cast iron	AL/cast iron
1FU8083–2TA□	X	X	AL/cast iron	AL/cast iron	AL/cast iron
1FU8086–2TA□	X	X	AL/cast iron	AL/cast iron	AL/cast iron
1FU8113–2TA□	X	X	AL/cast iron	AL/cast iron	–
1FU8073–4TA□	X	X	X	X	–
1FU8076–4TA□	X	X	X	X	–
1FU8080–4TA□	X	X	X	X	–
1FU8083–4TA□	X	X	X	X	–
1FU8086–4TA□	X	X	X	X	–
1FU8096–4TA□	X	X	X	X	–
1FU8098–4TA□	X	X	X	X	–
1FU8113–4TA□	X	X	X	X	–
1FU8134–6TD□	AL/cast iron	AL/cast iron	AL/cast iron	AL/cast iron	–
1FU8167–6TD□	AL/cast iron	AL/cast iron	AL/cast iron	AL/cast iron	–

The following terminology is used in the table:
X = completely aluminum
AL/cast iron = aluminum frame, cast iron bearing end shield

Code **L71** for cast iron bearing end shields at the drive end
Code **M07** for cast iron bearing end shields at the non-drive end
Code **M28** for cast iron frames, shaft heights 112 to 160

3.2 Degrees of protection

The motors have the following degrees of protection in compliance with DIN VDE 0530, Part 5:

- IP55 for 4 and 6-pole motors
- IP54 for 2-pole motors

They can be mounted in dusty and humid environments.

For all motors with the shaft end pointing upwards, water must be prevented from entering the motor along the shaft.

For types of construction with the shaft end pointing downwards, we recommend versions “with protective cover”.

When the motors are used or are stored outdoors, then we recommend that they are kept under some sort of cover so that they are not subject to direct intensive solar radiation, rain, snow, ice or dust over a long period of time.

If special application conditions prevail, please contact your local Siemens office.

3.3 Cooling and ventilation

The motors are, as standard, self-ventilated and are cooled by a radial fan which operates independently of the direction of rotation (cooling type IC411 acc. to DIN EN 60034–6). The air flows from the non-drive end to the drive end.

Plastic or, depending on the number poles/speed, aluminum fans are used. The fan cowls comprise corrosion-protected sheet steel Metal fans are optionally available – code **K35**.

On request, a separately-driven fan can be mounted in order to utilize the motor at low speeds.

When the motor is mounted and the air intake is restricted, then it must be ensured that a minimum clearance is maintained between the fan cowl and the wall. This is the difference between the protective cover and the fan cowl (dimension LM – L).

On request, a “textile cowl” is available for textile applications.

The motor is also available in a non-ventilated version for some applications. Please contact your local Siemens office for additional information.

3.4 Cooling-medium temperature and installation altitude

The motors have temperature Class F.
They are utilized according to temperature Class F.

Standard versions of the motors can be used in ambient temperatures between –20 °C and +40 °C.

The specified rated powers apply for continuous operation according to DIN EN 60034–1 for a cooling-medium temperature of 40 °C and installation altitudes up to 1000 m above sea level.

If this degree of utilization is to be maintained, then for deviating secondary conditions, the permissible power must be reduced corresponding to Table 3-2.

Cooling-medium temperature and installation altitude are rounded-off to 5 °C or 500 m.

Table 3-2 Power de-rating as a function of the installation altitude and the cooling-medium temperature

Installation altitude above sea level [m]	**Cooling-medium temperature in °C**					
	< 30	**30 – 40**	**45**	**50**	**55**	**60**
1000	1.07	1.00	0.96	0.92	0.87	0.82
1500	1.04	0.97	0.93	0.89	0.84	0.79
2000	1.00	0.94	0.90	0.86	0.82	0.77
2500	0.96	0.90	0.86	0.83	0.78	0.74
3000	0.92	0.86	0.82	0.79	0.75	0.70
3500	0.88	0.82	0.79	0.75	0.71	0.67
4000	0.82	0.77	0.74	0.71	0.67	0.63

3.5 Types of construction

For all motors with the shaft end pointing upwards, water must be prevented from entering the motor along the shaft. For types of construction with the shaft end pointing downwards, we recommend the version “with protective cover”.

Types of construction (acc. to EN 60034–7)

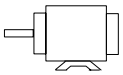
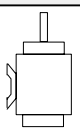
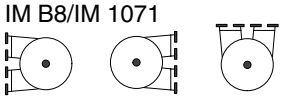
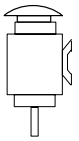
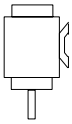
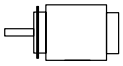
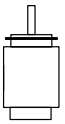
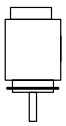
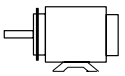
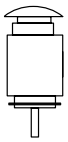
Type of construction Frame size 71M - 160L	Code 12th position	Code	Type of construction Frame size 71M - 160L	Code 12th position	Code
without flange					
 IM B3	0	–	 IM V6/IM 1031	0 9	– M1E
IM B6/IM 1051 IM B7/IM 1061 IM B8/IM 1071 	0	–	 IM V5/IM1011 with protective cover	0 9 [1]	– M1F
 IM V5/IM1011 without protective cover	0 9	– M1D			
with flange					
 IM B5/IM 3001	1	–	 IM V3/IM 3031	1	– M1G
 IM V1/IM 3011 without protective cover	1	– –	 IM B35/IM 2001	6	–
 IM V1/IM 3011 with protective cover	4 [1]	–			

Fig. 3-1 Types of construction, without/with flange

In DIN EN 50 347, the flanges are assigned to the frame sizes as FF with through holes. A-flanges acc. to DIN 42 948 are still valid.

1) A second K16 shaft end is not possible

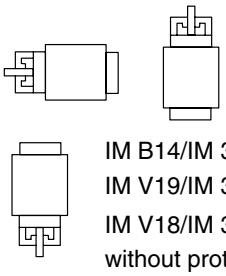
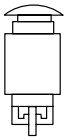
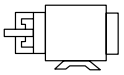
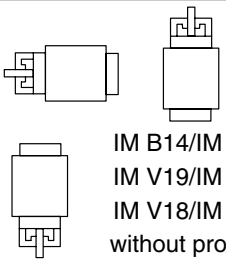
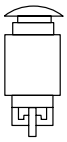
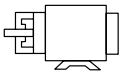
Type of construction Frame size 71M - 160L	Code 12th position	Code	Type of construction Frame size 71M - 160L	Code 12th position	Code
with standard flange					
 IM B14/IM 3601 IM V19/IM 3631 IM V18/IM 3611 without protective cover	2	–	 IM V18/IM 3611 with protective cover	9 [1]	M2A
			 IM B34/IM 2101	7	–
with special flange					
 IM B14/IM 3601 IM V19/IM 3631 IM V18/IM 3611 without protective cover	3	–	 IM V18/IM 3611 with protective cover	9 [1]	M2B
			 IM B34/IM 2101	9	M2C

Fig. 3-2 Types of construction, with standard flange, with special flange

In DIN EN 50 347, standard flanges are assigned to the frame sizes as FT with tapped holes. C flanges acc. to DIN 42948 are still valid. In the previous DIN 42677, the special flange was assigned as larger flange.

The dimensions of the following types of construction are the same:
IM B3, IM B6, IM B7, IM B8, IM V5 and IM V6.
IM B5, IM V1 and IM V3.
IM B14, IM V18 and IM V19.

The motors can be ordered in the basic types of construction IM B3, IM B5 and IM B14. These motors can be operated in the following mounting positions – IM B6, IM B7, IM B8, IM V5, IM V6, IM V1, IM V3 (up to frame size 160 L) or IM V18 and IM V19. Hoisting lugs are provided so that the motors can be transported and installed in the horizontal position. When motors are being mounted vertically, additional hoisting straps (DIN EN 1492–1) and/or belts (DIN EN 12195–2) should be used together with the hoisting lugs. This helps to stabilize the position of the motor. When motors are ordered for mounting position IM V1, then hoisting lugs are provided for vertical mounting. This is the reason that they are normally stamped on the rating plate only for the basic type of construction.

1) A second K16 shaft end is not possible

3.6 Shaft ends

Table 3-3 Shaft ends

Drive shaft end Diameter [mm]	Thread [mm]
7 to 10	DR M3
above 10 to 13	DR M4
above 13 to 16	DR M5
above 16 to 21	DR M6
above 21 to 24	DR M8
above 24 to 30	DR M10
above 30 to 38	DR M12
above 38 to 50	DR M16
above 50 to 85	DR M20
above 85 to 130	DR M24

Centering holes 60° acc. to DIN 332/Part 2.

Second standard shaft end, code **K16**.

Up to frame size 160 L, for coupling out-drives, the second shaft end can transmit full the rated power.

The full rated power is not applicable for 1FU8 motors, frame sizes 90 L to 132 M. In this case, only the rated power of the next smaller frame size can be transmitted.

Please inquire for the maximum power which can be transmitted and the permissible cantilever force for belts, chains or toothed-wheel (gearwheel) out-drive for the second shaft end.

A second shaft end cannot be provided if a separately-driven fan has been mounted to the motor. Please inquire for mounted brakes.

Dimensions and tolerances for keyways and keys are in compliance with DIN EN 50347. The motors are always supplied with a key inserted in the shaft.

3.7 Vibration severity, balancing, balance quality, radial eccentricity

Vibration severity grades acc. to IEC 60 034–14

The vibration severity is the RMS value of the vibration velocity (frequency range from 10 to 1000 Hz). The vibration severity is measured using electrical instruments in compliance with DIN 45 666.

The specified values apply for the motor, measured when freely suspended alone. These values can be increased due to the overall system vibrational behavior when the motor is mounted.

Speeds of 1800 RPM and 3600 RPM and the associated limit values are defined according to IEC 60 034–14. Speeds of 4500 RPM and 6000 RPM and the specified values are defined by the motor manufacturer.

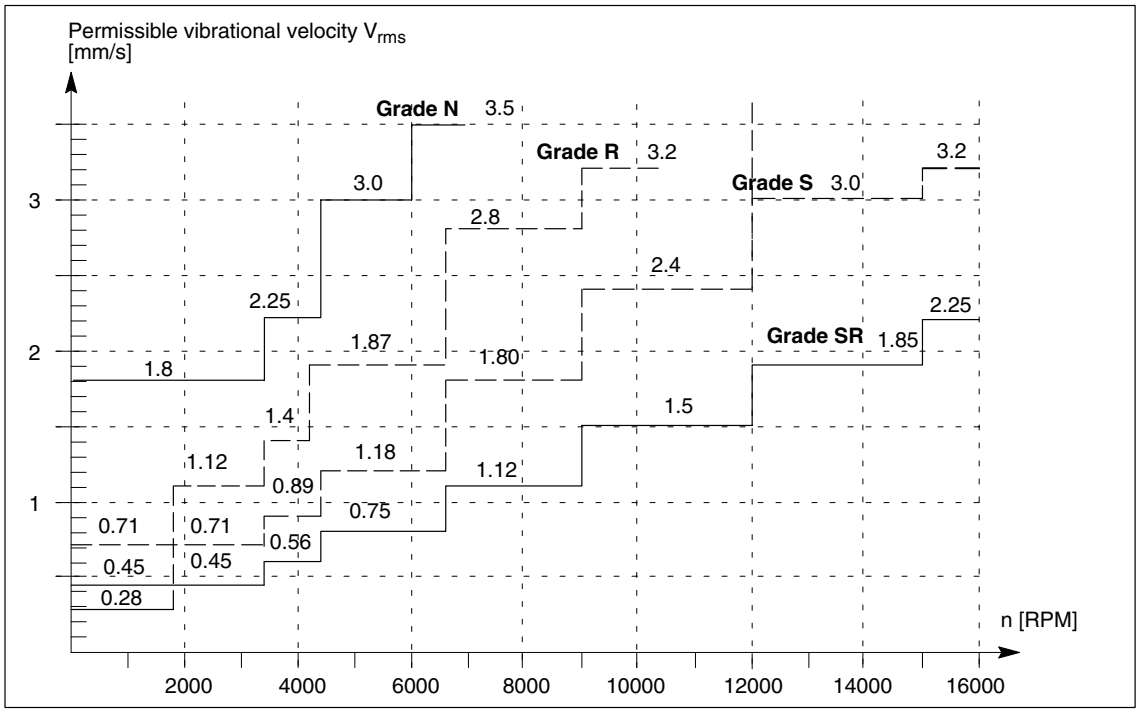


Fig. 3-3 Vibration severity grades - limit values for frame sizes 71 to 132

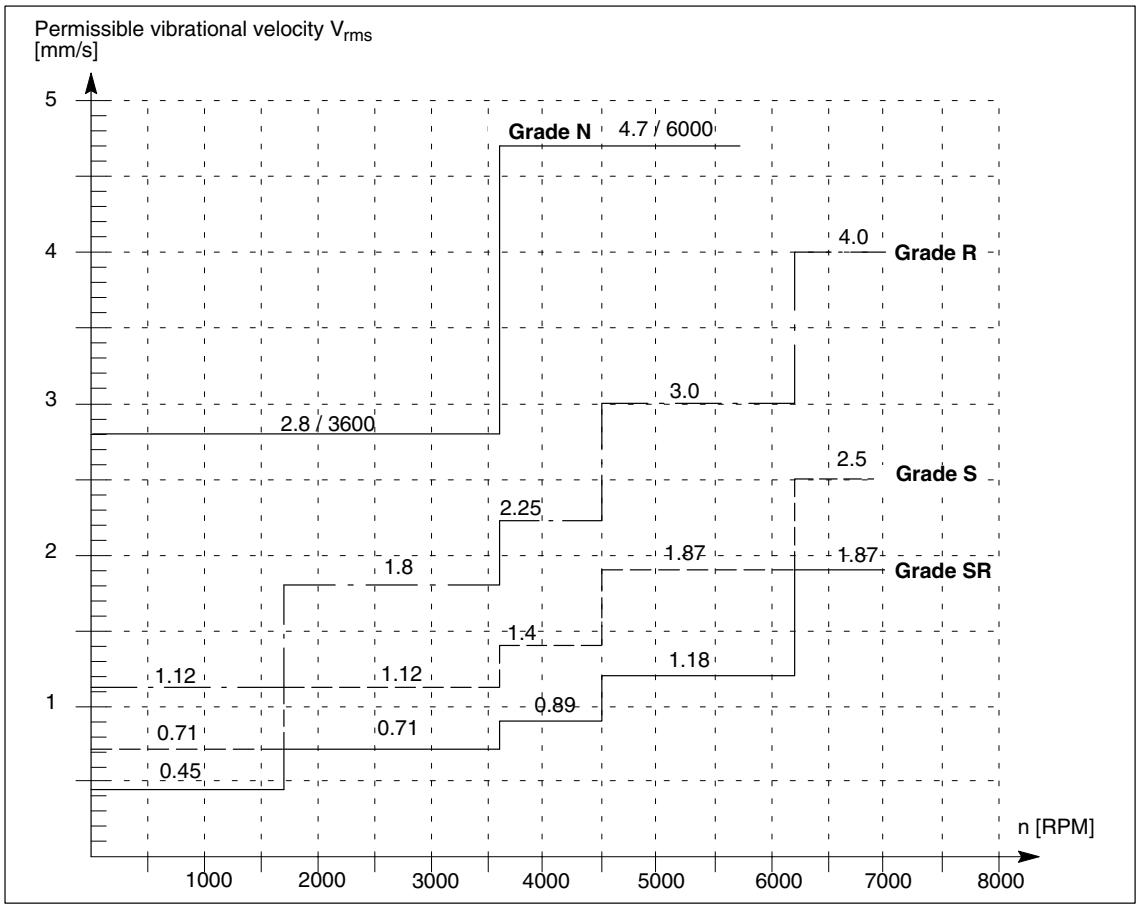


Fig. 3-4 Vibration severity grades – limit values for frame size 160

Balancing and vibration severity

All of the rotors are dynamically balanced with half key. This corresponds to vibration severity grade N (normal). The vibrational characteristics and behavior of electrical machinery is specified in DIN EN 60 034–14. Based on DIN ISO 8821, “half key balancing” is specified.

It must be noted that the measured values can deviate by ± 10 % from the actual values.

The balancing type is stamped on the face of the drive shaft end.

F = balancing with full key
H = balancing with half key
N = balancing without key

For 1FU8 motors, the balancing type is stamped on the rating plate. Full key balancing is possible, on request, by specifying code **L68**.

Special requirements placed on the mechanical smooth running properties:
Vibration severity grade R Code **K01**
Vibration severity grade S Code **K02**

For vibration severity grade SR, please contact your local Siemens office.

Radial eccentricity tolerance, shaft and flange accuracy (concentricity and axial eccentricity) acc. to IEC 60072

Table 3-4 Radial eccentricity tolerance of the shaft to the frame axis (referred to cylindrical shaft ends)

Diameter of the cylindrical shaft end	**Radial eccentricity tolerance**	
	Standard	**Option**
d	**N (normal)**	**R (reduced)**
up to 10	0.03	0.015
above 10 to 18	0.035	0.018
above 18 to 30	0.04	0.021
above 30 to 50	0.05	0.025

Table 3-5 Concentricity and axial eccentricity tolerance of the flange surface with respect to the shaft axis (refer to the centering diameter of the mounting flange)

Mounting flange centering diameter b1	Concentricity and axial eccentricity tolerance	
	Standard N (normal)	Option R (reduced)
up to 22	0.05	0.025
above 22 to < 40	0.06	0.03
40 to 100	0.08	0.04
above 100 to 230	0.1	0.05
above 230 to 450	0.125	0.063

Reduced radial eccentricity 0.025 mm Code **K04**
Reduced radial eccentricity 0.01 mm for tapered shaft ends on request

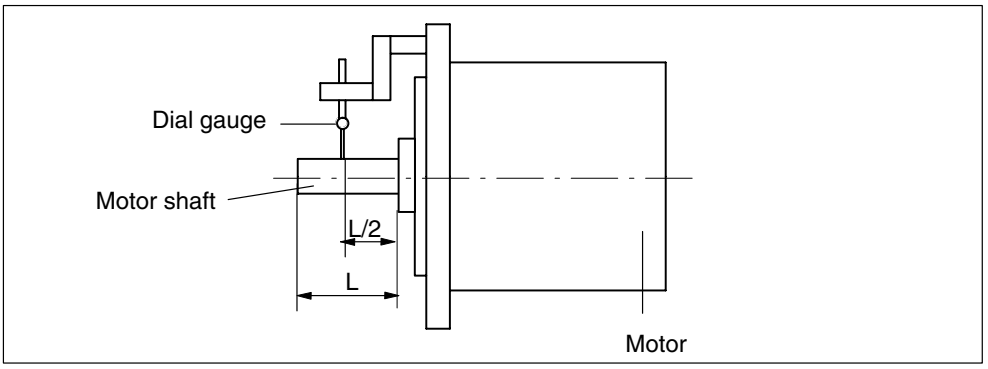


Fig. 3-5 Radial eccentricity test

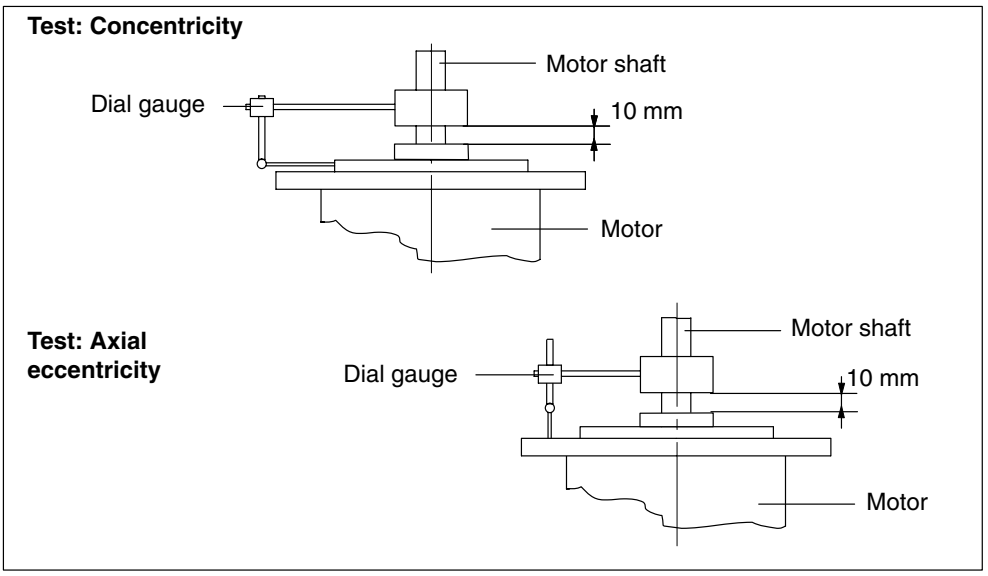


Fig. 3-6 Test, concentricity and axial eccentricity

3.8 Noise

Noise is measured in a room with low reflection characteristics according to DIN EN 21 680–1 – however, at rated power. The noise level is specified as A-weighted measuring surface sound pressure level L_{pfA} 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 power level is also specified as L_{WA} in dB (A).

The specified values apply for 50 Hz operation. The tolerance is +3 dB.

The fan noise increases at speeds that are higher than the rated speed of self-ventilated motors.

Table 3-6 Sound power level

A-weighted measuring surface sound pressure level and sound power level at the rated power **Normal version**						
Frame size	Measuring surface sound pressure level (L_{pfA}) Sound power level (L_{WA})					
	2-pole		4-pole		6-pole	
	L_{pfA} dB (A)	L_{WA} dB (A)	L_{pfA} dB (A)	L_{WA} dB (A)	L_{pfA} dB (A)	L_{WA} dB (A)
71	–	–	62	73	–	–
80	60	71	63	74	–	–
90	–	–	60	71	–	–
112	62	74	62	73	–	–
132	–	–	–	–	63	75
160	–	–	–	–	62	74

3.9 Bearing system

3.9.1 Bearing lifetime (nominal lifetime)

The nominal bearing lifetime is defined acc. to standardized calculation procedures (DIN ISO 281) and, for 90 % of the bearings is reached or even exceeded when the motors are operated in the compliance with the data provided in the Catalog.

For average operating conditions, a lifetime (L_{10h}) of 100000 hours can be achieved.

The bearing lifetime depends on:

- bearing size
- bearing load
- operating conditions
- speed
- grease lifetime [1)]

For horizontally mounted motors, the bearing lifetime for a coupling out-drive without any additional axial load is 40,000 hours and when utilized according to the maximum permissible load, 20,000 hours.

This assumes that the motor is operated at 50 Hz. The nominal bearing lifetime is reduced when the motor is fed from a drive converter at higher frequencies.

1) More detailed information on request.

3.9.2 Bearing design

In the basic bearing system, the floating bearing is located at the drive end and the locating bearing (axially retained from frame 160 and above) at the non-drive end NDE (refer to Fig. 3-7).

1FU8 motors have, including frame size 132, a floating bearing system.

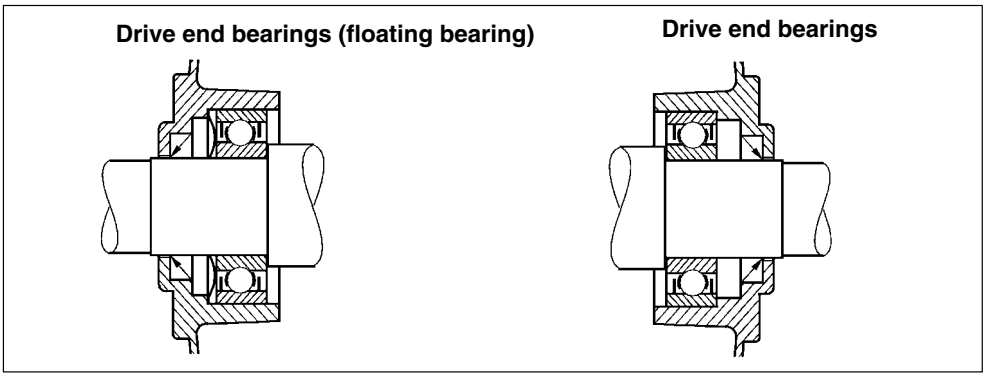


Fig. 3-7 Basic version for shaft heights 71 to 132

For frame size 160, for the basic bearing version, the bearings are axially retained at the non-drive end NDE – refer to Fig. 3-8.

On request, the locating bearing can also be supplied at the drive end DE – refer to Fig. 3-7, Code **K94**.

On request, for frame sizes 71 to 132, an additional axially retained bearing with security ring can be provided at the non-drive end, Code **L04**, refer to Fig. 3-8.

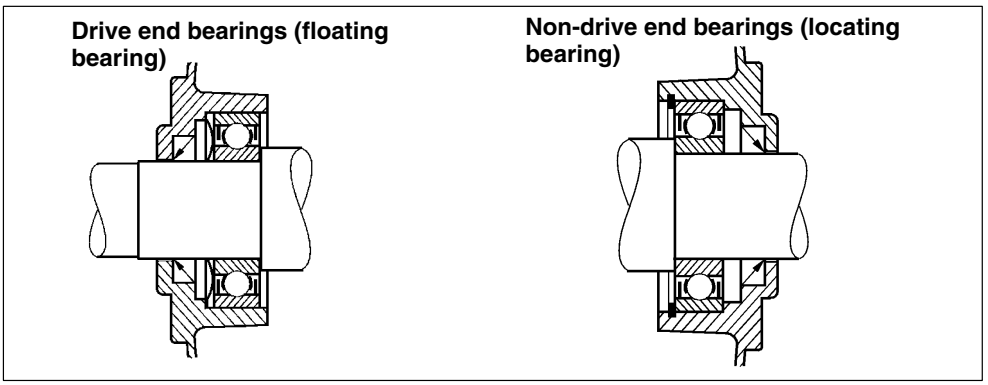


Fig. 3-8 Basic version for shaft height 160, locating bearing at the non-drive end NDE

On request, the locating bearing can be provided at the drive end, Code **K94**, refer to Fig. 3-9.

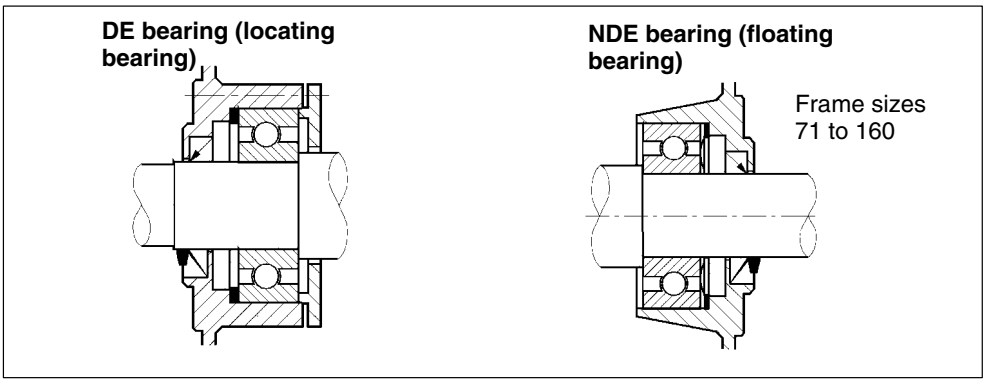


Fig. 3-9 Locating bearing at DE and floating bearing at NDE

For increased cantilever forces (e.g. belt drives), reinforced bearings can be used at the drive end DE, Code **K20**.

3.9.3 Permanent lubrication

For permanent lubrication, the bearing grease lifetime is harmonized with the bearing lifetime.

In the basic version, the motors up to and including shaft height 160 have permanent lubrication.

3.9.4 Re-greasing

For motors which can be re-greased at defined re-greasing intervals, the bearing lifetime can be extended and/or unfavorable factors such as temperature, mounting conditions, speed, bearing size and mechanical load can be compensated.

It is possible to re-grease motors, shaft heights 112 to 160. A lubricating nipple is optionally provided, Code **K40**.

Table 3-7 Lubrication type

Type of lubrication	Frame size	Pole number	Grease lifetime up to KT 40 [2)]
Permanent lubrication	71 to 160	2	20000 h
		4 to 8	40000 h Re-lubrication interval

2) When the temperature is increased by 10 K, the grease lifetime is reduced by half

Bearing assignment

Table 3-8 Bearing assignment for 1FU8 motors, basic version

Frame size	Motor type	Pole number	DE bearings horizontal and vertical types of construction	NDE bearings horizontal and vertical types of construction
71	1FU807 .	all	6202 2ZC3	6202 2ZC3
80	1FU808 .	all	6004 2ZC3[2)]	6004 2ZC3[2)]
90	1FU809 .	all	6205 2ZC3	6004 2ZC3
112	1FU8113	all	6206 2ZC3[1)2)]	6205 2ZC3[1)2)]
132	1FU813 .	all	6208 2ZC3[1)]	6208 2ZC3[1)]
160	1FU816 .	all	6209 2ZC3[1)]	6209 2ZC3[1)]

1) When motors are equipped with a re-greasing device K40, then open as well as bearings with Z disks are used.
2) For speeds greater than 9000 [RPM] for shaft height 80 and higher than 6000 [RPM] for shaft height 112, open bearings without Z disks are used. A special grease is used.

The bearing arrangement is only used when engineering drives.

Binding statements about the bearings for motors which have already been shipped can be requested. Please specify the serial number. The bearing sizes are stamped on the rating plate. For 1FU8 motors, for Z-bearing designs, the cover plate for the inner locating bearing is on the inside. The locating bearing is at the DE for 1FU8 motors; refer to the special version, Fig. 3-9.

3.10 Brakes

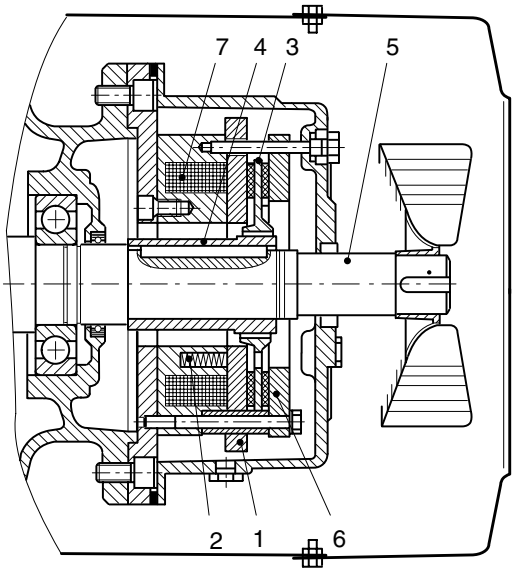
Spring-operated disk brake 2LM8

Spring-operated disk brakes are used. The 2LM8 spring-operated disk brake is used as standard for 1FU8 motors. In the standard version, the brakes are operated at 230 V together with rectifier and micro-switch, Code **G26**.

Design and mode of operation

Single-disk brakes with two braking surfaces are used. When the brake is de-energized, a braking torque is generated using one of several springs. The brake is electro-magnetically released.

When braking, the rotor which can axially move on the hub or shaft, is pressed against the mating frictional surface by springs which apply the force through the armature disk. When the brake is actuated, there is an air gap $S_{Lü}$ between the armature disk and the solenoid assembly. A DC voltage is applied to the solenoid coil to release the brake. The magnetic force generated attracts the armature disk to the solenoid against the spring force. This means that the rotor can then freely rotate. Also refer to Fig. 3-10.



1 Armature disk
2 Springs
3 Rotor which can axially move
4 Hub
5 Shaft
6 Mating frictional surface
7 Solenoid

Fig. 3-10 Brake design

Voltage and frequency

The solenoid coil and the brake rectifier can be connected to the following voltages:

1 230 V AC 50 Hz ±10 % or
1 230 V AC 60 Hz ±10 %.

When 60 Hz is used, it is not permissible that the brake voltage is increased!

The brake can also be supplied for other voltages.

Brake supply voltage:
24 V DC Code **C00**
2–ph. 400 V AC Code **C01**

The codes **C00** and **C01** may only be used in conjunction with Code **G26**. Refer to Fig. 3-11.

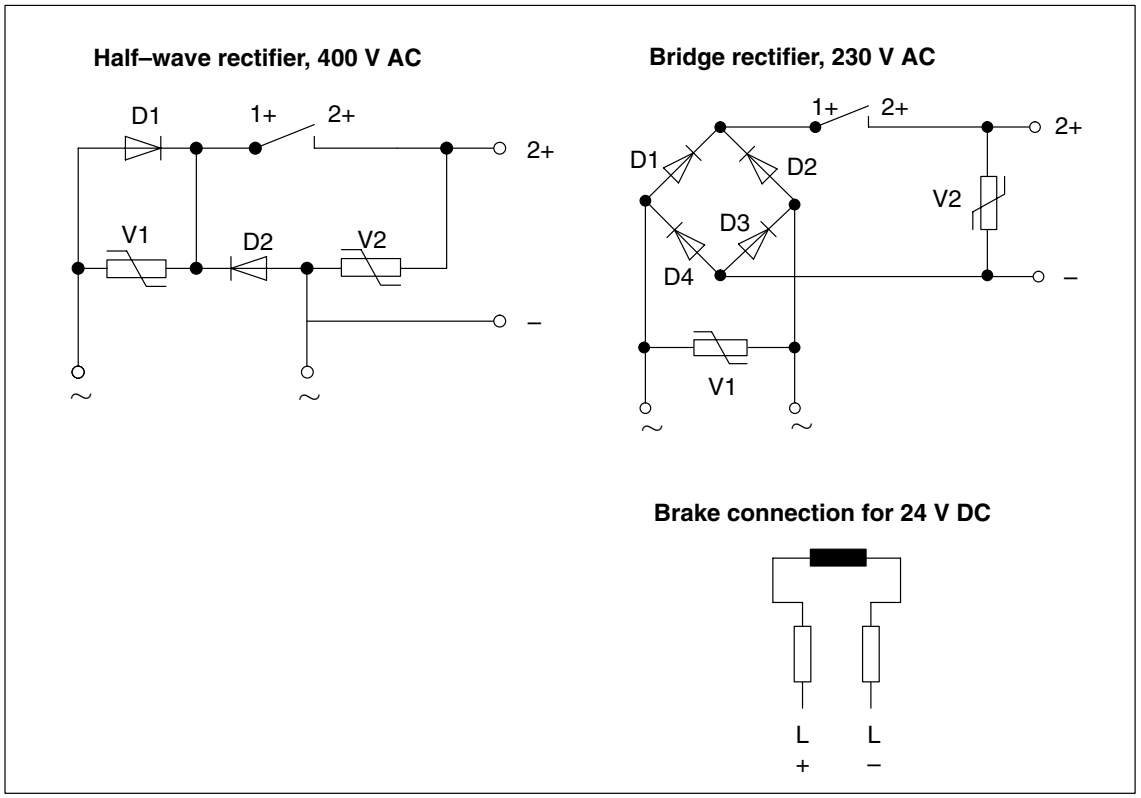


Fig. 3-11 Rectifier and brake connection

Rating plate

The motors have a second rating plate on the opposite side to the motor rating plate. The brake data is stamped on this second rating plate.

The 2LM8 brake has degree of protection IP54 or IP55.

Please inquire if motors with brakes are to be operated under the freezing point or in very humid environments (e.g. at or close to the sea) with long standstill times.

Connection

Labeled terminals are provided in the motor terminal box to connect the brake.

The AC voltage for the brake excitation winding is connected to the two free terminals of the rectifier block (~).

The brake can be released when the motor is at a standstill be separately exciting the solenoid. In this case, an AC voltage must be connected at the rectifier block terminals. The brake remains released as long as this voltage is present.

The rectifier is protected against overvoltages by varistors in the input and output circuits.

For 24 V DC brakes, the brake terminals are directly connected to the DC voltage source.

Fast brake application

If the brake is disconnected from the line supply, then the brake is applied. The application time for the brake disk is delayed as a result of the inductance of the solenoid coil (shutdown on the AC side). This results in a considerable delay before the brake is mechanically applied. In order to achieve short brake application times, then the circuit must be interrupted on the DC side. To realize this, the wire jumpers, located between contacts 1+ and 2+ at the rectifier are removed and replaced by the contact of an external switch – refer to Fig. 3-11.

Mechanical brake release

The brakes can be supplied with a mechanical manual release with lever, Code **K82**.

When a brake is mounted to the motor, the motor length increases by the dimension $\triangle$ l. Refer to Fig. 3-12 for the dimensions.

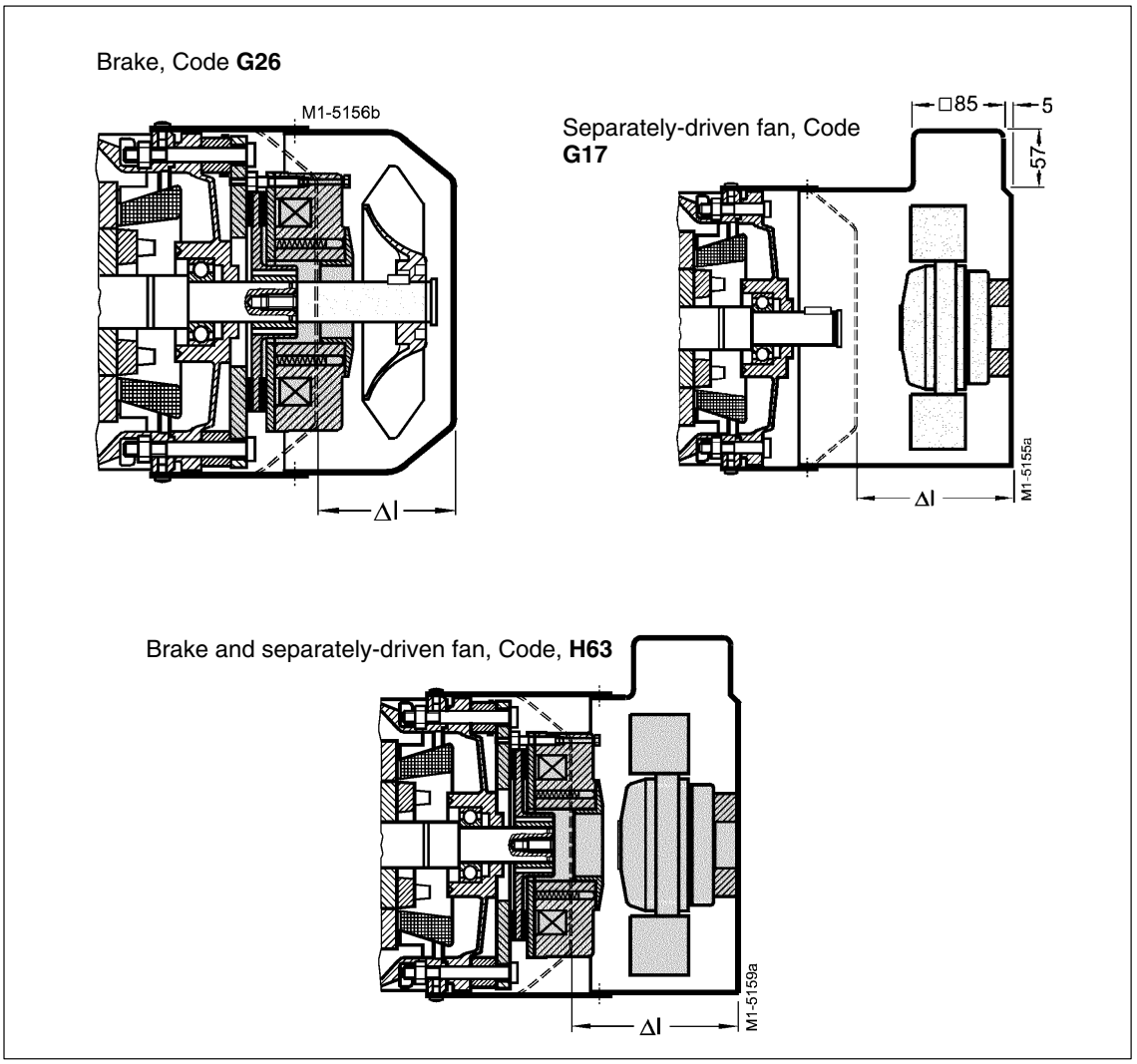


Fig. 3-12 Dimensions for Δ l (also refer to Table 3-9)

Table 3-9 Dimensions and weights

Frame size	1FU8	Separately-driven fan (G17)	Brake and separately-driven fan (H63)	Additional weight, separately-driven fan (G17)	Additional weight, brake and separately-driven fan (H63)	Brake (G26)	Additional weight, brake (G26)	Diameter of the cowl
		Δ l [mm]	Δ l [mm]	approx. [kg]	approx. [kg]	Δ l [mm]	approx. [kg]	[mm]
71	073, 076	90	90	2	3	51	1	–
80	080, 083, 086	102	102	2.5	4.5	54	2	–
90	096, 098	124	124	3	7	75	4	–
112	113	137	137	4.5	12.5	87	8	227
132	134	155	155	5.5	17.5	106	12	226
160	167	200	200	7.0	33	129	26	320

Table 3-10 Operating values for spring-operated brakes with standard excitation

Operating values for spring-operated brakes with standard excitation													**Working-capacity of the brake**	
For motor frame-size	Brake type	Rated braking torque at 100 [RPM]	Rated braking torque- with reference to the rated braking - torque at 100 [RPM] as a % for the following speeds			Voltage	Current/ power-drain [1]		Applica-tion time t_2 of the brake[2]	Brake release time	Moment of inertia of the brake	Switch-ing-noise L_p for the nomi-nal-air-gap	Lifetime of the brake-disk surface L	The air gap must be adjusted after braking work L_N
			1500 [RPM]	3000 [RPM]	Max. speed									
		Nm	%	%	%	V	O	W	ms	ms	kg m^2	dB (A)	Nm·10^6	Nm·10^6
71	2LM8 005-2NA10 2LM8 005-2NA60 2LM8 005-2NA80	5	87	80	65	AC 230 AC 400 DC 24	0.1 0.11 0.83	20	25	56	0.000013	77	105	16
80	2LM8 010-3NA10 2LM8 010-3NA60 2LM8 010-3NA80	10	85	78	65	AC 230 AC 400 DC 24	0.12 0.14 1.04	25	26	70	0.000045	75	270	29
90	2LM8 020-4NA10 2LM8 020-4NA60 2LM8 020-4NA80	20	83	76	66	AC 230 AC 400 DC 24	0.15 0.17 1.25	32	37	90	0.00016	75	740	79
112	2LM8 060-6NA10 2LM8 060-6NA60 2LM8 060-6NA80	60	80	73	65	AC 230 AC 400 DC 24	0.25 0.28 2.1	53	60	210	0.00063	77	1600	215
132	2LM8 100-7NA10 2LM8 100-7NA60 2LM8 100-7NA80	100	79	72	65	AC 230 AC 400 DC 24	0.27 0.31 2.3	55	50	270	0.0015	77	2450	325
160	2LM8 260-8NA10 2LM8 260-8NA60 2LM8 260-8NA80	260	75	68	65	AC 230 AC 400 DC 24	0.5 0.47 4.2	100	165	340	0.0073	79	7300	935

1) For 400 V AC for and 24 V DC, the power can deviate by up to +10 % as a function of the selected supply voltage.

2) The switching times listed are valid when switching on the DC side with the nominal release distance and with the solenoid coil in a warm condition. These are average values. They have a spread which is also dependent on the rectifier type and the release distance. When switched on the AC side, the brake application time is approximately 600% of the brake application time when switched on the DC side.

Lifetime of the brake disk surface

The braking work L_N up to when the brake should be adjusted, depends on various factors. The main influencing factors include the masses to be braked, the operating speed, the switching frequency and therefore the temperature at the frictional surfaces. This means that it is not possible to specify the frictional work under all operating conditions until the brake should be adjusted.

When used as operating brake, the specific frictional surface wear (wear volume for the frictional work) is approximately 0.05 up to 2 cm^3/kWh.

Maximum permissible speeds

The maximum permissible speeds from which Emergency Stops can be made, are listed in Table 3-11. These speeds should be considered as nominal values and must be checked under the specific conditions.

The maximum permissible frictional work depends on the switching frequency and, for the individual brakes, should be taken from the diagram – refer to Fig. 3-13. Increased wear can be expected when the brakes are used for Emergency Stops.

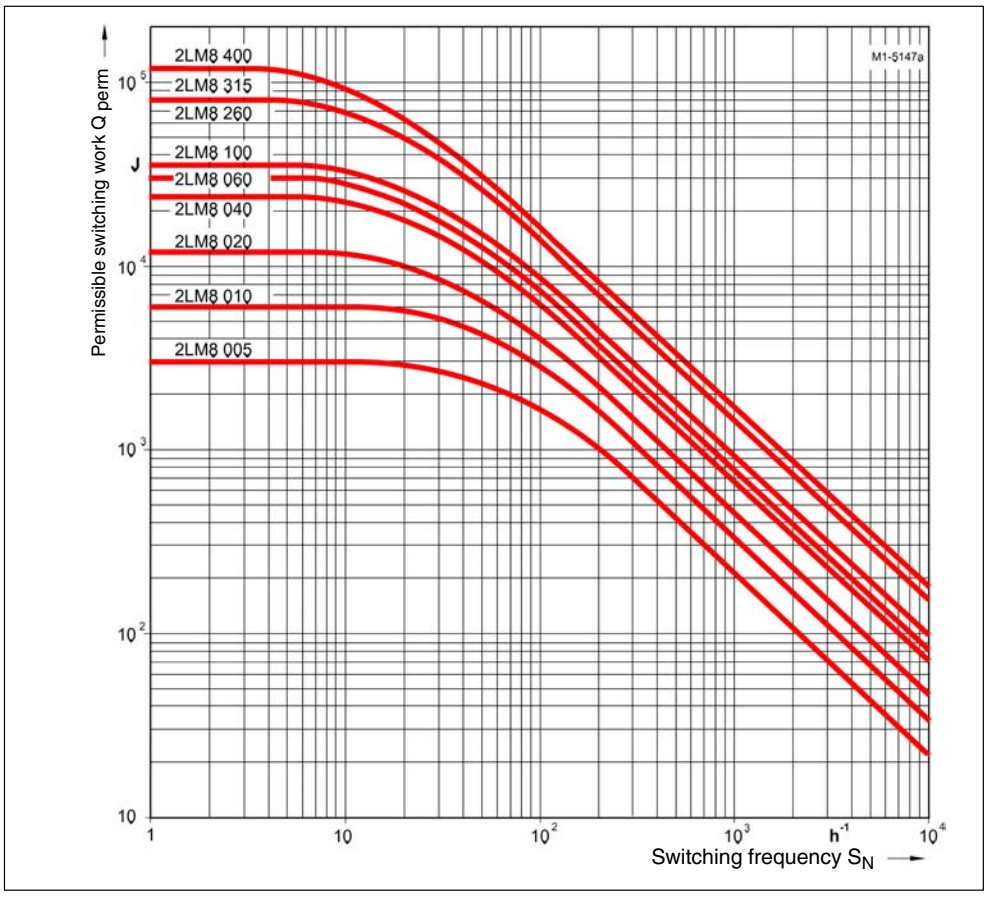


Fig. 3-13 Permissible switching work as a function of the switching frequency

Change in the braking torque

The brake is supplied with the selected rated braking torque as listed in Table 3-10. For 2LM8 brakes, the torque can be reduced by screwing-out the setting ring using an appropriate tool until max. dimensions O_1 (refer to Fig. 3-14).

For each setting ring notch, the braking torque changes as listed in the Table 3-11.

Table 3-11 Maximum permissible speeds for Emergency Stops and when changing the the braking torque

		Maximum permissible speeds			**Changing the braking torque**			**Adjusting the air gap**		
For motor frame size	Brake type	Max. perm. operating speed when-utilizing the max. permissible switching-work	Maximum permissible no-load speed with Emergency Stop function for horizontal mounting	for vertical mounting	Reduc-tion per notch	Di-men-sions "O_1"	Min. braking torque	Nominal air gap $S_{LüNomi-nal}$	Maxi-mum air gap $S_{Lümax.}$	Mini-mum rotor thick-ness $h_{min.}$
		[RPM]	[RPM]	[RPM]	[Nm]	[mm]	[Nm]	[mm]	[mm]	[mm]
71	2LM8 005-2NA ..	3000	6000	6000	0.17	7.0	3.7	0.2	0.4	4.5
80	2LM8 010-3NA ..	3000	6000	6000	0.35	8.0	7.0	0.2	0.45	5.5
90	2LM8 020-4NA ..	3000	6000	6000	0.76	7.5	18.2	0.2	0.55	7.5
112	2LM8 060-6NA ..	3000	6000	6000	1.66	11.0	32.8	0.3	0.75	7.5
132	2LM8 100-7NA ..	3000	5300	5000	1.55	13.0	61.1	0.3	0.75	8.0
160	2LM8 260-8NA ..	1500	4400	3200	5.6	17.0	157.5	0.4	1.2	12.0

Adjusting the air gap

For normal applications, the brake is practically maintenance-free. The air gap $S_{Lü}$ must only be checked at specific time intervals when an extremely high frictional work is involved. In this case, at the latest when the max. air gap $S_{Lü\ max}$ is reached, the nominal air gap $S_{Lü\ nominal}$ must be re-established – refer to Fig. 3-14.

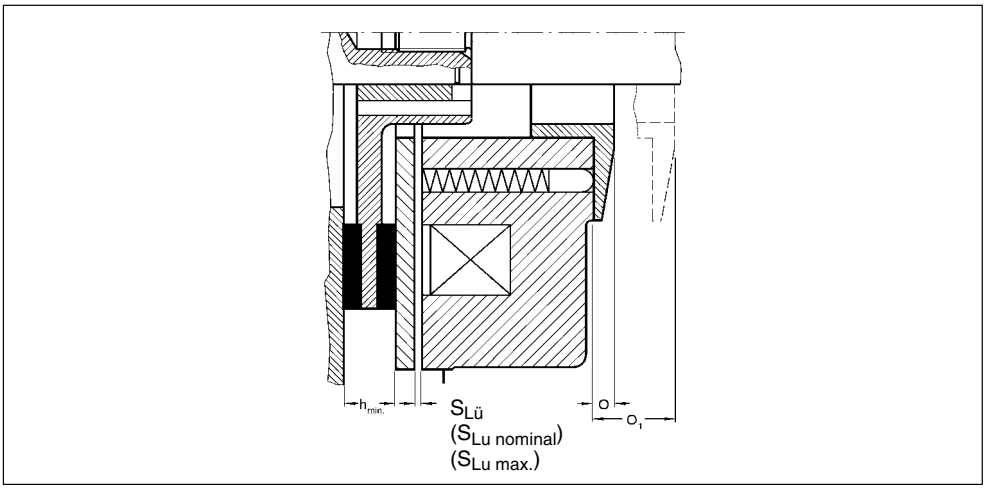


Fig. 3-14 Adjusting the air gap

Engineering motors with brakes

Braking time

The time until a motor comes to a complete standstill comprises 2 times:

- Brake application time t_2
- Braking time t_{Br}

$$t_{Br} = \frac{J \bullet n_N}{9.55 \bullet (M_B \pm M_L)}$$

t_{Br} Braking time in [s]

J Total moment of inertia [kgm^2]

n_N Rated speed of the motor with brake in [RPM]

M_B Rated braking torque [Nm]

M_L average load torque in [Nm]
(if M_L supports braking then M_L is positive)

Run-on revolutions U

The number of run-on revolution U of the motor with brake can be calculated as follows:

$$U = \frac{n_N}{60} \bullet \left(t_2 \bullet \frac{t_{er}}{2} \right)$$

t_2 Brake application time in [ms]

Braking work per braking operation Q_{perm}

The braking work per braking operation in Nm comprises the energy of the moments of inertia to be braked Q_{Kin} and the work Q_L, which must be applied in order to brake against a load torque.

$$Q_{perm} = Q_{Kin} + Q_L$$

- Energy of the moments of inertia in Nm

$$Q_{Kin} = \frac{J \bullet n_N^2}{182.4}$$

n_N Rated speed before braking in [RPM]
J Total moment of inertia kg m^2

- Braking energy in Nm against a load torque:

$$Q_L = \frac{M_L \bullet n_N \bullet t_{Br}}{19.1}$$

M_L average load torque in [Nm]

M_L is positive if it acts against the brake
M_L is negative if it supports the brake

Lifetime of the brake disk surface L and adjusting the air gap

The brake disk surface wears due to friction. This means that the air gap increases and for standard excitation, the brake release time is extended. The braking torque remains approximately constant over the complete lifetime of the brake disk.

The brake disk can be simply replaced.

In order to obtain the lifetime of the brake disk as switching operations S_{max}, then the lifetime of the brake disk L in [Nm] must be divided by the braking work Q_{perm}:

$$S_{max} = \frac{L}{Q_{perm}}$$

The interval between adjustments N in switching operations can be calculated by dividing the braking work L_N, which the brake can perform until it is necessary to adjust the working air gap by Q_{perm}:

$$N = \frac{L_N}{Q_{perm}}$$

3.11 Measures required when mounting gearboxes

The flange-type motors can be equipped with a radial sealing ring in order to mount a gearbox, code **K17.**

It must be guaranteed that the sealing ring is lubricated using grease, oil mist or oil spray. It is not permissible to use pressurized oil.

The shaft is hardened and ground in the area around the radial shaft sealing ring. It is not possible to retrofit a radial shaft sealing ring.

We recommend that the permissible bearing loads are carefully checked.

3.12 Paint finish

Table 3-12 Paint finish

Version	Suitability of the paint finish for climatic group acc. to DIN IEC 60 721, Part 2 – 1		
Special paint finish	**Worldwide** (global) for outdoor mounting Suitable for the tropics for max. 60 % relative air humidity at 40 °C	briefly: continuous: additionally:	To 140 °C To 120 °C If there is an aggressive atmosphere up to 1 % acid- and alkaline-concentration or in protected rooms, continuous moisture

1FU8 motors have, as standard, the “worldwide” special paint finish.

All of the motors can be painted using commercially available paints.

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

■

Technical Data and Cantilever Forces

4

4.1 Technical data

The motor power ratings for 50 Hz and f_{max} are specified in the tables (M = const. in the frequency range).

When ordering options, for every version required, a specific code must be specified (if required, in plain text). It is not permissible to repeat codes in plain text.

Order No.: 1FU8 □□□ – □T□□□ – Z
Code(s) □□□ + □□□ + □□□

The following tables listing the technical data are structured as follows:

2-pole, 20 Hz up to f_{max}, max. speed, 3000 to 15000 [RPM] refer to Table 4-1

4-pole, 20 Hz up to f_{max}, max. speed, 1500 to 6000 [RPM] refer to Table 4-2

4-pole, 13.3 Hz up to f_{max}, max. speed, 1500 to 6000 [RPM] refer to Table 4-3

6-pole, 20 Hz up to f_{max}, max. speed, 1000 to 4000 [RPM] refer to Table 4-4

1FU8-motors, 2-pole, 50 Hz, max. speed 3000 to 15000 [RPM]

Table 4-1 Technical data

M=const. for 20 Hz up to f_{max}	**50 Hz values**			**Values at the max. frequency**						
M_N [Nm]	P_N [kW]	I_N [A]	I_1 [A]	P_N [kW]	I_N [A]	I_1 [A]	Order-No.	$J_{intrinsic}$ [kgm^2]	J_{ext} [kgm^2]	Weight [1] [kg]
Max. frequency, 50 Hz at V_N=400 V / 50 Hz, max. speed, 3000 [RPM]										
1.3	0.41	2.0	7.3	–	–	–	1FU8080–2TA8□	0.00068	0.023	9
2.2	0.7	2.9	11.8	–	–	–	1FU8083–2TA8□	0.00088	0.035	11
2.9	0.9	3.8	17.5	–	–	–	1FU8086–2TA8□	0.00113	0.045	12
7.3	2.3	6.8	43	–	–	–	1FU8113–2TA8□	0.00526	0.3	29
Max. frequency, 100 Hz at V_N=200 V / 50 Hz, max. speed, 6000 [RPM]										
1.3	0.41	4.1	14.6	0.82	4.2	21.7	1FU8080–2TA6□	0.00068	0.023	9
2.2	0.7	5.8	23.5	1.4	6.0	34.6	1FU8083–2TA6□	0.00088	0.035	11
2.9	0.9	7.2	33	1.8	7.5	48	1FU8086–2TA6□	0.00113	0.045	12
7.3	2.3	13.5	85	4.6	14.1	130	1FU8113–2TA6□	0.00526	0.25	29
Max. frequency, 160 Hz at V_N=125 V / 50 Hz, max. speed, 9600 [RPM]										
1.3	0.41	5.5	18.8	1.31	5.8	33	1FU8080–2TA3□	0.00068	0.023	12
2.2	0.7	8.5	30.6	2.24	9.1	52.4	1FU8083–2TA3□	0.00088	0.035	14
2.9	0.9	13	58	2.92	13.5	100	1FU8086–2TA3□	0.00113	0.045	15
7.3	2.3	22	140	7.3	24.5	240	1FU8113–2TA3□	0.00526	0.2	35
Max. frequency, 200 Hz at V_N=100 V / 50 Hz, max. speed, 12000 [RPM]										
1.3	0.41	7.9	29.2	1.63	9.0	55.3	1FU8080–2TA2□	0.00068	0.02	12
2.2	0.7	10.2	40.5	2.8	11.2	74	1FU8083–2TA2□	0.00088	0.03	14
2.7	0.85	14.2	66.3	3.5	15.2	121	1FU8086–2TA2□	0.00113	0.04	15
6.5	2.04	21	130	8.2	22	225	1FU8113–2TA2□	0.00526	0.2	35
Max. frequency, 250 Hz at V_N=80 V / 50 Hz, max. speed, 15000 [RPM]										
1.3	0.41	9.0	33.6	2.04	11	66.6	1FU8080–2TA1□	0.00068	0.017	12
2.2	0.7	13	44	3.46	14	83.5	1FU8083–2TA1□	0.00088	0.025	14
2.4	0.75	14.5	83	3.8	16.7	140	1FU8086–2TA1□	0.00113	0.033	15

1) Specified values refer to the IM B5 type of construction

1FU8-motors, 4-pole, 50 Hz, max. speed 1500 to 6000 [RPM]

Table 4-2 Technical data

M=const. for 20 Hz up to f_{max}	**50 Hz values**			**Values at the max. frequency**						
M_N [Nm]	P_N [kW]	I_N [A]	I_1 [A]	P_N [kW]	I_N [A]	I_1 [A]	Order-No.	$J_{intrinsic}$ [kgm^2]	J_{ext} [kgm^2]	Weight 1) [kg]
Max. frequency, 50 Hz at V_N=400 V / 50 Hz, max. speed, 1500 [RPM]										
2	0.31	0.7	2.4	–	–	–	1FU8073–4TA8□	0.00068	0.006	6
2.6	0.41	0.9	3.2	–	–	–	1FU8076–4TA8□	0.00084	0.008	7
3.5	0.55	1.2	3.9	–	–	–	1FU8080–4TA8□	0.00130	0.007	9
5	0.79	1.7	5.7	–	–	–	1FU8083–4TA8□	0.00160	0.01	10
7	1.1	2.3	9.2	–	–	–	1FU8086–4TA8□	0.00220	0.013	12
8.5	1.33	3.1	14.3	–	–	–	1FU8096–4TA8□	0.00312	0.07	16
9.7	1.52	3.2	15.8	–	–	–	1FU8098–4TA8□	0.00380	0.08	18
18	2.83	6.7	33.7	–	–	–	1FU8113–4TA8□	0.01050	0.15	31
Max. frequency, 100 Hz at V_N=200 V / 50 Hz, max. speed, 3000 [RPM]										
2	0.31	1.4	4.8	0.62	1.5	7.7	1FU8073–4TA6□	0.00068	0.012	6
2.6	0.41	1.7	6.3	0.82	1.8	9.9	1FU8076–4TA6□	0.00084	0.015	7
3.5	0.55	2.4	7.8	1.1	2.4	13	1FU8080–4TA6□	0.00130	0.015	9
5	0.79	3.4	11.4	1.57	3.3	19	1FU8083–4TA6□	0.00160	0.025	10
7	1.1	4.5	18.4	2.2	4.5	30.3	1FU8086–4TA6□	0.00220	0.03	12
8.5	1.33	6.1	28.5	2.67	6.2	42.9	1FU8096–4TA6□	0.00312	0.13	16
9.7	1.52	6.4	31.6	3.05	6.4	45.8	1FU8098–4TA6□	0.00380	0.15	18
18	2.83	13.1	66.8	5.65	13.4	95.2	1FU8113–4TA6□	0.01050	0.4	31
Max. frequency, 160 Hz at V_N=125 V / 50 Hz, max. speed, 4800 [RPM]										
2	0.31	2.2	8.2	1.0	2.5	17	1FU8073–4TA3□	0.00068	0.012	6
2.6	0.41	2.7	10.0	1.31	2.9	19.7	1FU8076–4TA3□	0.00084	0.015	7
3.5	0.55	3.8	12.2	1.76	3.8	26.5	1FU8080–4TA3□	0.00130	0.015	9
5	0.79	5.3	19.3	2.51	5.3	42.3	1FU8083–4TA3□	0.00160	0.025	10
7	1.1	7.2	29.4	3.52	7.2	63.8	1FU8086–4TA3□	0.00220	0.03	12
8.5	1.33	9.7	50	4.27	10.0	93.3	1FU8096–4TA3□	0.00312	0.15	16
9.7	1.52	10.3	52.3	4.88	10.3	90.5	1FU8098–4TA3□	0.00380	0.18	18
18	2.83	22.4	117	9.05	23.5	211	1FU8113–4TA3□	0.01050	0.4	31
Max. frequency, 200 Hz at V_N=100 V / 50 Hz, max. speed, 6000 [RPM]										
2	0.31	2.7	9.5	1.26	3.0	21.4	1FU8073–4TA2□	0.00068	0.012	6
2.6	0.41	3.5	12.7	1.63	3.7	27.7	1FU8076–4TA2□	0.00084	0.015	7
3.5	0.55	4.8	15.6	2.2	4.9	37.7	1FU8080–4TA2□	0.00130	0.015	9
5	0.79	6.7	25	3.14	6.7	61.5	1FU8083–4TA2□	0.00160	0.025	10
7	1.1	9.0	36.8	4.4	9.0	88.7	1FU8086–4TA2□	0.00220	0.03	12
8.5	1.33	12.1	57	5.34	12.9	113	1FU8096–4TA2□	0.00312	0.15	16
9.7	1.52	12.7	63.3	6.1	12.7	115	1FU8098–4TA2□	0.00380	0.18	18
18	2.83	26.2	134	11.3	27.3	251	1FU8113–4TA2□	0.01050	0.4	31

1) Specified values refer to the IM B5 type of construction

1FU8-Motors, 4-pole, 50 Hz, max. speed 1500 to 6000 [RPM]

Table 4-3 Technical data

M=const. for 13.3 Hz up to f_{max}	**50 Hz values**			**Values at the max. frequency**						
M_N [Nm]	P_N [kW]	I_N [A]	I_1 [A]	P_N [kW]	I_N [A]	I_1 [A]	Order-No.	$J_{intrinsic}$ [kgm^2]	J_{ext} [kgm^2]	Weight [1] [kg]
Max. frequency, 50 Hz at V_N=400 V / 50 Hz, max. speed, 1500 [RPM]										
2.5	0.38	1.0	3.9	–	–	–	1FU8080–4TA8□	0.00130	0.005	9
5.2	0.82	1.7	9.2	–	–	–	1FU8086–4TA8□	0.00220	0.01	12
8	1.26	2.7	15.8	–	–	–	1FU8098–4TA8□	0.00380	0.06	18
16	2.51	6.0	33.7	–	–	–	1FU8113–4TA8□	0.01050	0.11	31
Max. frequency, 100 Hz at V_N=200 V / 50 Hz, max. speed, 3000 [RPM]										
2.5	0.38	2.0	7.8	0.79	2.0	13	1FU8080–4TA6□	0.00130	0.011	9
5.2	0.82	3.4	18.4	1.63	3.4	30.3	1FU8086–4TA6□	0.00220	0.022	12
8	1.26	5.5	31.6	2.51	5.5	45.8	1FU8098–4TA6□	0.00380	0.11	18
16	2.51	12.0	66.8	5.03	12.3	95.2	1FU8113–4TA6□	0.01050	0.33	31
Max. frequency, 160 Hz at V_N=125 V / 50 Hz, max. speed, 4800 [RPM]										
2.5	0.38	2.8	12.2	1.26	2.9	26.5	1FU8080–4TA3□	0.00130	0.011	9
5.2	0.82	5.3	29.4	2.61	5.3	63.8	1FU8086–4TA3□	0.00220	0.022	12
8	1.26	8.8	52.3	4.02	9.0	90.5	1FU8098–4TA3□	0.00380	0.13	18
16	2.51	20.7	117	8.04	21.8	211	1FU8113–4TA3□	0.01050	0.33	31
Max. frequency, 200 Hz at V_N=100 V / 50 Hz, max. speed, 6000 [RPM]										
2.5	0.39	4.1	15.6	1.57	4.1	37.7	1FU8080–4TA2□	0.00130	0.011	9
5.2	0.82	6.7	36.8	3.27	6.8	88.7	1FU8086–4TA2□	0.00220	0.022	12
8	1.26	10.9	63.3	5.03	11.1	115	1FU8098–4TA2□	0.00380	0.13	18
16	2.51	23.9	134	10.1	25.1	251	1FU8113–4TA2□	0.01050	0.33	31

1) Specified values refer to the IM B5 type of construction

1FU8-motors, 6-pole, 50 Hz, max. speed 1000 to 4000 [RPM]

Table 4-4 Technical data

M=const. for 20 Hz up to f_{max}	**50 Hz values**			**Values at the max. frequency**						
M_N [Nm]	P_N [kW]	I_N [A]	I_1 [A]	P_N [kW]	I_N [A]	I_1 [A]	Order-No.	$J_{intrinsic}$ [kgm^2]	J_{ext} [kgm^2]	Weight 1) [kg]
Max. frequency, 50 Hz at V_N=400 V / 50 Hz, max. speed, 1000 [RPM]										
34	3.6	8.1	36	–	–	–	1FU8134–6TD8□	0.04520	1.3	58
59.6	6.24	13.5	73	–	–	–	1FU8167–6TD8□	0.10850	2	109
Max. frequency, 100 Hz at V_N=200 V / 50 Hz, max. speed, 2000 [RPM]										
34	3.6	16.2	70	7.2	17.1	93	1FU8134–6TD6□	0.04520	1.3	58
59.6	6.24	26.8	146	12.48	28	188	1FU8167–6TD6□	0.10850	2	109
Max. frequency, 160 Hz at V_N=125 V / 50 Hz, max. speed, 3200 [RPM]										
28.9	3	28	111	9.7	31.2	160	1FU8134–6TD3□	0.04520	1.3	58
54.6	5.7	52	231	18.3	58	333	1FU8167–6TD3□	0.10850	2	109
Max. frequency, 200 Hz at V_N=100 V / 50 Hz, max. speed, 4000 [RPM]										
28.9	3	35.1	140	12.1	42	203	1FU8134–6TD2□	0.04520	1.3	58
54.6	5.7	65.5	290	22.9	78	437	1FU8167–6TD2□	0.10850	1.5	109

1) Specified values refer to the IM B5 type of construction

4.2 Permissible cantilever forces

Permissible cantilever forces, basic version

In order to calculate the permissible cantilever forces for a radial load, the line of action (center of the pulley) of the cantilever force F_Q *[N]* must lie within the free shaft end (dimension X).

Dimension X [mm] is the distance between the point of application of force F_Q and the shaft shoulder (x_o). Dimension x_{max} corresponds to the length of the shaft end.

Total cantilever force $F_Q = c \bullet F_u$

The pre-tension factor *c* is a value gained from experience from the belt manufacturer.
The following approximate value can be assumed:

For normal flat leather belts with tensioning roll *c = 2*;
for V belts *c = 2* to *2.5*;
for special-plastic belts, depending on the load type and belt type *c = 2* to *2.5*.

The circumferential force F_u [N] is calculated using the following equation:

$F_u = 2 \bullet 10^7 \bullet P / (n \bullet D)$

F_u	circumferential force in [N]
P	rated motor power (transmitted power) in [kW]
n	rated motor speed in [RPM]
D	pulley diameter in [mm]

The pulleys are standardized acc. to DIN 2211, Sheet 3.

The permissible cantilever forces at 60 Hz are approx. 80 % of the 50 Hz values – please inquire.

It should be observed that for types of construction IM B 6, IM B 7, IM B 8, IM V 5 and IM V6 the belt tension may only act in parallel to the mounting plane or towards the mounting plane and the feet must be supported. Both feet should be retained in the appropriate recesses in the foundation/faceframe.

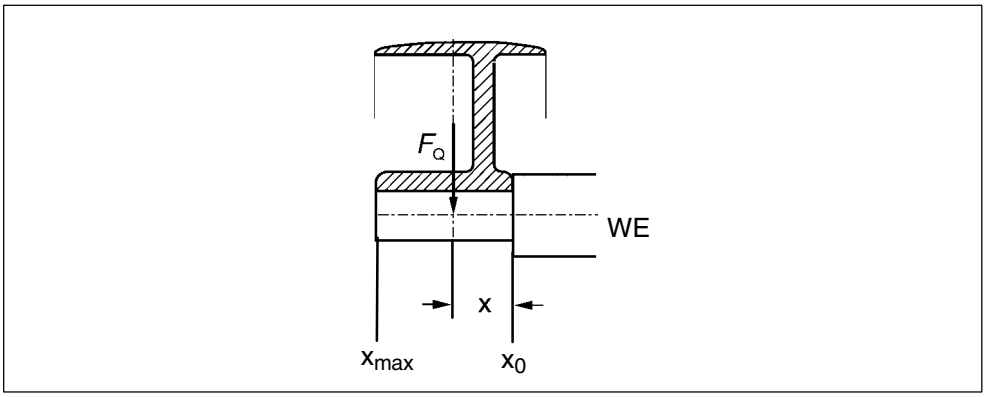


Fig. 4-1 Dimension X (free shaft end) and X_0 (shaft shoulder)

Table 4-5 Permissible cantilever forces for the basic 50 Hz version

Frame size	Speed	Permissible cantilever force at X_0	Permissible cantilever force at X_{max}
	[RPM]	[N]	[N]
71	1500 3000 4800 6000	530 415 350 310	450 355 290 250
80	1500 3000 4800 6000 9600 12000 15000	625 485 405 375 300 220 155	515 400 340 305 250 165 130
90	1500 3000 4800 6000	920 725 620 565	775 605 505 460
112	1500 3000 4800 6000 9600 12000	1270 1000 830 740 590 535	1040 800 670 610 500 455
132	1000 3000	2260 1490	1780 1180
160	1000 3000	2330 1540	1820 1210

Bearing design for increased cantilever forces

Table 4-6 Increased cantilever forces

Deep-groove ball bearings at the drive end (DE) Code K20				
Frame size	Motor	Speed	Permissible cantilever force F_Q at X_0	Permissible cantilever force F_Q X_{max}
		[RPM]	[N]	[N]
112	1FU8113	1000 1500 3000	2140 1960 1680	1720 1580 1490
132	1FU813□	1000 1500 3000	3100 2720 2250	2420 2170 1820
160	1FU816□	1000 1500 3000	3750 3330 2800	2900 2600 2250

Permissible load in the axial direction

When calculating the permissible load in the axial direction, the maximum permissible cantilever force is used as basis. Please inquire for changing load directions.

Table 4-7 1FU8 motors, vertical type of construction

Frame size	**Shaft end pointing**															
	3000 [RPM]				1500 [RPM]				1000 [RPM]				750 [RPM]			
	down Load		**up** Load		**down** Load		**up** Load		**down** Load		**up** Load		**down** Load		**up** Load	
	towards the bottom	towards the top	towards the bottom	towards the top	towards the bottom	towards the top	towards the bottom	towards the top	towards the bottom	towards the top	towards the bottom	towards the top	towards the bottom	towards the top	towards the bottom	towards the top
	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]
71	105	365	335	130	90	380	440	1302	90	590	550	130	90	700	660	130
80	110	425	360	160	100	540	480	165	100	650	590	165	100	760	700	165
90	110	440	360	180	100	680	580	190	100	920	820	190	100	1150	1050	190
112	140	710	550	300	130	1000	820	310	130	1290	1110	310	130	1570	1390	310
132	200	1200	950	470	180	1680	1200	470	180	1900	1600	470	190	2200	1900	440
160	1500	1400	950	1900	1900	1800	1300	2200	2200	2200	1600	2700	2700	2700	1950	2900

Higher speeds on request

Table 4-8 1FU8 motors in a horizontal type of construction

Frame size	3000 [RPM]				1500 [RPM]				1000 [RPM]				750 [RPM]			
	Pulling load	Thrust load (N) with radial load for		without radial load	Pulling load	Thrust load (N) with radial load for		without radial load	Pulling load	Thrust load (N) with radial load for		without radial load	Pulling load	Thrust load (N) with radial load for		without radial load
	N	x_0	$x_{max.}$		**N**	x_0	$x_{max.}$		**N**	x_0	$x_{max.}$		**N**	x_0	$x_{max.}$	
71	120	150	120	350	120	210	150	460	120	260	180	570	120	300	210	680
80	140	190	150	400	140	300	260	510	140	330	280	620	140	340	290	730
90	150	300	280	400	150	400	360	630	150	480	430	870	150	550	500	1100
112	220	450	350	630	220	600	500	910	220	650	550	1200	220	750	650	1480
132	350	650	520	1200	350	850	700	1600	350	1020	890	1900	350	1150	1020	2200
160	1500	850	720	1500	1500	1050	920	1800	1500	1250	1120	2200	1500	1350	1220	2600

Higher speeds on request

■

Engineering Information

5

Rated data corresponding to the selection and ordering data

- The rated values for the motors are specified for two operating points, 50 Hz and the max. frequency. A prerequisite is operation with V/f=constant.
- At higher frequencies, the rated torque slightly increases.
- The torque in the specified frequency range (13.3 and 20 Hz up to f_{max}) is constant for the specified current.
- The stall torque in the frequency range is a minimum $M_k \geq 1.35 \times M_N$; this value is maintained, also briefly at low frequency/speeds with the appropriate voltage boost.
- In the defined frequency range, the motor power increases proportionally with the speed/frequency (M = const.).

Voltage

- The standard insulating system of 1FU8 motors is designed so that operation is possible up to 400 V without any restrictions. For operation with voltages 400 – 500 V, the motor is especially tested. Special measures are required for voltages > 500 V.

Caution

The specified voltages do not refer to the voltages obtained by partial control of the frequency converter.

- The output voltage of the frequency converter should be parameterized corresponding to the rating plate. A voltage boost should be provided at low frequencies/speeds.

Cable length

If the motors are fed through long feeder cables, then increased voltage levels occur at the motor terminals as a result of the voltage edges of the frequency converter output voltage. This means that at the motor, not only are voltage blocks present that have the amplitude of the DC link voltage but also maximum peak voltage values up to twice this value can briefly occur.

The appropriate smoothing and filter measures must be provided. The specifications of the frequency converter manufacturer must be clearly maintained.

Motor currents

The currents of permanent-magnet synchronous motors may not be converted linearly with the voltage and to the torque. Precise values can be provided on request.

- The currents as listed in the selection and ordering data refer to a constant motor torque in the specified frequency range.
- At low speeds/frequencies, the no-load current of the synchronous motor can exceed the motor rated current, refer to Fig. 2-1.
- For a specific duty cycle, the rated current may not be exceeded (comprising the load and no-load currents).
- When a motor is connected to a power source, the starting current can be a multiple of the rated current (current inrush).

Dimensioning the frequency converter for single-motor drives

- The base load current of the frequency converter should be a min. of 1.2 x the rated motor current (voltage boost at low frequencies, no-load current at low frequencies)

  $I_{G\ (FU)} > 1.2 \bullet I_{N\ (motor)}$

- The short-time current of the frequency converter should be dimensioned to be 1.5 x I_N in order to guarantee that the drive accelerates at the max. accelerating torque M_K over the frequency range

  $I_{max\ (FU)} > 1.5 \bullet I_{N\ (motor)}$

Dimensioning the frequency converter for group drives

Frequency converters for group drives (when motors are connected to operational frequency converters), should be dimensioned as follows:

- **Rated operation**

  Base load current of the frequency converter $\geq$ sum of the rated currents of all motors (Z)

  $I_{G\ (FU)} > 1.2 \bullet Z \bullet I_{N\ (motor)}$

- **Connecting motors to an already running motor group**

  Short-time current of the frequency converter $\geq$ sum of the starting currents of the motors which are connected to the frequency converter at the same time (Y) plus those motors which are already operational (Z-Y)

  $I_{max\ (freqconv)} > 1.2 \bullet (Z\text{-}Y) \bullet I_{N\ (motor)} + Y \bullet I_{1\ (motor)}$

Table 5-1 Explanation of the abbreviations and symbols used in the formulas

Code	Description
Z	All of the motors
Y	Number of motors which are subsequently connected to the frequency converter
$I_{G(FU)}$	Base load current of the frequency converter
$I_{max(FU)}$	Short-time current of the frequency converter
$I_{N(motor)}$	Rated motor current at f_{max}
$I_{1(motor)}$	Motor current when connecting to the frequency converter at f_{max}

■

Notes

Dimensions and Weights

6

Note

Siemens AG reserves the right to change the dimensions of motors without prior notice as part of ongoing improvements to the mechanical design. Dimensions drawings can go out-of-date.

Current dimension drawings can be requested at no charge from your local Siemens office.

Dimension drawings

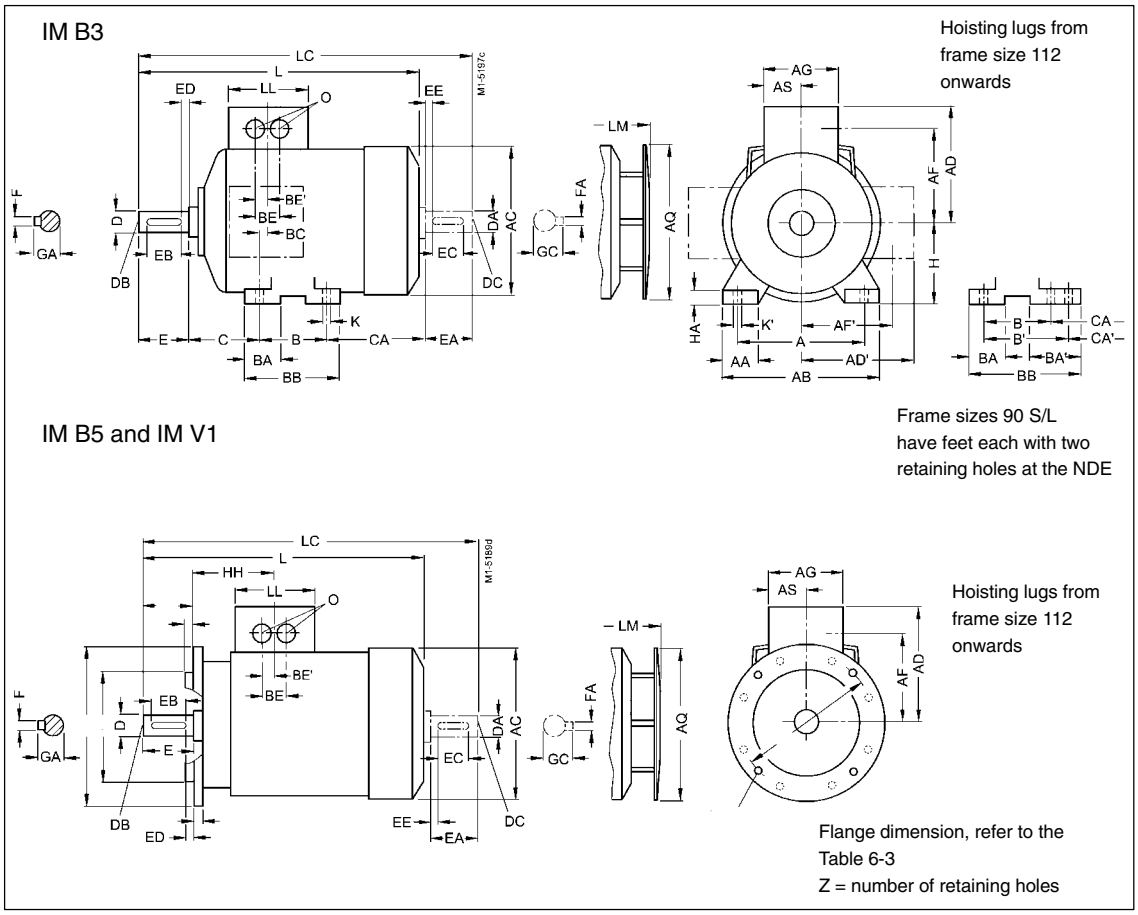


Fig. 6-1 Dimension drawings

Table 6-1 Dimensions A to CA'

For motor			Dimension codes acc. to **IEC**																					
Frame size	Type 1FU8	Pole number	O	AA	AB	AC[1]	AD	AD'	AF	AF'	AG	AQ	AS	B	B'	BA	BA'	BB	BC	BE	BE'	C	CA	CA'
71 M	073	4	112	27	132	145	111	111	88	88	75	124	37.5	90	–	27	–	106	18	32	18	45	83	–
	076	4	112	27	132	145	111	111	88	88	75	124	37.5	90	–	27	–	106	18	32	18	45	83	–
80 M	080	2+4	125	30.5	150	163	120	120	97	97	75	124	37.5	100	–	32	–	118	14	32	18	50	94	–
	083	2+4	125	30.5	150	163	120	120	97	97	75	124	37.5	100	–	32	–	118	14	32	18	50	94	–
	086	2+4	125	30.5	150	163	120	120	97	97	75	124	37.5	100	–	32	–	118	14	32	18	50	94	–
90 L	096	4	140	30.5	165	180	128	128	105	105	75	170	37.5	100	125	33	54	143	23	32	18	56	–	118
	098	4	140	30.5	165	180	128	128	105	105	75	170	37.5	–	125	33	54	143	23	32	18	56	–	143
112 M	113	2+4	190	46	226	227	148	176	91	136	120	170	60	140	–	47	–	176	32	42	21	70	141	–
132 M	134	6	216	53	256	267	167	194	107	154	140	250	70	178	–	49	–	218	39	42	21	89	162.5	–
160 L	167	6	254	60	300	320	197	226	127	183	165	250	82.5	254	–	57	–	300	53	54	27	108	179	–

1) Measured over the screw/bolt heads.
2) Cast terminal boxes have 4 knock-outs for metric threads.

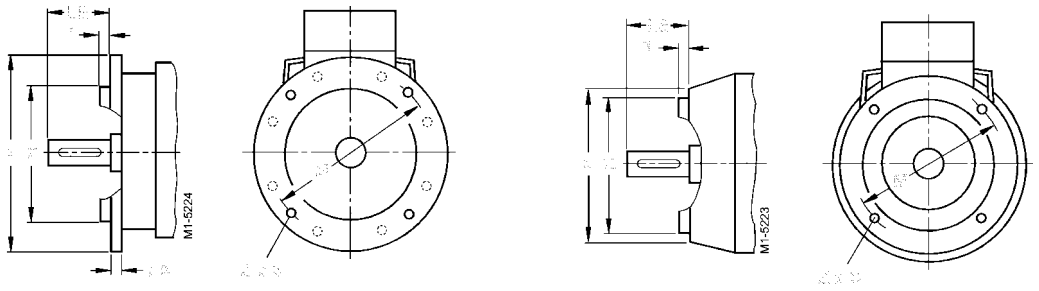
Table 6-2 Dimensions H to O

For motor	Dimension codes acc. to **IEC**										Drive shaft end							Non-drive shaft end						
Frame size	H	HA	HH	K	K'	L	LC	LL	LM	O	D	DB	I	EB	ED	F	GA	DA	DC	EA	EC	EE	FA	GC
71 M																								
...073	71	7	63.5	7	10	240	278	75	268	1xM16x1.5 1xM25x1.5	14	M5	30	22	4	5	16	14	M5	30	22	4	5	16
...076	71	7	63.5	7	10	240	278	75	268	1xM16x1.5 1xM25x1.5	14	M5	30	22	4	5	16	14	M5	30	22	4	5	16
80 M																								
...080	80	8	63.5	9.5	13.5	273.5	324	75	299.5	1xM16x1.5 1xM25x1.5	19	M6	40	32	4	6	21.5	19	M6	40	32	4	6	22
...083	80	8	63.5	9.5	13.5	273.5	324	75	299.5	1xM16x1.5 1xM25x1.5	19	M6	40	32	4	6	21.5	19	M6	40	32	4	6	22
...086	80	8	63.5	9.5	13.5	308.5	364	75	334.5	1xM16x1.5 1xM25x1.5	19	M6	40	32	4	6	21.5	19	M6	40	32	4	6	22
	90	10	79	10	14	331	389	75	382.5	1xM16x1.5 1xM25x1.5	24	M8	50	40	5	8	27	19	M6	40	32	4	6	22
90 L																								
	90	10	79	10	14	358	414	75	409.5	1xM16x1.5 1xM25x1.5	24	M8	50	40	5	8	27	19	M6	40	32	4	6	22
112 M	112	12	102	12	16	393	461	120	444.5	2xM32x1.5[2)]	28	M10	60	50	5	8	31	24	M8	50	40	5	8	27
132 M	132	15	128	12	16	490.5	569.5	140	543	2xM32x1.5[2)]	38	M12	80	70	5	10	41	28	M10	60	50	5	8	31
160 L	160	18	160.5	15	19	628	761	165	680.5	2xM40x1.5[2)]	42	M16	110	90	10	12	45	42	M16	110	90	10	12	45

1) Measured over the screw/bolt heads.

2) Cast terminal boxes have 4 knock-outs for metric threads.

Flange dimensions



In DIN EN 50347, the frame sizes are allocated flange FF with through holes and flange FT with tapped holes.

Standard DIN 42948 with flanges A and C still remains valid. Refer to the assignment table 6-3.
(Z = the number of retaining holes)

Fig. 6-2 Flange dimensions

Table 6-3 Flange dimensions for 1FU8 motors

Frame size	Type of construction, flange type	Flange with through holes (FF/A) tapped holes (FT/C)		Dimension codes acc. to IEC							
		acc. to	acc. to								
		DIN EN 50 237	DIN 42 948	**LA**	**LE**	**M (GND)**	**N**	**P**	**S**	**T**	**Z**
71	IM B5 flange	FF 130	A160	9	30	130	110	160	10	3.5	4
	IM B14 standard flange	FT 85	C 105	–	30	85	70	105	M 6	2.5	4
	IM B14 special flange	FT 115	C 140	–	30	115	95	140	M 8	3	4
80	IM B5 flange	FF 165	A200	10	40	165	130	200	12	3.5	4
	IM B14 standard flange	FT 100	C 120	–	40	100	80	120	M 6	3	4
	IM B14 special flange	FT 130	C 160	–	40	130	110	160	M 8	3.5	4
90	IM B5 flange	FF 165	A200	10	50	165	130	200	12	3.5	4
	IM B14 standard flange	FT 115	C 140	–	50	115	95	140	M 8	3	4
	IM B14 special flange	FT 130	C 160	–	50	130	110	160	M 8	3.5	4
100	IM B5 flange	FF 215	A250	11	60	215	180	250	14.5	4	4
	IM B14 standard flange	FT 130	C 160	–	60	130	110	160	M 8	3.5	4
	IM B14 special flange	FT 165	C 200	–	60	165	130	200	M 10	3.5	4
112	IM B5 flange	FF 215	A250	11	60	215	180	250	14.5	4	4
	IM B14 standard flange	FT 130	C 160	–	60	130	110	160	M 8	3.5	4
	IM B14 special flange	FT 165	C 200	–	60	165	130	200	M 10	3.5	4
132	IM B5 flange	FF 265	A300	12	80	265	230	300	14.5	4	4
	IM B14 standard flange	FT 165	C 200	–	80	165	130	200	M 10	3.5	4
	IM B14 special flange	FT 215	C 250	–	80	215	180	250	M 12	4	4
160	IM B5 flange	FF 300	A350	13	110	300	250	350	18.5	5	4
	IM B14 standard flange	FT 215	C 250	–	110	215	180	250	M 10	4	4

Packaging weights

Data apply for individual packaging.
Code for pallets packaging: L99

Table 6-4 Packaging weights

For motors	1FU8	For transport by land					
Frame size		Type of construction IM B 3			Type of construction IM B 5, IM V 1		
		in box Tare weight	on supports Tare weight	in crates Tare weight	in box Tare weight	on supports Tare weight	in crates Tare weight
		[kg]	[kg]	[kg]	[kg]	[kg]	[kg]
71 M	. . . . 073 076	0.65	–	–	0.65	–	–
80 M	. . . . 080 . . . . 083 086	0.65	–	–	0.65	–	–
90 L	. . . . 090 . . . . 096/098	0.65	–	–	0.65	–	–
112 M	 113	1.5	–	–	1.5	–	–
132 M	 134	4.7	–	–	5.2	–	–
160 L	 167	4.8	–	–	5.7	–	–

■

Notes

Distributed Drive Technology

7

7.1 SIEMOSYN 1FU8 motors with integrated frequency converter

SIEMOSYN motors with integrated frequency converter result in a variable-speed drive with sophisticated closed-loop control characteristics.

Neither an external frequency converter nor cabinet is required.

A SIEMOSYN 1FU8 motor and the MICROMASTER 411 frequency converter are mechanically coupled with one another.

The two physically and spatially separate components – the motor at the driven machine, the frequency converter in the electrical cabinet – are fused to become a compact single unit.

Advantages

In addition to the well-known advantages SIEMOSYN 1FU8 motors, other advantages come into play.

Versatile and communication-capable frequency converter electronics which can be connected to bus systems play an important role – within the scope of the automation solution – to minimize energy costs.

Significant time and cost saving with respect to conventional solutions:

- The electrical cabinet is not required (the frequency converter is mounted on the motor)
- Lower installation and mounting time and costs. The motor and frequency converter are shipped assembled which means that wiring between the two components is not required
- Lower emission (EMC) thanks to the extremely short cables;
  The motor – frequency converter connection is within the enclosure.
  This means that there are no problems associated with cable lengths and frequency converter output components are eliminated (those components associated with long cable lengths)
- Engineering time and costs are eliminated at the motor/frequency converter units are optimally matched to the customers requirements. They are shipped as a complete pre-assembled drive unit.
- The control is relieved as the frequency converter has its own integrated monitoring functions

- Integrated communications between the master control level and the field level ensure that all system components can be clearly and transparently accessed
- Service-friendly thanks to a new adapter concept which allows the motor and frequency converter to be easily separated
- Constant-speed motors can be easily replaced by variable-speed frequency converter motors as our SIEMOSYN 1FU8 motors have the same mechanical dimensions as conventional induction motors

Distributed architecture involving several units:

The power loss of the frequency converter is dissipated externally which means that climate control equipment can be minimized.

Space is saved in the electrical cabinet. The space required by the motor and frequency converter as single unit is hardly any higher than a motor by itself.

- Simple and straightforward wiring and installation allows variable-speed compact drives to be easily retrofitted in existing plants and systems.
- MICROMASTER 411 can be optionally mounted on the 1FU8 motor or can be mounted on a wall close to the motor.

MICROMASTER 411

MICROMASTER 411 frequency converters are listed in Catalog DA51.3. This Catalog lists the complete product range with ordering data, technical details and information.

The modular structure allows the frequency converters, including accessories to be selected on an individual basis, for example:

- Basic Operator Panel (BOP) to parameterize the frequency converter
- Advanced Operator Panel (AOP) with multi-language plain text display
- PROFIBUS module
- ASI module
- DeviceNet module
- Combination module comprising braking resistor and electro-mechanical brake control
- Electromechanical brake control module
- PC connecting kit
- PC start-up programs

Frequency converter data

- 0.37 – 3 kW, 3-ph. 400 V AC
- Degree of protection IP66, non-ventilated
- Electrical isolation between the electronics and terminals
- Parameter sets for fast start-up and therefore cost saving
- Operation is possible without an operator panel (when using jumpers and/or control potentiometers)
- Integrated control potentiometer accessible from the outside
- V/f characteristic (this can be freely configured)

The motors with integrated frequency converter can be optimally matched, assembled, checked and parameterized in-line with the customer's requirements.

Fig. 7-1 1FU8 motor with frequency converter

7.2 SIEMOSYN 1FU8 motors with integrated gear

1FU8 SIEMOSYN motors can also be supplied as geared motors with/without integrated MICROMASTER 411 frequency converter. The gears are the same as the gears as described in Catalog M15. However, instead of an 1LA7 squirrel-cage induction motors, 1FU8 permanent-magnet synchronous motors are used.

Siemens geared motors allow individual solutions to be created for a wide range of drive applications. A drive solution can be created for the particular drive application as a result of the wide range of combinations which are possible.

Depending on the particular version, gears are available for a ratio of between 2.78 and 485 and a maximum drive-out torque of 80 – 12 000 Nm for power ratings up to 7.5 kW.

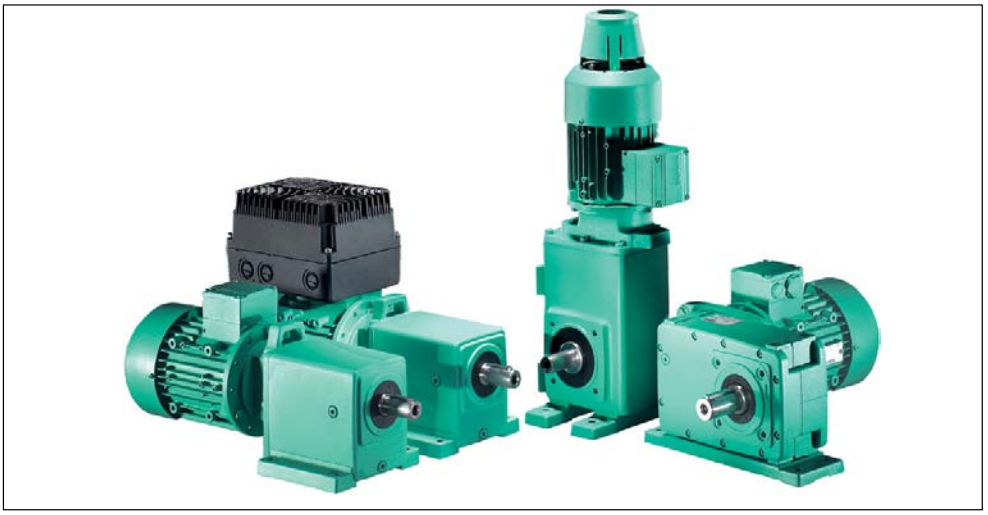


Fig. 7-2 1FU8 motor with integrated gear

Table 7-1 Technical data for 1FU8 motors with gear

	Gear type		
	Helical gear	**Offset gear**	**Angled gear**
Drive-out torque [Nm]	80 to 5800	130 to 11500	120 to 12000
Ratio	2.78 to 259	3.69 to 297	4.85 to 485

■

References

General Documentation

/DA48/ **Catalog DA 48**

Permanent-Magnet Synchronous Motors 0.31 kW to 22.9 kW
Order No.: E86060-K5448-A101-A1-7600

/BU/ **Catalog NC 60**

Automation Systems for Machine Tools
Order No.: E86060-K4460-A101-A9-7600

/Z/ **Catalog NC Z**

Connection Technology and System Components for SIMATIC, SINUMERIK, MASTERDRIVES and SIMOTION
Order No.: E86060-K4490-A101-B1-7600

Electronic Documentation

/CD1/ **DOC ON CD**

The SINUMERIK System
(includes all SINUMERIK 840D/810D and SIMODRIVE 611D publications)
Order No.: 6FC5298-6CA00-0BG3

Manufacturer/Service Documentation

/PFU/ **Planning Guide, SIEMOSYN Motors**

SINAMICS, SIMOVERT MASTERDRIVES, MICROMASTER
1FU8 SIEMOSYN Motors
Order No.: 6SN1197-0AC80-0BP0

/PJM/ Planning Guide, AC Servomotors

SIMODRIVE 611, SIMOVERT MASTERDRIVES
General Part, 1FT5, 1FT6, 1FK6, 1FK7
Order No.: 6SN1197-0AC20-0BP0

/PJAL/ Planning Guide, AC Servomotors

SIMODRIVE 611, SIMOVERT MASTERDRIVES
AC servomotors, General Part
Order No.: 6SN1197-0AD07-0BP0

/PFK7/ Planning Guide, AC Servomotors

SIMODRIVE 611, SIMOVERT MASTERDRIVES
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/PFK6/ Planning Guide, AC Servomotors

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/PFT6/ Planning Guide, AC Servomotors

SIMODRIVE 611, SIMOVERT MASTERDRIVES
AC Servomotors 1FT6
Order No.: 6SN1197-0AD02-0BP0

/PFS6/ Planning Guide, AC Servomotors

SIMOVERT MASTERDRIVES
AC Servomotors 1FS6, Explosion-Protected
Order No.: 6SN1197-0AD08-0BP0

/PPH/ Planning Guide, AC Induction Motors

SIMODRIVE
AC Induction Motors for Main Spindle Drives
1PH2, 1PH4, 1PH7
Order No.: 6SN1197-0AC60-0BP0

/PPM/ Planning Guide, Hollow Shaft Motors

SIMODRIVE
Hollow Shaft Motors for Main Spindle Drives
1PM6 and 1PM4
Order No.: 6SN1197-0AD03-0BP0

/PJFE/ Planning Guide, Synchronous Build-in Motors

SIMODRIVE
AC Motors for Main Spindle Drives
Synchronous Build-in Motors 1FE1
Order No.: 6SN1197-0AC00-0BP4

/PJTM/ Planning Guide, Build-in Torque Motors

SIMODRIVE
Build-in Torque Motors 1FW6
Order No.: 6SN197-0AD00-0BP0

/PMS/ Planning Guide, Motor Spindles

SIMODRIVE
ECO-Motor Spindle 2SP1
Order No.: 6SN1197-0AD04-0BP0

/PJLM/ Planning Guide, Linear Motors

SIMODRIVE
Linear Motors 1FN1 and 1FN3
Order No.: 6SN1197-0AB70-0BP3

/PJU/ Planning Guide, Drive Converters

SIMODRIVE 611
Drive Converters
Order No.: 6SN1197-0AA00-0BP5

/EMV/ Planning Guide, EMC Installation Guide

SINUMERIK, SIROTEC, SIMODRIVE
Order No.: 6FC5297-0AD30-0BP1

1FU8 Operating Instructions

Order No.: 610.413 9002 000

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To
SIEMENS AG
A&D MC BMS
P.O. Box 3180

D-91050 Erlangen, Germany

Phone: ++49-(0)180-5050-222 [ServiceSupport]
Fax: ++49-(0)9131-98-2176 [Documentation]
Email: motioncontrol.docu@erlf.siemens.de

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Manufacturer/Service Documentation

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