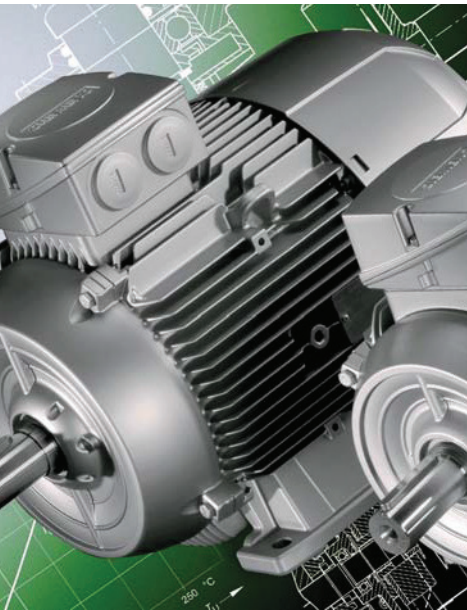


Introduction
















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1/2	Innovative drive technology for all industries, applications and power classes	1/51	Types of construction
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Introduction

SIMOTICS motors

Innovative drive technology for all industries, applications and power classes

Overview

SIMOTICS						
Low-voltage motors for line and converter operation						
General Purpose SIMOTICS GP	Severe Duty SIMOTICS SD	Explosion-proof SIMOTICS XP	Definite Purpose SIMOTICS DP	Flexible Duty SIMOTICS FD	Non standard SIMOTICS TN	High Torque SIMOTICS HT
						
DC motors			High-voltage motors			
Direct current SIMOTICS DC			High Voltage SIMOTICS HV			
						
Motors for motion control						
SIMOTICS S servomotors		SIMOTICS M main motors		SIMOTICS L linear motors		SIMOTICS T torque motors
Servomotors	Servo geared motors					

G_D081_EN_00495

SIMOTICS motors

With SIMOTICS, Siemens has the most comprehensive portfolio of electric motors worldwide. From energy-efficient, low-voltage motors through servomotors with high dynamic performance up to well-proven DC motors and powerful high-voltage motors. Innovative drive technology for all industries, applications and power classes.

Outstanding performance, quality, efficiency, and compactness.

The SIMOTICS motor portfolio:

- SIMOTICS low-voltage motors for line and converter operation:
For standard applications with low to high motor power ratings
- SIMOTICS Motion Control motors:
For highly dynamic and extremely precise applications in mechanical engineering
- SIMOTICS DC motors:
For DC applications
- SIMOTICS high-voltage motors:
For line and converter operation in standard applications with high to very high motor power ratings

SIMOTICS low-voltage motors for line and converter operation

SIMOTICS low-voltage motors are the right choice for solving drive tasks efficiently and reliably. In contrast to Motion Control motors, which are additionally characterized by very high dynamic response and precision, the more favorably priced low-voltage motors are predestined for continuous or periodic, as well as powerful motions with fixed or variable speed, such as in pumps, fans, compressors, conveyor belts, lifts, hoisting and traversing gear, winders, mixers, kneaders and centrifuges.

SIMOTICS low-voltage motors are characterized by very high reliability, ruggedness, and efficiency in operation.

They are available in diverse series and versions, which means that the appropriate motor can always be found for any application in an industrial or commercial environment, as well as in building management systems, shipbuilding and infrastructure.

SIMOTICS low-voltage motors comply with the most important relevant standards and guidelines and are available in IEC, NEMA, and APAC versions. They can be used all over the world, and have a global long-term spare parts service. For these reasons, they provide a sustainable basis for export-oriented, globally operating companies to enable them to conduct their international business efficiently.

Overview (continued)

SIMOTICS GP – General Purpose motors are the most economical solution for use under standard environmental conditions. Typically, these motors have an aluminum housing and are characterized by their low weight. SIMOTICS GP motors are available in the power range from 0.09 to 45 kW.

Available motor variants:

- Induction motors, optimized for line operation
 - in efficiency classes IE4, IE3, IE2, IE1
 - as a standards-compliant version or compact version with increased power (IE3, IE2, IE1)
 - as a 2, 4, 6, 8-pole version
 - as pole-changing motors
 - as an APAC version for use in the ASEAN Pacific region (IE3, IE2)
 - as a NEMA version for use in the NAFTA area
 - electrically (mechanically acc. to IEC): Eagle Line
 - electrically and mechanically
 - can optionally be run on a converter
- Motors optimized for operation on frequency converters
 - as a SIMOTICS GP – VSD10 line induction motor
 - as a SIMOTICS GP – VSD4000 line synchronous reluctance motor for particularly efficient operation in conjunction with SINAMICS converters.
- Different types of construction, voltage versions, and a wide variety of options/add-ons for precise adaptation of the motors to application and customer-specific requirements.

SIMOTICS SD – Severe Duty motors have a rugged cast-iron housing, which means they are also suitable for use in harsh to very harsh environments. With a wide power range from 0.09 to 500 kW, SIMOTICS SD motors are the basis for machine and plant builders and owners who require a universal motor for flexible requirements and conditions of use.

Available motor variants:

- Induction motors, optimized for line operation
 - in efficiency classes IE4, IE3, IE2, IE1
 - standards-compliant version or compact version with increased power (IE3, IE2, IE1)
 - as a 2, 4, 6, 8-pole version
 - as an APAC version for use in the ASEAN Pacific region (IE3, IE2)
 - as a NEMA version for use in the NAFTA area
 - electrically (mechanically acc. to IEC): Eagle Line
 - electrically and mechanically
 - can optionally be run on a converter
- Motors optimized for operation on frequency converters
 - as a SIMOTICS SD – VSD10 line induction motor
 - as a SIMOTICS SD – VSD4000 line synchronous reluctance motor for particularly efficient operation in conjunction with SINAMICS converters.
- Basic Line and particularly rugged Performance Line
- Different types of construction, voltage versions, and a very wide variety of options/add-ons for precise adaptation of the motors to application and customer-specific requirements.

SIMOTICS – next generation is the next innovation step in low-voltage motors. In particular, these motors offer the following advantages for customers:

- More efficiency in the engineering process due to the Digital Twin Concept.
- Further increase in availability due to the Smart Motor Concept.

SIMOTICS XP – Explosion Proof motors are designed for use in hazardous environments. For all conditions of use and hazard zones, e.g. in explosive gas atmospheres of the chemical/petrochemical sector or in explosive dust atmospheres in the mining or food and beverage sectors, there are suitable motor versions in aluminum and cast iron that ensure maximum safety and satisfy the relevant standards and regulations.

SIMOTICS XP motors are available in the power range from 0.09 to 200 kW.

Available motor variants:

- Motors for use in Zones 2, 21, and 22.
- Induction motors optimized for line operation
 - in efficiency classes IE3, IE2, IE1
 - as a 2, 4, 6, 8-pole version
 - as a NEMA version for use in the NAFTA area
- Motors suitable for line and converter operation
- Basic Line and particularly rugged Performance Line in a cast-iron housing
- Different types of construction, voltage versions, and a wide variety of options/add-ons for precise adaptation of the motors to application and customer-specific requirements.

SIMOTICS DP – Definite Purpose motors are low-voltage motors for application-specific, customized and industry-specific use.

They have the required respective industry-specific properties and certificates.

SIMOTICS DP motors:

- Crane motors for use in cranes (primarily for hoisting gear)
- Marine motors for use on ships
- Steel plant motors for use in the steel industry
- Roller table motors for roller table applications in the steel industry
- Smoke extraction motors for use in smoke extraction applications

SIMOTICS FD – Flexible Duty motors have been optimized for converter operation to flexibly address applications in power ranges extending from 200 to over 1600 kW. These are available with various cooling methods (air cooling, water cooling).

SIMOTICS TN – Transnorm motors are low-voltage motors for line and converter operation in a cast-iron housing with higher power ratings up to 5000 kW from shaft height 315. In non-standard (Transnorm) motors, the assignment of the power rating and shaft extensions to frame size is not standardized.

SIMOTICS HT – High Torque motors are permanent magnet synchronous motors and are used in applications that require extremely powerful drives without gear units, even at low speeds.

Introduction

SIMOTICS motors

SIMOTICS Digital Data App

Overview

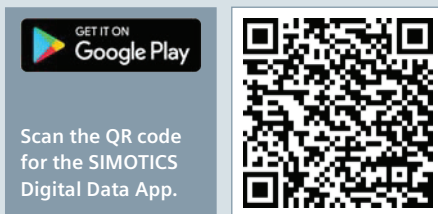
The SIMOTICS Digital Data App provides access to technical data, spare part information, and operating instructions for SIMOTICS GP/SD motors any time any place. This gives our customers quick access to important contents of the digital twin, which simplifies and optimizes the customer's processes. By scanning the data matrix code on the additional rating plate of the motor, the relevant electrical and mechanical data can be displayed for this motor.

- Electronic and mechanical rating plate data
- Additional motor data
- Service information, e.g. display of the spare part list
- Display of the ordering options installed
- Documentation and manuals

The SIMOTICS Digital Data App is available for Apple and Android devices and can be installed from the respective stores. To do this, please scan the appropriate QR code.

Benefits

- Shorter commissioning and service times
- Fast access to relevant service information
- Online availability of the motor data for integration into ERP systems



Overview

Harmonization of the efficiency classes

Various energy efficiency standards exist worldwide for induction motors. To promote global standardization, the international standard IEC 60034-30-1:2014 (Rotating electrical machines – Part 30-1: Efficiency classes of single-speed, three-phase, cage-induction motors (IE code) were defined and are used as the basis for local standards in most countries. Only the NAFTA countries USA, Canada, and Mexico use the differing standards of NEMA MG1. Standard IEC 60034-30-1:2014 divides low-voltage induction motors into new efficiency classes IE1 to IE4, which supersede the efficiency classes EFF2 and EFF1 previously valid in the EU.

Applicability (excerpt)

- Low-voltage motors up to 1000 V (50/60 Hz in line operation)
- Power rating: 0.12 to 1000 kW; with 2, 4, 6, or 8-poles
- Operating mode: S1

The efficiencies in IEC 60034-30-1 are based on the method for determining losses according to IEC 60034-2-1:2014.

IE efficiency classes

The efficiency classes are grouped according to the following nomenclature (IE = International Efficiency):

- IE1 (Standard Efficiency)
- IE2 (High Efficiency)
- IE3 (Premium Efficiency)
- IE4 (Super Premium Efficiency)

IEC 60034-30-1 EU and other countries	NEMA MG1 NAFTA (USA, Canada, Mexico)	GB 18613-2012 China
IE4 ¹⁾		Grade 1 (IE4)
IE3	Premium Efficient (60 Hz)	Grade 2 (IE3)
IE2	Energy Efficient (60 Hz)	Grade 3 (IE2)

Comparison of IE efficiency classes

Note:

All efficiency classes are stated with reference to 50 Hz data (unless specified otherwise).

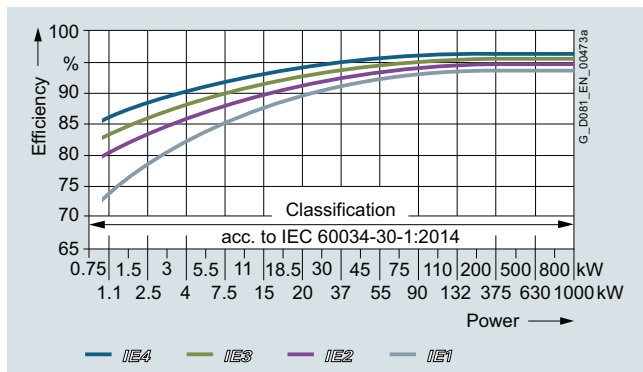
Measuring method according to IEC 60034-2-1:2014 for determining the efficiency

With this measuring method, motor losses are no longer applied as a percentage, but are determined by standard methods. The nominal efficiencies are therefore reduced from EFF1 to IE2 and from EFF2 to IE1, even though there have been no technical or physical changes to the motors.

Previously: P_{LL} = 0.5 % of P₁ (power drawn; IEC 60034-2)

Now: P_{LL} = individual measurement (IEC 60034-1)

P_{LL} = additional load losses



IE1-IE4 efficiencies, 4-pole 50 Hz, depending on the power

Minimum efficiencies according to IEC 60034-30-1:2014

Rated power P _{rated} , 50 Hz kW	Efficiency η in % IEC IE class							
	IE1 – Standard Efficiency				IE2 – High Efficiency			
	2-pole	4-pole	6-pole	8-pole	2-pole	4-pole	6-pole	8-pole
0.18	52.8	57.0	45.5	38.0	60.4	64.7	56.6	45.9
0.20	54.6	58.5	47.6	39.7	61.9	65.9	58.2	47.4
0.25	58.2	61.5	52.1	43.4	64.8	68.5	61.6	50.6
0.37	63.9	66.0	59.7	49.7	69.5	72.7	67.6	56.1
0.40	64.9	66.8	61.1	50.9	70.4	73.5	68.8	57.2
0.55	69.0	70.0	65.8	56.1	74.1	77.1	73.1	61.7
0.75	72.1	72.1	70.0	61.2	77.4	79.6	75.9	66.2
1.1	75.0	75.0	72.9	66.5	79.6	81.4	78.1	70.8
1.5	77.2	77.2	75.2	70.2	81.3	82.8	79.8	74.1
2.2	79.7	79.7	77.7	74.2	83.2	84.3	81.8	77.6
3	81.5	81.5	79.7	77.0	84.6	85.5	83.3	80.0
4	83.1	83.1	81.4	79.2	85.8	86.6	84.6	81.9
5.5	84.7	84.7	83.1	81.4	87.0	87.7	86.0	83.8
7.5	86.0	86.0	84.7	83.1	88.1	88.7	87.2	85.3
11	87.6	87.6	86.4	85.0	89.4	89.8	88.7	86.9
15	88.7	88.7	87.7	86.2	90.3	90.6	89.7	88.0
18.5	89.3	89.3	88.6	86.9	90.9	91.2	90.4	88.6
22	89.9	89.9	89.2	87.4	91.3	91.6	90.9	89.1
30	90.7	90.7	90.2	88.3	92.0	92.3	91.7	89.8
37	91.2	91.2	90.8	88.8	92.5	92.7	92.2	90.3
45	91.7	91.7	91.4	89.2	92.9	93.1	92.7	90.7
55	92.1	92.1	91.9	89.7	93.2	93.5	93.1	91.0
75	92.7	92.7	92.6	90.3	93.8	94.0	93.7	91.6
90	93.0	93.0	92.9	90.7	94.1	94.2	94.0	91.9
110	93.3	93.3	93.3	91.1	94.3	94.5	94.3	92.3
132	93.5	93.5	93.5	91.5	94.6	94.7	94.6	92.6
160	93.8	93.8	93.8	91.9	94.8	94.9	94.8	93.0
200 ... 1000	94.0	94.0	94.0	92.5	95.0	95.1	95.0	93.5

Rated power P _{rated} , 50 Hz kW	Efficiency η in % IEC IE class							
	IE3 – Premium Efficiency				IE4 – Super Premium Efficiency			
	2-pole	4-pole	6-pole	8-pole	2-pole	4-pole	6-pole	8-pole
0.18	65.9	69.9	63.9	58.7	70.8	74.7	70.1	67.2
0.20	67.2	71.1	65.4	60.6	71.9	75.8	71.4	68.4
0.25	69.7	73.5	68.6	64.1	74.3	77.9	74.1	70.8
0.37	73.8	77.3	73.5	69.3	78.1	81.1	78.0	74.3
0.40	74.6	78.0	74.4	70.1	78.9	81.7	78.7	74.9
0.55	77.8	80.8	77.2	73.0	81.5	83.9	80.9	77.0
0.75	80.7	82.5	78.9	75.0	83.5	85.7	82.7	78.4
1.1	82.7	84.1	81.0	77.7	85.2	87.2	84.5	80.8
1.5	84.2	85.3	82.5	79.7	86.5	88.2	85.9	82.6
2.2	85.9	86.7	84.3	81.9	88.0	89.5	87.4	84.5
3	87.1	87.7	85.6	83.5	89.1	90.4	88.6	85.9
4	88.1	88.6	86.8	84.8	90.0	91.1	89.5	87.1
5.5	89.2	89.6	88.0	86.2	90.9	91.9	90.5	88.3
7.5	90.1	90.4	89.1	87.3	91.7	92.6	91.3	89.3
11	91.2	91.4	90.3	88.6	92.6	93.3	92.3	90.4
15	91.9	92.1	91.2	89.6	93.3	93.9	92.9	91.2
18.5	92.4	92.6	91.7	90.1	93.7	94.2	93.4	91.7
22	92.7	93.0	92.2	90.6	94.0	94.5	93.7	92.1
30	93.3	93.6	92.9	91.3	94.5	94.9	94.2	92.7
37	93.7	93.9	93.3	91.8	94.8	95.2	94.5	93.1
45	94.0	94.2	93.7	92.2	95.0	95.4	94.8	93.4
55	94.3	94.6	94.1	92.5	95.3	95.7	95.1	93.7
75	94.7	95.0	94.6	93.1	95.6	96.0	95.4	94.2
90	95.0	95.2	94.9	93.4	95.8	96.1	95.6	94.4
110	95.2	95.4	95.1	93.7	96.0	96.3	95.8	94.7
132	95.4	95.6	95.4	94.0	96.2	96.4	96.0	94.9
160	95.6	95.8	95.6	94.3	96.3	96.6	96.2	95.1
200	95.8	96.0	95.8	94.6	96.5	96.7	96.3	95.4
250	95.8	96.0	95.8	94.6	96.5	96.7	96.5	95.4
315 ... 1000	95.8	96.0	95.8	94.6	96.5	96.7	96.6	95.4

¹⁾ Defined in IEC/TS 60034-31.

Introduction

Information regarding efficiency in accordance with International Efficiency

Efficiency classes and efficiencies according to IEC 60034-30-1

1

Overview (continued)

Background information

Comprehensive laws have been introduced in the European Union with the objective of reducing energy consumption and therefore CO₂ emissions. EU Directive 640/2009 concerns the energy consumption or efficiency of induction motors in the industrial environment. This Directive is now in force in every country of the European Economic Area.

For further details on internationally applicable standards and legal requirements, visit:

www.siemens.com/international-efficiency

Exceptions to the EU Directive

- Motors that are designed to be operated totally submerged in a liquid;
- Motors fully integrated into a product (e.g. a gear unit, pump, fan or compressor) whose energy efficiency cannot be measured independently of the product;
- Motors that are specially designed for operation under the following conditions:
 - At altitudes greater than 4000 meters above sea level;
 - At ambient temperatures above 60 °C;
 - At maximum operating temperatures above 400 °C;
 - At ambient temperatures below -30 °C
 - With cooling liquid temperatures at the product intake of below 0 °C or above 32 °C;
 - In hazardous areas in the context of Directive 94/9/EU of the European Parliament and Council;
- Brake motors

The following motors are not involved:

- Pole-changing motors
- Synchronous motors
- Motors for intermittent duty S2 to S9
- Single-phase motors
- Motors specially developed for converter operation in accordance with IEC 60034-25

The following changes came into effect on the dates below:

From January 1, 2015:

Compliance with the legally required minimum efficiency class IE3 for power ratings from 7.5 to 375 kW or, as an alternative, IE2 motor plus frequency converter.

From January 1, 2017:

Compliance with the legally required minimum efficiency class IE3 for power ratings from 0.75 to 375 kW or, as an alternative, IE2 motor plus frequency converter.

Changes according to EU motor regulation 640/2009

Low-voltage motors with a power rating of 0.75 kW to < 7.5 kW, from January 1, 2017, and low-voltage motors with a power ranging from 7.5 kW to 375 kW with efficiency class IE2, have been labeled as follows since January 1, 2015:



This obligation applies only within the European Economic Area. Correct application is the sole responsibility of the customer.

Other potential restrictions as described in the technical documentation may apply to converter operation and must be taken into account!

The following are generally recommended for converter operation:

- Motor temperature detection by embedded temperature sensor
- Bearing insulation with frame size 225 and larger

Motor series SIMOTICS VSD10 (1LE1092/1LE1592), VSD4000 (1FP10/1FP15) and SIMOTICS FD (1LH1) are the preferred motor types for converter operation.

Note:

Different minimum efficiency class requirements apply in China, Korea, and Australia. Other countries will be available soon.

Motors for the North American market

The Energy Policy Act (EPAAct) was superseded in December 2010 by the Energy Independence Security Act (EISA).

The following motors must fulfill the NEMA Premium Efficient Level:

- 1 hp (0.75 kW) ... 500 hp (373 kW): 2, 4-pole
- 1 hp (0.75 kW) ... 350 hp (261 kW): 6-pole
- 1 hp (0.75 kW) ... 250 hp (186 kW): 8-pole
- 2, 4, 6 and 8-pole
- ≤ 600 V
- NEMA Design A, B, or C. IEC Design N or H

For details, see NEMA MG1, Table 12-11 and Table 12-12.

Abbreviations

NEMA: National Electrical Manufacturers Association

IEC: International Electrotechnical Commission

EEA: European Economic Area

Overview

Steps for drive selection

Step 1		Orientation and general technical information	
Technical requirements for the motor	Rated frequency and rated voltage	3 AC 50/60 Hz, 400, 500 or 690 V	
	Operating mode	Standard duty (continuous duty S1 according to EN 60034-1)	
	Degree of protection or type of explosion protection required	IP..	
	Rated speed (No. of poles)	$n = \dots\dots\dots$ rpm	
	Rated power	$P = \dots\dots\dots$ kW	
	Rated torque	$T = P \cdot 9550/n = \dots\dots\dots$ Nm	
	Type of construction	IM..	
Step 2		Preselection in accordance with the application	
Determination of the installation conditions and definition of the application, if necessary	Ambient temperature	≤ 40 °C	> 40 °C
	Installation altitude	≤ 1000 m	> 1000 m
	Factors for derating	None	Determine the factor for derating (for reduction factor, see "Coolant temperature and installation altitude" on Page 1/35)
Cross-reference to other motors		These can be LOHER motors for special requirements in the area of explosion protection and applications or motors to the NEMA standard	
Step 3		Preliminary selection of the motor	
Determination of the range of possible motors		Select the frame size and therefore the possible motors on the basis of the following parameters: cooling method, degree of protection, rated power, rated speed and rated torque range. <u>Note:</u> The standard temperature range of the motors is from -20 to +40 °C.	

Layout of the selection and ordering tables and description of the columns of the table headers

Power, frame size, temperature class			Operating values at rated power													Article No., add. data				
Table header – Meaning																				
$P_{rated, 50 Hz}$	$P_{rated, 60 Hz}$	$P_{rated, 60 Hz}$	Frame size	$n_{rated, 50 Hz}$	$T_{rated, 50 Hz}$	Different IE class	CC No. CC032A	$\eta_{rated, 50 Hz, 4/4}$	$\eta_{rated, 50 Hz, 3/4}$	$\eta_{rated, 50 Hz, 2/4}$	COS- $\phi_{rated, 50 Hz, 4/4}$	$I_{rated, 50 Hz, 400 V}$	T_{LR}/T_{rated}	I_{LR}/I_{rated}	T_B/T_{rated}	$L_{pA, 50 Hz}$	$L_{WA, 50 Hz}$	Article No.	m IM B3	J
kW	kW	hp	FS	rpm	Nm			%	%	%		A				dB (A)	dB (A)		kg	kgm ²
Rated power at 50 Hz	Rated power at 60 Hz	Rated power at 60 Hz	Frame size	Rated speed at 50 Hz	Rated torque at 50 Hz	Efficiency class according to IEC 60034-30-1	CC No. CC032A	Efficiency at 50 Hz, 4/4-load	Efficiency at 50 Hz, 3/4-load	Efficiency at 50 Hz, 2/4-load	Power factor at 50 Hz, 4/4-load	Rated current at 400 V, 50 Hz	Locked-rotor torque on direct switch-on as a multiple of the rated torque	Locked-rotor current on direct switch-on as a multiple of the rated current	Breakdown torque on direct switch-on as a multiple of the rated torque	Measuring-surface sound pressure level at 50 Hz	Sound power level at 50 Hz	Article number	Weight for type of construction IM B3, approx.	Moment of inertia

Legend:

Primary key
Standard values for all motors
Specially for NEMA Energy Efficient MG1 motors, Table 12-11 or NEMA Premium Efficient MG1 motors, Table 12-12

Note on pole-changing motors:

The operating values are specified here for the rated power for the two different pole numbers.

Step 4		Detailed selection of the motor in the selection and ordering data tables	
Determination of the basic Article No. of the motor	Determine the motor Article No. according to the following parameters: rated power, rated speed, rated torque and rated current from the "Selection and ordering data" for the motors that have already been identified as possibilities.		
Step 5		Selection of the special versions or options	
Completing the motor Article No.	Determine special versions and the associated order codes (e.g. special voltages and types of construction, motor protection and degrees of protection, windings and insulation, colors and paint finish, mountings and mounting technology, etc.).		
Step 6		Additional information for motor selection	
Checking the required dimensions	The dimensions are specified in each catalog section under the heading of "Dimensions".		
Selection of the frequency converter, if required	Article No. of the converter as well as its selection, see Catalogs D 11, D 18.1, D 21.3, D 31, and DA 51.2.		

Introduction

Guide to selecting and ordering the motors

Catalog orientation and drive selection

Overview (continued)

Steps for drive selection in the catalog

		Catalog section
Step 1	Introduction	1
Step 2	SIMOTICS GP/SD 1LE1 standard motors	2
Step 3	Orientation	
Step 4	SIMOTICS GP/SD 1LE1 <ul style="list-style-type: none"> • Motors with IE4 Super Premium Efficiency • Motors with IE3 Premium Efficiency • Motors with IE2 High Efficiency • Motors with IE1 Standard Efficiency 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 3	Orientation	
Step 4	SIMOTICS GP/SD 1LE1 – APAC Line <ul style="list-style-type: none"> • Motors with IE3 Premium Efficiency • Motors with IE2 High Efficiency 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 3	Orientation	
Step 4	SIMOTICS GP/SD 1LE1 – Eagle Line <ul style="list-style-type: none"> • NEMA Premium Efficient motors • NEMA Energy Efficient motors 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 3	Orientation	
Step 4	SIMOTICS GP 1LE1 – pole-changing <ul style="list-style-type: none"> • Aluminum series 1LE1011, self-ventilated, const. load torque • Aluminum series 1LE1011/1LE1012 self-ventilated, quadrat. load torque 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 2	SIMOTICS SD 1LE5 standard motors	3
Step 3	Orientation	
Step 4	SIMOTICS SD 1LE5 <ul style="list-style-type: none"> • Motors with IE4 Super Premium Efficiency • Motors with IE3 Premium Efficiency 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 2	SIMOTICS VSD motors for converter operation	4
Introduction		
Step 3	Orientation	
Step 4	SIMOTICS GP/SD VSD4000 line reluctance motors with SINAMICS converters <ul style="list-style-type: none"> • IE4 Super Premium Efficiency 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 3	Orientation	
Step 4	SIMOTICS GP/SD VSD10 line standard motors for converter operation <ul style="list-style-type: none"> • Standard Efficiency 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	

Overview (continued)

		Catalog section
Step 2	SIMOTICS XP 1MB1 explosion-proof motors	5
Step 3	Orientation	
Step 4	Motors for Zone 21/22 or 2 in type of protection Ex t or Ex ec <ul style="list-style-type: none"> • Motors with IE3 Premium Efficiency <ul style="list-style-type: none"> - Aluminum series 1MB10 - Cast-iron series 1MB15/6 • Motors with IE2 High Efficiency <ul style="list-style-type: none"> - Aluminum series 1MB10 - Cast-iron series 1MB15/6 • Motors with IE1 Standard Efficiency <ul style="list-style-type: none"> - Aluminum series 1MB10 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 2	SIMOTICS DP application-specific motors	
Introduction		
Step 3	Smoke extraction motors	
Step 4	Orientation <ul style="list-style-type: none"> • Motors with IE3 Premium Efficiency <ul style="list-style-type: none"> • Aluminum series 1PC1303 • Cast-iron series 1PC1304 • Motors with IE2 High Efficiency <ul style="list-style-type: none"> • Aluminum series 1PC1300 • Cast-iron series 1PC1301 	
Step 5	Article No. supplements and special versions	
Step 6	Dimensions	
Step 3	Marine motors	
Step 4	Orientation <ul style="list-style-type: none"> • Special versions <ul style="list-style-type: none"> • Motors with IE4 Super Premium Efficiency <ul style="list-style-type: none"> - Aluminum series 1LE1004 - Cast-iron series 1LE1..4, 1LE5..4 • Motors with IE3 Premium Efficiency <ul style="list-style-type: none"> - Aluminum series 1LE10.3, 1MB10.3 - Cast-iron series 1LE1..3, 1LE5..3, 1MB1..3 • Motors with IE2 High Efficiency <ul style="list-style-type: none"> - Aluminum series 1LE10.1, 1MB10.1 - Cast-iron series 1LE1..1, 1MB1..1 • Motors with IE1 Standard Efficiency <ul style="list-style-type: none"> - Aluminum series 1LE10.2, 1MB10.2 - Cast-iron series 1LE1..2 • Pole-changing motors <ul style="list-style-type: none"> - Aluminum series 1LE1011, 1LE1012 	

Introduction

Guide to selecting and ordering the motors

Catalog orientation and drive selection

Overview (continued)

1LE1 standard motors

Motor version	Efficiency class	Rated power at 50 Hz (values in kW) or 60 Hz (values in hp)	Frame size – motor type														Page		
			63	71	80	90	100	112	132	160	180	200	225	250	280	315			
SIMOTICS GP aluminum housing																			
IEC	IE4 Super Premium Efficiency	2.2 ... 37 kW																1LE1004	2/8
	IE3 Premium Efficiency	0.37 ... 45 kW																1LE1003	2/13
	IE2 High Efficiency	0.12 ... 45 kW																1LE1001	2/26
	IE1 Standard Efficiency	0.09 ... 37 kW																1LE1002	2/44
APAC Line	IE3 Premium Efficiency	0.75 ... 45 kW																1LE1043	2/54
	IE2 High Efficiency	0.75 ... 22 kW																1LE1041	2/65
Eagle Line	NEMA Premium Efficient	0.37 ... 37 kW 0.5 ... 50 hp																1LE1023	2/71
	NEMA Energy Efficient	0.37 ... 0.55 kW 0.5 ... 0.75 hp																1LE1021	2/80
Pole-changing	–	– For a constant load torque																1LE1011 4/2-pole, 8/4-pole	2/82
	–	– For square-law load torque																1LE1011 4/2-pole, 8/4-pole	2/83
	–	–																1LE1012 6/4-pole	2/83
SIMOTICS SD cast-iron housing																			
IEC	IE4 Super Premium Efficiency	– Basic Line	2.2 ... 200 kW															1LE1504	2/9
		– Performance Line	2.2 ... 200 kW															1LE1604	2/9
	IE3 Premium Efficiency	– Basic Line	0.18 ... 200 kW															1LE1503	2/17
		– Performance Line	1.5 ... 200 kW															1LE1603	2/17
	IE2 High Efficiency	– Basic Line	0.09 ... 200 kW															1LE1501	2/32
		– Performance Line	0.75 ... 200 kW															1LE1601	2/32
	IE1 Standard Efficiency	– Basic Line	0.75 ... 200 kW															1LE1502	2/48
		–	–															1LE1543	2/57
APAC Line	IE3 Premium Efficiency	– Basic Line	0.75 ... 200 kW															1LE1643	2/57
		– Performance Line	0.75 ... 200 kW															1LE1541	2/68
Eagle Line	NEMA Premium Efficient	– Basic Line	0.18 ... 185 kW 0.25 ... 250 hp															1LE1523	2/73
		– Performance Line	2.2 ... 185 kW 3 ... 250 hp															1LE1623	2/73
	NEMA Energy Efficient	– Basic Line	0.09 ... 0.55 kW 0.12 ... 0.75 hp															1LE1521	2/81

1LE5 standard motors – next generation

Motor version	Efficiency class	Rated power at	Frame size – motor type														Page		
			63	71	80	90	100	112	132	160	180	200	225	250	280	315		355	
SIMOTICS SD cast-iron housing																			
IEC	IE4 Super Premium Efficiency	– Basic Line	250 ... 315 kW															1LE5504	3/8
		– Performance Line	250 ... 500 kW																1LE5604
	IE3 Premium Efficiency	– Basic Line	250 ... 315 kW															1LE5503	3/12
		– Performance Line	250 ... 500 kW																1LE5603
SIMOTICS SD Add cast-iron housing																			
IEC	IE4 Super Premium Efficiency	– Basic Line	250 ... 315 kW															1LE5534	3/10
		– Performance Line	250 ... 500 kW																1LE5634
	IE3 Premium Efficiency	– Basic Line	250 ... 315 kW															1LE5533	3/14
		– Performance Line	250 ... 500 kW																1LE5633

SIMOTICS VSD motors for converter operation
 SIMOTICS GP/SD VSD4000 line reluctance motors for SINAMICS converters,
 SIMOTICS GP/SD VSD10 line standard motors for converter operation

Motor version	Efficiency class	Rated power	Frame size – motor type														Page		
			63	71	80	90	100	112	132	160	180	200	225	250	280	315			
SIMOTICS GP aluminum housing																			
VSD4000 line	Super Premium Efficiency	0.55 ... 30 kW																1FP10.4	4/26
VSD10 line	Standard Efficiency	2.2 ... 18.5 kW																1LE1092	4/70
SIMOTICS SD cast-iron housing																			
VSD4000 line	Super Premium Efficiency	0.55 ... 30 kW																1FP15.4	4/28
VSD10 line	Standard Efficiency	2.2 ... 200 kW																1LE1592	4/76

Overview (continued)

Explosion-proof motors with type of protection Ex tb (Zone 21), Ex tc (Zone 22), Ex ec (Zone 2)

Motor version	Efficiency class	Rated power	Frame size – motor type													Page
			63	71	80	90	100	112	132	160	180	200	225	250	280	
SIMOTICS XP aluminum housing																
IEC	IE3 Premium Efficiency	0.37 ... 18.5 kW														5/16
	IE2 High Efficiency	0.37 ... 18.5 kW														5/20
	IE1 Standard Efficiency	0.75 ... 18.5 kW														5/26
SIMOTICS XP cast-iron housing																
IEC	IE3 Premium Efficiency	– Basic Line	0.18 ... 200 kW													5/17
		– Performance Line	1.5 ... 200 kW													5/17
	IE2 High Efficiency	– Basic Line	0.09 ... 200 kW													5/22
		– Performance Line	0.75 ... 200 kW													5/22

SIMOTICS DP application-specific motors

Motor version	Efficiency class	Rated power at 50 Hz (values in kW) or 60 Hz (values in hp)	Frame size – motor type													Page
			63	71	80	90	100	112	132	160	180	200	225	250	280	
Smoke extraction motors – aluminum housing																
IEC	IE3 Premium Efficiency	0.55 ... 18.5 kW														6/9
	IE2 High Efficiency	0.37 ... 18.5 kW														6/11
Smoke extraction motors – cast-iron housing																
IEC	IE3 Premium Efficiency	18.5 ... 200 kW														6/10
	IE2 High Efficiency	15 ... 200 kW														6/13
Marine motors – aluminum housing																
IEC	IE4 Super Premium Efficiency	2.2 ... 37 kW														6/46
	IE3 Premium Efficiency	0.37 ... 45 kW														6/46
	IE2 High Efficiency	0.18 ... 45 kW														6/46
	IE1 Standard Efficiency	0.09 ... 37 kW														6/46
IEC – with explosion protection	IE3 Premium Efficiency	0.37 ... 18.5 kW														6/49
	IE2 High Efficiency	0.37 ... 18.5 kW														6/49
	IE1 Standard Efficiency	0.75 ... 18.5 kW														6/49
Eagle Line	NEMA Premium Efficient	0.37 ... 37 kW 0.5 ... 50 hp														6/46
	NEMA Energy Efficient	0.37 ... 0.55 kW 0.5 ... 0.75 hp														6/46
Pole-changing	–	0.5 ... 28 kW														6/46
	–	0.6 ... 26 kW														6/46
Marine motors – cast-iron housing																
IEC	IE4 Super Premium Efficiency	– Basic Line	2.2 ... 200 kW													6/47
			160 ... 500 kW													6/48
		– Performance Line	2.2 ... 200 kW													6/47
			160 ... 500 kW													6/48
	IE3 Premium Efficiency	– Basic Line	0.18 ... 200 kW													6/47
			160 ... 500 kW													6/48
		– Performance Line	1.5 ... 200 kW													6/47
			160 ... 500 kW													6/48
IE2 High Efficiency	– Basic Line	0.09 ... 200 kW													6/47	
		0.75 ... 200 kW													6/47	
	– Performance Line	1.5 ... 200 kW													6/47	
		160 ... 500 kW													6/48	
IEC – with explosion protection	IE3 Premium Efficiency	– Basic Line	0.18 ... 200 kW													6/49
		– Performance Line	1.5 ... 200 kW												6/49	
	IE2 High Efficiency	– Basic Line	0.09 ... 200 kW													6/49
		– Performance Line	0.75 ... 200 kW													6/49
Eagle Line	NEMA Premium Efficient	– Basic Line	0.18 ... 185 kW 0.25 ... 250 hp													6/47
		– Performance Line	2.2 ... 185 kW 3 ... 250 hp													6/47
	NEMA Energy Efficient	– Basic Line	0.09 ... 0.55 kW 0.12 ... 0.75 hp													6/47

Introduction

Guide to selecting and ordering the motors

Special versions

1

Overview

The following table contains a list of all available special versions according to category and availability in the catalog sections where you will find them. The order codes are listed here according to the function. An alphanumerical listing of all special versions can be found in the Appendix in the Index of order codes.

Note:

Options cannot always be freely combined. It is not possible to describe every single impermissible option combination in the catalog. Incompatibility between options may result in rejection of an order when multiple options are ordered, see also in the DT Configurator:

www.siemens.com/dt-configurator

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors	
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Version for converter operation											
Version for converter operation in basic version with operating data SINAMICS G120 with PM240-2.	B40	5/7						5/38	5/42		
Version for converter operation in basic version with operating data SINAMICS S150.	B41	5/7						5/38	5/42		
Operating data such as order code B40 with alternative SINAMICS converters on the rating plate <ul style="list-style-type: none"> • G120 with PM230 • G120 with PM240 • G120C • G120P with PM230 • G120P with PM240-2 • G120P with PM240P-2 • G120P with PM330 • G130, G150, G180 • S120 (BLM/SLM) • V20 Operating data such as the B41 order code with alternative SINAMICS converter on the rating plate <ul style="list-style-type: none"> • S120 (ALM) 	Y68 and converter type	5/7						5/38	5/42		
Version in accordance with standards and specifications											
VIK version	C02	1/28	2/105	2/113							
CCC China Compulsory Certification	D01	1/27	2/105	2/113						6/21	
Motor without CE marking for export outside EEA (see EU Directive 640/2009)	D22		2/105	2/113	3/25						
Motor exclusively for use in transportation equipment for passengers and freight transport corresponding to EVPG §1 dated February 27, 2008	D23				3/25						
Electrical according to NEMA MG1-12	D30	1/26	2/105	2/113	3/25						
Design according to UL with "Recognition Mark"	D31	1/26	2/105	2/113	3/25						
Ex certification for China	D32	<i>New!</i>							5/44		
KEMCO Korea Energy Efficiency Label	D33	1/27	2/105	2/113							
China Energy Efficiency Label	D34	1/27	2/105	2/113					5/44		
Ex certificate EAC for the Eurasian customs union	D35	5/14						5/39	5/44		
IEC Ex certification	D37							5/39	5/44		
Version according to UL and CSA (Canadian regulation)	D39					4/43 4/99	4/47 4/103				
Canadian regulations (CSA)	D40		2/105	2/113	3/25						
TR CU product safety certificate EAC for Eurasian customs union	D47	1/28	2/105	2/113	3/25	4/99	4/103				
Version suitable for railways IC 411, EN IEC 60349, without EN 45545, with external fan and fan cover in plastic	L90	1/28	2/105								
Version suitable for railways IC 411, EN IEC 60349, with EN 45545, with external fan and fan cover in metal	L91	1/28	2/105								
Version suitable for railways IC 418, EN IEC 60349, without EN 45545, without external fan and fan cover	L92		2/105								

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors	
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Balance and vibration severity											
Vibration severity grade B	L00	1/56	2/106	2/114	3/25			5/40	5/44	6/21	6/23
Balancing without feather key	L01	1/56	2/106	2/114	3/25	4/43	4/47	5/40	5/44	6/21	6/23
Full-key balancing	L02	1/56	2/106	2/114	3/25	4/43	4/47	5/40	5/44	6/21	6/23
Explosion-proof version											
Version (IP55) for Zones 2 or 22, for non-conductive dust	B30	5/6						5/38	5/42		
Design for Zone 2 in Ex ec IIB T3 Gc	B31	5/6						5/38	5/42		
VIK version	C02	1/28						5/38	5/42		
Colors and paint finish											
Unpainted (only cast-iron parts primed)	S00	1/21	2/104	2/111	3/23	4/42	4/46	5/39	5/43	6/21	6/23
Unpainted, only primed	S01	1/21	2/104	2/111	3/23	4/42	4/46	5/39	5/43	6/21	6/23
Special paint finish C3	S02	1/21	2/104	2/111	3/23	4/42	4/46	5/39	5/43		6/23
Special paint finish sea air resistant C4	S03	1/21	2/104	2/111	3/23	4/42	4/46	5/39	5/43	6/21	6/23
Special paint finish for offshore C5	S04	1/21		2/111	3/23		4/46		5/43		
Internal coating	S05	1/21	2/104	2/111	3/23	4/42	4/46				6/23
Top coat polyurethane	S06	1/21	2/104	2/111	3/23			5/39	5/43	6/21	6/23
Paint finish in other standard RAL colors: RAL 1002, 1013, 1015, 1019, 2003, 2004, 3000, 3007, 5002, 5007, 5009, 5010, 5012, 5015, 5017, 5018, 5019, 6011, 6019, 6021, 7000, 7001, 7004, 7011, 7016, 7022, 7031, 7032, 7033, 7035, 9001, 9002, 9005	Y53 and paint finish RAL....	1/23	2/104	2/111	3/23	4/98	4/46	5/39	5/43	6/21	6/23
Paint finish in special RAL colors: For RAL colors, see "Special paint finish in special RAL colors"	Y56 and paint finish RAL....	1/23	2/104	2/111	3/23	4/42	4/46	5/39	5/43	6/21	6/23
Heating and ventilation											
Sheet metal fan cover	F74	1/36	2/106	2/115	3/26	4/43	4/48				
Fan cover for textile industry	F75	1/36	2/106			4/43	4/99				
Metal external fan	F76	1/36	2/106	2/115		4/43	4/48	5/40	5/45		
Without external fan and without fan cover	F90	1/36	2/106	2/115	3/26	4/43				6/22	6/24
Anti-condensation heating for 230 V (2 terminals)	Q02	1/36	2/106	2/115	3/26	4/43	4/48	5/40	5/45		
Anti-condensation heating for 115 V (2 terminals)	Q03	1/36	2/106	2/115	3/26	4/43	4/48	5/40	5/45		
Anti-condensation heating for 400 V (2 terminals)	Q06 <i>New!</i>				3/26						
Separately driven fan with non-standard voltage and/or frequency	Y81 and customer specifications	1/80		2/115	3/26		4/104				
Coolant temperature and installation altitude											
Coolant temperature –50 to +40 °C	D02			2/113	3/25		4/47				
Coolant temperature –40 to +40 °C	D03	1/35	2/105	2/113	3/25	4/42	4/47	5/39	5/44		
Coolant temperature –30 to +40 °C	D04	1/35	2/105	2/113	3/25	4/42	4/47			6/21	6/23
Bearings and lubrication											
Regreasing device with M10 × 1 grease nipple according to DIN 71412-A	L19	1/59	2/105	2/114	3/25				5/44		6/23
Located bearing DE	L20	1/58	2/105	2/114	3/25	4/43	4/47	5/40	5/44		
Located bearing NDE	L21	1/58	2/105	2/114		4/43	4/47	5/40	5/44		
Bearing design for increased cantilever forces	L22	1/58	2/105	2/114	3/25	4/43	4/47	5/40	5/44	6/21	6/23
Regreasing device	L23	1/59	2/105	2/114		4/43	4/47	5/40	5/44	6/21	6/23

Introduction

Guide to selecting and ordering the motors

Special versions

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors	
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Bearings and lubrication (continued)											
Hot bearing grease	L24 <i>New!</i>				3/25						
Bearings reinforced at both ends for DE and NDE, bearing size 63	L25	1/58	2/105	2/114		4/43 4/99	4/47 4/103	5/40	5/44		
Bearings reinforced at both DE and NDE, DE bearings for increased cantilever forces	L28			2/114			4/47 4/103				
Drainage for used grease	L30 <i>New!</i>				3/25						
Special version with higher speeds	L37 <i>New!</i>				3/25						
Bearing insulation DE	L50	1/58		2/114	3/25		4/103			6/21 6/23	
Bearing insulation NDE	L51	1/58		2/114	3/25		4/103		5/44	6/21 6/23	
Measuring nipple for SPM shock pulse measurement for bearing inspection	Q01	1/58	2/105	2/114	3/25	4/43 4/99	4/47 4/103	5/40	5/44	6/21 6/23	
Rating plate and additional rating plates											
Additional rating plate for voltage tolerance	B07	1/30	2/106	2/115	3/26					6/22 6/24	
Second rating plate, loose	M10	1/30	2/106	2/115	3/26	4/43 4/99	4/48 4/104	5/40	5/45	6/22 6/24	
Rating plate, stainless steel	M11	1/30	2/106	2/115	3/26	4/43 4/99	4/48 4/104	5/40	5/45		
Additional rating plate with deviating rating plate data	Y80 and customer specifications	1/30	2/106	2/115	3/26			5/40	5/45	6/22 6/24	
Additional rating plate with customer specifications	Y82 and customer specifications	1/30	2/106	2/115	3/26	4/43 4/99	4/48 4/104	5/40	5/45	6/22 6/24	
Additional information on rating plate and on package label (max.20 characters)	Y84 and customer specifications	1/30	2/106	2/115	3/26	4/43 4/99	4/48 4/104	5/40	5/45	6/22 6/24	
Adhesive label, supplied loose (printed with: Article No., Serial No.; 2 lines of text)	Y85 and customer specifications	1/30	2/106	2/115	3/26	4/43 4/99	4/48 4/104				
Mechanical version and degrees of protection											
Low-noise version for 2-pole motors with clockwise direction of rotation	F77	1/57	2/104	2/113	3/24			5/39	5/44		
Low-noise version for 2-pole motors with counterclockwise direction of rotation	F78	1/57	2/104	2/113	3/24			5/39	5/44		
Prepared for mountings, centering hole only	G40	1/79	2/104	2/113		4/42 4/98	4/47 4/103				
Prepared for mountings with D12 shaft	G41	1/79	2/104	2/113	3/24	4/42 4/98	4/47 4/103				
Prepared for mountings with D16 shaft	G42	1/79	2/104	2/113	3/24	4/42 4/98	4/47 4/103				
Mechanical protection for encoder	G43	1/79	2/104	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44		
Protective cover	H00	1/50	2/105	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44	6/21	
Screwed-on (instead of cast) feet	H01	1/41	2/105	2/113		4/42 4/98	4/47 4/103			6/21 6/23	
Vibration-proof version; vibration resistance to Class 3M4 according to IEC 60721-3-3:1994	H02	1/77	2/105	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44		
Condensation drainage holes	H03	1/50	2/105	2/113	3/24	4/42 4/98		5/39	5/44		
Rust-resistant screws (externally)	H07	1/77	2/105	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44	6/21 6/23	
Housing with screw mounting	H10	1/41	2/105			4/42	4/47				
IP65 degree of protection	H20	1/50	2/105	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44	6/21 6/23	
IP54 degree of protection	H21			2/113	3/24		4/47 4/103				
IP56 degree of protection	H22	1/50	2/105	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44	6/21 6/23	
Drive-end seal for flange-mounted motors, oil-tight to 0.1 bar	H23	1/55	2/105	2/113	3/24	4/42 4/98	4/47 4/103	5/39	5/44		
Viton sealing ring	H25 <i>New!</i>				3/24						
Grounding brush for converter operation	L52	1/79		2/113	3/24		4/103				

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors	
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Modular technology – Basic versions											
Mounting of holding brake (standard assignment)	F01	1/81	2/104	2/112	3/23	4/42 4/98	4/46 4/102				
Mounting of brake for higher switching frequency (operating brake)	F02	1/81	2/104			4/42 4/98					
Mounting of PRECIMA brake	F04	1/93		2/112							
Mounted separately driven fan	F70	1/80	2/104	2/112	3/23	4/42 4/98	4/46 4/102	5/39	5/43		
Mounting of 1XP8012-10 (HTL) rotary pulse encoder	G01	1/98	2/104	2/112	3/23	4/42 4/98	4/46 4/102				
Mounting of 1XP8012-20 (TTL) rotary pulse encoder	G02	1/98	2/104	2/112	3/23	4/42 4/98	4/46 4/102				
Mounting of Kübler Sendix 5020 HTL, 1024 I rotary pulse encoder	G11	1/104	2/104	2/112	3/23						
Mounting of Kübler Sendix 5020 TTL, 1024 I rotary pulse encoder	G12	1/104	2/104	2/112	3/23						
Modular technology – Additional versions											
Brake supply voltage 24 V DC	F10	1/82	2/104	2/112	3/23	4/42 4/98	4/46 4/102				
Brake supply voltage 230 V AC, 50/60 Hz	F11	1/82	2/104	2/112	3/23	4/42 4/98	4/46 4/102				
Brake supply voltage 400 V AC, 50/60 Hz	F12	1/82	2/104	2/112	3/23	4/42 4/98	4/46 4/102				
Backstop, counterclockwise motion blocked, clockwise direction of rotation	F40	1/105		2/112	3/23		4/46				
Backstop, clockwise motion blocked, counterclockwise direction of rotation	F41	1/105		2/112	3/23		4/46				
Mechanical manual brake release with lever (no locking)	F50	1/86	2/104	2/112		4/42 4/98	4/46 4/102				
Motor connection and terminal box											
External grounding	H04	1/41	2/102	2/109		4/41 4/97	4/45 4/101			6/21	
Terminal box on NDE	H08	1/41	2/102	2/109	3/21	4/41 4/97	4/45 4/101			6/21 6/23	
Second external grounding	H70	1/41		2/109	3/21		4/45 4/101				
Terminal box rotated through 90°, entry from DE	R10	1/42	2/102	2/109	3/21	4/41 4/97	4/45 4/101	5/38	5/42		
Terminal box rotated through 90°, entry from NDE	R11	1/42	2/102	2/109	3/21	4/41 4/97	4/45 4/101	5/38	5/42		
Terminal box rotated through 180°	R12	1/42	2/102	2/110	3/22	4/41 4/97	4/45 4/101	5/38	5/42	6/21 6/23	
Terminal box in position 0°; connection from right	R13	1/42	2/102			4/41 4/97				6/21 6/23	
One EMC cable gland	R14			2/110	3/22		4/45 4/101				
One metal cable gland	R15	1/43	2/102	2/110	3/22	4/41 4/97	4/45 4/101				
EMC cable gland, maximum configuration	R16			2/110	3/22		4/45 4/101				
Stud terminal for cable connection, accessories pack (3 items)	R17			2/110	3/22		4/101		5/42		
Metal cable gland, maximum configuration	R18		2/102	2/110	3/22	4/41		5/38	5/42		
Saddle terminal for connection without cable lug, accessories pack	R19			2/110	3/22		4/101		5/42		
3 cables protruding, 0.5 m long	R20	1/43	2/102	2/110		4/41 4/97					
3 cables protruding, 1.5 m long	R21	1/43	2/102	2/110	3/22	4/41					
6 cables protruding, 0.5 m long	R22	1/43	2/102	2/110		4/41 4/97					
6 cables protruding, 1.5 m long	R23	1/43	2/102	2/110	3/22	4/41					
6 cables protruding, 3 m long	R24	1/43	2/103	2/110	3/22	4/41					
Reduction piece for M cable gland in accordance with British Standard, both cable entries mounted	R30	1/43	2/103	2/110							

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Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors	
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Motor connection and terminal box (continued)											
Larger terminal box	R50	1/41	2/103	2/110	3/22	4/41 4/97	4/45 4/101	5/38	5/42		
Terminal box without cable entry opening	R51			2/110	3/22		4/45 4/101				
Drilled removable entry plate	R52	1/48		2/110	3/22		4/45 4/101				
Undrilled removable entry plate	R53	1/48		2/110	3/22		4/45 4/101				
Auxiliary terminal box, aluminum	R60		2/103								
Cast-iron auxiliary terminal box (small)	R62	1/48		2/110	3/22		4/45 4/102		5/42		
Larger cast-iron terminal box	R63 <i>New!</i>	1/48			3/22						
Motor connector Han-Drive 10e for 230 VΔ/400 VY	R70	1/43	2/103				4/41 4/97				
Motor connector Han-Drive 10e EMC for 230 VΔ/400 VY	R71	1/43	2/103				4/41 4/97				
Small motor connector CQ12 with EMC	R72	1/43	2/103								
Small motor connector CQ12 without EMC	R73	1/43	2/103								
Silicon-free version	R74			2/110	3/22		4/102				
Non-standard threaded through hole (NPT or G thread)	Y61 and customer specifications			2/110	3/22		4/45 4/102				
Motor protection											
1 or 3 PTC thermistors – for tripping (2 terminals)	Q11	1/38	2/102	2/109	3/21	4/41 4/97	4/45 4/101				
2 or 6 PTC thermistors – for alarm and tripping (4 terminals)	Q12	1/38	2/102	2/109	3/21	4/41 4/97	4/45 4/101				
1 KTY84-130 temperature sensor (2 terminals)	Q23		2/102	2/109	3/21	4/41 4/97	4/45 4/101				
2 KTY84-130 temperature sensors (4 terminals)	Q25		2/102	2/109	3/21	4/41 4/97	4/45 4/101				
3 bimetal sensors (normally closed contacts) for tripping (2 terminals)	Q31		2/102	2/109	3/21	4/41 4/97	4/45 4/101				
6 bimetal sensors (normally closed contacts) for alarm and tripping (4 terminals)	Q32		2/102	2/109	3/21	4/41 4/97	4/45 4/101				
3 bimetal sensors (normally closed contacts) for tripping (6 terminals)	Q33		2/102	2/109	3/21	4/41 4/97	4/45 4/101				
6 bimetal sensors (normally closed contacts) for alarm and tripping (12 terminals)	Q34		2/102	2/109	3/21	4/41	4/45 4/101				
1 Pt1000 resistance thermometer (2 terminals)	Q35	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101	5/38	5/42		
2 Pt1000 resistance thermometers (4 terminals)	Q36	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101	5/38	5/42		
3 Pt100 resistance thermometers – 2-wire input (6 terminals)	Q60	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101				
6 Pt100 resistance thermometers – 2-wire input (12 terminals)	Q61	1/40	2/102	2/109	3/21	4/41 4/97					
1 Pt100 resistance thermometer – 2-wire input (2 terminals)	Q62	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101				
3 Pt100 resistance thermometers – 3-wire input (9 terminals)	Q63	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101				
6 Pt100 resistance thermometers – 3-wire input (18 terminals)	Q64	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101				
2 Pt100 screw-in thermometers in basic configuration for bearings (2 terminals)	Q72	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101		5/42		
2 Pt100 screw-in thermometers in 3-wire input for bearing (6 terminals)	Q78	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101		5/42		
2 Pt100 double screw-in thermometers in 3-wire input for bearing (12 terminals)	Q79	1/40	2/102	2/109	3/21	4/41 4/97	4/45 4/101		5/42		
Special technology											
Mounting of LL 861 900 220 rotary pulse encoder	G04	1/99	2/104	2/112	3/24	4/42 4/98	4/46 4/102				
Mounting of HOG 9 DN 1024 I rotary pulse encoder	G05	1/100	2/104	2/112	3/24	4/42 4/98	4/46 4/102				
Mounting of HOG 10 D 1024 I rotary pulse encoder	G06	1/103	2/104	2/112	3/24	4/42 4/98	4/46 4/102				

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors	
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Special technology (continued)											
Mounting of POG 10D rotary pulse encoder (only in combination with separately driven fan or brake)	G07	1/102		2/112	3/24		4/46 4/102				
Mounting of POG9 rotary pulse encoder (only in combination with separately driven fan or brake)	G08	1/101		2/112	3/24		4/46 4/102				
Mounting of HOG 10 DN 1024 I rotary pulse encoder, terminal box moisture protection	G15			2/112	3/24						
Mounting of HOG 10 DN 1024 I rotary pulse encoder, terminal box dust protection	G16			2/112	3/24						
Mounting of explosion-proof rotary pulse encoder for use in Zones 2, 21, and 22	G30	5/10						5/39	5/43		
Mounting of a special type of rotary pulse encoder	Y70 and customer specifications						4/46 4/102				
Mounting of HOG 10 DN 1024 I + FSL rotary pulse encoder, (integrated centrifugal switch, speed ... rpm), terminal box moisture protection	Y74 and spec. speed ... rpm			2/112	3/24						
Mounting of HOG 10 DN 1024 I + FSL rotary pulse encoder, (integrated centrifugal switch, speed ... rpm), terminal box dust protection	Y76 and spec. speed ... rpm			2/112	3/24						
Mounting of HOG 10 DN 1024 I + ESL 93 rotary pulse encoder, (integrated electronic speed switch, speed ... rpm), terminal box dust protection	Y79 and spec. speed (max. 3) ... rpm			2/112	3/24						
Extension of the liability for defects											
Extension of the liability for defects period by 12 months to a total of 24 months (2 years) from delivery	Q80	1/24		2/115	3/26		4/48 4/104				
Extension of the liability for defects period by 18 months to a total of 30 months (2.5 years) from delivery	Q81 <i>New!</i>				3/26						
Extension of the liability for defects period by 24 months to a total of 36 months (3 years) from delivery	Q82	1/24		2/115	3/26		4/48 4/104				
Extension of the liability for defects period by 30 months to a total of 42 months (3.5 years) from delivery	Q83 <i>New!</i>				3/26						
Extension of the liability for defects period by 36 months to a total of 48 months (4 years) from delivery	Q84 <i>New!</i>				3/26						
Extension of the liability for defects period by 42 months to a total of 60 months (5 years) from delivery	Q85 <i>New!</i>				3/26						
Packaging, safety notes, documentation and test certificates											
Printed German/English Operating Instructions (compact) enclosed in each wire-lattice pallet	B01			2/107			4/44 4/100				
Acceptance test certificate 3.1 in accordance with EN 10204	B02	1/24		2/107	2/115	3/26	4/44 4/100	4/48 4/104	5/41	5/45	
Printed German/English Operating Instructions enclosed	B04	1/24		2/107	2/115	3/26	4/44 4/100	4/48 4/104	5/41	5/45	
Without "Made in manufacturing country" marking	B13 <i>New!</i>					3/26					
Equivalent circuit diagram	B51 <i>New!</i>					3/26					
Starting diagram (torque vs. speed and current vs. speed)	B52 <i>New!</i>					3/26					
Document – Electrical datasheet	B60			2/107	2/115	3/26	4/44 4/100	4/48 4/104			
Document – Order dimensional drawing	B61			2/107	2/115	3/26	4/44 4/100	4/48 4/104			
Standard test (routine test) with acceptance	B65				2/115	3/26		4/48 4/104		6/22	
Temperature test without acceptance	B67 <i>New!</i>					3/26				6/24	
Temperature test with acceptance	B68 <i>New!</i>					3/26				6/24	

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Special versions

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page									
			2 Standard motors		3	4 VSD motors for converter operation		5 Explosion-proof motors		6 Smoke extraction motors		
			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304	
Packaging, safety notes, documentation and test certificates (continued)												
Type test with heat run for vertical motors, without acceptance	B80 <i>New!</i>				3/27							
Type test with heat run for vertical motors, with acceptance	B81 <i>New!</i>				3/27							
Type test with heat run for horizontal motors, without acceptance	B82	1/24		2/115	3/27							
Type test with heat run for horizontal motors, with acceptance	B83	1/24	2/107	2/115	3/27	4/44 4/100	4/48 4/104	5/41	5/45	6/22	6/24	
"Basic" documentation package	B90 <i>New!</i>		2/107	2/115	3/27	4/44 4/100	4/48 4/104	5/41	5/45	6/22	6/24	
"Advanced" documentation package	B91 <i>New!</i>		2/107	2/115	3/27	4/44 4/100	4/48 4/104	5/41	5/45	6/22	6/24	
"Projects" documentation package	B92 <i>New!</i>		2/107	2/115	3/27	4/44 4/100	4/48 4/104	5/41	5/45	6/22	6/24	
Wire-lattice pallet packaging	B99	1/24	2/107			4/44 4/100		5/41	5/45			
Connected in star for dispatch	M01	1/24	2/107	2/115	3/27	4/44 4/100	4/48 4/104	5/41	5/45			
Connected in delta for dispatch	M02	1/24	2/107	2/115	3/27	4/44 4/100	4/48 4/104	5/41	5/45			
Printed Operating Instructions (Compact) for explosion-proof motors enclosed in other official EU languages	Y98 and customer specifications							5/41	5/45			
Shaft and rotor												
Shaft extension with standard dimensions, without feather keyway	L04	1/54	2/106	2/114	3/25	4/43 4/99	4/47 4/103	5/40	5/45	6/22	6/23	
Standard, cylindrical shaft extension (second shaft extension) NDE acc. to EN 50347	L05	1/54	2/106	2/114	3/25	4/43 4/99	4/47 4/103	5/40	5/45	6/22	6/23	
Standard shaft made of stainless steel (e.g. 1.4021)	L06	1/54	2/106	2/114	3/25	4/43 4/99	4/47 4/103	5/40	5/45			
Concentricity of shaft extension in accordance with DIN 42955 Tolerance R	L07	1/55	2/106	2/114	3/25	4/43 4/99	4/47 4/103	5/40	5/45	6/22	6/24	
Concentricity of shaft extension, coaxiality, and linear movement in accordance with DIN 42955 Tolerance R for flange-mounted motors	L08	1/55	2/106	2/114	3/25	4/43 4/99	4/47 4/103	5/40	5/45	6/22	6/24	
Non-standard cylindrical shaft extension, DE	Y58 and customer specifications	1/54	2/106	2/114	3/26	4/43 4/99	4/47 4/104	5/40	5/45	6/22	6/24	
Non-standard cylindrical shaft extension, NDE	Y59 and customer specifications	1/54	2/106	2/114	3/26	4/43 4/99	4/47 4/104	5/40	5/45	6/22	6/24	
Special shaft steel	Y60 and customer specifications			2/114	3/26		4/47 4/104			6/22	6/24	
Windings and insulation												
Temperature class 155 (F), utilized according to 155 (F), with service factor	N01	1/33	2/103	2/110	3/22							
Temperature class 155 (F), utilized acc. to 155 (F), with increased power	N02	1/33	2/103	2/110	3/22							
Temperature class 155 (F), utilized acc. to 155 (F), with increased coolant temperature	N03	1/33	2/103	2/110	3/22							
Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 45 °C, derating approx. 4 %	N05	1/33	2/103	2/110	3/22			5/38	5/43			
Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 50 °C, derating approx. 8 %	N06	1/33	2/103	2/110	3/22			5/38	5/43			
Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 55 °C, derating approx. 13 %	N07	1/33	2/103	2/110	3/22			5/38	5/43			
Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 60 °C, derating approx. 18 %	N08	1/33	2/103	2/111	3/22			5/38	5/43			
Temperature class 180 (H)	N10	1/33	2/103	2/111	3/22							
Temperature class 180 (H) at rated power and max. CT 60 °C	N11	1/33	2/103	2/111	3/22	4/42	4/46					
Increased air humidity/temperature with 30 to 60 g water per m ³ of air	N30	1/33	2/103	2/111	3/22	4/42 4/97	4/46 4/102	5/38	5/43	6/21	6/23	

Special versions	Additional identification code -Z with order code and plain text if required	For further information, see page	Catalog section – page								
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			Aluminum series 1LE10	Cast-iron series 1LE15 1LE16	Cast-iron series 1LE5	Aluminum series 1FP10.4 1LE1092	Cast-iron series 1FP15.4 1LE1592	Aluminum series 1MB10	Cast-iron series 1MB15 1MB16	Aluminum series 1PC1300 1PC1303	Cast-iron series 1PC1301 1PC1304
Windings and insulation (continued)											
Increased air humidity/temperature with 60 to 100 g water per m ³ of air	N31	1/33	2/103	2/111	3/22	4/42	4/46 4/102	5/39	5/43		
Temperature class 155 (F), utilized acc. to 130 (B), with higher coolant temperature and/or installation altitude	Y50 and spec. power, CT ... °C or IA ... m above sea level	1/33	2/103	2/111	3/22			5/39	5/43		
Temperature class 155 (F), utilized according to 155 (F), other requirements	Y52 and spec. power, CT ... °C or IA ... m above sea level	1/33	2/103	2/111	3/22						
Temperature class 180 (H), utilized according to 155 (F)	Y75 and spec. power, CT ... °C or IA ... m above sea level	1/33	2/103	2/111	3/22						
			6 Marine motors								
Marine version – Acceptance/certification											
Individual acceptance by marine classification society	B10		6/46 ... 6/49								
Type test with heat run for vertical motors, with acceptance	B81 <i>New!</i>		6/48								
Type test with heat run for horizontal motors, with acceptance	B83		6/46 ... 6/49								
Marine version – Basic version											
With type test certificate according to Lloyds Register (LR), CT 45 °C, temperature class 155 (F), utilized according to 155 (F)	E21		6/46 ... 6/49								
With type test certificate according to Bureau Veritas (BV), CT 45 °C, temperature class 155 (F), utilized according to 155 (F)	E31		6/46, 6/47, 6/49								
With type test certificate according to Registro Italiano Navale (RINA), CT 45 °C, temperature class 155 (F), utilized according to 155 (F)	E41		6/46 ... 6/49								
With type test certificate according to Russian Maritime Register (RS), CT 45 °C, temperature class 155 (F), utilized according to 155 (F)	E46		6/46 ... 6/49								
With type test certificate according to DNV GL Maritime, CT 45 °C, temperature class 155 (F), utilized according to 155 (F)	E51		6/46 ... 6/49								
With type test certificate according to American Bureau of Shipping (ABS), CT 50 °C, temperature class 155 (F), utilized according to 155 (F)	E52		6/46 ... 6/49								
With type test certificate according to Korean Register of Shipping (KR), CT 45 °C, temperature class 155 (F), utilized according to 155 (F)	E54		6/46, 6/47, 6/49								

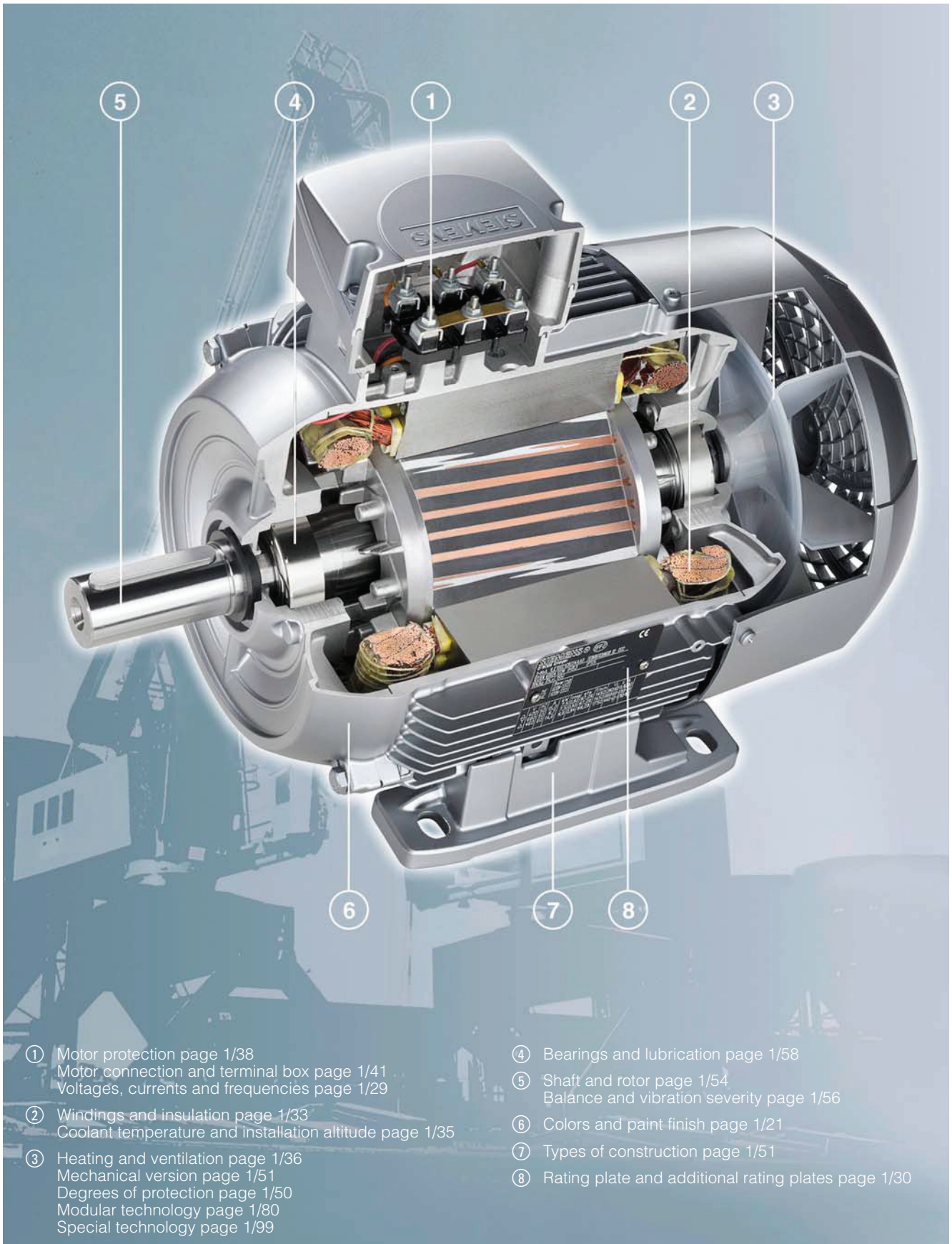
Introduction

General information

Cut-away diagram of a low-voltage motor

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Overview



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Overview

To protect the drives against corrosion and external influences, high-quality paint systems are available in various colors.

Standard version	Additional identification code –Z with order code						
	S00	S01	S02	S03	S04	S05	S06
Paint finish, suitability of paint finish for climate group in accordance with IEC 60721-2-1							
Standard paint finish C2	Unpainted, but unfinished cast-iron surfaces are primed	Unpainted, motor primed	Special paint finish C3	Special paint finish system "sea air resistant" C4	Special paint finish system "offshore" C5	Interior paint finish, all bare internal components primed with rust inhibitor ¹⁾	Polyurethane-based top coat, can only be ordered with S03 or S04
Use							
Moderate (extended) for indoor and outdoor installation under a roof not directly exposed to weather conditions.	The motors can be supplied unpainted on request.	The motors can be supplied with just a primer coat on request.	Worldwide (global) for outdoor installation in direct sunlight and/or exposed to weather conditions.	Recommended for indoor or outdoor installation directly exposed to weather conditions, industrial climate with moderate SO ₂ exposure, VIK requirements, inshore maritime climate, but not offshore maritime climate, e.g. for crane drives and in the paper industry.	Recommended for outdoor installations exposed to direct weather conditions, industrial climate with moderate SO ₂ exposure, and offshore maritime climate, e.g. for crane drives.	The motors can be supplied with internal paint finish on request. Recommended when there is a risk of heavy condensate formation.	Exposure to direct sunlight (UV light) may cause a change in color. When color stability is a requirement, a polyurethane-based paint system is recommended for the top coat (RAL 7030). Colors other than RAL 7030 are available on request.
Test requirements according to EN ISO 12944-2 Corrosivity Category							
C2	–	–	C3	C4	C5	–	–
Total film thickness – nominal film thickness in µm ^{2) 3)}							
Motors in aluminum version							
2-K epoxy resin 30 ^{4) 5)}	–	30	60	120	–	–	–
Polyurethane/ S06	–	–	–	120	–	–	Film thickness similar to S03/S04
Motors in cast-iron version							
2-K epoxy resin 60	30	60	90	150	170 ⁶⁾	–	–
Polyurethane/ S06	–	–	–	150	170 ⁶⁾	–	Film thickness similar to S03/S04
Resistance							
			For corrosive atmospheres up to 1 % acid and alkali concentration or permanent dampness in sheltered rooms.	Chemical exposure up to 5 % acid and alkali concentration.	Chemical exposure up to 5 % acid and alkali concentration.		Sunlight
Temperature range							
Up to 120 °C for brief periods	–	–	Up to 140 °C for brief periods	–40 ... 140 °C	–40 ... 140 °C		
Up to 100 °C continuously			Up to 120 °C continuously				
Rel. air humidity at (temperature)							
60 % (40 °C)	–	–	100 % (40 °C)	75 % (50 °C)	75 % (60 °C)		

Table continues on the next page.

Introduction

General information

Colors and paint finish

Overview (continued)

Standard version	Additional identification code –Z with order code						
	S00	S01	S02	S03	S04	S05	S06
Suitability for recoating ⁷⁾	Can be recoated within 1 week						
Pre-treatment of parts	All parts cleaned and degreased, steel and cast-iron parts sandblasted						
Drying	All layers oven-dried						
Top coat colors	RAL 7030 (stone gray)						
Standard version	RAL 7030 (stone gray)						
Available colors	Alternative standard and special RAL colors must be ordered with order code Y53 or Y56 and specification in plain text of the required RAL number (see tables for order codes Y53 and Y56 on the following page for selection of available RAL numbers/RAL colors). S06 is available only in standard RAL 7030						
Treatment of bare metal areas of shaft extensions and flanges	Coated with anti-corrosion agent that repels water and palm sweat						

Note:

For transport, the bare parts are coated with anti-corrosion paint which will last for a limited amount of time.

- 1) Machined laminated rotor core, shaft, inner diameter of cast-iron housing, interior surfaces of cast-iron bearing plates.
- 2) Total film thickness:
 - The specified film thickness represents average values for the external motor surfaces
 - Unpainted or one layer of paint (30 µm) less beneath the fan cover
 - The film thickness may differ at inaccessible locations (pockets/recesses or bases of ribs)

The film thickness specified for aluminum/cast-iron versions refers not only to motors, but also to components such as the bearing plate and housing. Motors are also available in an aluminum/cast-iron composite design.
- 3) The paint coat can become electrostatically charged where there is a thick film. Electrostatic discharges can occur. There is a risk of explosion if potentially explosive mixtures are also present at this moment. This can result in death, serious injury or material damage. When painted surfaces are recoated, one of the following conditions must be fulfilled:
 - Limit the total paint film thickness according to the explosion protection group:
 - IIA, IIB: Total paint film thickness ≤ 2 mm
 - IIC: Total paint film thickness ≤ 0.2 mm for motors of group II (gas)
 - Limit the surface resistance of the paint used:
 - Surface resistance ≤ 1 GΩ for motors of groups II and III (gas and dust)
 - Charge transfer limit:
 - 60 nC for Group I or Group IIA devices
 - 25 nC for Group IIB devices
 - 10 nC for Group IIC devices
 - 200 nC for Group III devices
 - Breakdown voltage ≤ 4 kV for explosion group III (dust only)

Note:
Paints for IIC with film thickness exceeding 200 µm are optionally available. Paints with film thickness exceeding 200 µm have been tested for electrostatic charging. Motors with a coating thickness exceeding 200 µm may only be painted over if the conditions mentioned above are complied with.

 - Order code **S06** (polyurethane-based top coat) is not admissible for motors with type of protection Ex tb and Ex tc. Product has not yet been tested for electrostatic discharge in environments with explosive dusts.
- 4) Aluminum motors/components without a paint finish already meet the requirements for corrosivity class C2. It is not therefore necessary to apply paint to components that are not visible. Paint is therefore applied only for the purpose of coloring.
- 5) Aluminum motors with cast-iron components (e.g. DE bearing plate) have a film thickness of > 30 µm on cast-iron components.
- 6) 50 µm zinc galvanized layer + 120 µm paint film thickness.
- 7) Primers, water-based 2-K epoxy resin paints and polyurethane-based paints can be overpainted with paints of the same kind if the motors are in the original packaging and are still covered by the warranty. A suitability test should be conducted before any recoating work is undertaken if the customer intends to use a coating of a different kind to overpaint the motor. Alternatively, a test in accordance with EN ISO 16927 "Determination of the overcoatability and recoatability of a coating" can be requested and ordered.

Overview (continued)

**Paint finish in other standard RAL colors –
Order code Y53
(RAL number is required in plain text)**

RAL No.	Color name	RAL No.	Color name
3007	Black red	7000	Squirrel gray
5002	Ultramarine blue	7001	Silver gray
5007	Brilliant blue	7004	Signal gray
5009	Azure blue	7011	Iron gray
5010	Gentian blue	7016	Anthracite gray
5015	Sky blue	7022	Umbra gray
5017	Traffic blue	7031	Blue gray
5018	Turquoise blue	7032	Pebble gray
5019	Capri blue	7033	Cement gray
6011	Reseda green	7035	Light gray
6021	Pale green	9005	Jet black

The following weakly covering paints must be applied at least twice owing to their poor opacity. The standard paint finish for these colors is not possible and must be ordered with **S02**, **S03**, or **S04**.

RAL No.	Color name
1002	Sand yellow
1013	Oyster white
1015	Light ivory
1019	Gray beige
2003	Pastel orange
2004	Pure orange
3000	Flame red
5012	Light blue
6019	Pastel green
9001	Cream white
9002	Gray white

**Paint finish in special RAL colors –
Order code Y56
(RAL number is required in plain text)**

RAL No.	Color name	RAL No.	Color name
3004	Purple red	6034	Pastel turquoise
3011	Brown red	6034	Pastel turquoise
3015	Light pink	7005	Mouse gray
3020	Traffic red	7009	Green gray
4005	Blue lilac	7012	Basalt gray
5000	Violet blue	7015	Slate gray
5001	Green blue	7023	Concrete gray
5003	Sapphire blue	7036	Platinum gray
5005	Signal blue	7037	Dusty gray
5011	Steel blue	7038	Agate gray
5013	Cobalt blue	7039	Quartz gray
5014	Pigeon blue	7040	Window gray
5020	Ocean blue	7042	Traffic gray A
5021	Water blue	7044	Silk gray
5022	Night blue	7045	Telegray 1
5023	Distant blue	7046	Telegray 2
6000	Patina green	7047	Telegray 4
6001	Emerald green	8012	Red brown
6002	Leaf green	8025	Pale brown
6005	Moss green	8028	Terra brown
6009	Fir green	9003	Signal white
6010	Grass green	9004	Signal black
6016	Turquoise green	9006	White aluminum
6017	May green	9007	Gray aluminum
6018	Yellow green	9010	Pure white
6024	Traffic green	9011	Graphite black
6026	Opal green	9016	Traffic white
6029	Mint green	9017	Traffic black
6032	Signal green		

The following weakly covering paints must be applied at least twice owing to their poor opacity. The standard paint finish for these colors is not possible and must be ordered with **S02**, **S03**, or **S04**.

RAL No.	Color name
1003	Signal yellow
1004	Golden yellow
1006	Maize yellow
1007	Daffodil yellow
1012	Lemon yellow
1014	Ivory
1018	Zinc yellow
1021	Rape yellow
1023	Traffic yellow
1028	Melon yellow
1032	Broom yellow
1033	Dahlia yellow
2008	Bright red orange
2009	Traffic orange
2010	Signal orange
3002	Carmin red
5024	Pastel blue
6027	Light green

Coating structure and colors not specified in the catalog are available on request.

Introduction

General information

Packaging and dispatch · Safety notes and documentation · Test certificates · Extension of the liability for defects

Overview

Connected in star for dispatch – Order code **M01**

The terminal board of the motor is connected in star for dispatch.

Connected in delta for dispatch – Order code **M02**

The terminal board of the motor is connected in delta for dispatch.

Packing weights

For motors Frame size	Type 1LE1...- 1LE5...- 1PC1...- 1MB1...-	For land transport Type of construction IM B3				Types of construction IM B5, IM V1			
		in box Tare	on ISPM wooden base board with telescopic box Tare	on pallet Tare	in crate Tare	in box Tare	on ISPM wooden base board with telescopic box Tare	on pallet Tare	in crate Tare
		kg	kg	kg	kg	kg	kg	kg	kg
63 M	0B.2	0.65	–	–	–	0.65	–	–	–
71 M	0C.2	0.65	–	–	–	0.65	–	–	–
80 M	0D.2	0.65	–	–	–	0.65	–	–	–
90 S	0E.0	0.65	–	–	–	0.65	–	–	–
100 L	1A.4	–	5.0	–	–	–	5.0	–	–
	1A.5	–	5.0	–	–	–	5.0	–	–
	1A.6	–	5.0	–	–	–	5.0	–	–
112 M	1B.2	–	5.0	–	–	–	5.0	–	–
	1B.6	–	5.0	–	–	–	5.0	–	–
132 S	1C.0	4.7	–	–	–	5.2	–	–	–
	1C.1	4.7	–	–	–	5.2	–	–	–
132 M	1C.2	4.7	–	–	–	5.2	–	–	–
	1C.3	4.7	–	–	–	5.2	–	–	–
	1C.6	8.7	–	–	–	9.2	–	–	–
160 M	1D.2	4.8	–	–	–	5.7	–	–	–
	1D.3	4.8	–	–	–	5.7	–	–	–
160 L	1D.4	4.8	–	–	–	5.7	–	–	–
	1D.6	8.8	–	–	–	9.7	–	–	–
180		–	–	8.0	–	–	–	10.0	–
200		–	–	11.0	–	–	–	13.0	–
225		–	–	14.0	–	–	–	17.0	–
250		–	–	22.0	–	–	–	25.0	–
280		–	–	24.0	–	–	–	27.0	–
315		–	–	28.0	–	–	–	32.0	–
315	1LE5	–	–	32.0	–	–	–	46.0	–
355	1LE5	–	–	58.0	–	–	–	78.0	–

Data apply for individual packaging. Wire-lattice pallets can be used, order code **B99**.

Safety notes

Printed German and English Operating Instructions (compact), enclosed in each wire-lattice pallet – Order code **B04**

Documentation

Printed German and English Operating Instructions enclosed with the motor are available as an option (standard documentation in PDF format can be obtained using the Drive Technology Configurator) – Order code **B04**

Test certificates

Acceptance test certificate 3.1 in accordance with **EN 10204** – Order code **B02**

An acceptance test certificate 3.1 in accordance with EN 10204 can be supplied for most motors.

Type test with temperature-rise run for horizontal motors

- **With acceptance** – Order code **B83**
- **Without acceptance** – Order code **B82**

During the type test, a temperature-rise test is performed; no-load, short-circuit, and load characteristics are recorded; the iron losses and friction losses are determined and the efficiency is calculated from the summed losses. This option is only applicable to motors with a horizontal type of construction. Acceptance testing is performed by an external representative (e.g. customer, classification society). No acceptance test is performed when order code **B82** is stated.

Extension of the liability for defects for SIMOTICS 1LE15 and 1MB15 Low-Voltage Motors

For SIMOTICS 1LE15 and 1MB15 Low-Voltage Motors, it is possible to obtain an extension of the liability for defects beyond the standard liability period.

The standard warranty period is quoted in the standard conditions of supply and delivery and is 12 months. The standard warranty period for SIMOTICS 1LE16 and 1MB16 Low-Voltage Motors is 36 months.

For the case of a new product order

With the following optional order suffixes listed in the table, extension of the liability for defects beyond the standard liability period is possible in conjunction with a new order for a product.

The markup on the product price is graded according to the duration of the extension.

Extension of the liability for defects for 1LE15 and 1MB15 motors

Additional identification code –Z with order code	Description
Q80	Extension of liability for defects, by 12 months to a total of 24 months (2 years) from delivery
Q82	Extension of liability for defects, by 24 months to a total of 36 months (3 years) from delivery

Overview**Applicable standards and specifications**

The 1LE... motors comply with the IEC 60034 series of international product standards for rotating electrical machines and, in particular, those parts that are listed in the table below.

Title	IEC/EN	DIN EN
General specifications for rotating electrical machines	IEC 60034-1, IEC 60085	EN 60034-1
Specification of the losses and efficiency of rotating electrical machines	IEC 60034-2-1	EN 60034-2-1
General-purpose three-phase induction motors having standard dimensions and powers	IEC 60072 Mounting dimensions and power series only (no assignment of frame size to power)	EN 50347 Mounting dimensions according to IEC 60072 and power assignment for Europe
Starting performance of rotating electrical machines	IEC 60034-12	EN 60034-12
Terminal designations and direction of rotation for electrical machines	IEC 60034-8	EN 60034-8
Designation for types of construction, mounting, and terminal box position (IM code)	IEC 60034-7	EN 60034-7
Terminal box cable entries	–	DIN 42925
Built-in thermal protection	IEC 60034-11	EN 60034-11
Noise limits of rotating electrical machines	IEC 60034-9	EN 60034-9
IEC standard voltages	IEC 60038	IEC 60038
Methods of cooling of rotating electrical machines (IC code)	IEC 60034-6	EN 60034-6
Vibration severity of rotating electrical machines	IEC 60034-14	EN 60034-14
Vibration limits	–	ISO 10816
Degrees of protection for rotating electrical machines (IP code)	IEC 60034-5	EN 60034-5
International efficiency classes for rotating electrical machines (IE code)	IEC 60034-30-1	EN 60034-30
In addition, the following applies to Ex motors:		
General provisions	IEC/EN 60079-0	EN 60079-0
Type of protection "n" (non-sparking)	IEC/EN 60079-15	EN 60079-15
Areas containing flammable dust	IEC/EN 60079-31	EN 60079-31

The following applies to explosion-proof motors:

Since the requirements of explosion-proof motors comply with the European standards EN 60079-0, EN 60079-15, EN 60079-31 and Directive 2014/34/EU (ATEX 95), the certificates issued by authorized testing agencies (PTB, FTZU, etc.) are accepted by all member states of the EU. The remaining members of CENELEC, Switzerland in particular, also accept the certificates.

Tolerances for electrical data

According to EN 60034, the following tolerances are permitted: Motors that comply with EN 60034-1 must have a voltage tolerance of $\pm 5\%$ /frequency tolerance of $\pm 2\%$ (Design A). If this is fully utilized, the admissible limit temperature of the temperature class may be exceeded by 10 K.

Efficiency η at

$$P_{\text{rated}} \leq 150 \text{ kW: } -0.15 \cdot (1 - \eta)$$

$$P_{\text{rated}} > 150 \text{ kW: } -0.1 \cdot (1 - \eta)$$

Where η is a decimal number.

$$\text{Power factor} = \frac{1 - \cos \phi}{6}$$

- Minimum absolute value: 0.02
- Maximum absolute value: 0.07

Slip $\pm 20\%$ (for motors $< 1 \text{ kW}$ $\pm 30\%$ is admissible)

Locked-rotor current $+20\%$

Locked-rotor torque -15% to $+25\%$

Breakdown torque -10%

Moment of inertia $\pm 10\%$

Certifications

Product certifications are differentiated in terms of safety-related certificates and efficiency certificates.

Since 2011, it has been obligatory for low-voltage motors with power ratings in the range of 0.75 to 375 kW (2, 4, and 6-pole) to be classified in accordance with the IEC 60034-30-1 efficiency standard and to be marked with the corresponding IE code (International Efficiency IE1, IE2, or IE3). The efficiency is determined using the summed losses method in accordance with IEC 60034-2-1.

Introduction

General information

Versions in accordance with standards and specifications

Overview (continued)

Energy-saving motors for the European Economic Area in accordance with EU Directive 640/2009

Since January 2017, all low-voltage motors that fall within the scope of the EU directive must fulfill the specifications of international efficiency class IE3.

- Line voltage ≤ 1000 V
- Line frequency 50 or 50/60 Hz
- Power range 0.75 to 375 kW
- Pole number 2, 4 and 6-pole
- Continuous duty S1

IE2 motors are only admissible if they are speed-controlled via converters.

Energy-saving motors for the North-American economic area in accordance with EISA

In accordance with EISA, modified conditions have been in effect since June 1, 2016.

This law stipulates that all motors must comply with the requirements stated in NEMA MG1 Table 12-12 (NPE = Nema Premium Efficient).

From this date onwards, therefore, motors previously covered by the EPAct must also comply with NPE. The NPE requirements apply to motors with the following characteristics / operating conditions:

- Line voltage ≤ 600 V
- Line frequency 60 Hz
- Power range 1 hp to 500 hp
- Number of poles: 2, 4, 6, 8-pole motors and geared motors
- Continuous duty S1

Explosion-proof motors are also included.

Exclusions from the EISA efficiency requirements:

- Brake motors
- Converter motors

Note:

Option **D30**: el. acc. to NEMA

Option **D31**: UL version

These options can be ordered for motors that are not subject to the EISA specifications (e.g. for use outside North America).

Options **D30** and **D31** do not authorize operation within North America.



The logo NEMA Premium is a registered trademark. It is only permitted to be used by companies that voluntarily submit to the control of the NEMA organization.

Approval for the USA: UL safety and DoE listing

For the USA, the motor series **1LE1.21** (NEE) and **1LE1.23** (NPE) are listed at the Department of Energy (DoE) and marked with the certification number **CC032A**.

Additional specifications to NEMA MG1: Nominal efficiency acc. to NEMA MG1 Table 12-11 or Table 12-12, design letter, code letter, CONT, CC No. CC 032A (Siemens) and service factor SF 1.15.

Motor series 1LE1.21 and 1LE1.23 remain certified up to a rated voltage of 600 V from Underwriters Laboratories Inc. and are marked accordingly ("Recognition Mark" = R/C).



UL approval does not apply to motors for Zones 2, 21, 22 or marine motors.

Approval for Canada: CSA safety and CSA Energy Efficiency Verification

In April 2012, the EISA requirements were implemented in Canada; in this case, all powers are subject to certification without the restrictions applicable to the NEMA frame sizes. Motor series 1LE1.21 and 1LE1.23 are certified for Canada through the Canadian Standard Association (CSA), listed by the Office of Energy Efficiency (OEE) and marked with both the CSA safety logo and the CSA efficiency label. These motors comply with the efficiency requirements of the new CSA standard C390-10. The efficiency is determined in the same manner as with IEC 60034-2-1.



Externally or internally mounted components which are used are listed by CSA or are used by manufacturers in accordance with regulations. It may have to be decided whether the motor is suitable for the application. Approval does not apply to 1MB1 motors for Zones 2, 21, 22 or marine motors.

Approval for Mexico:

The EISA regulations are applicable for Mexico.

Korea certification – Order code D33

Minimum efficiencies required by law

According to a legislative amendment with reference to the MKE-2015-28 (Ministry of Knowledge Economy Korea) dated February 12, 2015, Minimum Efficiency IE3 shall become obligatory in Korea by the following dates:

- October 1, 2015 for motors ranging from 37 to 200 kW
- October 1, 2016 for motors ranging from 200 to 375 kW
- October 1, 2018 for motors ranging from 0.75 to 37 kW

For this reason, we shall be launching the SIMOTICS GP/SD APAC series (Asia/Pacific) with efficiency class IE3, which complies with the IE3 energy efficiency requirements for line frequencies 50 Hz and 60 Hz (P50) onto this market:

- SIMOTICS GP, 2, 4, and 6-pole motors of the 1LE1043 motor series
- SIMOTICS SD, 2, 4, and 6-pole motors of the 1LE1543 and 1LE1643 motor series

Scope of Korean standard KS C 60034-2-1

This Korean standard is applicable to three-phase asynchronous motors with the following parameters:

- Voltage: ≤ 600 V
- Power supply: 60 Hz three-phase
- Rated power: 0.75 ... 375 kW
- Number of poles: 2, 4, 6 and 8
- Speed: Constant
- Coolant temperature: ≤ 40 °C
- Mounting method: Foot or flange-mounted

Overview (continued)**Korea Energy Label**

Option **D33** KEMCO (Korea Energy Management Cooperation KEMCO) Korea Energy Efficiency Label can be ordered only for those motors which comply with Korean efficiency requirements. Confirmation that the motor efficiency and power factor comply with KS C 60034-2-1 is provided by certification.

The Korea Energy Label includes the following information:

- Full-load efficiency
- Motor Type (MT)
- Rated output power
- No. of poles
- CO₂ emissions per hour
- Energy costs per annum

**Rating plate**

KEMCO-certified motors with option code **D33** are fitted with a modified rating plate that indicates the admissible minimum energy efficiency value (P50 for 60 Hz) in accordance with the Korean Energy Efficiency Ordinance with reference to Korean Standard KS C 60034-2-1.

The energy efficiency values stipulated by KS C 60034 are identical to the international efficiency values IE (IEC 60034-30).

SIEMENS		IE3		CE			
Made in Czech. Rep. D-90441 Nürnberg							
3-Mot. 1CV3314B 1LE15433AB434AA4-Z UC 1701/1234567 001 001							
IEC/EN 60034 315L IMB3 IP55							
990kg Th.Cl. 155(F) -20°C ≤ TAMB ≤ 40°C							
Bearing UNIREX-N3							
DE 6319-C3 40g INTERVAL: 6000h							
NE 6319-C3 40g							
KS C 60034-2-1							
V	Hz	A	kW	cosφ	NOM.EFF	1/min	IE-CL
400 Δ	50	275	160	0.87	95.8	1490	IE3
690 Y	50	161	160	0.87	95.8	1490	IE3
460 Δ	60	275	184	0.88	96.2	1788	IE3
460 Δ	60	240	160	0.87	96.2	1791	IE3

You will find a complete list of KEMCO-certified motors (APAC Line) on the selection tables in Chapter 2.

1PC3 motors: 1PC3 motors are also covered by certification provided that the electrical design complies with local requirements as stipulated in standard KS C 60034-2-1. Please contact QC for further clarification if required.

Motors from the APAC Line can be ordered with or without option **D33** depending on the final destination region.

Energy-saving motors for China: China Energy Label

In 2012, the directive for the China Energy Label was redefined. Applicability was extended to explosion-proof motors.

- Line voltage ≤ 1000 V
- Line frequency 50 Hz
- Power range 0.75 kW to 375 kW
- Number of poles: 2, 4, 6-pole
- Continuous duty S1

The minimum requirements for the efficiency classes previously defined in the Chinese standard GB 18613-2006 were classified in the new standard GB 18613-2012 (Minimum Allowable Values of Energy Efficiency and Energy Efficiency Grades for Small and Medium Three-Phase Asynchronous Motors) in accordance with International Efficiency IE2-4.



IEC IE class	GB 18613-2012
IE4	Grade 1
IE3	Grade 2
IE2	Grade 3
IE1	

The 1LE1 motor series for IE2 and IE3, plus order code **D34** were previously certified for China Energy Label 2012.

CCC safety certification is also required for motors with lower powers.

CCC – China Compulsory Certification – Order code D01

Motors with small powers (small power motors) that are exported to China must be certified up to a rated power of:

- 2-pole: ≤ 2.2 kW
- 4-pole: ≤ 1.1 kW
- 6-pole: ≤ 0.75 kW
- 8-pole: ≤ 0.55 kW

Notes:

Chinese customs checks the need for certification of imported products by means of the commodity code.

The following do not need to be certified:

- Explosion-proof motors
- Multi-voltage motors
- Multi-speed motors with powers higher than those listed above
- Repair parts

Introduction

General information

Versions in accordance with standards and specifications

Overview (continued)

VIK version

VIK = Verband der Industriellen Energie- und Kraftwirtschaft e.V. (German Association of the Energy and Power Supply Industry)

- **VIK standard version** – 1LE1 + order code **C02**
"VIK" identification on rating plate.
→ Product range in catalog section 2.
- **VIK-Ex ec version** – 1MB1.3 + order code **C02**
"VIK" and "Ex ec IIC T3 Gc" marking on the rating plate according to Directive 94/9/EC (ATEX).
→ Product range in catalog section 5.

Both versions include technology for Zone 2 to type of protection Ex ec IIC T3 Gc. Motors up to frame size 355 can be supplied in accordance with the technical requirements of the VIK recommendation.

Minimum efficiency class:

- VIK standard version:
IE3 in accordance with legal specifications.
- VIK Ex ec version:
At least IE3 in accordance with the final draft of the VIK recommendation dated February 2017.

Notes:

- 8-pole motors or all motors < 0.75 kW are still possible as these motors are outside the power range specified for IE stamping.
- Motors in VIK version with mounted technology (brake, rotary pulse encoder and separately driven fan) are not compatible with Zone 2.
Versions for Zone 21/22 are not possible.

TR CU product safety certificate EAC for the Eurasian customs union (Russia, Belarus, Kazakhstan)

TR CU = Technical Regulation Customs Union
EAC = Eurasian Conformity

The TR CU product safety certificate is required in order to import motors into the Eurasian customs union area.

"TR CU product safety certificate EAC for Eurasian customs union" – order code **D47**

When motors are ordered with order code **D47**, the motor rating plate and packaging are marked with the logo "EAC".

The motor must have a "TR CU product safety certificate EAC", although the certificate does not generally have to be shipped with the motor. The customs authorities use the motor article number to check the motor certification.

The following are available in the SIOS (Siemens Industry Online Support) and the Drive Technology Configurator:

- TR CU product safety certificate in accordance with the Low-Voltage Directive
- Additional TR CU product certificate in accordance with the EMC Directive.

Train-compatible version

Train-compatible version IC418, EN IEC 60349, acc. to EN 45545, without external fan and without fan cover (1LE10 aluminum motors in frame sizes 80 to 200)

- Electrical design in accordance with EN IEC 60349;
 $U_{rated} \leq 500$ V AC.
- DC-link voltage: $U_{dc} \leq 700$ V; $du/dt \leq 5$ kV/ μ s
- Vibration resistance to Class 3M4 according to IEC 60721-3-3
- Metal cable gland
- Including external grounding depending on construction type (corresponds to order code **H04**).
- Standard paint finish certified according to EN 45545 (polyurethane-based paint without test certificate – corresponds to order code **S06**)

Train-compatible version IC411, EN IEC 60349, with EN 45545, with external fan and fan cover in metal – order code **L91** for cooling method IC411

- 1LE10 aluminum motors in frame sizes 80 to 200
- Electrical design in accordance with EN IEC 60349;
 $U_{rated} \leq 500$ V AC
- DC-link voltage: $U_{dc} \leq 700$ V; $du/dt \leq 5$ kV/ μ s
- Vibration resistance to Class 3M4 according to IEC 60721-3-3
- Metal cable gland
- Including external grounding depending on construction type (corresponds to order code **H04**)
- Standard paint finish certified according to EN 45545 (polyurethane-based paint without test certificate – corresponds to order code **S06**)
- Incl. metal fan cover

Train-compatible version IC411, EN IEC 60349, without EN 45545, with external fan and fan cover in plastic – Order code **L90** for cooling method IC411

- 1LE10 aluminum motors in frame sizes 80 to 200
- Electrical design in accordance with EN IEC 60349;
 $U_{rated} \leq 500$ V AC
- DC-link voltage: $U_{dc} \leq 700$ V; $du/dt \leq 5$ kV/ μ s
- Vibration resistance to Class 3M4 according to IEC 60721-3-3
- Metal cable gland
- Including external grounding depending on construction type (corresponds to order code **H04**)
- Standard paint finish, without EN 45545 (polyurethane-based paint without test certificate – corresponds to order code **S06**)
- Incl. plastic fan cover

Recommended supplementary options:

- Located bearing DE (order code **L20**)
- Temperature class 155 (F), utilized according to 130 (B), coolant temperature 55 °C, derating approx. 13 % (order code **N07**)
- Coolant temperature –30 to +40 °C (order code **D04**)
- Coolant temperature –40 to +40 °C (order code **D03**)

Overview

Voltages, currents and frequencies

Standard voltages

EN 60034-1 differentiates between Category A (combination of voltage deviation ±5 % and frequency deviation ±2 %) and Category B (combination of voltage deviation ±10 % and frequency deviation +3/-5 %) for voltage and frequency fluctuations. The motors can supply their rated torque in both Category A and Category B. In Category A, the temperature rise is approx. 10 K higher than during rated operation.

Standard	Category	Category
IEC 60034-1	A	B
Voltage deviation	±5 %	±10 %
Frequency deviation	±2 %	+3 %/-5 %
Rating plate data stamped with rated voltage a (e.g. 230 V)	a ±5 % (e.g. 230 V ±5 %)	a ±10 % (e.g. 230 ±10 %)
Rating plate data stamped with rated voltage ranges b to c (e.g. 220 to 240 V)	b -5 % to c +5 % (e.g. 220 -5 % to 240 +5 %)	b -10 % to c +10 % (e.g. 220 -10 % to 240 +10 %)

For further details, see EN 60034-1.

In Category B, the standard does not recommend extended operation, so it is not permissible for explosion-proof motors. See "Rating plates and additional rating plates" for details of the rating plate inscriptions and corresponding examples. The selection and ordering data give the rated current at 460 V, 60 Hz. The IEC 60038 standard specifies a tolerance of ±10% for line voltages of 230 V, 400 V, and 690 V.

Line voltages	Voltage code
1LE1 motors	
230 VΔ/400 VY, 50 Hz 460 VY, 60 Hz	22
400 VΔ/690 VY, 50 Hz 460 VΔ, 60 Hz	34
500 VY, 50 Hz 575 VY, 60 Hz	27
500 VΔ, 50 Hz 575 VΔ, 60 Hz	40

Non-standard voltages and/or frequencies

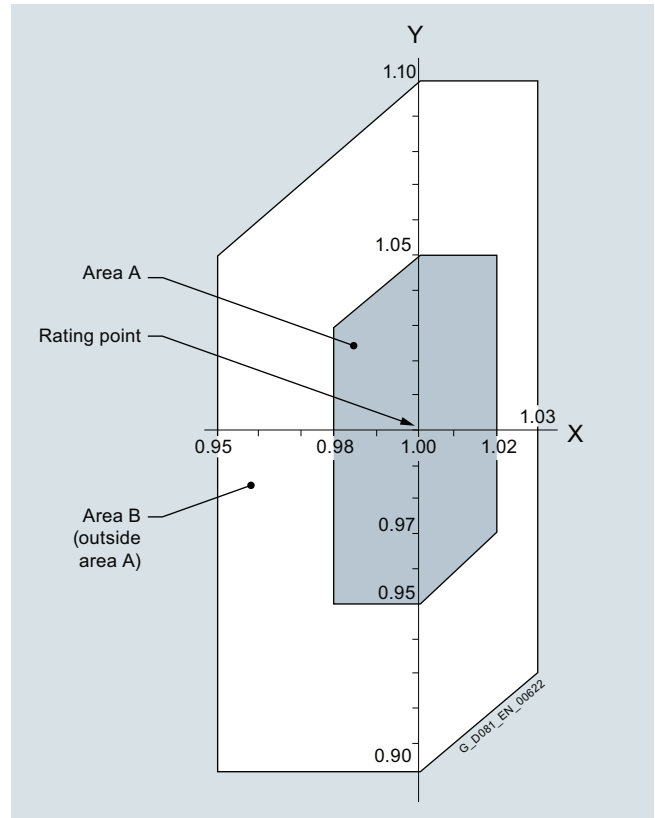
The tolerance laid down by EN 60034-1 applies to all non-standard voltages.

For some non-standard voltages at 50 or 60 Hz, order codes are specified. They are ordered by specifying the code digit **9** for voltage in the 12th position of the Article No. as well as the code digit **0** in the 13th position of the Article No. and the corresponding order code.

M1Y Non-standard rated voltage between 200 V and 690 V (voltages outside this range are available on request), frequency, circuit, for 60 Hz additionally required rated power in kW.

Motor series	Frame size	Rated voltages that can be supplied for M1Y	
		Lowest/highest voltage for Delta	Star
1LE1, 1MB1	63 ... 315	200/690 V	250/690 V

Order codes for other rated voltages are listed under "Order suffixes" in the "Selection and ordering data" as well as "Special versions" under "Voltages".



Y-axis: Voltage tolerance
X-axis: Frequency tolerance

Line voltages according to NEMA

Assignment of rated voltage of the motor to that of the line

Line voltage	Motor voltage
208 V	200 V
240 V	230 V
480 V	460 V
600 V	575 V

Powers

The powers or rated powers are listed in the selection tables for both 50 Hz and 60 Hz. For 60 Hz, the rated power values must, in some cases, be increased, e.g. for pole-changing motors.

Assignment of standard powers kW-hp and vice versa, in accordance with IEC

$kW \cdot 1.341 = hp$
 $hp \cdot 0.746 = kW$

P_{rated} kW	P_{rated} hp	P_{rated} kW	P_{rated} hp	P_{rated} kW	P_{rated} hp	P_{rated} kW	P_{rated} hp	P_{rated} kW	P_{rated} hp	P_{rated} kW	P_{rated} hp
0.06	0.08	0.37	0.5	2.2	3	11	15	37	50	110	150
0.09	0.12	0.55	0.75	3	3.7	15	20	45	60	132	200
0.12	0.16	0.75	1	4	5	18.5	25	55	75	160	250
0.18	0.25	1.1	1.5	5.5	7.5	22	30	75	100	200	300
0.25	0.33	1.5	2	7.5	10	30	40	90	125		

Introduction

Electrical design

Rating plate and additional rating plates

Overview

In accordance with EN 60034-1, the approximate total weight is specified on the rating plate for all motors.

Supplementary data (maximum of 20 characters) can be indicated on the rating plate or additional rating plate and on the packaging label, order code **Y84**.

An adhesive label can also be supplied loose, order code **Y85**.

An additional rating plate for customer specifications is also possible, additional text: 9 lines of 40 characters each, order code **Y82**.

An additional rating plate with deviating rating plate data can also be ordered (only for ratings such as voltage, power, speed), order code **Y80**.

An "additional rating plate for voltage tolerance" can also be ordered.

Can be ordered for 230 VΔ/400 VY or 400 VΔ/690 VY (voltage code "22" or "34"). Not possible for pole-changing motors, naturally cooled 1PC1 motors, 8-pole motors and in combination with order code D34.

Order code **B07**
(voltage range plate is always provided in the form of an adhesive label)

The number of rating plates and/or the material quality of the rating plate including additional rating plates can be ordered using order codes Y82, Y84 and Y80. Does not apply to order code B07, rotational direction arrows, PTC thermistor plates, other notices.

- Additional (rating) plate(s)
Order code **M10**.
- Plate(s) with resistance to scratches, heat, cold and acid
Order code **M11**.

In the standard version, the rating plate is available in international format or in the German/English language. The language for the rating plate can be ordered by specifying in plain text. An overview of the languages that can be ordered is provided by the table below.

Overview of languages on the rating plate

Motor type	Frame size	Rating plate	
		German (de)	English (en)
1LE10	63 ... 200	□	○
1LE15/6	71 ... 315	□	○
1LE5	315 ... 355	□	○
1MB1	80 ... 315	□	○
1PC1	100 ... 315	□	○

- Standard version
- Without additional charge

Other languages on request

Examples of rating plates

SIEMENS		Made in Germany		IEC/EN 60034		CE	
3-MOT 1AV2092A		1LE10010EA422AA0		TH.CL.155(F)		IP55	
F no E1701/1234567 01 001		FS 90L		IMB3		WT 13kg	
V	Hz	kW	A	PF	RPM	EFF-CL	ETA %
230 Δ	50	2.2	7.8	0.85	2890	IE2	83.2
400 Y	50	2.2	4.50	0.85	2890	IE2	83.2
460 Y	60	2.55	4.35	0.86	3485	IE2	85.5

Adhesive rating plate up to frame size 90

SIEMENS		Made in Czech. Rep.		D-90441 Nürnberg		IE3		CE	
3-Mot. 1CV3314B		1LE15433AB434AA0-Z		UC 1701/1234567 001 001					
IEC/EN 60034 315L		IMB3		IP55					
990kg		Th.Cl. 155(F)		-20°C ≤TAMB≤40°C					
Bearing		UNIREX-N3		INTERVAL: 6000h					
DE 6319-C3		40g							
NE 6319-C3		40g							
				KS C 60034-2-1					
V	Hz	A	kW	cosφ	NOM.EFF	1/min	IE-CL		
400 Δ	50	275	160	0.87	95.8	1490	IE3		
690 Y	50	161	160	0.87	95.8	1490	IE3		
460 Δ	60	275	184	0.88	96.2	1788	IE3		
460 Δ	60	240	160	0.87	96.2	1791	IE3		

Rating plate for motor with KEMCO certification

SIEMENS		Made in Germany		D-90441 Nürnberg		IE3		CE	
3-Mot. 1AV3164A		1LE10431DA434AA0-Z		E 1701/1410842 001 001					
IEC/EN 60034 160L		IMB3		IP10=FAN COVER/IP55		Brake:			
94kg		Th.Cl. 155(F)		-20°C ≤TAMB≤45°C		2000M		2LM8040-5NA10	
RINA		Bearing		UNIREX-N3		INTERVAL: 2000h		230V AC 50/60Hz 1.25A	
DE 6209-2ZC3		20g						TH.Cl. 155(F) 40Nm	
NE 6209-2ZC3		20g							
		Vibration B		SF 1.1 CONT		KS C 60034-2-1			
V	Hz	A	kW	cosφ	NOM.EFF	1/min	IE-CL		
400 Δ	50	32.0	18.5	0.90	92.4	2955	IE3		
690 Y	50	18.6	18.5	0.90	92.4	2955	IE3		
460 Δ	60	32.0	21.3	0.91	91.7	3550	IE3		
460 Δ	60	28.0	18.5	0.90	91.7	3560	IE3		
KDNNo. 12345678999111		MATNo. 12345678		Space Heater 230V					

Standard rating plate (metal) for IEC motors – maximum characteristics

SIEMENS		Made in Germany		D-90441 Nürnberg		IE3		CE	
3-Mot. 1AV3164A		1LE10231DA434AA0-Z		E 1701/1410842 001 001					
IEC/EN 60034 160L		IMB3		IP55		Brake:			
94kg		Th.Cl. 155(F)		-20°C ≤TAMB≤45°C		2000M		2LM8040-5NA10	
RINA		Bearing		UNIREX-N3		INTERVAL: 2000h		230V AC 50/60Hz 1.25A	
DE 6209-2ZC3		20g						TH.Cl. 155(F) 40Nm	
NE 6209-2ZC3		20g							
		Vibration B		60Hz: SF 1.1 CONT		NEMA MG1 12-12		TEFC DES A 25.0 HP	
V	Hz	A	kW	PF	NOM.EFF	rpm	IE-CL	CL	
400 Δ	50	32.0	18.5	0.90	92.4	2955	IE3	M	
690 Y	50	18.6	18.5	0.90	92.4	2955	IE3	M	
460 Δ	60	32.0	21.3	0.91	91.7	3550	IE3	M	
460 Δ	60	28.0	18.5	0.90	91.7	3560	IE3	N	
KDNNo. 12345678999111		MATNo. 12345678		Space Heater 230V					

Standard rating plate (metal) for NEMA motors – maximum characteristics

Overview (continued)

V	Hz	A	kW	PF	NOM.EFF	rpm	IE-CL	CL
400 Δ	50	32.0	18.5	0.90	92.4	2955	IE3	M
690 Y	50	18.6	18.5	0.90	92.4	2955	IE3	M
460 Δ	60	32.0	21.3	0.91	91.7	3550	IE3	M
460 Δ	60	28.0	18.5	0.90	91.7	3560	IE3	N

1 Machine type: Three-phase low-voltage motor
 2 Article No.
 3 Factory serial number (Ident.-no., serial number)
 4 Type of construction
 5 Degree of protection
 6 Rated voltage [V] and winding connections
 7 Frequency [Hz]
 8 Rated current [A]
 9 Rated power [kW]
 10 Power factor (cos φ)
 11 Efficiency
 12 Rated speed [rpm]
 13 IE efficiency class
 14 Standards and specifications
 15 Weight of machine [kg]
 16 Temperature class
 17 Frame size
 18 Supplementary data (optional)
 19 Operating temperature range (only if it deviates from standard)
 20 Installation altitude (only when higher than 1000 m)
 21 Customer data (optional)
 22 Date of manufacture YYMM
 23 Half-key balancing
 24 Code letter "CL"
 25 Motor type number (MT)
 26 IEC standard series, power 50 Hz (P50/50 Hz) 400 Δ
 27 IEC standard series, power 50 Hz (P50/50 Hz) 690 Δ
 28 Equivalent power 60 Hz at the same utilization as IEC standard series 50 Hz
 29 IEC standard series power 60 Hz (P50/60 Hz)
 30 Manufacturer's address
 31 Marine certificates
 32 Optional information
 33 Bearing size
 34 Relubrication data optional

Explanation of the standard rating plate

Efficiency, power factor, rated speed, direction of rotation, rated torque

Overview

Efficiency and power factor

The efficiency η for 4/4, 3/4 and 1/2 load and the power factor $\cos \varphi$ for each rated power are listed in the selection tables in the individual sections of this catalog. See page 1/5 for minimum efficiencies.

Rated speed and direction of rotation

The rated speeds are applicable for the rated data. The synchronous speed changes proportionally with the line frequency. The motors are suitable for clockwise and counterclockwise rotation.

When U1, V1, W1 are connected to L1, L2, L3 the motor rotates clockwise when viewing the drive shaft extension. Counterclockwise rotation is achieved by swapping two phases (see also "Heating and ventilation" on page 1/36).

Rated torque

The rated torque in Nm delivered at the motor shaft is

$$T = \frac{9.55 \cdot P \cdot 1000}{n}$$

P Rated power in kW
 n Speed in rpm

Note:

If the voltage deviates from its rated value within the admissible limits, the locked-rotor torque, the pull-up torque and the breakdown torque vary with the approximate square of the value, but the locked-rotor current varies approximately linearly.

In the case of squirrel-cage motors, the locked-rotor torque and breakdown torque are listed in the selection tables as multiples of the rated torque.

Preferred practice is to start squirrel-cage motors directly on line. The torque class indicates that with direct-on-line starting, even if there is an undervoltage of -5 %, it is possible to start up the motor against a load torque of

- 160 % for CL 16
- 130 % for CL 13
- 100 % for CL 10
- 70 % for CL 7
- 50 % for CL 5

of the rated torque.

Introduction

Electrical design

Converter operation

Overview

All motors in the SIMOTICS generation are equipped with innovative insulation systems, consisting of high-quality enamel wires and insulating sheet materials in conjunction with highly temperature-resistant impregnations.

The motors can be operated with SINAMICS G and SINAMICS S converters (controlled and uncontrolled infeed) while adhering to the admissible voltage peaks in accordance with the adjacent table.

Continuous operation while fully utilizing the admissible voltage tolerances must be avoided and is not recommended in accordance with IEC 60034-1 2011 Chapter 7.3.

The preferred supply system configurations are TT systems and TN systems with neutral-point grounding. We do not recommend operation in TN systems because of the higher voltage load.

Operation on non-grounded IT systems is also possible. However, in a ground fault, the insulation is excessively stressed. In the case of a ground fault, the process should be terminated as quickly as possible ($t < 2$ h), and the fault resolved.

For motors with protruding connection cables (order codes **R20**, **R21**, **R22**, **R23**, and **R24**), please inquire in the case of converter operation.

Impulse Voltage Insulation Class (IVIC) – category C (strong)

The insulation system of SIMOTICS motors significantly exceeds the requirements of stress category C (IVIC C = high stress). If voltage peaks higher than those specified according to IVIC C can occur, observe the data in the following table.

- For a line voltage (converter input voltage) up to max. 500 V and operation connected to a SINAMICS G/SINAMICS S converter with uncontrolled infeed (BLM, SLM), the relevant guidelines for the motor and converter configuration must be observed.
- For a line voltage (converter input voltage) up to max. 480 V and operation connected to a SINAMICS S converter with controlled infeed (ALM), the relevant guidelines for the motor and converter configuration must be observed.
- For line voltages (converter input voltages) higher than those stated above (max. 690 V), motors that are ordered for converter operation must have a suitable insulation system.
- For operation of a converter of another manufacturer, the permissible voltage peaks according to IEC 60034-18-41 in accordance with stress category C (see table below) must be observed, depending on the particular line voltage (converter input voltage) and the motor insulation system.

		Line voltage U_{rated}					
		400 V		480 V		500 V	
Standard		IVIC C	Siemens	IVIC C	Siemens	IVIC C	Siemens
U_{phase}	$V_{pk/pk}$	1680	2200	2016	2200	2100	2200
$U_{phase-to-ground}$	V_{pk}	840	1100	1008	1100	1050	1100
$U_{phase-to-phase}$	$V_{pk/pk}$	2360	3000	2832	3000	2950	3000
$U_{phase-to-phase}$	V_{pk}	1180	1500	1416	1500	1475	1500

The following applies for the voltage rise time: $T_a > 0.3$ μ s.

The voltages according to EN 60034-18-41/IVIC CC are specified as peak-to-peak values ($V_{pk/pk}$). For information, the conventional peak values (V_{pk}) are also stated.

Insulation systems for converter operation > 480 V/500 V

The SIMOTICS motors can be operated in their standard version on SINAMICS converters without an additional filter up to a maximum converter input voltage of 500 V 3 AC on uncontrolled infeeds (SINAMICS G/S/V, BLM/SLM) and up to 480 V 3 AC on controlled infeeds (SINAMICS S, ALM). The specific configuration guidelines for motors and converters must be observed.

For higher converter input voltages, > 480 V/500 V 3 AC, a special insulation system of the motor (PREMIUM) is required. This is available for converter motors, such as SIMOTICS GP/SD VSD10, SIMOTICS DP crane motors, SIMOTICS FD, and the converter-capable SIMOTICS SD Pro motors.

For IE3 standard motors as of frame size 225, the PREMIUM insulation system can be obtained on request.

Bearing insulation/shaft grounding brushes

To avoid damage to bearings due to bearing currents, we recommend bearing insulation at the non-drive end (NDE) for frame size 225 and larger (order code **L51**).

For frame size 315 and larger, bearing insulation at the non-drive end (NDE) is always provided (order code **L51**).

When rotary encoders are used, it must be ensured that these do not bypass the bearing insulation. The rotary encoders in this catalog meet this requirement except for type 1XP8.

In most cases, NDE bearing insulation provides sufficient protection against damage to bearings due to bearing currents.

In rare cases, depending on the application and system, it may be necessary to take further measures on the converter or motor. On the motor side, bearing insulation is provided on the drive end (DE) (order code **L50** on frame size 225 and larger) and shaft grounding brushes (order code **L52** as of frame size 280).

When NDE bearing insulation is used together with DE bearing insulation, the option "shaft grounding brush" must additionally be selected to keep the shaft at a defined potential. In this constellation, to avoid damage to the bearings of the driven machine due to bearing currents, it is also necessary to insulate the coupling between the motor and the driven machine.

The EMC guidelines must always be complied with when the drive system is installed.

Thermal utilization of the motor

When motors are operated on a converter, additional losses occur due to the harmonics in the motor currents, which, depending on the permissible winding temperature, can make it necessary to reduce the torque. For operation on SINAMICS converters, the permissible torque values can be obtained from the SIZER engineering tool.

For operation on SINAMICS converters with the power ratings specified in the catalog, the motors are used according to temperature class 155 (F), i.e. in this case neither a service factor > 1 nor an increased coolant temperature is possible (order codes **N01**, **N02** and **N03** cannot be ordered).

Explosion-proof motors

For converter operation of Ex motors, special measures must be considered, see Chapter 5.

Overview***DURIGNIT IR 2000 insulation system***

The DURIGNIT IR 2000 insulation system consists of high-quality enamel wires and insulating sheet materials in conjunction with temperature-resistant resin impregnation. This ensures that these motors will have a high mechanical and electrical strength, high service value, and a long lifetime. The insulation system protects the winding to a large degree 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 m³ of air. Moisture condensation should be prevented from forming on the winding. For higher values, the **N30** and **N31** options are available – see page 1/34.

Please inquire about extreme applications.

Restarting against residual field and opposite phase

All motors can be restarted against 100 % residual field after a line voltage failure.

Winding and insulation version with regard to temperature class

All motors are designed for temperature class 155 (F). At rated power with line operation, the motors can be used in temperature class 130 (B).

Temperature class 155 (F), utilized according to 155 (F), with service factor (SF)

According to the selection table, at rated power and rated voltage, all 1LE1/1PC1 motors in line operation have a service factor of 1.15. An exception to this are IE1 motors, which have a service factor of 1.1.

Order code **N01**

Temperature class 155 (F), utilized according to 155 (F), for higher power

When utilized according to temperature class 155 (F), the rated power specified in the selection and ordering data can be increased by 15 %. Exception for IE1 motors – can be increased by 10 %.

Order code **N02**

Temperature class 155 (F), utilized acc. to 155 (F), with increased coolant temperature

With power as defined in the catalog and line operation, coolant temperature is permitted to rise to 55 °C.

Order code **N03**

The service factor (SF) is not indicated on the rating plate for order codes **N02** and **N03**.

For converter operation at the power specified in the catalog, the motors are utilized according to temperature class 155 (F). Order codes **N01**, **N02**, and **N03** are not possible.

Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 45 °C, derating approx. 4 %

Motor series 1LE1 and 1MB1 can be ordered according to temperature class 155 (F) for utilization according to temperature class 130 (B) and a maximum coolant temperature of 45 °C with derating of 4 %.

Order code **N05**

Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 50 °C, derating approx. 8 %

Motor series 1LE1 and 1MB1 can be ordered according to temperature class 155 (F) for utilization according to temperature class 130 (B) and a maximum coolant temperature of 50 °C with derating of 8 %.

Order code **N06**

Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 55 °C, derating approx. 13 %

Motor series 1LE1 and 1MB1 can be ordered according to temperature class 155 (F) for utilization according to temperature class 130 (B) and a maximum coolant temperature of 55 °C with derating of 13 %.

Order code **N07**

Temperature class 155 (F), utilized acc. to 130 (B), coolant temperature 60 °C, derating approx. 18 %

Motor series 1LE1 and 1MB1 can be ordered according to temperature class 155 (F) for utilization according to temperature class 130 (B) and a maximum coolant temperature of 60 °C with derating of 18 %.

Order code **N08**

Temperature class 180 (H)

With motor series 1LE1, and 1PC1, utilization according to temperature class 180 (H) is permitted.

Order code **N10**

Temperature class 180 (H) at rated power and max. CT 60 °C

With motor series 1LE1, and 1PC1, utilization according to temperature class 180 (H) is permitted at rated power and a maximum coolant temperature of 60 °C.

Order code **N11** (not possible for 1LE15 and 1LE16 motors with increased power).

The grease lifetime specified is valid for a coolant temperature of 40 °C. If the coolant temperature is increased by 10 K, the grease lifetime and regreasing interval are halved.

Temperature class 155 (F), utilized acc. to 130 (B), with higher coolant temperature and/or installation altitude

The motors can be ordered according to temperature class 155 (F) for utilization according to temperature class 130 (B) with other customized requirements if they are specified in plain text in the order.

Order code **Y50**

Temperature class 155 (F), utilized according to 155 (F), other requirements

The motors can be ordered according to temperature class 155 (F) for utilization according to temperature class 155 (F) with other customized requirements if they are specified in plain text in the order.

Order code **Y52**

Temperature class 180 (H), utilized according to 155 (F)

The motors can be ordered according to temperature class 180 (H) for utilization according to temperature class 155 (F) with other customized requirements if they are specified in plain text in the order.

Order code **Y75**

Introduction

Electrical design

Windings and insulation

Overview (continued)

Increased air humidity/temperature with 30 to 60 g water per m³ of air

With motor series 1LE1, 1MB1 and 1PC1, motors are available in a version designed for increased air humidity in the range of 30 to 60 g water per m³ of air, depending on the temperature, as shown in the table below. This version has condensation drainage holes (sealed).

Order code **N30** (includes order code **H03**, **M11**, stainless bolts in the terminal box cover, and **S02** standard/special paint finish for Performance Line cast-iron motors).

You must contact us if order code **N30** is to be combined with mountings (e.g. rotary pulse encoders or brakes).

Increased air humidity/temperature with over 60 to 100 g water per m³ air

With motor series 1LE1, 1MB1 and 1PC1, motors are available in a version designed for increased air humidity of over 60 to 100 g water per m³ of air, depending on the temperature, as shown in the table below. This version has condensation drainage holes.

Order code **N31** (includes order code **H03**, **M11**, stainless bolts in the terminal box cover, and either the **S02** special paint finish or the **S03** "sea air resistant" special paint finish for Performance Line cast-iron motors).

Please inquire before combining order code **N31** with mountings (e.g. rotary pulse encoder, brakes)!

Absolute/relative conversion of air humidity

Relative humidity	Temperature							
	up to 20 °C	up to 30 °C	up to 40 °C	up to 50 °C	up to 60 °C	up to 70 °C	up to 80 °C	up to 90 °C
10 %	2	3	5	8	13	20	29	42
15 %	3	5	8	12	19	30	44	63
20 %	3	6	10	17	26	39	58	84
25 %	4	8	13	21	32	49	73	105
30 %	5	9	15	25	39	59	87	126
35 %	6	11	18	29	45	69	102	146
40 %	7	12	20	33	52	79	116	167
45 %	8	14	23	37	58	89	131	188
50 %	9	15	26	41	65	98	145	209
55 %	10	17	28	46	71	108	160	230
60 %	10	19	31	50	78	118	174	251
65 %	11	20	33	54	84	128	189	272
70 %	12	21	36	58	91	138	203	293
75 %	13	23	38	62	97	148	218	314
80 %	14	24	41	66	104	157	233	335
85 %	15	26	43	70	110	167	247	356
90 %	16	27	46	74	117	177	262	377
95 %	16	29	49	79	123	187	276	398
100 %	17	30	51	83	130	197	291	419

The values in the table with a blue background are covered by the standard version (up to < 30 g water per m³ of air).

The values in the table with a light gray background are covered by order code **N30** (30 to < 60 g of water per m³ of air).

The values in the table with a dark gray background are covered by order code **N31** (60 to < 100 g of water per m³ of air).

Please get in contact regarding requirements exceeding 100 g water per m³ of air.

Note:

- The coolant temperature and installation altitude can be found from page 1/35 onwards!
- The metal fan cover is available in combination with order code **F74** (not standard). Metal fan cover is always standard for cast-iron Performance Line motors (1LE16).
- In case of increased thermal stress, please combine with the order codes **N05** to **N08**.
- In conjunction with more stringent requirements for the paint finish or corrosion protection stress (offshore, sea air, etc.), the corresponding order codes **S02**, **S03**, **S04**, and potentially **H07**, must be combined.
- Order code **N31** requires additional specifications for the ambient temperature CT 50 °C to CT 90 °C.

Overview

The specified rated power is applicable for continuous duty in accordance with IEC 60034-1 at the frequency of 50 Hz, a coolant temperature (CT) or ambient temperature of 40 °C and an installation altitude (IA) up to 1000 m above sea level. 1LE1, 1MB1 and 1PC1 motors for ambient temperatures exceeding 40 °C are equipped with various types of seal. Mountings such as brake, terminal box at NDE, type of construction IM V1, type of construction IM V3 can sometimes exceed utilization in accordance with temperature class 130 (B).

For higher coolant temperatures and/or installation altitudes greater than 1000 m above sea level, the specified motor power must be reduced using the factor k_{HT} .

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

This results in an admissible motor power of:

$$P_{adm} = P_{rated} \cdot k_{HT}$$

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

Abbreviation	Description	Unit
P_{adm}	Admissible motor power	kW
P_{rated}	Rated power	kW
k_{HT}	Factor for abnormal coolant temperature and/or installation altitude	

The motors are designed for temperature class 155 (F) and utilized in temperature class 130 (B). Under non-standard operating conditions, if they are to be used in this class, the admissible power rating must be determined from the table below.

Reduction factor k_{HT} for different installation altitudes and/or coolant temperatures

Installation altitude above sea level m	Coolant temperature					
	< 30 °C	30 ... 40 °C	45 °C	50 °C	55 °C	60 °C
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

Coolant temperature and installation altitude are rounded to 5 °C and 500 m respectively.

For details of derating for utilization in temperature class 155 (F), see "DURIGNIT IR 2000 insulation system".

Motors for coolant temperatures other than 40 °C or installation altitudes higher than 1000 m above sea level for utilization in temperature class 130 (B) must always be ordered with the additional identification code "-Z" and plain text. In the case of extreme derating, the operating data for the motors, i.e. efficiency and power factor, will also be less favorable due to partial utilization.

The following special versions are possible for 1LE1 and 1PC1 motors:

- Motors for coolant temperatures from –40 to +40 °C order code **D03**
- Motors for coolant temperatures from –30 to +40 °C order code **D04**

When ordering with order codes **D03** or **D04** in combination with mountings, the respective technical specifications have to be observed and it is necessary to inquire.

For details of order codes for use in temperature class 155 (F), see "DURIGNIT IR 2000 insulation system" under "Windings and insulation" on page 1/33.

Ambient temperature:

All motors can be used in the standard version at ambient temperatures between –20 and +40 °C. Exposure to direct sunlight can result in uncontrollable rises in motor temperature. To prevent this, appropriate shading measures such as a sun protective cover are recommended.

Motors can be utilized in temperature class 155 (F)

- at 40 °C with service factor 1.1, i.e. the motor can be continuously overloaded with 10 % of the rated power in the case of IE1 motors
- at 40 °C with service factor 1.15, i.e. the motor can be continuously overloaded with 15 % of the rated power in the case of IE2 motors and higher efficiency classes
- above 40 °C at rated power.

When motors are used in temperature class 130 (B) for higher ambient temperatures and/or installation altitudes, derating occurs in accordance with the Table "Reduction factor k_{HT} for different installation altitudes and/or coolant temperatures". For motors ex stock, the service factor is indicated on the rating plate.

For other temperatures, special measures are necessary. When brakes are to be mounted on motors intended for operation at temperatures below freezing, please inquire.

Introduction

Electrical design

Heating and ventilation

Overview

Anti-condensation heating

Supply voltage 230 V (1AC)
Order code **Q02**

Supply voltage 115 V (1AC)
Order code **Q03**

For motors with windings at risk of condensation due to the climatic conditions, e.g. inactive motors in humid atmospheres or motors that are subjected to widely fluctuating temperatures, anti-condensation heaters must be used.

An additional cable entry is provided for the connecting cable in the terminal box.

Motor series	Frame size	Cable entry
Aluminum motors (GP)	≤ 200	1 × M16 × 1.5
Cast-iron motors (SD)	≤ 180	1 × M16 × 1.5
	200	1 × M20 × 1.5
	225 ... 315	2 × M20 × 1.5
	355	2 × M20 × 1.5

Anti-condensation heating must not be switched on during operation.

Frame size	Heat power of the anti-condensation heating	
	Supply voltage at 230 V	115 V (110 V)
	Order code Q02	Order code Q03
	W	W

1LE1/1LE5/1PC1 motors		
63 ... 80	12.5	12.5
90 ... 112	25	25
132 ... 200	50	50
225 ... 250	92	92
280 ... 315	109	109
315 ... 355	218	218
1MB1 motors		
80 ... 112	7	7
132 ... 160	12	12
180 ... 200	57	57
225 ... 250	92	92
280 ... 315	109	109

Instead of an anti-condensation heater, another possibility is to connect a voltage that is approximately 4 to 10 % of the rated motor voltage to stator terminals U1 and V1; 20 to 30 % of rated motor current is sufficient to heat the motor.

Fans/separately driven fans

1LE1 and 1MB1 motors of frame size 71 to 315 have radial-flow fans in the standard version (with the exception of 1LE1, 1MB1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover") that cool regardless of the direction of rotation of the motor (cooling method IC411 acc. to EN 60034-6). The air flow is forced from the non-drive-end (NDE) to the drive end (DE).

For details of separately driven fans for frame size 100 to 315, see also "Separately driven fans" on page 1/80.

Supply voltage of separately driven fan for 1LE1 motors:
The supply voltage tolerance of the separately driven fan is ±5 %. For voltage ranges, see page 1/80.

In confined spaces, it must be ensured that the minimum spacing is maintained between the fan cover and the wall. This also applies to adjacent parts, such as large handwheels and flywheels on the second shaft extension.

Clearance from wall/fan grilles

Frame size	mm
63, 71	15
80, 90, 100	20
112	25
132	30
160	40
180, 200	90
225, 250	100
280, 315	110
355	140

For version of the fan and the fan cover, see the table below.

Motor series	Frame size	Fan material	Fan cover material
1LE10	63 ... 71	Plastic	Metal
	80 ... 200	Plastic	Plastic ¹⁾
1LE15	71 ... 90	Plastic	Metal
	100 ... 315	Plastic	Plastic
1LE16	100 ... 315	Plastic	Metal
1LE55	315	Metal	Plastic
1LE56	315 ... 355	Metal	Metal
1MB1.3	71 ... 90	Metal	Metal
1MB1.3	100 ... 315	Plastic	Metal
1MB1.1, 1MB1.2	71 ... 315	Metal	Metal

Metal external fan impeller

The standard fan impeller made of plastic can be replaced with a fan impeller made of metal. This version is available for motor series 1LE1 (with the exception of 1LE1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover"). A metal external fan is already included for the low-noise version. Up to frame size 160, the metal external fan impeller is manufactured from aluminum.

Order code **F76**

Fan cover for textile industry

For 1LE1 motors (with the exception of 1LE1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover") the standard version of the fan cover cannot be used in the textile industry.

For the motor series 1LE1 (with the exception of 1LE1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover") a special version of the fan cover is available for the textile industry. This has a protective cover and is made of non-corrosive sheet steel.

The motor length increases when the fan cover for the textile industry is mounted, see page 1/111 Fig. 12

Order code **F75**

Sheet metal fan cover

In place of the plastic fan cover, a sheet metal fan cover can be ordered for motor series 1LE1 (with the exception of 1LE1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover").

Order code **F74**

The sheet metal fan cover is supplied as standard with 1LE16 motors (Performance Line).

¹⁾ For the frame size codes **A, D, F, H, J, K, L, N, T, U**, and **V**, a screwed-on cover (plastic or metal) is used in conjunction with the option **H03** (condensation drainage holes). Mounted separately driven fans or brakes are only available in sheet metal version.

Overview (continued)

Necessary minimum cooling air flow for forced-air cooled motors in standard duty

The cooling air flow specified in the selection table applies to continuous duty according to EN 60034-1 at a coolant temperature (CT) or ambient temperature of 40 °C respectively and an installation altitude (IA) up to 1000 m above sea level.

In the 1LE1/1LE5 motor version without external fan and fan cover, order code **F90**, the motor is located in the air flow of the

driven fan that must drive the minimum cooling air flow over the motor housing. The minimum air flow must pass closely over the housing (comparable to self-ventilation of the motor). Otherwise higher air flows are required to comply with admissible motor heating levels.

1LE1 motors

Frame size	Required cooling air flow for number of poles							
	2		4		6		8	
	IE2							
	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min
63	0.83	1.02	0.41	0.48	0.27	0.32	–	–
71	1.49/1.73	1.81/2.08	0.75/0.86	0.87/1.02	0.49/0.58	0.58/0.71	0.36/0.42	0.43/0.54
80	1.82	2.18	0.9	1.1	0.6	0.73	0.44	0.53
90	3.3	4.03	1.64	2.01	1.11	1.31	0.76	0.94
	IE2/IE1		IE2		IE1		IE2/IE1	
	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min
100	3.8	4.4	2.1	2.6	2.3	2.8	1.5	1.2
112	5.0/5.4 ¹⁾	5.7/6.1 ¹⁾	2.9	3.5	2.9	3.5	1.9	1.4
132	6.3	7.2	4.6	5.7	4.6	5.7	3.1	2.4
160	10.9	13.3	6.7	8.1	7.6	9.1	5	3.8
180	12.4	14.8	7.8	9.4	7.8	9.4	5.2	4.8
200	14.3	17.2	10.4	12.5	10.4	12.5	7.9	6
	IE2							
	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min
225	22	26	19	23	15	17.5	11.5	13.5
250	28	33	21	24.5	19	22.5	14.5	16.3
280	32	37.5	32.5	39	24	29.5	18	22
315	48	58	49	58	34	40	25	30.5
	IE4/IE3							
	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min
180	10.3	12.3	7	8.3	5.2	6.2	–	–
200	10.4	12.5	7.6	9.1	6.5	7.8	–	–
225	14	17.5	12	15	15.5	18	11.5	12.5
250	18.5	22	12	15	16	20	12	13.5
280	26	30.5	27.5	32.5	22.5	26.5	18	21.5
315	40	48.5	32.5	39	31	37	25	30.5
	IE3/IE2							
	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min
80	1.36	1.66	0.66	0.8	0.42	0.51	0.3	0.38
90	2.86	3.41	1.34	1.7	0.87	1.06	0.65	0.8

1LE5 motors

Frame size	Required cooling air flow for number of poles							
	2		4		6		8	
	IE3/IE4							
	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min	50 Hz m ³ /min	60 Hz m ³ /min
315	46/44	56/53	38.5/38	46/46	26.5/–	31/–	–	–
355	44/–	53/–	63/63	75/75	40.5/–	48.5/–	–	–

1) Value: IE2/IE1

Introduction

Electrical design

Motor protection

Overview

The order variants for motor protection are coded with letters in the 15th position of the Article No. and, if necessary, using order codes.

In the standard version, the motor is designed without motor protection.

15th position of the Article No. letter **A**.

A distinction is made between current-dependent and motor-temperature-dependent protection devices.

The following applies to all motors:

The motors can withstand 1.5 times the rated current at rated voltage and frequency for two minutes (EN 60034).

Current dependent protection devices

Fuses are only used to protect power cables in the event of a short-circuit. They are not suitable for overload protection of the motor.

The motors are usually protected by thermally delayed overload protection devices (circuit breakers for motor protection or overload relays), for example with SIRIUS switching and protective devices. For further details, see Catalog IC 10.

This protection is current-dependent and is particularly effective in the case of a locked rotor.

For standard duty with short start-up times and starting currents not too excessive and for low numbers of switching operations, motor protection switches provide adequate protection. Motor protection switches are not suitable for heavy starting duty or large numbers of switching operations. Differences in the thermal time constants for the protection equipment and the motor result in unnecessary early tripping when the protection switch is set to rated current.

Motor-temperature-dependent protective devices and motor temperature detection with converter operation

Depending on the specific requirements, various different components can be built into the motor winding for switching off the motor before it overheats and for monitoring the winding temperature and motor temperature.

Temperature detectors – Bimetal switches

Bimetal switches operate on the principle of mechanical deformation as a result of long-term heating. Bimetal strips bent as a result of such heating have a spring action that results in sudden reversal of the curvature (concave to convex or vice-versa).

When a limit temperature is reached, these temperature detectors (NC contacts) can deactivate an auxiliary circuit. The circuit can only be reclosed following a considerable fall in temperature. Bimetal switches are suitable protection devices in the case of slowly rising motor temperatures. When the motor current rises quickly (e.g. with a locked rotor), these switches are not suitable due to their large thermal time constants.

Temperature detectors for tripping:

15th position of the Article No. letter **Z** and order code **Q3A**.

The temperature detectors have the following current-carrying capacity and switching capacity:

230 V, AC: 2.5 A

24 V, DC: 1.6 A

PTC thermistors – Thermistor motor protection

PTC thermistors provide the most comprehensive protection against thermal overloading of the motor. A rise in the winding temperature over the admissible value can be accurately detected thanks to the low heat capacity of these PTC (Positive Temperature Coefficient) thermistors and their excellent heat contact with the winding. When the limit temperature is reached (rated tripping temperature), the PTC thermistors undergo a sudden change in resistance. This is evaluated by tripping units and can be used to open auxiliary circuits. PTC thermistors can-

not themselves be subjected to high currents and voltages. This results in the destruction of the semiconductor. The switching hysteresis of the PTC thermistor and tripping unit is low, which supports fast restarting of the drive. Motor protection of this type is recommended for heavy duty starting, switching duty, extreme changes in load, high ambient temperatures or fluctuating supply systems.

Motor protection with PTC thermistor for tripping. In the terminal box, two auxiliary terminals are required. 15th position of the Article No. letter **B**.

Two temperature sensor circuits are used if a warning is required before the motor is shut down (tripped). The warning is normally set to 10 K below the tripping temperature.

Motor protection with PTC thermistor for alarm and tripping. In the terminal box, 4 auxiliary terminals are required. 15th position of the Article No. letter **C**.

Motor protection for frame sizes 80 and 90 is implemented with the 15th position of the Article No. letter **B**, and with the order code **Q11** with a PTC thermistor.

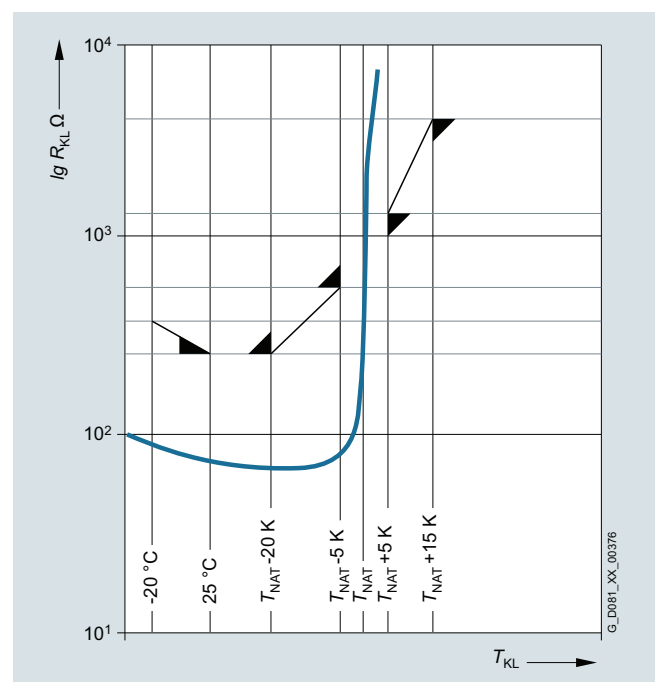
Motor protection for frame sizes 80 and 90 is implemented with the 15th position of the Article No. letter **C**, and with the order code **Q12** with two PTC thermistors.

In order to achieve full thermal protection, it is necessary to combine a thermally delayed overcurrent release and a PTC thermistor. For full motor protection implemented only with PTC thermistors, please inquire.

The SIRIUS 3RN2 thermistor motor protection device for protecting motors against overheating by means of direct temperature measurement, also for a hazardous area with ATEX approval, can be ordered separately. For further details, see Catalog IC 10 or www.siemens.com/product?3RN2.

PTC sensor characteristic

The PTC thermistor is a temperature-dependent component. At the smallest changes in temperature in the region of the rated shutdown temperature, the resistance of the PTC increases steeply.



PTC sensor characteristic

Overview (continued)NTC thermistor

NTC thermistors have a negative temperature coefficient and conduct current at higher temperatures better than at lower temperatures.

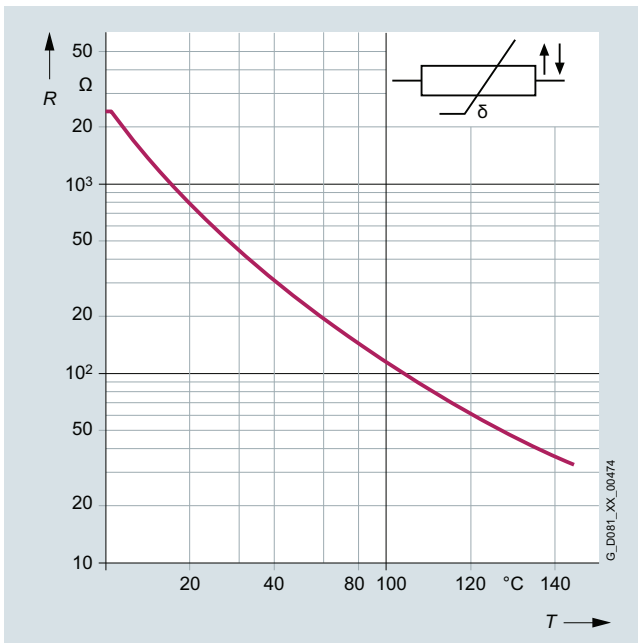
NTC thermistors are typically used for temperature compensation of electronic circuits, or to limit inrush currents, to achieve the soft starting of electrical machines, for example.

Motor temperature monitoring and shutdown using NTC thermistors is unusual, but it is technically possible. The tripping temperature can be set when using suitable tripping devices of this type.

NTC thermistors for tripping: 15th position of the Article No. letter **Z** and order code **Q2A**.

For line operation, the SIRIUS temperature monitoring relays 3RS1, 3RS2, components of the protective device, can be ordered separately.

For further details, see [Catalog IC 10](#) or www.siemens.com/product?3RS1.

NTC thermistor characteristicKTY 84-130 temperature sensor

This temperature sensor is a semiconductor which, in a similar manner to a PTC thermistor, changes its resistance as a function of its temperature at a defined rate. Within the measuring range, however, the KTY 84-130 characteristic rises almost linearly. The temperature sensor is embedded in the winding overhang of the motor in the same way as the components mentioned above. It is characterized by its outstanding precision, high reliability, and temperature stability, as well as a fast response time. Thanks to these properties, which permit the almost analog monitoring of winding temperature, the KTY 84-130 is preferred for converter operation.

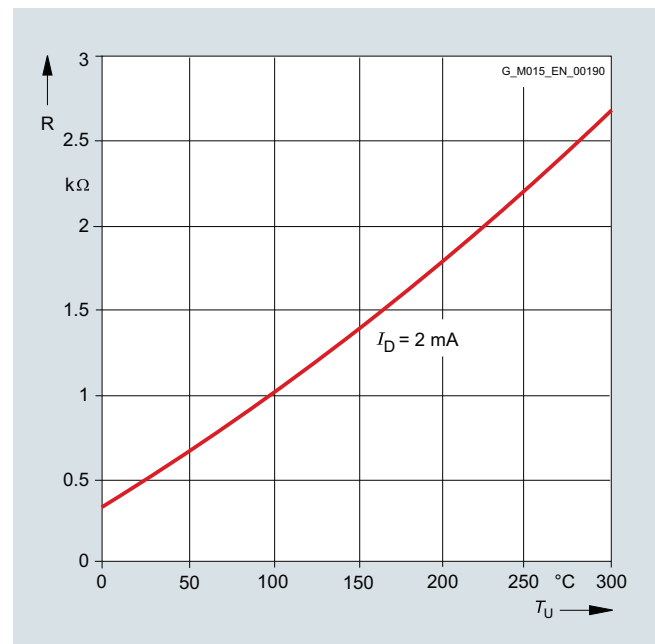
Motor temperature detection with embedded KTY 84-130 temperature sensor: In the terminal box, two auxiliary terminals are required.

15th position of the Article No. letter **F**.

Temperatures for alarm and tripping can be set as required when using converters from Siemens that determine the motor temperature in accordance with the measuring principle described above. With these devices, the measured signal is evaluated directly in the converter.

For line operation, the SIRIUS 3RS1, 3RS2 temperature monitoring device, which is part of the protection equipment, can be ordered separately.

For further details, see [Catalog IC 10](#) or www.siemens.com/product?3RS1.

KTY 84-130 temperature sensor characteristic

Introduction

Electrical design

Motor protection

1

Overview (continued)

Pt100/Pt1000 resistance thermometer

The resistance thermometer has a chip for a temperature sensor, the resistance of which changes in relation to temperature according to a series of reproducible basic values. The changes in resistance are transferred as changes in current. At 0 °C, the measurement resistances are adjusted to 100 Ω for the Pt100 and 1000 Ω for the Pt1000, and correspond to the accuracy class B (i.e. the relationship between resistance and temperature). The limit deviation is ± 0.3 °C, and the admissible deviations are defined in EN 60751.

The Pt1000 resistance thermometer will, in the future, gradually replace the KTY84-130 temperature sensors available today. Similar to the method of operation of the Pt100, the relationship between the temperature and the electrical resistance of conductors is utilized in the Pt1000 to measure the temperature, just like with the additional resistance thermometers described above.

Pure metals undergo larger changes in resistance than alloys and have a relatively constant temperature coefficient.

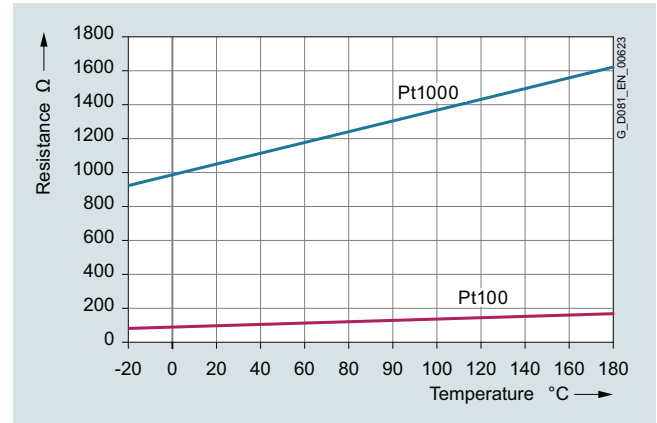
The order options for the Pt100/Pt1000 temperature sensors are described in Chapter 2 (15th position of the Article No.: **H, J, K, L, P, Q,** or **R**, or order codes **Q35, Q36, Q60, Q61, Q62, Q63, Q64, Q72, Q78,** or **Q79**).

Temperatures for alarm and tripping can be set as required when using converters from Siemens that determine the motor temperature in accordance with the measuring principle described above. With these devices, the measured signal is evaluated directly in the converter.

In line operation, the SIRIUS 3RS1, 3RS2 temperature monitoring relay can be ordered separately for the protection equipment.

For further details, see [Catalog IC 10](#) or www.siemens.com/product?3RS1.

Pt100/Pt1000 resistance thermometer characteristics



OverviewLocation of the terminal box

The terminal box of the motor can be mounted in four different locations or positions. For the motors of the 1LE10 aluminum series, frame sizes 63 and 71, the terminal box can only be mounted on the top (16th position of the Article No. **4**).

The position of the terminal box is coded using the 16th position of the motor Article No.

When defining the position of the terminal box, please observe the following:

- Motors with feet must always be viewed looking onto the drive end with the shaft in the horizontal position. The feet are then always at "6 o'clock". This is especially important with construction types IM B6, IM B7, and IM B8, and also applies to combined construction types such as IM B35.
- Flange-mounted motors (e.g. IM B5) whose drive-end flange has a condensation drainage hole must always be viewed looking onto the drive end with the shaft in the horizontal position. The condensation drainage hole is then always at "6 o'clock".

The aluminum series motors 1LE10 and 1PC10 with feet and standard power range have cast feet in the standard version in frame sizes up to 160, e.g. IM B3, IM B6, etc. (applies only to IE3 motors with standard housing; IE3 motors with long housing always have screwed-on feet). Motors from frame size 180 upwards have screwed-on feet. If rotation of the terminal box is to be possible in the future, the "Screwed-on feet" option, order code **H01**, must be ordered.

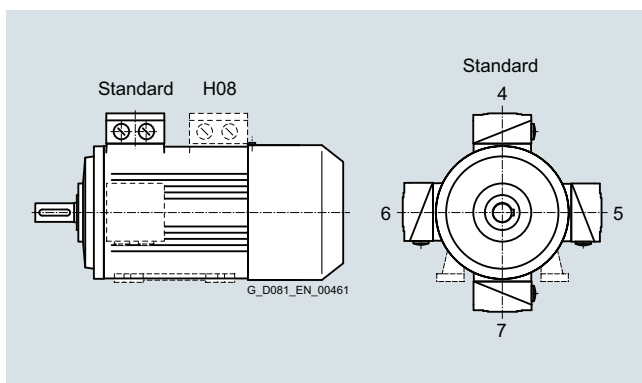
In accordance with the type of construction, spare holes that are not used for mounting the feet can be used by the customer. If the customer would like this option, it is advisable to include order code **H10** "Housing with screw mounting" in the order – possible only for frame sizes 80, 90, 180 and 200. Responsibility for any strength calculations required for this type of customer mounting lies with the customer.

For all motors with increased power and with feet, the feet are screw-mounted as standard. The terminal box can be rotated later. Motors with frame sizes 225 to 315 are supplied as standard with cast feet.

Terminal box on right-hand side:
16th position of the Article No. digit **5**

Terminal box on left-hand side:
16th position of the Article No. digit **6**

Terminal box below:
16th position of the Article No. digit **7**



Location of the terminal box with the corresponding digits in the 16th position of the Article No.

The number of winding ends depends on the winding design. Three-phase motors are connected to the three phase conductors L1, L2 and L3 of a three-phase system. The rated voltage of the motor in the running connection must match the phase conductor voltages of the network.

When the three phases are operating in a time sequence and are connected to the terminals of the motor in alphabetical order U1, V1 and W1, clockwise rotation of the motor shaft is established as viewed onto the drive end. The direction of rotation of the motor can be changed to counterclockwise if two connecting leads are interchanged.

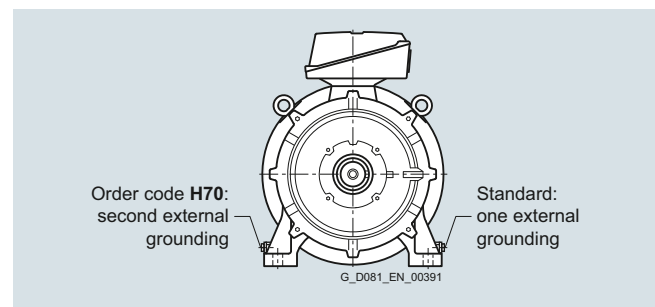
Labeled terminals are provided to connect the protective conductor.

A PE terminal is provided in the terminal box for grounding. A grounding terminal is provided on the outside of the motor frame – special version for 1LE1/1PC1 motors.

Order code **H04**

External grounding terminal/external grounding is standard for 1LE15/16 motors from frame size 180 upwards.

A second external grounding connection can also be ordered. Order code **H70** (must be ordered in combination with option **H04**)



If a brake control system or thermal protection is installed, the connections will also be in the terminal box. The motors are suitable for direct connection to the line supply.

Design of the terminal box

The number of terminals and the size of the terminal box are designed for standard requirements.

For special requirements, or on customer request, a larger terminal box can be supplied.

For motors with frame sizes 71 up to 90, the following constraints apply:

When the terminal box is located on the left or right-hand sides, the customer must not align the cable entry towards the housing feet, because this can cause collisions between the motor connection cables and the foundations.

Larger terminal box

Order code **R50**

If the necessary installation angle of the motor would cause machine components to collide with the terminal box, the terminal box can be moved from the drive end (DE) to the non-drive end (NDE). Only use according to temperature class 155 (F). When the terminal box is rotated to the non-drive end (NDE) of the motor, it is important to note that dimensions "C" and "CA" will not comply with the values specified by EN 50347. Dimensional drawings can be requested via DT Configurator.

Order code **H08**

Introduction

Electrical design

Connection, circuit and terminal boxes

Overview (continued)

Motor connection

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
- The cable routing
- The ambient temperature and the corresponding admissible current in accordance with DIN VDE 0298

For motors with auxiliary terminals (e.g. 15th position of the Article No. letter **B**), additional cable entry holes are provided (M16 × 1.5 or M20 × 1.5 depending on frame size). For further details, see the data sheet function in the DT Configurator.

The terminal box is located on the housing and bolted in place. The terminal box can be turned by 4 × 90° degrees on the terminal base of the machine housing in the case of a terminal board with 6 terminal studs (standard version).

Parallel feeders

Some motors must be fitted with parallel feeders due to the maximum permissible current per terminal. These motors are indicated in the selection and ordering data in the respective chapter.

The temperature rises in the terminal box must be taken into account when selecting the connection cable or individual connections.

These approximate temperature rises are as follows:

- Range of ambient temperature (T_{amb}) +50 K for motors with temperature class Th.Cl.155 (F).
- Range of ambient temperature (T_{amb}) +60 K for motors with temperature class Th.Cl.180 (H).
- Without any specifications in field 19 (T_{amb}) on the rating plate, T_{amb} is equal to 40 °C.

Cable entry on terminal box

With a view onto the drive end of the motor with the shaft in the horizontal position and the terminal box on the top, the cable entry is always on the right-hand side of the motor, as shown in the figure below. Standard position 0°, (smoke extraction motors, order code **R13**). The terminal box can be rotated on the base of the motor housing such that the cable entry is located in the positions given below:

- Towards the drive end (DE) (rotation of terminal box by 90°, entry from DE) for B5 types of constructions only with order code **H08!**
With B14 construction types, the customer must ensure that sufficient space is available for cable outlet.
Order code **R10**
- Towards the fan end (NDE) (rotation of terminal box by 90°, entry from NDE)
Order code **R11**
- Opposite the standard position 0° (rotation of terminal box by 180°, entry opposite the standard position 0°)
Order code **R12**

The dimensions of the terminal box are listed in the section "Dimensions" on pages 2/122 to 2/153 in accordance with the frame size and the "Dimensional drawings". If the position of the terminal box (right-hand side, left-hand side, or top) is changed, the position of the cable entry must be checked and, if necessary, ordered with the corresponding order codes (**R10**, **R11**, and **R12**).

Location of the cable entries with the corresponding order codes

Motor	Frame size	Terminal box	Terminal box position				Retrofitting possible	Rotation of the terminal box and cable entry			Retrofitting possible
			Top	Right-hand side	Left-hand side	Continuously by 360°		-90°	+90°	180°	
Type	Type	16th position of Article No. and with specification of order code, Article No. with -Z	4	5	6	4	Article No. with -Z and order code	R10	R11	R12	
1LE10, 1MB10, 1PC10	63 ... 71	TB1B00, TB1B10	✓	–	–	– ¹⁾	–	✓	✓	✓	Yes
	80 ... 90	TB1E00, TB1E10	✓	✓	✓	– ¹⁾	–	✓	✓	✓	Yes
	100, 112	TB1F00, TB1F10	✓	✓	✓	– ¹⁾	–	✓	✓	✓	Yes
	132	TB1H00, TB1H10	✓	✓	✓	– ¹⁾	–	✓	✓	✓	Yes
	160, 180	TB1J00, TB1J10	✓	✓	✓	– ¹⁾	–	✓	✓	✓	Yes
	200	TB1L00, TB1L10	✓	✓	✓	– ¹⁾	–	✓	✓	✓	Yes
1LE15	71	TB1D01	✓	✓	✓	–	–	✓	✓	✓	Yes
	80, 90	TB1D01	✓	✓	✓	–	–	✓	✓	✓	Yes
1LE15, 1LE16, 1MB15, 1MB16	100 ... 315	TB1F01 ... TB1R01	✓	✓	✓	–	–	✓	✓	✓	Yes

Motor	Frame size	Terminal box	Terminal box position						Bottom	-90°	+90°	180°	Retrofitting possible
			Top Left	Top Right	45° Left	45° Right	90° Right	90° Left					
Type	Type	16th position of Article No. and with specification of order code, Article No. with -Z	0	1	2	3	5	6	9	R10	R11	R12	
1LE5	315	TB3Q01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
	355	TB3R01	✓	✓	✓	✓	✓	✓	✓	✓ ²⁾	✓	✓	Yes

¹⁾ Not applicable for smoke extraction motors.

²⁾ Not possible together with terminal box code (16th position of the Article No.) **0**, **1**, **5**, **6** and flange A 900.

Overview (continued)



Terminal box in standard position, detailed view

Ordering example:

Terminal box on right-hand side (16th position of the Article No. digit **5**):

Cable entry is from below unless another order code is specified.

Cable entry from drive end (DE) – Article No. with **-Z** and order code **R10**.

For cable entry to a standard terminal box, a metal cable gland can be ordered for motor connection.

One metal cable gland – Article No. with **-Z** and order code **R15**.

For special requirements for which standard holes for the cable entries are inadequate for the UK market, reduction pieces for M cable glands in accordance with British Standard that are mounted on both cable entries can be supplied (only up to frame size 160).

Order code **R30**

Frame size	Cable entry acc. to	
	IEC	British Standard
100	2 × M32	2 × M20
112/132	2 × M32	2 × M25
160	2 × M40	2 × M32

Motor connectors

Motors of frame sizes 80 to 132 can be supplied with a motor connector.

The motor connectors are mounted on the specially designed terminal box at the factory and are aligned towards NDE in the basic version. The terminal boxes can be rotated by $4 \times 90^\circ$ on the base of the motor housing (order codes **R10**, **R12**, and **R13**).

The following motor connector variants are available:

- Motor connector HAN10B-10E
Order code **R70**
- Motor connector HAN10B-10E EMC
Order code **R71**
- Motor connector HAN3A-Q12 EMC
Order code **R72**
- Motor connector HAN3A-Q12
Order code **R73**

Motor connector assignment

Motor Type	Frame size	Motor connectors Type	Size of the terminal box
1LE10	63 ... 70	HAN10B-10E HAN10B-10E EMC	TB1B60
	80 ... 90	HAN3A-Q12 HAN3A-Q12 EMC	TB1E00 with mounted brake TB1E10
	80 ... 90	HAN10B-10E HAN10B-10E EMC	Only possible with TB1E10
1LE10, 1PC10	100 ... 132	HAN10B-10E HAN10B-10E EMC	Currently only available with TB1F10 (frame sizes 100 and 112) or TB1H10 (frame size 132)

Technical characteristic values of motor connectors according to EN 60664-1 and EN 61984

Characteristic value	Motor connector			
	HAN3A-Q12		HAN10B-10E	
	Degree of pollution			
	3	2	3	2
Rated current	10 A		16 A	
Rated voltage	400 V	400/690 V	500 V	400/690 V
Rated voltage acc. to UL/CSA	600 V		600 V	

For further technical specifications of the motor connectors, refer to the catalog of Harting Deutschland GmbH & Co. at www.harting.com

or

<https://b2b.harting.com/ebusiness/de/industrie-steckverbinderhan/100382>.

Protruding cable ends

For confined spaces, protruding cable ends can be ordered without a terminal box with cover plate.

The following lengths of protruding cables can be ordered as standard using order codes:

- 3 cables protruding, 0.5 m long ¹⁾
Order code **R20**
- 3 cables protruding, 1.5 m long ¹⁾
Order code **R21**
- 6 cables protruding, 0.5 m long
Order code **R22**
- 6 cables protruding, 1.5 m long
Order code **R23**
- 6 cables protruding, 3.0 m long
Order code **R24**

The cross-section of the named cable refers to a coolant temperature of up to CT 40 °C.

¹⁾ For 3 protruding cables only, it must be specified in plain text whether star or delta connection is required (voltage code **90** and **M1Y**).

Introduction

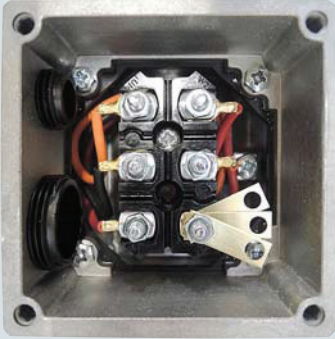
Electrical design

Connection, circuit and terminal boxes

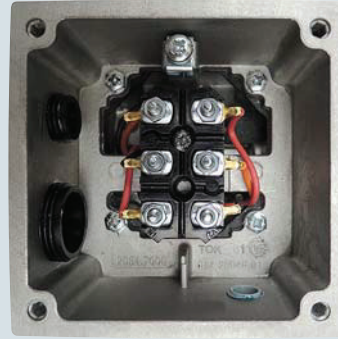
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Overview (continued)

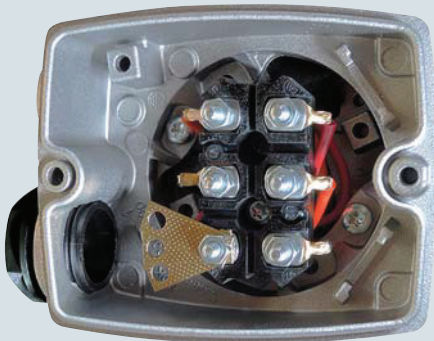
Terminal box type TB1B00



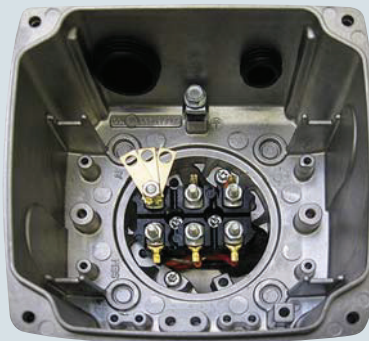
Terminal box type TB1B10



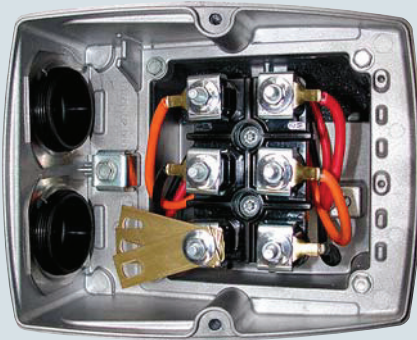
Terminal box type TB1E00



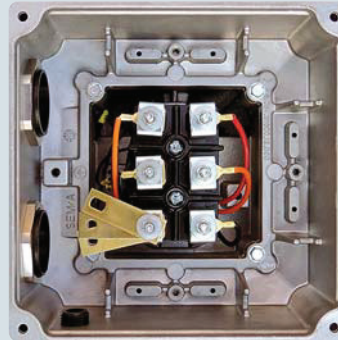
Terminal box type TB1E10 – order code **R50**



Terminal box types TB1F00, TB1H00, TB1J00



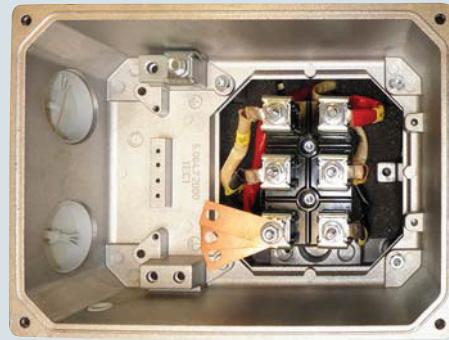
Terminal box type TB1F10, TB1H10, TB1J10 – order code **R50**



Terminal box type TB1L00



Terminal box type TB1L10 – order code **R50**



Overview (continued)

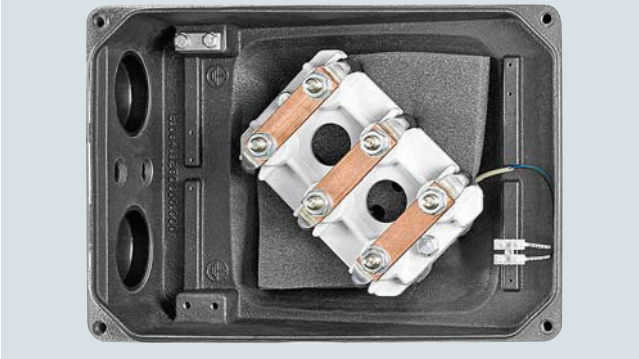
Terminal box type TB1J01



Terminal box type TB1L01



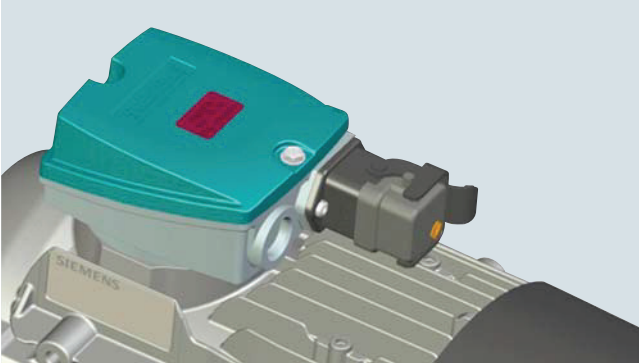
Terminal box type TB1N01



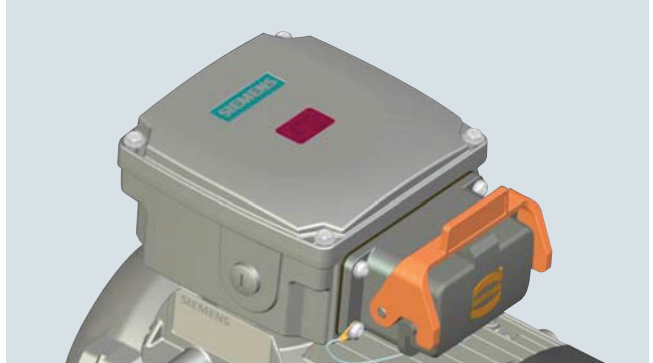
Terminal box type TB1Q01



Motor connector type HAN3A-Q12



Motor connector type HAN10B-10E



Introduction

Electrical design

Connection, circuit and terminal boxes

1

Overview (continued)

Basic data for terminal boxes for 1LE1, 1MB1 and 1PC1 motors

Motor	Frame size	Terminal box	Cable entries/locking	Terminal box material	Feeder connection
1LE10/1MB10/1PC10					
1LE10	63 ... 71	TB1B00 TB1B10	2 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Aluminum alloy	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE10	80 ... 90	TB1E00	1 entry complete with sealing plugs, thread in terminal box, (2 entries with additional mounting components in the winding) Terminal box mounted and screwed	Aluminum alloy	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE10/ 1MB10	80 ... 90	TB1E10	2 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Aluminum alloy	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE10 1MB10 ¹⁾ 1PC10	100 ... 180 80 ... 160 100 ... 160	TB1F00 TB1H00 TB1J00 TB1F10 TB1H10 TB1J10	2 entries complete with sealing plugs and locknuts, terminal box mounted and screwed in place	Aluminum alloy	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE10	200	TB1L00 TB1L10	2 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Aluminum alloy	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE15/1LE16/1LE5/1MB15/1MB16					
1LE15/ 1MB15 ¹⁾	71 ... 90	TB1D01	2 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Cast iron	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE15/ 1LE16/ 1MB15/ 1MB16 ¹⁾	100 ... 315	TB1F01 ... TB1R01	2 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Cast iron	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE5	315 ... 355	TB3Q01 TB3R01	2 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Cast iron	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug
1LE5	355 (500 kW)	TB3R01	4 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Cast iron	<ul style="list-style-type: none"> • Cable lug • Rigid cable, no cable lug

¹⁾ The certified cable entries are supplied as standard for explosion-proof motors.
 - Frame sizes 71 to 200: One certified metric cable gland and one certified metric sealing plug
 - Frame sizes 225 to 315: Two certified metric cable glands

Overview (continued)

Technical specifications for terminal boxes for 1LE1, 1LE5, 1MB1, and 1PC1 motors

Frame size	Terminal box ¹⁾ Standard/larger (order code R50)	Number of terminals	Thread of the contact screw	Max. connectable cable mm ²	Outer cable diameter (sealing range) mm	Cable entry ^{2) 3)}
1LE10/1MB10/1PC1						
63 ... 71	TB1B00/TB1B10	6	M4	1.5/2.5 with cable lug	M16 × 1.5: 4.5 ... 10; M25 × 1.5: 9 ... 17	1 × M25 × 1.5/ 1 × M16 × 1.5 + 1 × M25 × 1.5
80 and 90	TB1E00/TB1E10 ⁴⁾	6	M4	1.5/2.5 with cable lug	M16 × 1.5: 4.5 ... 10; M25 × 1.5: 9 ... 17	1 × M25 × 1.5/ 1 × M16 × 1.5 + 1 × M25 × 1.5
100 112	TB1F00/TB1F10	6	M4	4	11 ... 21	2 × M32 × 1.5
132	TB1H00/TB1H10	6	M4	6	11 ... 21	2 × M32 × 1.5
160	TB1J00/TB1J10	6	M5	16	19 ... 28	2 × M40 × 1.5
180						
200	TB1L00/TB1L10	6	M6	25	27 ... 35	2 × M50 × 1.5
1LE15/1MB15						
71 ... 90	TB1D01	6	M4	1.5/2.5 with cable lug	M16 × 1.5: 4.5 ... 10 M25 × 1.5: 9 ... 17	1 × M16 × 1.5 + 1 × M25 × 1.5
1LE15/1LE16/1MB15/1MB16						
100 112	TB1F01/TB1J01	6	M4	4	11 ... 21	2 × M32 × 1.5/ 2 × M40 × 1.5
132	TB1H01/TB1J01	6	M4	6	11 ... 21	2 × M32 × 1.5
160	TB1J01/TB1K01	6	M5	16	19 ... 28	2 × M40 × 1.5
180	TB1J01/TB1K01	6	M5/M6	16/25	19 ... 28/ 27 ... 35	2 × M40 × 1.5/ 2 × M50 × 1.5
200	TB1L01/TB1L01	6	M6/M8	25/35	27 ... 35/ 27 ... 35	2 × M50 × 1.5/ 2 × M50 × 1.5
225	TB1L01/TB1N01	6	M8/M10	35/120	27 ... 35/ 34 ... 42	2 × M50 × 1.5/ 2 × M63 × 1.5
250 280	TB1N01/TB1Q01	6	M10/M12	120/240	34 ... 42/ 38 ... 45	2 × M63 × 1.5 2 × M63 × 1.5
315	TB1Q01/TB1R01	6	M12/M16	240	38 ... 45/ 44 ... 54	2 × M63 × 1.5 2 × M63 × 1.5
	TB3Q01	6	M12	185	38 ... 45	2 × M63 × 1.5
	TB3Q61			240	42 ... 54	2 × M63 × 1.5
355	TB1R01	6	M16	240	56 ... 68.5	2 × M80 × 2
		12	2 × M16			4 × M80 × 2
1LE55/1LE56						
315	TB3Q01/TB3R01	6	M12/M16	185/240	38 ... 45/ 42 ... 54	2 × M63 × 1.5 4 × M80 × 2
355	TB3R01/TB3R61	12	M16/2 × M16	300	56 ... 68.5/ 56 ... 68.5	2 × M80 × 2 4 × M80 × 2

– not available

Terminal connection

The terminal board accommodates the terminals that are connected to the leads to the motor windings. The terminals are designed so that for frame sizes 71 to 315, the external (line) connections can be made without the need for cable lugs.

¹⁾ In addition to the exact part designation, please specify the machine type and the serial number in all orders for spare parts and repair parts.

²⁾ Designed for cable glands with O-ring.

³⁾ NPT threads can be ordered with order code **Y61**.

⁴⁾ For 1LE1021 and 1LE1023 terminal boxes TB1E10 normal version.

Introduction

Electrical design

Connection, circuit and terminal boxes

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Overview (continued)

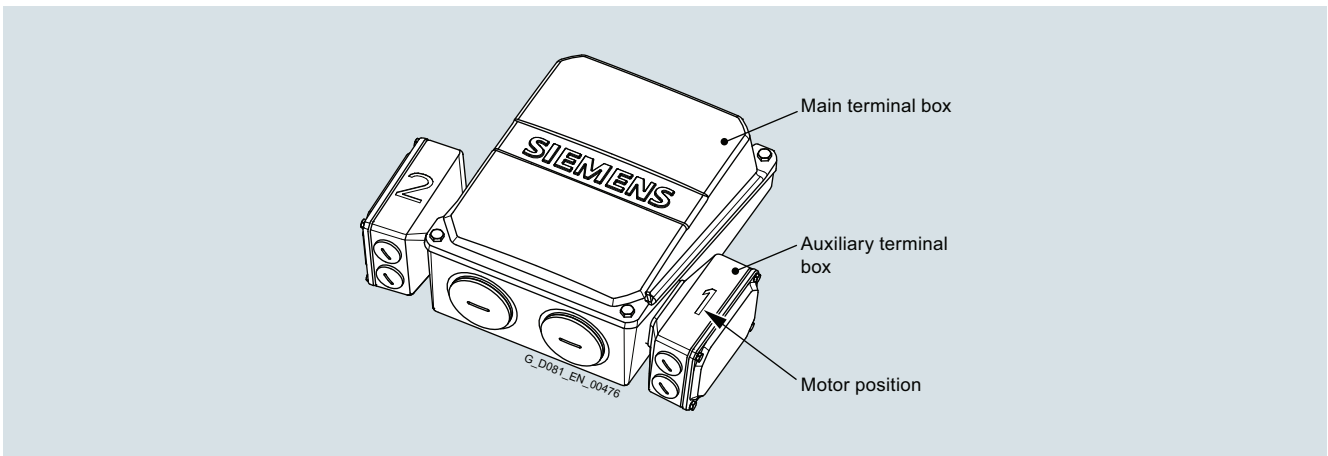
Maximum number of auxiliary terminal boxes for main terminal box

Maximum number of auxiliary terminal boxes TB2J01, TB2N01 (order code R62, R63) in combination with standard terminal box												
Auxiliary terminal box	Type	Order code	Terminal box									
			100, 112	132	160	180	200	225	250	280	315	355
TB2J01		R62	–	–	2	–	2	–	2	–	4	4
TB2N01		R63	–	–	–	–	–	–	–	–	2	2

Maximum number of auxiliary terminal boxes TB2J01, TB2N01 (order code R62, R63) in combination with large terminal box (order code R50)												
Auxiliary terminal box	Type	Order code	Terminal box									
			100, 112	132	160	180	200	225	250	280	315	355
TB2J01		R62	2	2	2	–	2	2	2	–	2	4
TB2N01		R63	–	–	–	–	–	–	–	–	–	2

Maximum number of auxiliary terminal boxes TB2J01, TB2N01 (order code R62, R63) in combination with universal terminal box (order code R52 or R53)												
Auxiliary terminal box	Type	Order code	Terminal box									
			100 ... 160	180	200	225	250	280	315	355		
TB2J01		R62	Not available	2	2	–	2	–	2	–	4	4
TB2N01		R63	–	–	–	–	–	–	–	–	2	2

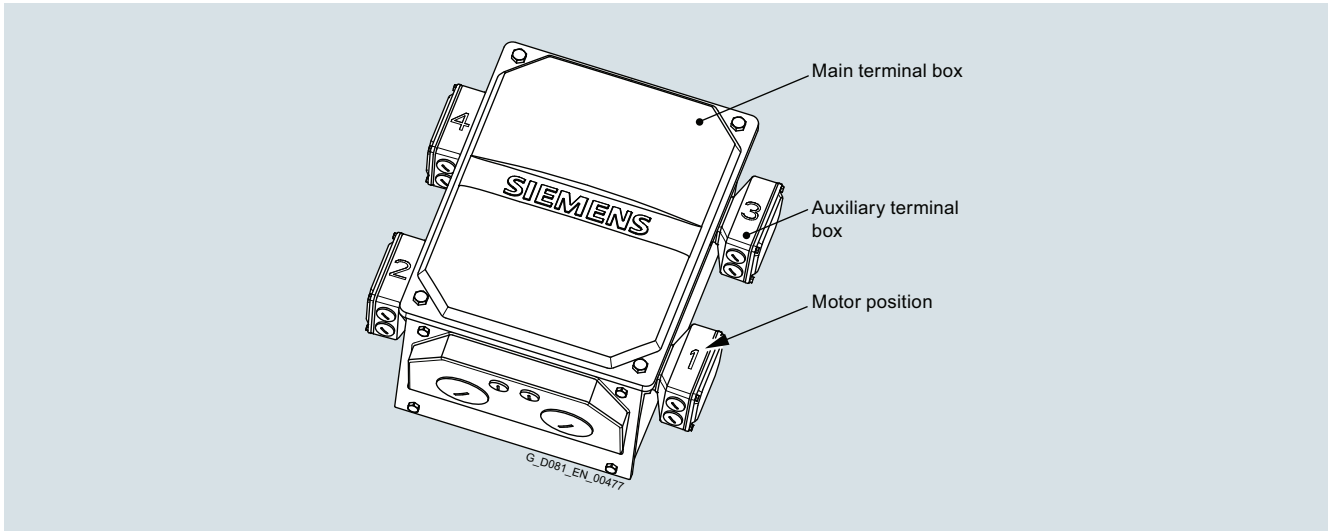
Position of auxiliary terminal box in relation to position of TB1J01, TB1L01, TB1N01, TB1Q01, TB1K01 main terminal box



Auxiliary terminal box TB2J01 (order code R62) in combination with TB1J01, TB1L01, TB1N01, TB1Q01, TB1K01 main terminal box												
Number of auxiliary terminal boxes	Right-hand side				Left-hand side							
	Top	90°, entry from DE	90°, entry from NDE	180°	Top	90°, entry from DE	90°, entry from NDE	180°				
1	1	1	1	2	1	2	1	2	2	1	2	1
2	1 + 2	1 + 2	1 + 2	1 + 2	1 + 2	–	–	1 + 2	1 + 2	–	–	1 + 2

Overview (continued)

Position of auxiliary terminal box in relation to position of TB1R01, TB1J61, TB1L61, TB1N61, TB1Q61 main terminal box



Auxiliary terminal box TB2J01 (order code R62) in combination with TB1R01, TB1J61, TB1L61, TB1N61, TB1Q61 main terminal box

Position of the main terminal box

Top | Right-hand side | Left-hand side

16th position of Article No. and when ordering with order code, Article No. with **-Z**

4 | **5** | **6**

Rotation of terminal box

0° (default) | 90°, entry from DE | 90°, entry from NDE | 180° | 0° (default) | 90°, entry from DE | 90°, entry from NDE | 180° | 0° (default) | 90°, entry from DE | 90°, entry from NDE | 180°

Order code

- | **R10** | **R11** | **R12** | - | **R10** | **R11** | **R12** | - | **R10** | **R11** | **R12**

Number of Auxiliary terminal boxes

Positions of auxiliary terminal boxes – see Figure

	4				5				6			
1	1	1	1	2	1	2	1	2	2	1	2	1
2	1+3	1+3	1+3	2+4	1+3	2+4	1+3	2+4	2+4	1+3	2+4	1+3
(3 on requ.)	1+2+3	1+2+3	1+2+3	1+2+4	1+2+3	-	-	1+2+4	1+2+4	-	-	1+2+3
(4 on requ.)	1+2+3+ 4	1+2+3+ 4	1+2+3+ 4	1+2+3+ 4	1+2+3+ 4	1+2+3+ 4	-	1+2+3+ 4	1+2+3+ 4	-	-	1+2+3+ 4

Introduction

Electrical design

Degrees of protection

1

Overview

All motors are designed to degree of protection IP55. They can be installed in dusty or humid environments. The motors are suitable for operation in tropical climates. Guide value < 60% relative air humidity at CT 40 °C. Other requirements are available on request (see table on page 1/34).

Brief explanation of the degree of protection

IP54:

- Protection against harmful dust deposits
- Protected against spray water

IP55:

- Protection against harmful dust deposits
- Protection against water jets from any direction

IP56:

- Protection against harmful dust deposits
- Protection against powerful water jets from any direction

Order code **H22**

Important: Note that submersion by waves or total immersion, even temporarily, is not permitted especially in the case of motors with fans. This corresponds to IP67 or IP68 degree of protection (please inquire).

EN 60034-5 defines protection level 6 for water protection as: "Protection against water due to heavy seas or water in a powerful jet". IP56 degree of protection can only be used with the requirement "Protection against a powerful jet" and not for the requirement "Protection against heavy sea".

Not possible in combination with brake 2LM8 (order code **F01**).

IP65:

- Complete protection against dust deposits
- Protection against water jets from any direction

Order code **H20**

In EN 60034-5, the code 6 for protection against the ingress of foreign bodies and touch hazard protection for electrical machines is not listed – Data for code 6 (protection against the ingress of dust) is given in EN 60529.

Not possible in combination with HOG 9 DN 1024 I rotary pulse encoder (order code **G05**) and/or brake 2LM8 (order code **F01**) and/or paint finish, cast-iron parts primed (order code **S00**).

EN 60529 contains a comprehensive description of this degree of protection as well as test conditions.

With motors that have a vertical shaft extension, the end user must prevent an ingress of fluid along the shaft.

For motors with shaft extension pointing downwards, the version "Protective cover for types of construction" order code **H00** is urgently recommended, see also the explanations on "Types of construction" on page 1/51.













With flange-mounted motors, for IM V3 type of construction, collection of fluid in the flange basin can be prevented by drainage holes (on request).

The condensation drainage holes at the drive end (DE) and non-drive end (NDE) are sealed (IP55) on delivery. If the condensation drainage holes are ordered for motors of the IM B6, IM B7 or IM B8 type of construction (feet on side or top), the position of the drainage holes will be in the correct position for the type of construction.


Order code **H03**

Overview

Standard types of construction and special types of construction

Type of construction acc. to EN 60034-7		Frame size	Letter of the 14th position of the Article No.	Additional identification code -Z with order code
Without flange				
IM B3/IM 1001		63 to 355	A	–
IM B6/IM 1051		63 to 355	T	–
IM B7/IM 1061		63 to 355	U	–
IM B8/IM 1071		63 to 355	V	–
IM V5/IM 1011 without protective cover		63 to 355	C ¹⁾	–
IM V6/IM 1031		63 to 355	D	–
IM V5/IM 1011 with protective cover		71 to 355	C	+ H00 ²⁾
With flange				
IM B5/IM 3001		63 to 355	F	–
IM V1/IM 3011 without protective cover		63 to 355	G ¹⁾	–
IM V1/IM 3011 with protective cover		71 to 355	G	+ H00 ²⁾
IM V3/IM 3031		63 to 355	H	–
IM B35/IM 2001		63 to 355	J	–

In the EN 50347 standard, flanges FF with through holes and flanges FT with tapped holes are specified.

¹⁾  The following applies for explosion-proof motors: In the case of the types of construction with shaft extension pointing downwards, the version "with protective cover" is required. For types of construction with shaft extension pointing upwards, a suitable cover must be implemented to prevent small parts from falling into the fan cover (see the standard IEC/EN 60079-0). The cover must not block the cooling air flow.

²⁾ Standard cylindrical shaft extension (second shaft extension) **L05** is not possible.

Introduction

Mechanical version

Types of construction

Overview (continued)


Type of construction acc. to EN 60034-7	Frame size	Letter of the 14th position of the Article No.	Additional identification code -Z with order code
With flange			
IM B14/IM 3601	80 to 315	K	–
IM V19/IM 3631	80 to 315	L	–
IM V18/IM 3611 without protective cover	80 to 315	M ¹⁾	–
IM V 18/IM 3611 with protective cover	80 to 315	M	+ H00 ²⁾
IM B34/IM 2101	80 to 315	N	–
With special flange			
IM B14/IM 3601	80 to 315	K	+ P01
IM B34/IM 2101	80 to 315	N	+ P01
IM V18/IM 3611 without protective cover	80 to 315	M ¹⁾	+ P01
IM V 18/IM 3611 with protective cover	80 to 315	M	+ P01 + H00 ²⁾
IM V19/IM 3631	80 to 315	L	+ P01

In EN 50347, flanges are assigned to the frame sizes as FT with tapped holes. See the table on the next page for flange dimensions.

The dimensions of the following types of construction are identical: 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

Motors in the standard power range can be ordered in basic types of construction IM B3, IM B5 or IM B14 and operated in 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. Lifting eyes are available for transport and installation in a horizontal position. In conjunction with the lifting eyes, for the purpose of stabilizing the position when the motor is arranged vertically, additional lifting straps (EN 1492-1) and/or clamping bands (EN 12195-2) must be used.

When a motor for mounting position IM V1 is ordered directly, the motor is supplied with lifting eyes for vertical mounting (up to frame size 90 and frame sizes 180 and 200 for aluminum motors without eyebolts).

¹⁾  The following applies for explosion-proof motors: In the case of the types of construction with shaft extension pointing downwards, the version "with protective cover" is required. For types of construction with shaft extension pointing upwards, a suitable cover must be implemented to prevent small parts from falling into the fan cover (see the standard IEC/EN 60079-0). The cover must not block the cooling air flow.

The motors are designated in accordance with the types of construction on the rating plate.

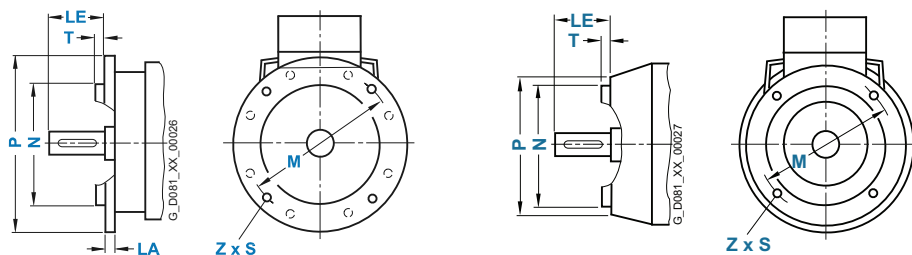
With motors that have a vertical shaft extension, the end user must prevent an ingress of fluid along the shaft. In the case of all types of construction with shaft extension pointing downwards, the version "with protective cover" is urgently recommended, see section "Degrees of protection" on page 1/50 – housing version.

Motors with feet, in some cases, have two fixing holes at the non-drive end (NDE), see dimension tables on pages 2/122 to 2/153.

A screw-mounted cover (made of sheet metal or plastic depending on shaft height) is included as standard for horizontal types of construction and types of construction with shaft pointing upwards (14th position of the Article No. letter **A, T, U, V, D, F, H, J, K, L, N**) on motors up to FS 160 in combination with condensation drainage holes, order code **H03**.

²⁾ Standard cylindrical shaft extension (second shaft extension) **L05** is not possible.

Overview



In EN 50347, the frame sizes are allocated flange FF with through holes and flange FT with tapped holes. The designation of flange A and C according to DIN 42948 (invalid since September 2003) are also listed for information purposes. See the table below.

(Z = the number of retaining holes)

Frame size	Type of construction	Flange type	Flange with through holes (FF/A) Flange with tapped holes (FT/C)		Dimension designation acc. to IEC							
			Acc. to EN 50347	Acc. to DIN 42948	LA	LE	M	N	P	S	T	Z
63 M	IM B5, IM B35, IM V1, IM V3	Flange	FF115	A 140	–	23	115	95	140	10	3	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT75	C 90	–	23	75	60	90	M6	2.5	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange – Order code P01	FT100	C 120	–	23	100	80	120	M6	3	4
71 M	IM B5, IM B35, IM V1, IM V3	Flange	FF130	A 160	5	30	130	110	160	10	3.5	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT85	C 105	–	30	85	70	105	M6	2.5	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange ¹⁾ – Order code P01	FT115	C 140	–	30	115	95	140	M8	3	4
80 M	IM B5, IM B35, IM V1, IM V3	Flange	FF165	A 200	10	40	165	130	200	12	3.5	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT100	C 120	–	40	100	80	120	M6	3	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange ¹⁾ – Order code P01	FT130	C 160	–	40	130	110	160	M8	3.5	4
90 S/L	IM B5, IM B35, IM V1, IM V3	Flange	FF165	A 200	10	50	165	130	200	12	3.5	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT115	C 140	–	50	115	95	140	M8	3	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange – Order code P01	FT130	C 160	–	50	130	110	160	M8	3.5	4
100 L	IM B5, IM B35, IM V1, IM V3	Flange	FF215	A 250	11	60	215	180	250	14.5	4	4
	IM B5, IM B35, IM V1, IM V3	Next largest flange – Order code P01	FF265	A 300	12	60	265	230	300	14.5	4	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF165	A 200	11	60	165	130	200	12	3.5	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT130	C 160	–	60	130	110	160	M8	3.5	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange – Order code P01	FT165	C 200	–	60	165	130	200	M10	3.5	4
112 M	IM B5, IM B35, IM V1, IM V3	Flange	FF215	A 250	11	60	215	180	250	14.5	4	4
	IM B5, IM B35, IM V1, IM V3	Next largest flange – Order code P01	FF265	A 300	12	60	265	230	300	14.5	4	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF165	A 200	11	60	165	130	200	12	3.5	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT130	C 160	–	60	130	110	160	M8	3.5	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange – Order code P01	FT165	C 200	–	60	165	130	200	M10	3.5	4
132 S/M	IM B5, IM B35, IM V1, IM V3	Flange	FF265	A 300	12	80	265	230	300	14.5	4	4
	IM B5, IM B35, IM V1, IM V3	Next largest flange – Order code P01	FF300	A 350	13	80	300	250	350	18.5	5	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF215	A 250	11	80	215	180	250	14.5	4	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT165	C 200	–	80	165	130	200	M10	3.5	4
	IM B14, IM B34, IM V18, IM V19	Next largest flange – Order code P01	FT215	C 250	–	80	215	180	250	M12	4	4
160 M/L	IM B5, IM B35, IM V1, IM V3	Flange	FF300	A 350	13	110	300	250	350	18.5	5	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF265	A 300	12	110	265	230	300	14.5	4	4
	IM B14, IM B34, IM V18, IM V19	Flange	FT215	C 250	–	110	215	180	250	M12	4	4
180 M/L	IM B5, IM B35, IM V1, IM V3	Flange	FF300	A 350	13	110	300	250	350	18.5	5	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF 265	A 300	12	110	265	230	300	14.5	4	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF350	A 400	15	110	350	300	400	18.5	5	4
200 L	IM B5, IM B35, IM V1, IM V3	Flange	FF350	A 400	15	110	350	300	400	18.5	5	4
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF300	A 350	13	110	300	250	350	18.5	5	4
225 S/M 2-pole 4-... 8-pole	IM B5, IM B35, IM V1, IM V3	Flange	FF400	A 450	16	110 140	400	350	450	18.5	5	8
250 M	IM B5, IM B35, IM V1, IM V3	Flange	FF500	A 550	18	140	500	450	550	18.5	5	8
280 S/M	IM B5, IM B35, IM V1, IM V3	Flange	FF500	A 550	18	140	500	450	550	18.5	5	8
315 S/M/L 2-pole 4-... 8-pole	IM B5, IM B35, IM V1, IM V3	Flange	FF600	A 660	22	140 170	600	550	660	24	6	8
315 L for 1LE5 2-pole 4-pole 2-pole 4-pole	IM B5, IM B35, IM V1, IM V3	Flange	FF740	A 800	25	140 170	740	680	800	24	6	8
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF600	A 660	22	140 170	600	550	660	24	6	8
355 M/L for 1LE5 2-pole 4-pole 2-pole 4-pole	IM B5, IM B35, IM V1, IM V3	Flange	FF840	A 900	25	140 170	840	780	900	24	6	8
	IM B5, IM B35, IM V1, IM V3	Next smallest flange – Order code P02	FF740	A 800	25	140 170	740	680	800	24	6	8

¹⁾ With reference to standard EN 50347, flanges that are 2 steps larger are used with option **P01** in the frame sizes 71 and 80.

Introduction

Mechanical version

Shaft and rotor

Overview

Shaft extension

60° center hole acc. to DIN 332, Part 2 with M3 to M24 tapped hole depending on the shaft diameter (see dimension tables in section 2 of the catalog).

DE (shaft extension)	
Diameter	Thread
mm	mm
7 ... 10	DR M3
> 10 ... 13	DR M4
> 13 ... 16	DR M5
> 16 ... 21	DR M6
> 21 ... 24	DR M8
> 24 ... 30	DR M10
> 30 ... 38	DR M12
> 38 ... 50	DR M16/DS M16
> 50 ... 85	DS M20
> 85 ... 130	DS M24

Shaft extension with standard dimensions, without feather keyway

For motor series 1LE1, 1MB1 and 1PC1, the standard shaft extension can be ordered with standard dimensions without a feather keyway. The key convention does not have to be stamped onto the rating plate for balancing.

Order code **L04**

Standard shaft made of stainless steel

A standard shaft made of stainless steel can be ordered (e.g. 1.4021) for the 1LE1, 1MB1 and 1PC1 motor series. This is only possible for shaft extensions of standard dimensions. Order code **L06**

Special non-rusting materials are only available on request.

Non-standard cylindrical shaft extension

The non-standard cylindrical shaft extension can be used on the drive end (DE) (with plain text according to table). The feather keys are supplied in every case.

Order code **Y58**

For order code **Y58** non-standard cylindrical shaft extension (DE):

- Dimension D: less than or equal to the inner diameter of the roller bearing, tolerance band less than tolerance band acc. to EN 50347.
- Dimension E: less than or equal to 2 × length E (standard) of the shaft extension.

See the table below "Admissible changes to the shaft extension DE" and the dimension tables in the relevant sections of the catalog.

Admissible changes to the shaft extension DE (Y58)

Motor series	Frame size	No. of poles	Shaft extension length E in mm		Shaft extension diameter D in mm		
			Standard	up to max.	minimum	Standard	up to max. ¹⁾
1LE1	63	2 ... 6	23	46	11	11	12
1LE1, 1MB1	71	2 ... 8	30	60	14	14	15
	80	2 ... 8	40	80	19	19	20
	90		50	100	24	24	25
1LE1, 1MB1, 1PC1	100	2 ... 8	60	120	24	28	30
	112						
	132	2 ... 8	80	160	28	38	40
	160	2 ... 8	110	220	38	42	45
1LE15, 1LE16, 1MB1	180	2 ... 8	110	220		48	48
	200	2 ... 8	110	220		55	55
	225	2	110	220		55	60
		4 ... 8	140	280		60	60
	250	2	140	280		60	70
		4 ... 8	140	280	On re-request	65	70
	280	2	140	280		65	70
		4 ... 8	140	280		75	80
	315	2	140	280		65	75
		4 ... 8	140	280		80	90
1LE5	315	2	140	280		65	75
		4	170	280		85	90
	355	2	140	280		75	85
		4	170	340		95	95

Standard, cylindrical shaft extension NDE acc. to EN 50347 (second shaft extension)

Order code **L05** (on request)

For a coupling output, the standard, cylindrical shaft extension can transmit the full rated power.

Please also inquire about the transmitted power and admissible cantilever force if belt pulleys, chains or gear pinions are used on the standard, cylindrical shaft extension.

A standard, cylindrical shaft extension (second shaft extension) NDE is not available if a rotary pulse encoder and/or a separately driven fan has been mounted onto the motor. Please inquire for mounted brakes.

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

If the second shaft extension has non-standard dimensions, this must be ordered with order code **L05** in combination with order code **Y59** non-standard shaft dimensions NDE.

For the order code **L05**, this is with order code **Y59** (with plain text specifications according to the table).

- Dimension D: less than or equal to fan hub inner diameter, for frame size 160 tolerance band is less than tolerance band to EN 50347
- Dimension E: less than or equal to 2 × length E (standard) of the shaft extension

See the table below "Admissible changes to the shaft extension NDE" and the dimension tables in the relevant sections of the catalog.

Admissible changes to the shaft extension NDE (Y59)

Motor series	Frame size	No. of poles	Shaft extension length E in mm		Shaft extension diameter D in mm		
			Standard	up to max.	minimum	Standard	up to max. ¹⁾
1LE1	63	2 ... 6	23	46	11	11	12
1LE1, 1MB1	71	2 ... 8	30	60		14	15
1LE1, 1MB1	80/90	2 ... 8	40	80		19	20
1LE1, 1MB1, 1PC1	100	2 ... 8	50	100		24	25
	112						
	132	2 ... 8	60	120		28	35
	160	2 ... 8	110	220		42	45
1LE15, 1LE16, 1MB1	180	2 ... 8	110	220		48	48
	200	2 ... 8	110	220		55	55
	225	2	110	220	On re-request	48	55
		4 ... 8	110	220		55	55
	250	2	110	220		55	70
		4 ... 8	140	280		60	70
	280	2	140	280		60	70
		4 ... 8	140	280		65	70
	315	2	140	280		60	75
		4 ... 8	140	280		70	75
1LE5	315	2	140	280		60	75
		4	140	280		70	75
	355	2	140	280		60	75
		4	170	280		80	90

Non-standard, cylindrical shaft extensions up to the specified lengths and diameters can be supplied for the motor series listed in the tables "Admissible changes to the shaft extension DE (Y58)" and "Admissible changes to the shaft extension NDE (Y59)". All other dimensions are available on request.

It is the responsibility of the customer to ensure that the admissible cantilever forces are reduced in accordance with the non-standard shaft extension.

¹⁾ At maximum admissible diameter, a step increase in shaft diameter is not possible.

Overview (continued)**Concentricity of shaft extension, coaxiality, and linear movement in accordance with IEC 60072-1 Tolerance R for flange-mounted motors**

The following are specified in DIN 42955 with Tolerance N (normal) and Tolerance R (reduced):

1. Concentricity tolerances for the shaft extension
2. Coaxiality tolerances for the shaft extension and flange centering
3. Linear movement tolerances for the shaft extension and flange surface

The concentricity of the shaft extension, coaxiality and linear movement according to IEC 60072-1 Tolerance R for flange-mounted motors can be ordered using order code **L08**. This order code can be combined for motors with deep-groove bearings of series 60..., 62... and 63... This is not possible in combination with a mounted brake or encoder.

Concentricity of the shaft extension can be ordered according to IEC 60072-1 Tolerance R for types of construction without flange with order code **L07**.

Concentricity tolerance for the shaft extension

Diameter of the cylindrical shaft extension d	Concentricity tolerance	
	N (normal)	R (reduced)
mm	mm	mm
≤ 10	0.03	0.015
> 10 ... 18	0.035	0.018
> 18 ... 30	0.04	0.021
> 30 ... 50	0.05	0.025
> 50 ... 80	0.06	0.03
> 80 ... 120	0.07	0.035
> 120 ... 180	0.08	0.04
> 180 ... 250	0.09	0.045
> 250 ... 315	0.1	0.05
> 315 ... 400	0.11	0.055
> 400 ... 500	0.125	0.063
> 500 ... 600	0.14	0.07

IEC dimension code D

Coaxiality tolerance of the centering spigot and linear movement tolerance of the flange surface to the shaft extension axis

Mounting flange Centering diameter b ₁	Coaxiality tolerance and linear movement tolerance	
	N (normal)	R (reduced)
mm	mm	mm
≤ 22	0.05	0.025
> 22 ... < 40	0.06	0.03
40 ... 100	0.08	0.04
> 100 ... 230	0.1	0.05
> 230 ... 450	0.125	0.063
> 450 ... 800	0.16	0.08
> 800 ... 1400	0.2	0.1
> 1400 ... 2000	0.25	0.125
> 2000 ... 2240	0.315	0.16

IEC dimension code N

Overview

The flange-mounted motors can be equipped with a radial sealing ring in order to mount gearing.
Order code **H23**

It must be ensured that the sealing ring is lubricated using grease, oil mist, or oil spray. (It is not admissible to use pressurized oil > 0.1 bar.) We recommend that the admissible bearing loads are carefully checked.

Introduction

Mechanical version

Balance and vibration severity

Overview

All rotors are dynamically balanced with an inserted half key. This corresponds to vibration severity grade A (normal or standard). EN 60034-14 Sept. 2004 regulates the vibrational behavior of machinery. Based on ISO 8821, the key convention "half key (H)" must be used for balancing.

Note:

If there is a keyway, a full feather key is always inserted on delivery.

The type of key convention is stamped on the face of the shaft extension at the customer side DE/NDE:

- F = Balancing with full key
(full-key convention)
- H = Balancing with half key
(half-key convention) – standard
- N = Balancing without key –
Plain text required (convention without key)

For motors up to frame size 112 the code is stamped on the rating plate.

Full-key balancing or balancing with full feather key (F) is possible by specifying order code **L02** (additional charge).

Balancing without feather key (N) is possible by specifying order code **L01** (additional charge).

Vibration severity grade A is the standard version and is valid up to a rated frequency of 60 Hz. If 2-pole motors of frame sizes 280

and 315 are to be rigidly installed, cast feet are necessary in order to comply with the vibration requirements of IEC 60034-14. IE4 2-pole motors in frame size 315 and pole-changing motors (4-pole/2-pole) fulfill the vibration requirements specified in IEC 60034-14 only when the motor is elastically suspended.

The low-vibration version B can be supplied to fulfill stricter requirements on smooth running (additional charge).

Vibration severity grade B
Not possible with parallel roller bearings.
Order code **L00**

The order code **L00** vibration severity grade B is not possible in combination with order codes **G40, G41, G42**. 2-pole trans-standard aluminum motors in frame sizes 180 and 200 (14th position of the Article No. is A, C, D, J, T, U, V) and order code **L00** have cast-iron feet.

This vibration is assessed in accordance with vibration severity grade A or B according to EN 60034-14 (see table).

The limits stated in the table apply to uncoupled, freely suspended, idling motors.

For converter operation with frequencies higher than 60 Hz, special balancing is required for compliance with the specified limit values (plain text: maximum supply frequency/speed).

For further details, see the online help in the DT Configurator.

Limits (rms values) for max. vibration severity in terms of vibration displacement (s), vibration velocity (v), and acceleration (a) for the shaft height H										
Vibration severity grade	Machine installation	Shaft height H in mm								
		56 ≤ H ≤ 132			132 < H ≤ 280			H > 280		
		s_{rms} μm	v_{rms} mm/s	a_{rms} m/s ²	s_{rms} μm	v_{rms} mm/s	a_{rms} m/s ²	s_{rms} μm	v_{rms} mm/s	a_{rms} m/s ²
A	Free suspension	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
	Rigid clamping	21	1.3	2.0	29	1.8	2.8	37	2.3	3.6
B	Free suspension	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8
	Rigid clamping	–	–	–	14	0.9	1.4	24	1.5	2.4

For details, see standard EN 60034-14 Sept. 2004.

If the type tests for machines with shaft height $H > 280$ mm demonstrate a determining component with twice the line frequency, the limit for maximum vibration severity in Table 1 (grade A) can be increased from 2.3 mm/s (rms value) to 2.8 mm/s (rms value). Higher values must be agreed beforehand. A component with twice the line frequency is regarded as dominant if the type test shows that it is greater than 2.3 mm/s (rms value).

Overview

The noise is measured in accordance with EN ISO 1680 in a dead room. It is specified as A-weighted enveloping 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 are valid at 50 Hz and rated power (see the selection and ordering data). The tolerance is +3 dB. Noise values for motors in converter operation on request.

To reduce noise levels, 2-pole motors of frame size 132 S and higher can be equipped with a unidirectional axial fan. The values are listed in the table "Low-noise version" below.

Clockwise rotation:

Order code **F77**

Counterclockwise rotation:

Order code **F78**

Second shaft extension and/or mountings (mounting of brake, separately driven fan or encoder) not possible.

Low-noise version

Motor series	Frame size	2-pole motors	
		L_{pFA} dB (A)	L_{WA} dB (A)
1LE1 ¹⁾	132	60	72
1MB1 ¹⁾	160	60	72
1LE10, 1LE15/6, 1MB15/6	180	63	76
	200	64	77
1LE15/6, 1MB15/6	225	72	86
	250	73	87
	280	72	85
	315	76	90
1LE5	315	78.9	93.6
	355	79.2	94

¹⁾ With the exception of 1LE1 and 1MB1 motors with option **F90** – version "Forced-air cooled motors without external fan and fan cover".

Introduction

Mechanical version

Bearings and Lubrication

Overview

Bearing lifetime (nominal lifetime)

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

Under average operating conditions, a lifetime (L_{10h}) of 100 000 hours can be achieved.

Generally, the bearing lifetime is defined by the bearing size, the bearing load, the operating conditions, the speed and the grease lifetime. A bearing lifetime calculation is possible on request.

Bearing system

The bearing lifetime of motors with horizontal mounting is 40 000 hours if there is no additional axial loading at the coupling output and 20 000 hours when utilized according to the maximum admissible load. This assumes that the motor is operated at 50 Hz. The nominal bearing lifetime is reduced for converter operation at higher frequencies.

In order to achieve the calculated lifetime in continuous operation, the admissible vibration values (measured at bearing plate) must be determined according to evaluation zones A and B stipulated in ISO 10816. If higher vibration velocities occur in operation (e.g. with option **H02**), special measures must be taken (please inquire).

Due to their physical characteristics, variable-speed motors have a different bearing lifetime under the same load conditions – this relationship is linear, i.e. if the frequency increases by 20 % from 50 Hz to 60 Hz, the lifetime decreases by 20 % from 20 000 to 16 000 hours under the load conditions specified in the catalog.

If the frequency falls by 20 % from 50 Hz to 40 Hz, under the load conditions specified in the catalog, the lifetime rises by 20 % from 20 000 to 24 000 hours.

It should be observed that, for types of construction IM B6, IM B7, IM B8, IM V5, and IM V6, the belt tension is only permitted to act parallel to the mounting plane or towards the mounting plane and the feet must be supported. Both feet must be secured for foot-mounting types of construction.

In the basic bearing system, the floating bearing is situated at the drive end (DE) and the located bearing is situated at the non-drive end (NDE).

The bearing system is axially preloaded with a spring element at the drive end (DE) to ensure smooth running of the motor without play (see Fig. 1 in the diagrams of bearings on page 1/65).

From frame size 160 upwards, the located bearing is axially secured at the non-drive end (NDE). Up to frame size 132, an additional axially-secured located bearing can be supplied on the non-drive end (NDE) complete with a retaining ring (see Fig. 2 in the diagrams of bearings on page 1/65).
Order code **L21**

On request, the located bearing can also be supplied at the drive end (DE) (see Fig. 3 in the diagrams of bearings on Page 1/65). A located bearing at the drive end (DE) is recommended when gearing is installed or pumps and fans are mounted directly on the motor shaft.

Order code **L20**

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

Order code **L22**

1LE1, 1MB1, and 1PC1 motors can be supplied with reinforced bearings (size range 03) at both ends.

In this case, the bearing plates are made of cast iron (standard for series 1LE16 motors).

Order code **L25**

A measuring nipple for SPM shock pulse measurement can be mounted to check bearing vibration. The motors have an M8 tapped hole for each bearing plate and a measuring nipple with a protective cap. If a second tapped hole is provided, it is fitted with a sealing cap. Not possible for frame sizes < 100.

Order code **Q01**

Bearing selection for increased cantilever forces (see the Table "Bearing selection for 1LE10, 1MB10, and 1PC10 motors – Bearings for increased cantilever forces" on page 1/61) – for the maximum axial load, see page 1/71 onwards.

Bearing insulation

To prevent damage caused by bearing currents, insulated bearings can be supplied for frame sizes 225 to 355 – they are recommended for motors from frame size 225 upwards.

- **L50** (DE bearing insulation) means NDE located bearing as standard
- **L51** (NDE bearing insulation) means DE located bearing as standard
- **L50 + L51** (insulated DE and NDE bearings) means NDE located bearing as standard
- Combination of order codes **L50** or **L51** or **L50 + L51** with **L22** (bearing version for increased cantilever forces) means NDE located bearing as standard.

According to IEC 60034-1-11, it is up to the user in the case of DE bearing insulation (order code **L50**) + NDE bearing insulation (order code **L51**) to ensure grounding of the rotor.

The rotor grounding can be implemented either in the system via the coupled driven machine or in the motor via a grounding brush.

The grounding brush (order code **L52**) must always be provided when the driven machine is connected to the motor via an insulating coupling or an insulating belt output shaft.

Permanent lubrication

On motors equipped with permanent lubrication, the bearing grease lifetime is matched to the bearing lifetime. This can, however, only be achieved if the motor is operated in accordance with the catalog specifications.

In the basic version, the motors have permanent lubrication.

Overview (continued)**Regreasing**

For motors which can be regreased at defined regreasing 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.

This regreasing option is possible in the following frame sizes:

- Frame sizes 100 to 160: M8 × 1 acc. to DIN 71412-A (conical lubricating nipple)
- Frame sizes 180 to 315: M10 × 1 acc. to DIN 3404-A (flat lubricating nipple).

Order code L23

(frame sizes ≥ 280 basic version, for the Performance Line motors of frame sizes ≥ 160 basic version)

A regreasing device with M10 × 1 lubricating nipple to DIN 71412-A can be optionally provided for frame sizes 180 to 315.

Order code L19

In the case of motors equipped with regreasing device, information regarding regreasing intervals, quantity of grease, type of grease and any additional data is provided on the lubrication plate or rating plate. For regreasing intervals for the basic version, see the Table "Grease lifetime and regreasing intervals for horizontal installation". For motors with a mounted holding brake (order code **F01**) a regreasing device cannot be installed, including up to FS 160.

Mechanical stress and grease lifetime

High speeds that exceed the rated speed with converter operation and the resulting increased vibrations alter the mechanical running smoothness and the bearings are subjected to increased mechanical stress. This reduces the grease lifetime and the bearing lifetime (please inquire where applicable).

The use of rigid couplings should be avoided as far as possible. For converter operation in particular, compliance with the mechanical limit speeds n_{\max} at maximum supply frequency f_{\max} is essential, see the following table "Mechanical limit speeds n_{\max} at maximum supply frequency f_{\max} ".

Introduction

Mechanical version

Bearings and lubrication

Overview (continued)

Mechanical limit speeds n_{max} at maximum supply frequency f_{max} (standard values) for 1LE1, 1PC1 motors – basic version and 1LE15 and 1LE16 motors – basic version with order codes L22, L25, L28 – 1MB10/5/6 motors with order codes L22 and L25

Frame size	Type	2-pole		4-pole		6-pole		8-pole	
		n_{max} rpm	f_{max} Hz	n_{max} rpm	f_{max} Hz	n_{max} rpm	f_{max} Hz	n_{max} rpm	f_{max} Hz
1LE10 motors, basic version									
1LE10..-									
63	0B...	6000	100	4200	140	3600	180	3000	200
71	0C...	6000	100	4200	140	3600	180	3000	200
80 M	0D...	6000	100	4200	140	3600	180	3000	200
90 S/L	0E...	6000	100	4200	140	3600	180	3000	200
1LE15 Basic Line motors – bearings for increased cantilever forces – order code L22									
1LE15 Basic Line motors – bearings reinforced at both ends – order code L25									
1LE15..-									
71 M	0C...	6000	100	4200	140	3600	180	3000	200
80 M	0D...	6000	100	4200	140	3600	180	3000	200
90 S/L	0E...	6000	100	4200	140	3600	180	3000	200
1LE10, 1PC1 motors, basic version									
1LE15 Basic Line and 1LE16 Performance Line – bearings for increased cantilever forces – order code L22									
1LE15 Basic Line and 1LE16 Performance Line – bearings reinforced at both ends – order code L25									
1LE1...-									
1PC1...-									
100 L	1A...	6000	100	4200	140	3600	180	3000	200
112 M	1B...	6000	100	4200	140	3600	180	3000	200
132 S/M	1C...	5600	90	4200	140	3600	180	3000	200
160 M/L	1D...	4800	80	4200	140	3600	180	3000	200
180 M/L	1E...	4600	76	4200	140	3600	180	3000	200
200 L	2A...	4500	75	4200	140	3600	180	3000	200
1LE15 Basic Line and 1LE16 Performance Line – basic version									
1LE15 Basic Line and 1LE16 Performance Line – bearings for increased cantilever forces – order code L22									
1LE15 Basic Line and 1LE16 Performance Line – bearings reinforced at both ends – order code L25									
1LE15 Basic Line and 1LE16 Performance Line – DE cylindrical roller bearings and NDE reinforced bearings – order code L28									
1LE15..-									
1LE16..-									
180 M/L	1E...	4600	76	4200	140	3600	180	3000	200
200 L	2A...	4500	75	4200	140	3600	180	3000	200
225 S/M	2B...	4500	75	4500	150	4400	220	4400	293
250 M	2C...	3900	65	3700	123	3700	185	3700	247
280 S/M	2D...	3600	60	3000	100	3000	150	3000	200
315 S/M/L	3A...	3600	60	2600	87	2600	130	2600	173
1LE55 Basic Line and 1LE56 Performance Line – basic version									
1LE55 Basic Line and 1LE56 Performance Line – bearings for increased cantilever forces – order code L22									
1LE55..-									
1LE56..-									
315 L	3A...	5200	87	3400	113	3400	170	3400	227
355 M/L	3B...	5200	87	3800	93	2800	140	2800	187

The specified limit speeds are applicable to motors without additional mountings, such as brakes or rotary encoders. In such applications, the characteristics of the respective mounting parts must be taken into account.

Overview (continued)

Grease lifetime and regreasing intervals for horizontal installation

Motor series	Frame size	No. of poles	Grease lifetime up to CT 40 °C ²⁾			
Permanent lubrication¹⁾						
1LE1/1MB1/1PC1	71 ... 250	2 ... 8	20000 h or 40000 h ³⁾			
Regreasing¹⁾						
1LE1/1MB1/1PC1	100 ... 160 180 ... 280 315	2 ... 8	Lubrication interval ISO CI F 155 °C		Lubrication interval ISO CI H 180 °C	
			CT ≤ 60 °C		40 °C < CT ≤ 60 °C	
			60 °C < CT ≤ 80 °C		60 °C < CT ≤ 80 °C	
			8000 h	4000 h ²⁾	4000 h	2000 h ²⁾
			4000 h	2000 h ²⁾	1000 h	1000 h ²⁾
			8000 h	4000 h ²⁾	2000 h	2000 h ²⁾
1LE5	315, 355	2 4, 6	CT ≤ 40 °C		CT ≤ 40 °C	
			40 °C < CT ≤ 80 °C		40 °C < CT ≤ 80 °C	
			3000 h	1500 h ²⁾	3000 h	1500 h ²⁾
			6000 h	3000 h ²⁾	6000 h	3000 h ²⁾
			3000 h	1500 h ²⁾	3000 h	1500 h ²⁾
			6000 h	3000 h ²⁾	6000 h	3000 h ²⁾

Bearing selection table for 1LE10, 1MB10, and 1PC10 motors – basic version

The bearing selection tables are only intended for planning purposes. Authoritative information on the actual type of bearings fitted in motors already supplied can be obtained by the factory by quoting the serial number or can be read from the rating plate.

When deep-groove bearings with side plates are used, the side plate is on the inside. Located bearing at drive end (DE) for 1LE1, 1MB1 and 1PC1 motors, see special version Fig. 2 in the "Diagrams of bearings" on Page 1/65.

Frame size	No. of poles	Drive end (DE) bearing Horizontal and vertical types of construction	Non-drive end (NDE) bearing Horizontal and vertical types of construction	Fig. No. on page 1/65
1LE10/1MB10				
63	2 ... 6	6201 2ZC3	6201 2ZC3	–
71	2 ... 8	6202 2ZC3	6202 2ZC3	–
80	2 ... 8	6004 2ZC3	6004 2ZC3	Fig. 1
90	2 ... 8	6205 2ZC3	6004 2ZC3	Fig. 1
1LE10/1MB10/1PC10				
100 L	2 ... 8	6206 2ZC3	6206 2ZC3	Fig. 1
112 M	2 ... 8	6206 2ZC3	6206 2ZC3	Fig. 1
132 S/M	2 ... 8	6208 2ZC3 ⁴⁾	6208 2ZC3 ⁴⁾	Fig. 1
160 M/L	2 ... 8	6209 2ZC3 ⁴⁾	6209 2ZC3 ⁴⁾	Fig. 2
1LE10				
180 M/L	2 ... 8	6210 ZC3 ⁵⁾	6210 ZC3 ⁵⁾	Fig. 4
200 L	2 ... 8	6212 ZC3 ⁵⁾	6212 ZC3 ⁵⁾	Fig. 4

Bearing selection table for 1LE10, 1MB10, and 1PC10 motors – bearings for increased cantilever forces – order code L22

Please inquire about noise and vibration data. The bearing selection tables are only intended for planning purposes. Authoritative information on the actual type of bearings fitted in motors already supplied can be obtained by the factory by quoting the serial number or can be read from the rating plate.

When deep-groove bearings with side plates are used, the side plate is on the inside.

Frame size	No. of poles	Drive end (DE) bearing Horizontal and vertical types of construction	Non-drive end (NDE) bearing Horizontal and vertical types of construction	Fig. No. on page 1/65
1LE10/1MB10				
80	2 ... 8	6304 2ZC3	6204 2ZC3	–
90	2 ... 8	6305 2ZC3	6205 2ZC3	–
1LE10/1MB10/1PC10				
100 L	2 ... 8	6306 2ZC3	6206 2ZC3	Fig. 1
112 M	2 ... 8	6306 2ZC3	6206 2ZC3	–
132 S/M	2 ... 8	6308 2ZC3 ⁴⁾	6208 2ZC3 ⁴⁾	–
160 M/L	2 ... 8	6309 2ZC3 ⁴⁾	6209 2ZC3 ⁴⁾	Fig. 2
1LE10				
180 M/L	2 ... 8	6310 ZC3 ⁵⁾	6210 ZC3 ⁵⁾	Fig. 4
200 L	2 ... 8	6312 ZC3 ⁵⁾	6212 ZC3 ⁵⁾	Fig. 4

¹⁾ For special uses and special greases, please inquire about grease lifetime and regreasing intervals.

²⁾ For every 10 K the coolant temperature is increased above 80 °C, the grease lifetime and regreasing interval are halved.

³⁾ 40 000 hours apply to horizontally installed motors with coupling output without additional axial loads.

⁴⁾ Deep-groove bearings with a side plate are used for regreaseable versions (**L23**).

⁵⁾ Deep-groove bearings without a side plate are used for regreaseable versions (**L23**).

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Bearings and lubrication

Overview (continued)

Bearing selection table for 1LE10, 1MB10, and 1PC10 motors – bearings reinforced at both ends – order code L25

Please inquire about noise and vibration data. The bearing selection tables are only intended for planning purposes. Authoritative information on the actual type of bearings fitted in motors already supplied can be obtained by the factory by quoting the serial number or can be read from the rating plate.

When deep-groove bearings with side plates are used, the side plate is on the inside.

Frame size	No. of poles	Drive end (DE) bearing		Non-drive end (NDE) bearing		Fig. No. on page 1/65
		Horizontal and vertical types of construction		Horizontal and vertical types of construction		
1LE10/1MB10						
80	2 ... 8	6304 2ZC3		6204 2ZC3		–
90	2 ... 8	6305 2ZC3		6205 2ZC3		–
1LE10/1MB10/1PC10						
100 L	2 ... 8	6306 2ZC3		6306 2ZC3		Fig. 1
112 M	2 ... 8	6306 2ZC3		6306 2ZC3		
132 S/M	2 ... 8	6308 2ZC3 ¹⁾		6308 2ZC3 ¹⁾		
160 M/L	2 ... 8	6309 2ZC3 ¹⁾		6309 2ZC3 ¹⁾		Fig. 2
1LE10						
180 M/L	2 ... 8	6310 ZC3 ²⁾		6310 ZC3 ²⁾		Fig. 4
200 L	2 ... 8	6312 ZC3 ²⁾		6312 ZC3 ²⁾		Fig. 4

Bearing assignment for 1LE15/1MB15, 1LE16/1MB16, and 1LE5 motors (basic version)

Frame size	No. of poles	Drive end (DE) bearing		Non-drive end (NDE) bearing		Fig. No. on page 1/65
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
1LE15, 1MB15 – Basic Line						
71 M	2 ... 8	6202 2ZC3		6202 2ZC3		Fig. 1
80 M	2 ... 8	6204 2ZC3		6204 2ZC3		Fig. 1
90 S/L	2 ... 8	6205 2ZC3		6204 2ZC3		Fig. 1
100 L	2 ... 8	6206 2ZC3 ¹⁾		6206 2ZC3 ¹⁾		Fig. 1
112 M	2 ... 8	6206 2ZC3 ¹⁾		6206 2ZC3 ¹⁾		
132 S/M	2 ... 8	6208 2ZC3 ¹⁾		6208 2ZC3 ¹⁾		
160 M/L	2 ... 8	6209 2ZC3 ¹⁾		6209 2ZC3 ¹⁾		Fig. 2
180 M/L	2 ... 8	6210 ZC3 ²⁾		6210 ZC3 ²⁾		Fig. 4
200 L	2 ... 8	6212 ZC3 ²⁾		6212 ZC3 ²⁾		
225 S/M	2 ... 8	6213 ZC3 ²⁾		6213 ZC3 ²⁾		Fig. 1
250 M	2 ... 8	6215 ZC3 ²⁾		6215 ZC3 ²⁾		
280 S/M	2	6315 C3		6315 C3		Fig. 2
	4 ... 8	6317 C3		6317 C3		
315 S/M/L	2	6316 C3		6316 C3		
	4 ... 8	6319 C3		6319 C3		
1LE16, 1MB16 – Performance Line						
100 L	2 ... 8	6306 2ZC3		6306 2ZC3		Fig. 1
112 M	2 ... 8	6306 2ZC3		6306 2ZC3		
132 S/M	2 ... 8	6308 2ZC3		6308 2ZC3		
160 M/L	2 ... 8	6309 ZC3		6309 ZC3		Fig. 2
180 M/L	2 ... 8	6310 C3		6310 C3		Fig. 4
200 L	2 ... 8	6312 C3		6312 C3		
225 S/M	2 ... 8	6313 C3		6313 C3		Fig. 4
250 M	2 ... 8	6315 C3		6315 C3		
280 S/M	2	6315 C3		6315 C3		
	4 ... 8	6317 C3		6317 C3		
315 S/M/L	2	6316 C3		6316 C3		
	4 ... 8	6319 C3		6319 C3		
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
1LE5						
315 L	2	6316 C4	6316 C4	6316 C4	7316 B	–
	4, 6	6319 C4	6319 C4	6319 C4	7319 B	–
355 M/L	2	6317 C4	6317 C4	6317 C4	7317 B	–
	4, 6	6320 C4	6320 C4	6320 C4	7320 B	–

¹⁾ Deep-groove bearings with a side plate are used for regreasable versions (**L23**).

²⁾ Deep-groove bearings without a side plate are used for regreasable versions (**L23**).

Overview (continued)

Bearing selection table for 1LE15, 1MB15, 1LE16, and 1MB16 motors (bearings for increased cantilever forces – order code L22)

For NU bearings (cylindrical roller bearings), in contrast to ball bearings, a minimum cantilever force is required. Cylindrical roller bearings are not suitable for coupling output.

$$F_{\min} \sim F_{\max}/2$$

Frame size	No. of poles	Drive end (DE) bearing		Non-drive end (NDE) bearing		Fig. No. on page 1/65
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
1LE15/1MB15 – Basic Line						
71 M	2 ... 8	6302 2ZC3		6202 2ZC3 ³⁾		
80 M	2 ... 8	6304 2ZC3		6204 2ZC3 ³⁾		
90 S/L	2 ... 8	6305 2ZC3		6204 2ZC3		
100 L	2 ... 8	6306 2ZC3 ¹⁾		6206 2ZC3 ¹⁾³⁾		
112 M	2 ... 8	6306 2ZC3 ¹⁾		6206 2ZC3 ¹⁾³⁾		
132 M	2 ... 8	6308 2ZC3 ¹⁾		6208 2ZC3 ¹⁾³⁾		
160 M/L	2 ... 8	6309 2ZC3 ¹⁾		6209 2ZC3 ¹⁾³⁾		
180 M/L	2 ... 8	NU 210		6210 C3		Fig. 5
200 L	2 ... 8	NU 212		6212 C3		
225 M	2 ... 8	NU 213		6213 C3		
250 M	2 ... 8	NU 215		6215 C3		
280 M	2	NU 315		6315 C3 ³⁾		
	4 ... 8	NU 317		6317 C3 ³⁾		
315 M/L	2	NU 316		6316 C3 ³⁾		
	4 ... 8	NU 319		6319 C3 ³⁾		
1LE16/1MB16 – Performance Line						
100 L	2 ... 8	2)				
112 M	2 ... 8	2)				
132 M	2 ... 8	2)				
160 M/L	2 ... 8	2)				
180 M/L	2 ... 8	NU 310		6310 C3 ³⁾		
200 L	2 ... 8	NU 312		6312 C3 ³⁾		
225 M	2 ... 8	NU 313		6313 C3 ³⁾		Fig. 5
250 M	2 ... 8	NU 315		6315 C3 ³⁾		
280 M	2	NU 315		6315 C3 ³⁾		
	4 ... 8	NU 317		6317 C3 ³⁾		
315 M/L	2	NU 316		6316 C3 ³⁾		
	4 ... 8	NU 319		6319 C3 ³⁾		
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
1LE5						
315 L	2	NU316	NU316	6316 C4	O. R.	–
	4, 6	NU319	NU319	6319 C4	O. R.	–
355 M/L	2	NU317	NU317	6317 C4	O. R.	–
	4, 6	NU320	NU320	6320 C4	O. R.	–

Introduction

Mechanical version

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Overview (continued)

Bearing selection table for 1LE15/1MB15 and 1LE16/1MB16 motors (bearings reinforced at both ends – order code L25, for 1LE16 motors – standard)

Frame size	No. of poles	Drive end (DE) bearing		Non-drive end (NDE) bearing		Fig. No. on page 1/65
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
1LE15, 1MB15 – Basic Line						
71 M	2 ... 8	6302 2ZC3		6302 2ZC3		Fig. 4
80 M	2 ... 8	6304 2ZC3		6304 2ZC3		
90 S/L	2 ... 8	6305 2ZC3		6304 2ZC3		
100 L	2 ... 8	6306 2ZC3 ¹⁾		6306 2ZC3 ¹⁾		
112 M	2 ... 8	6306 2ZC3 ¹⁾		6306 2ZC3 ¹⁾		
132 M	2 ... 8	6308 2ZC3 ¹⁾		6308 2ZC3 ¹⁾		
160 M/L	2 ... 8	6309 2ZC3 ¹⁾		6309 2ZC3 ¹⁾		
180 M/L	2 ... 8	6310 ZC3 ⁴⁾		6310 ZC3 ⁴⁾		
200 L	2 ... 8	6312 ZC3 ⁴⁾		6312 ZC3 ⁴⁾		
225 M	2 ... 8	6313 ZC3 ⁴⁾		6313 ZC3 ⁴⁾		
250 M	2 ... 8	6315 ZC3 ⁴⁾		6315 ZC3 ⁴⁾		
280 M	2	6315 C3 ³⁾		6315 C3 ³⁾		
	4 ... 8	6317 C3 ³⁾		6317 C3 ³⁾		
315 M/L	2	6316 C3 ³⁾		6316 C3 ³⁾		
	4 ... 8	6319 C3 ³⁾		6319 C3 ³⁾		
1LE16, 1MB16 – Performance Line – bearing version Performance Line basic version						
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
1LE5						
315 L	2	6316 C4	6316 C4	6316 C4	7316 B	–
	4, 6	6319 C4	6319 C4	6319 C4	7319 B	–
355 M/L	2	6317 C4	6317 C4	6317 C4	7317 B	–
	4, 6	6320 C4	6320 C4	6320 C4	7320 B	–

¹⁾ Deep-groove bearings with a side plate are used for regreasable versions (**L23**).

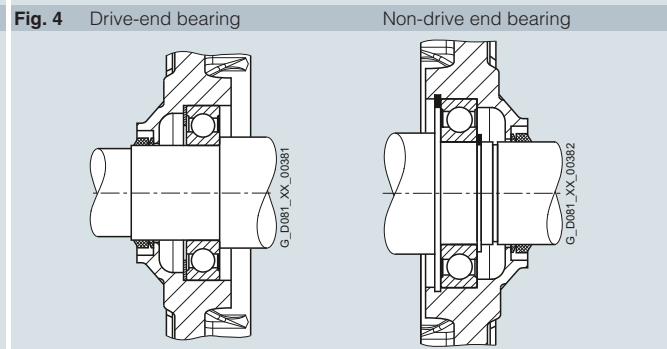
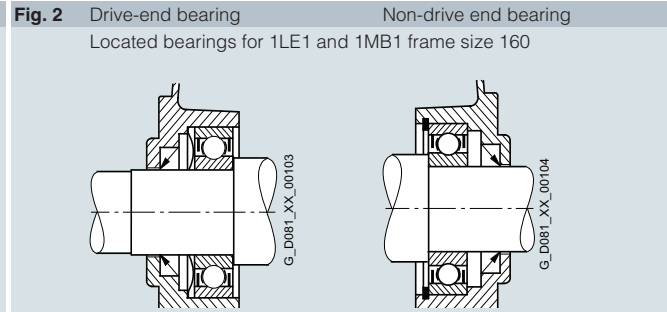
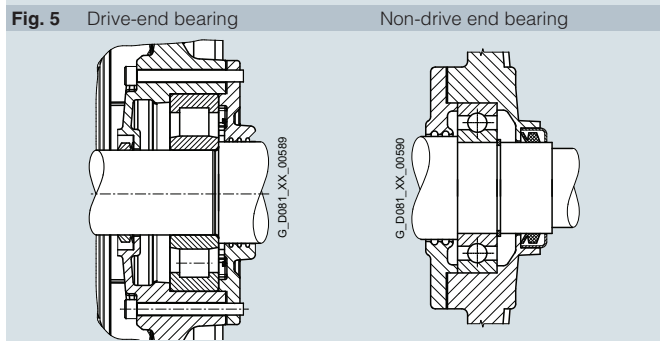
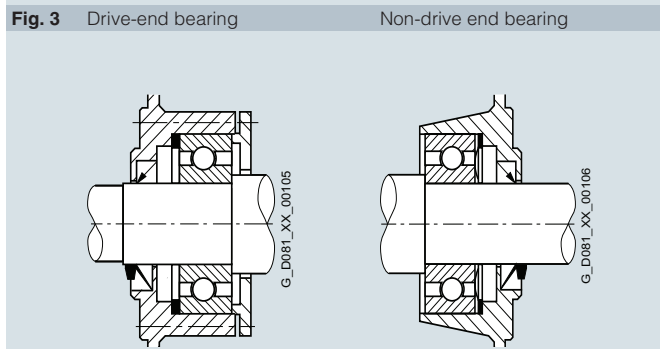
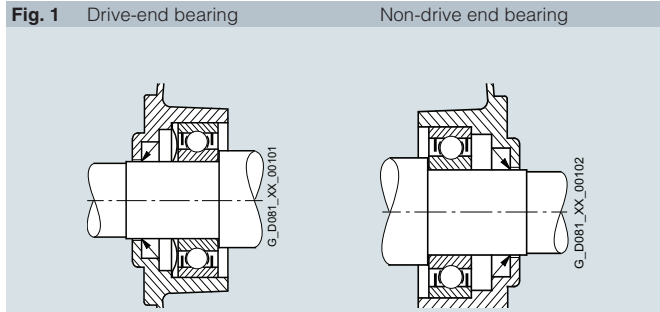
²⁾ Not permitted.

³⁾ As for basic version.

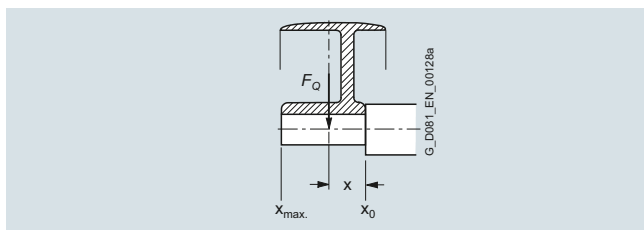
⁴⁾ Deep-groove bearings without a side plate are used for regreasable versions (**L23**).

Overview (continued)

Diagrams of bearings



Admissible cantilever forces



In order to calculate the admissible cantilever forces for a radial load, the line of force (i.e. the centerline of the pulley) of the cantilever force F_Q (N) must be within the free shaft extension (dimension x).

Dimension x (mm) is the distance between the point of application of the force F_Q and the shaft shoulder. The dimension x_{max} corresponds to the length of the shaft extension.

Total cantilever force $F_Q = c \cdot F_U$

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 an idler pulley $c = 2$;
for V-belts $c = 2$ to 2.5 ;
for special synthetic belts (depending on the type of load and type of belt) $c = 2$ to 2.5 .

The circumferential force F_U (N) is calculated using the following equation

$$F_U = 2 \cdot 10^7 \frac{P}{n \cdot D}$$

- F_U circumferential force in N
- P rated motor power (transmitted power) in kW
- n rated motor speed in rpm
- D belt pulley diameter in mm

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Bearings and Lubrication

Overview (continued)

Admissible cantilever forces – basic version

1LE10, 1MB10 motors (frame sizes 80 ... 160) and 1PC10 (frame sizes 100 ... 160) at 50 Hz			Admissible cantilever force F_Q	
Valid are: x_0 values for $x = 0$ and x_{max} values for $x = l$ (l = shaft extension)			at x_0	at x_{max}
For motors	Frame size	Type	No. of poles N	N
1LE1 motors – values for IE2 motors with increased power ¹⁾				
80	1LE1001-0DA	2	485	400
	1LE1001-0DB	4	625	515
	1LE1001-0DC	6	735	605
90	1LE1001-0EA	2	725	605
	1LE1001-0EB	4	920	775
	1LE1001-0EC	6	1090	910
100	1LE1001-1AA	2	1010	825
	1LE1001-1AB	4	1230	1010
	1LE1001-1AC	6	1440	1180
112	1LE1001-1BA	2	970	785
	1LE1001-1BB	4	1235	1000
	1LE1001-1BC	6	1440	1165
132	1LE1001-1CA	2	1470	1180
	1LE1001-1CB	4	1830	1470
	1LE1001-1CC	6	2150	1730
160	1LE1001-1DA	2	1550	1270
	1LE1001-1DB	4	1910	1550
	1LE1001-1DC	6	2230	1810
1LE1 motors – standard values for IE2 motors ¹⁾				
1MB1 motors – standard values for IE2 motors ¹⁾				
1PC1 motors – standard values for IE2 motors ¹⁾				
63	1LE1001-0BA	2	270	240
	1LE1001-0BB	4	350	305
71	1LE1001-0CA	2	415	355
	1LE1001-0CB	4	530	450
80	1LE1001-0DA	2	485	400
	1LE1001-0DB	4	625	515
	1LE1001-0DC	6	735	605
	1LE1001-0DD	8	815	675
90	1LE1001-0EA	2	725	605
	1LE1001-0EB	4	920	775
	1LE1001-0EC	6	1090	910
	1LE1001-0ED	8	1230	1030

1LE10, 1MB10 motors (frame sizes 80 ... 160) and 1PC10 (frame sizes 100 ... 160) at 50 Hz			Admissible cantilever force F_Q	
Valid are: x_0 values for $x = 0$ and x_{max} values for $x = l$ (l = shaft extension)			at x_0	at x_{max}
For motors	Frame size	Type	No. of poles N	N
1LE1 motors – standard values for IE2 motors ¹⁾				
1MB1 motors – standard values for IE2 motors ¹⁾				
1PC1 motors – standard values for IE2 motors ¹⁾				
100	1LE1001-1AA	2	1020	815
	1LE1001-1AB	4	1250	1000
	1LE1001-1AC	6	1450	1155
	1LE1001-1AD	8	1615	1290
112	1LE1001-1BA	2	1000	790
	1LE1001-1BB	4	1250	990
	1LE1001-1BC	6	1450	1150
	1LE1001-1BD	8	1610	1275
132	1LE1001-1CA	2	1505	1170
	1LE1001-1CB	4	1880	1460
	1LE1001-1CC	6	2170	1680
	1LE1001-1CD	8	2420	1880
160	1LE1001-1DA	2	1560	1240
	1LE1001-1DB	4	2040	1590
	1LE1001-1DC	6	2350	1820
	1LE1001-1DD	8	2610	2030
180	1LE10..	2	1670	1380
		4	2150	1740
		6	2500	2000
200	1LE10..	2	2460	2070
		4	3180	2630
		6	3600	2980

In the case of cantilever forces that exceed this, see "Bearings for increased cantilever forces".

Note:

1PC10 only for frame sizes 100 to 160.

¹⁾ For IE1 motors, the admissible cantilever force can be increased by up to 5 %.

Overview (continued)

1LE15, 1LE55 and 1MB15 motors at 50 HzValid are: x_0 values for $x = 0$ and x_{max} values for $x = l$
(l = shaft extension)

Frame size	No. of poles	Admissible cantilever force at x_0 at x_{max} N N	
1LE1501/03/21/23, 1MB15 – Basic Line			
71	2	400	340
	4	500	420
	6	570	490
80	2	680	570
	4	860	720
	6	980	820
90	2	760	620
	4	950	790
	6	1090	900
100	2	1010	815
	4	1230	1000
	6	1440	1155
	8	1615	1290
112	2	970	785
	4	1235	990
	6	1440	1150
	8	1610	1275
132	2	1470	1170
	4	1830	1460
	6	2150	1680
	8	2420	1880
160	2	1550	1240
	4	1910	1550
	6	2230	1810
	8	2610	2030
180	2	1670	1380
	4	2150	1740
	6	2500	2000
200	2	2460	2070
	4	3180	2630
	6	3600	2980
225	2	2850	2300
	4	3550	2800
	6	4050	3240
	8	4500	3500
250	2	3250	2600
	4	4100	3400
	6	4800	4000
	8	5250	4450
280	2	5200	4200
	4	8500	7000
	6	9800	8150
	8	10800	9000
315 S/M	2	5300	4500
	4	9150	7400
	6	10750	8750
	8	11600	9600
315 L	2	4900	4300
	4	8900	7700
	6	10100	9150
	8	11100	10200
1LE5504/34/03/33 – Basic Line			
315 L	2	5800	5200
	4	9300	8000
	6	10600	9200
	8	12000	9200

1LE16, 1LE56 and 1MB16 motors at 50 HzValid are: x_0 values for $x = 0$ and x_{max} values for $x = l$
(l = shaft extension)

Frame size	No. of poles	Admissible cantilever force at x_0 at x_{max} N N	
1LE1601/03/21/23, 1MB16 – Performance Line			
100	2	1585	1270
	4	1960	1575
	6	2270	1815
	8	2520	2015
112	2	1545	1240
	4	1960	1555
	6	2270	1800
	8	2510	1990
132	2	2285	1795
	4	2860	2250
	6	3320	2580
	8	3700	2870
160	2	2800	2170
	4	3450	2750
	6	4000	3160
	8	4510	3500
180	2	3250	2610
	4	4110	3270
	6	4720	3740
	8	5480	4500
200	2	4320	3550
	4	5480	4500
	6	6220	5110
	8	7800	6200
225	2	5000	4150
	4	6250	4900
	6	7200	5750
	8	7800	6200
250	2	6000	4800
	4	7600	6200
	6	8750	7350
	8	9500	8000
280	2	5200	4200
	4	8500	7000
	6	9800	8150
	8	10800	9000
315 S/M	2	5300	4500
	4	9150	7400
	6	10750	8750
	8	11600	9600
315 L	2	4900	4300
	4	8900	7700
	6	10100	9150
	8	11100	10200
1LE5604/34/03/33 – Performance Line			
315 L	2	5800	5200
	4	9300	8000
	6	10600	9200
	8	12000	9200
355 M,L	2	5800	5200
	4	9900	8700
	6	11200	9800
	8	11200	10000

In the case of cantilever forces that exceed this, see "Bearings for increased cantilever forces".

Overview (continued)

1LE15 and 1MB15 motors at 50 Hz with reinforced deep-groove bearings at DE up to frame size 160 with cylindrical roller bearings at DE in frame size 180 and above

Valid are: x_0 values for $x = 0$ and x_{max} values for $x = l$ (l = shaft extension)

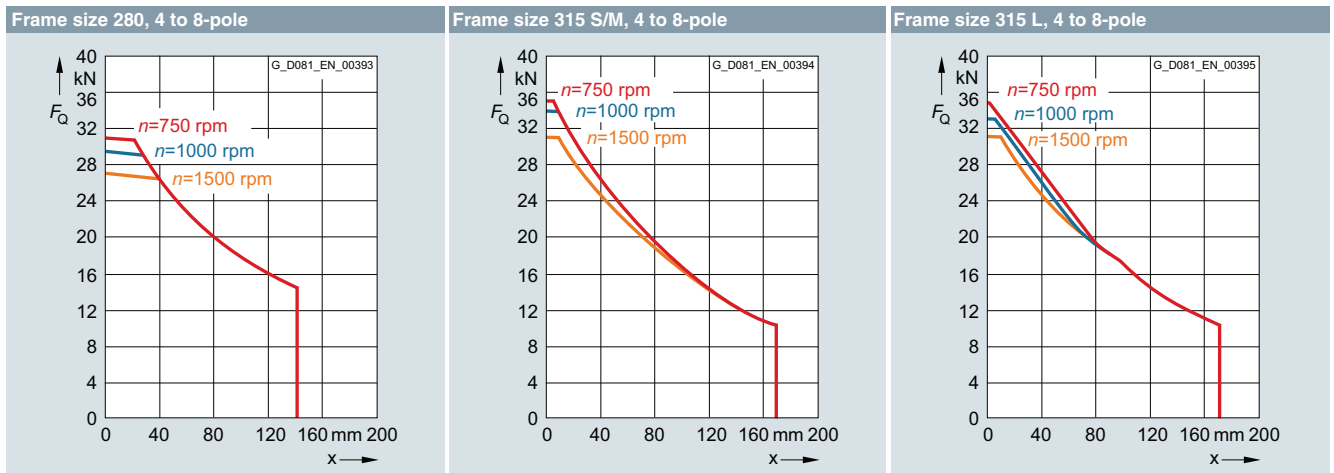
Frame size	Type	No. of poles	N	Admissible cantilever force at x_0	Admissible cantilever force at x_{max}	
1LE1501/03/21/23, 1MB15 – Basic Line (continued)						
225	1LE15...2BA 1MB15...2BA	2	8000	6800		
	1LE15...2BB 1MB15...2BB	4	9800	7250		
	1LE15...2BC 1MB15...2BC	6	11100	7300		
	1LE15...2BD 1MB15...2BD	8	11300	7300		
	250	1LE15...2CA 1MB15...2CA	2	9500	7400	
		1LE15...2CB 1MB15...2CB	4	12500	9400	
1LE15...2CC 1MB15...2CC		6	13500	9700		
1LE15...2CD 1MB15...2CD		8	14700	9700		
280 ¹⁾	1LE15...2DA 1MB15...2DA	2	16500	9800		
	315 ¹⁾	1LE15...3AA 1MB15...3AA	2	18400	7600	

1LE16 and 1MB16 motors at 50 Hz with reinforced cylindrical roller bearings (DE)

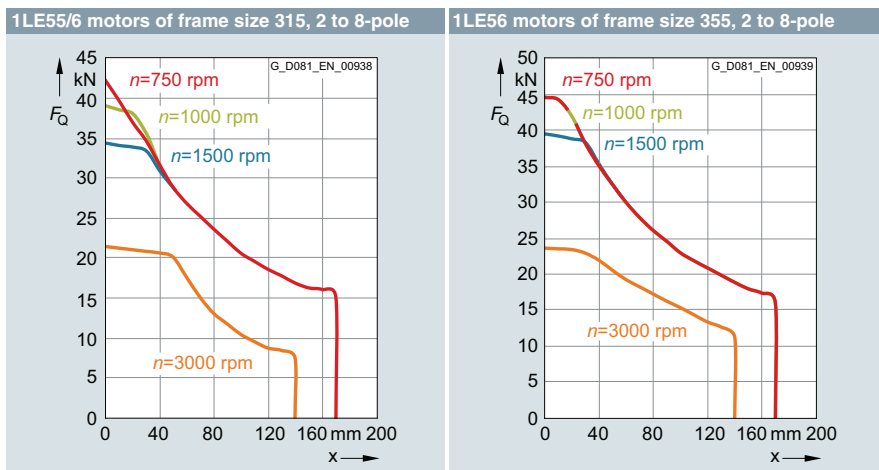
Valid are: x_0 values for $x = 0$ and x_{max} values for $x = l$ (l = shaft extension)

Frame size	No. of poles	N	Admissible cantilever force at x_0	Admissible cantilever force at x_{max}
1LE1601/03/21/23, 1MB16 – Performance Line				
100, 112, 132, 160	2, 4, 6, 8	–	–	–
180	2		8150	4050
	4		9800	4050
	6		9800	4050
200	2		11200	6000
	4		13600	6000
	6		13600	6000
225	2		12700	7900
	4		15700	7250
	6		15700	7300
	8		15700	7300
250	2		17000	7750
	4		21000	9400
	6		21000	9700
	8		21000	9700
280 ¹⁾	2		16500	9800
315 S, M ¹⁾	2		18400	7600
315 L ¹⁾	2		18400	7600

1LE15/6 and 1MB15/6 motors for 50 Hz with cylindrical roller bearings (DE) for frame sizes 280 to 315 in 4 to 8-pole version



1LE55/6 motors for 50 Hz with cylindrical roller bearings (DE) for frame sizes 315 to 355 in 2 to 8-pole version



¹⁾ For admissible cantilever forces 4, 6, and 8-pole versions, see diagrams on this page.

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Bearings and Lubrication

Overview (continued)

Admissible cantilever forces – bearings reinforced at both ends – order code **L25**

1LE10, 1MB10 motors (frame sizes 80 ... 160) and 1PC10 (frame sizes 100 ... 160) for 50 Hz with deep-groove bearings reinforced at both ends

Valid are: x_0 values for $x = 0$ and x_{max} values for $x = l$ (l = shaft extension)

Frame size	No. of poles	Admissible cantilever force	
		at x_0	at x_{max}
1LE1501/03/21/23, 1MB15 – Basic Line			
1LE10, 1MB10, 1PC10			
71	2	610	510
	4	760	640
	6	880	740
	8	970	820
80	2	950	800
	4	1190	1000
	6	1370	1150
	8	1520	1270
90	2	1200	1000
	4	1530	1270
	6	1760	1450
	8	1950	1610
100	2	1585	1270
	4	1960	1575
	6	2270	1815
	8	2520	2015
112	2	1545	1240
	4	1960	1555
	6	2270	1800
	8	2510	1990
132	2	2285	1795
	4	2860	2250
	6	3320	2580
	8	3700	2870
160	2	2800	2170
	4	3450	2750
	6	4000	3160
	8	4510	3500
180	2	3250	2610
	4	4110	3270
	6	4720	3740
	8	5130	4050
200	2	4320	3550
	4	5480	4500
	6	6220	5110
	8	6870	5640
225	2	5000	4150
	4	6250	4900
	6	7200	5750
	8	7800	6200
250	2	6000	4800
	4	7600	6200
	6	8750	7350
	8	9500	8000
280 ¹⁾	2, 4, 6, 8	–	–
315	2, 4, 6, 8	–	–

Note:

1PC10 only for frame sizes 100 to 160.

Admissible cantilever forces – bearings reinforced at both ends. DE bearings for increased cantilever forces – order code **L28**

1LE15 and 1MB15 motors for 50 Hz with cylindrical roller bearings (DE) with deep-groove bearings (NDE)

Valid are: x_0 values for $x = 0$ and x_{max} values for $x = l$ (l = shaft extension)

Frame size	No. of poles	Admissible cantilever force	
		at x_0	at x_{max}
1LE1501/03/21/23, 1MB15 – Basic Line			
100	2, 4, 6, 8	–	–
112	2, 4, 6, 8	–	–
132	2, 4, 6, 8	–	–
160	2, 4, 6, 8	–	–
180	2	8150	4050
	4	9800	4050
	6	9800	4050
200	2	11200	6000
	4	13600	6000
	6	13600	6000
225	2	12700	7900
	4	15700	7250
	6	15700	7300
250	8	15700	7300
	2	17000	7750
	4	21000	9400
280	6	21000	9700
	8	21000	9700
	2, 4, 6, 8	–	–
315 S, M	2, 4, 6, 8	–	–
315 L	2, 4, 6, 8	–	–

¹⁾ For values for frame sizes 280 to 315, see page 1/67.
For frame sizes 280 to 315, bearings of size 63 are standard.

Overview (continued)

Admissible axial load

1LE10, 1MB10, and 1PC10 motors in vertical type of construction – basic version (with the exception of motors with increased power)

Frame size	3000 rpm				1500 rpm				1000 rpm				750 rpm			
	Shaft extension pointing down		Shaft extension pointing up		down		up		down		up		down		up	
	Load down N	up N	down N	up N	down N	up N	down N	up N	down N	up N	down N	up N	down N	up N	down N	up N
63	80	245	230	95	80	330	310	95	80	410	390	95	–	–	–	–
71	105	365	335	130	90	380	440	130	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
100	140	700	550	280	130	990	820	285	130	1280	1110	285	130	1560	1390	285
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
180	1260	1230	500	1990	1600	1770	840	2530	1920	2150	1160	2900	2050	2500	1290	3260
200	1810	1720	660	2870	2410	2480	1260	3630	2700	3050	1550	4200	3060	3510	1910	4660

The values shown do not assume a cantilever force on the shaft extension.

The admissible loads are valid for operation at 50 Hz; for 60 Hz, please inquire.

The calculation of the admissible axial load was based on the drive with generally available coupling. For suppliers, see section "Accessories" on page 2/117 in the respective section of the catalog.

Please inquire if the load direction alternates.

1LE10, 1MB10, ¹⁾ and 1PC10 ¹⁾ motors in horizontal type of construction – basic version (with the exception of motors with increased power)

Frame size	3000 rpm				1500 rpm				1000 rpm				750 rpm			
	Tensile load		Thrust load (N)		Tensile load		Thrust load (N)		Tensile load		Thrust load (N)		Tensile load		Thrust load (N)	
	with radial load at		without radial load		with radial load at		without radial load		with radial load at		without radial load		with radial load at		without radial load	
	x_0	$x_{max.}$	x_0	$x_{max.}$	x_0	$x_{max.}$	x_0	$x_{max.}$	x_0	$x_{max.}$	x_0	$x_{max.}$	x_0	$x_{max.}$	x_0	$x_{max.}$
63	90	120	90	240	90	140	110	320	90	170	120	400	–	–	–	–
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
100	220	450	350	630	220	600	500	910	220	650	550	1200	220	750	650	1480
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
180	1630	–	–	870	2070	–	–	1310	2420	–	–	1660	2660	–	–	1900
200	2340	–	–	1190	3020	–	–	1870	3450	–	–	2300	3860	–	–	2710

The values shown do not assume a cantilever force on the shaft extension.

The admissible loads are valid for operation at 50 Hz; for 60 Hz, please inquire.

The calculation of the admissible axial load was based on the drive with generally available coupling. For suppliers, see the section "Accessories" on page 2/117.

Please inquire if the load direction alternates.

¹⁾ 1MB10 and 1PC10 motors only available for frame sizes 100 to 160.

Introduction

Mechanical version

Bearings and Lubrication

Overview (continued)

1LE15 and 1MB15 motors in vertical type of construction – bearings reinforced at both ends – order code **L25**

Frame size	Type	2-pole – 3000 rpm				4-pole – 1500 rpm				6-pole – 1000 rpm				8-pole – 750 rpm			
		Shaft extension pointing down		Shaft extension pointing up		down		up		down		up		down		up	
		Load down	up	down	up	down	up	down	up	down	up	down	up	down	up	down	up
		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
1LE15, 1MB15 – Basic Line																	
71/80/90		Available soon															
100	1..15.1-1A.4	220	930	820	330	200	1330	1180	350	180	1640	1450	370	200	1900	1740	360
	1..15.1-1A.5	–	–	–	–	190	1320	1150	360	–	–	–	–	180	1900	1710	370
	1..15.1-1A.6	210	930	800	340	170	1320	1110	380	160	1640	1410	390	–	–	–	–
	1..15.3-1A.4	210	930	800	340	170	1320	1110	380	–	–	–	–	–	–	–	–
	1..15.3-1A.5	–	–	–	–	170	1320	1110	380	–	–	–	–	–	–	–	–
112	1..15.1-1B.2	200	940	790	350	180	1340	1150	370	170	1650	1440	380	170	1910	1700	380
	1..15.1-1B.6	180	940	750	370	170	1340	1120	390	160	1640	1410	390	–	–	–	–
	1..15.3-1B.2	180	940	750	370	170	1340	1120	390	160	1640	1410	390	–	–	–	–
132	1..15.1-1C.0	540	1120	890	770	520	1700	1430	790	520	2150	1880	790	510	2530	2240	800
	1..15.1-1C.1	520	1130	860	790	–	–	–	–	–	–	–	–	–	–	–	–
	1..15.1-1C.2	–	–	–	–	490	1710	1380	820	500	2150	1840	810	480	2540	2180	840
	1..15.1-1C.3	–	–	–	–	–	–	–	–	470	2150	1780	840	–	–	–	–
	1..15.1-1C.6	480	1130	780	830	440	1710	1280	870	420	2160	1690	890	–	–	–	–
	1..15.3-1C.0	520	1130	860	790	440	1710	1280	870	470	2150	1780	840	–	–	–	–
	1..15.3-1C.1	480	1130	780	830	–	–	–	–	–	–	–	–	–	–	–	–
	1..15.3-1C.2	–	–	–	–	440	1710	1280	870	470	2150	1780	840	–	–	–	–
	1..15.3-1C.3	–	–	–	–	–	–	–	–	420	2160	1690	890	–	–	–	–
	160	1..15.1-1D.2	2200	1870	1480	2590	2860	2610	2140	3330	3320	3170	2600	3890	3830	3620	3110
1..15.1-1D.3		2150	1880	1430	2600	–	–	–	–	–	–	–	–	3730	3620	3010	4340
1..15.1-1D.4		2120	1890	1400	2610	2760	2610	2040	3330	3200	3180	2480	3900	3650	3640	2930	4360
1..15.1-1D.6		2020	1890	1300	2610	2680	2640	1960	3360	3050	3180	2330	3900	–	–	–	–
1..15.1-1D.7		–	–	–	–	2570	2670	1850	3390	–	–	–	–	–	–	–	–
1..15.3-1D.2		2150	1880	1430	2600	2760	2610	2040	3330	3200	3180	2480	3900	–	–	–	–
1..15.3-1D.3		2120	1890	1400	2610	–	–	–	–	–	–	–	–	–	–	–	–
1..15.3-1D.4		2020	1890	1300	2610	2680	2640	1960	3360	3050	3180	2330	3900	–	–	–	–
180	1..15...1E.2	2510	2050	1360	3200	3240	2920	2090	4070	–	–	–	–	–	–	–	–
	1..15...1E.4	–	–	–	–	3180	2930	2020	4090	3740	3560	2580	4710	4300	4090	3150	5240
	1..15...1E.6	2490	2060	1330	3220	3160	2950	2010	4100	3740	3570	2580	4730	4090	4140	2940	5290
200	1..15...2A.4	2920	3030	2110	3840	–	–	–	–	4570	5010	3760	5820	–	–	–	–
	1..15...2A.5	2810	3060	2000	3870	3820	4210	3010	5020	4470	5060	3660	5870	5200	5750	4390	6560
	1..15...2A.6	2810	3060	2000	3870	3820	4230	3010	5040	4400	5090	3590	5900	5010	5800	4200	6610
225	1..15...2B.0	–	–	–	–	4200	4750	3150	5800	–	–	–	–	5900	6400	4850	7650
	1..15...2B.2	3100	3400	2050	4450	4100	4850	3000	5850	4700	5800	3650	6850	5800	6450	4700	7500
	1..15...2B.6	3100	3400	2050	4450	4100	4850	3000	5850	4650	5850	3600	6900	5500	6600	4400	7650
250	1..15...2C.2	3850	4100	2250	5600	4850	5650	3250	7250	5750	6750	4200	8350	6900	7700	5300	9200
	1..15...2C.6	3850	4100	2250	5600	4800	5750	3200	7400	5750	6750	4200	8450	6700	7800	5000	9300

For frame sizes > 250 standard version.

Introduction

Mechanical version

Bearings and lubrication

1

Overview (continued)

Frame size	Type	2-pole – 3000 rpm		4-pole – 1500 rpm		6-pole – 1000 rpm		8-pole – 750 rpm		Type	2-pole – 3000 rpm		4-pole – 1500 rpm		6-pole – 1000 rpm		8-pole – 750 rpm		
		Load		Load		Load		Load			Load		Load		Load		Load		
		Tension	Thrust	Tension	Thrust	Tension	Thrust	Tension	Thrust		Tension	Thrust	Tension	Thrust	Tension	Thrust	Tension	Thrust	
		N	N	N	N	N	N	N	N		N	N	N	N	N	N	N	N	
1LE55 – Basic Line										1LE56 – Performance Line									
315	1LE55..-3A.6	5400	3000	7750	5400	–	–	–	–	1LE56..-3A.6	5400	3000	7750	5400	–	–	–	–	
	1LE55..-3A.7	5200	2800	7750	5400	9100	6750	–	–	1LE56..-3A.7	5200	2800	7750	5400	9100	6750	–	–	
	1LE55..-3A.8	–	–	–	–	9000	6650	–	–	1LE56..-3A.8	–	–	–	–	9000	6650	–	–	
355	–	–	–	–	–	–	–	–	–	1LE56..-3B.2	–	–	–	–	9900	6000	–	–	
	–	–	–	–	–	–	–	–	–	1LE56..-3B.3	5000	3200	8800	5000	9800	5900	–	–	
	–	–	–	–	–	–	–	–	–	1LE56..-3B.4	5000	3200	8750	4950	9800	5900	–	–	
	–	–	–	–	–	–	–	–	–	1LE56..-3B.5	5000	3200	8700	4900	–	–	–	–	

1LE15 and 1MB15 motors in horizontal type of construction – bearings reinforced at both ends – order code **L25**

Frame size	Type	2-pole – 3000 rpm		4-pole – 1500 rpm		6-pole – 1000 rpm		750 rpm		Frame size	Type	2-pole – 3000 rpm		4-pole – 1500 rpm		6-pole – 1000 rpm		8-pole – 750 rpm		
		Load		Load		Load		Load				Load		Load		Load		Load		
		Ten- sion	Thrust	Ten- sion	Thrust	Ten- sion	Thrust	Ten- sion	Thrust			Ten- sion	Thrust	Ten- sion	Thrust	Ten- sion	Thrust	Ten- sion	Thrust	
		N	N	N	N	N	N	N	N			N	N	N	N	N	N	N	N	
1LE15, 1MB15 – Basic Line										1LE15, 1MB15 – Basic Line										
71/80/90		Available soon								160		1..15.1-1D.2	2400	1680	3100	2380	3610	2890	4090	3370
100	1..15.1-1A.4	1440	880	1820	1260	2110	1550	2380	1820		1..15.1-1D.3	2380	1660	–	–	–	–	4040	3320	
	1..15.1-1A.5	–	–	1800	1240	–	–	2370	1810		1..15.1-1D.4	2370	1650	3050	2330	3550	2830	4010	3290	
	1..15.3-1A.4	1430	870	1780	1220	2090	1530	–	–		1..15.1-1D.6	2320	1600	3020	2300	3480	2760	–	–	
112	1..15.3-1A.5	–	–	1780	1220	–	–	–	–		1..15.1-1D.7	–	–	2980	2260	–	–	–	–	
	1..15.3-1A.5	–	–	1780	1220	–	–	–	–		1..15.3-1D.2	2380	1660	3050	2330	3550	2830	–	–	
	1..15.1-1B.2	1430	870	1810	1250	2110	1550	2370	1810		1..15.3-1D.3	2370	1650	–	–	–	–	–	–	
132	1..15.1-1B.6	1410	850	1790	1230	2090	1530	–	–		1..15.3-1D.4	2320	1600	3020	2300	3480	2760	–	–	
	1..15.3-1B.2	1410	850	1790	1230	2090	1530	–	–		180 1..15..-1E.2	2860	1710	3660	2510	–	–	–	–	
	1..15.1-1C.0	2330	1010	2890	1570	3340	2020	3710	2390		1..15..-1E.4	–	–	3630	2480	4230	3080	4770	3620	
	1..15.1-1C.1	2320	1000	–	–	–	–	–	–		1..15..-1E.6	2850	1700	3630	2480	4230	3080	4690	3540	
	1..15.1-1C.2	–	–	2870	1550	3320	2000	3680	2360		200 1..15..-2A.4	3390	2580	–	–	5210	4400	–	–	
	1..15.1-1C.3	–	–	–	–	3290	1970	–	–		1..15..-2A.5	3340	2530	4430	3620	5170	4360	5880	5070	
	1..15.1-1C.6	2280	960	2820	1500	3250	1930	–	–		1..15..-2A.6	3340	2530	4430	3620	5150	4340	5810	5000	
	1..15.3-1C.0	2320	1000	2820	1500	3290	1970	–	–		225 1..15..-2B.0	–	–	4950	3900	–	–	6600	5550	
	1..15.3-1C.1	2280	960	–	–	–	–	–	–		1..15..-2B.2	3800	2750	4950	3900	5750	4700	6550	5500	
	1..15.3-1C.2	–	–	2820	1500	3290	1970	–	–		1..15..-2B.6	3800	2750	4900	3850	5700	4650	6500	5450	
1..15.3-1C.3	–	–	–	–	3250	1930	–	–		250 1..15..-2C.2	4750	3150	6050	4450	7100	5500	8100	6500		
										1..15..-2C.6	4750	3150	6050	4450	7100	5500	8000	6400		

For frame sizes > 250 standard version.

Overview

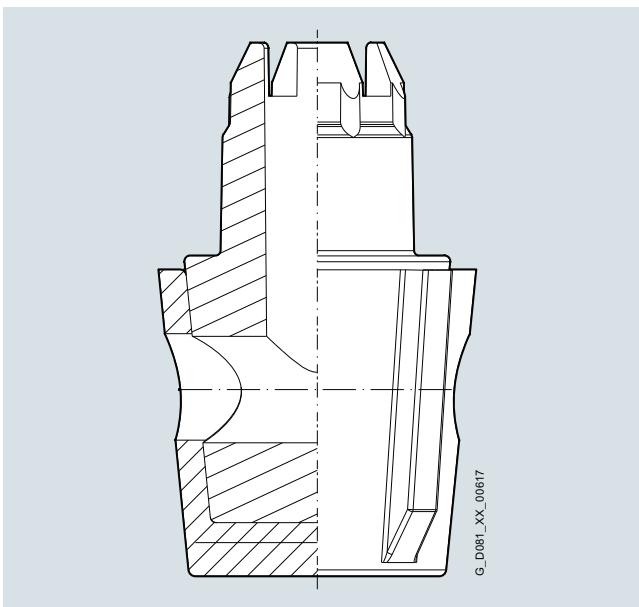
The drainage of condensed water is an important aspect of proper motor maintenance.

Drainage of condensed water is made easy by rotating the outer cap.

If there are condensate drain holes present, these must be opened at regular intervals, depending on climatic conditions and in accordance with the motor operating instructions.

"Modifiable T-Drain" is closed on delivery of the motor and corresponds to degree of protection IP55/IP56.

When opened, it corresponds to degree of protection IP45/IP46. The opened T-Drain can be used for continuous drainage of condensed water in environments with low amounts of dust.

**Note:**

Motors of the LOHER CHEMSTAR series can be designed in IP66, see Catalog D 83.1.

A screw-mounted cover (made of sheet metal or plastic depending on shaft height) is included as standard for horizontal types of construction and types of construction with shaft pointing upwards (14th position of the Article No. letter **A, T, U, V, D, F, H, J, K, L, N**) in combination with condensation drainage holes, order code (**H03**) to facilitate assembly/disassembly.

When the motors are used or stored outdoors, we recommend that they be kept under some sort of additional cover so that they are not subjected to direct intensive solar radiation, rain, snow, ice or dust over a long period of time. In such cases, technical consultation may be appropriate.

When the motors are used outdoors or in a corrosive environment, it is recommended that non-rusting screws are used externally.

Order code **H07**

Vibration-proof version

Continuous vibration resistance to class 3M4 according to IEC 721-3-3:1994 (order code **H02** in combination with order code **G01, G02, G04, G05, G06, G11, and G12** or **F70** on request only).

Order code **H02**

For availability of individual options for the relevant motor series, see section "Special versions" in the respective sections of the catalog.

Introduction

Mechanical version

Lifting eyes and transport

1

Overview

1LE10, 1MB10 and 1PC10 motors without feet have four cast lifting eyes as standard, each offset by 90°; in the case of screwed-on feet, two lifting eyes are covered by the feet, so in this case only two lifting eyes are available for use. This data is only valid up to frame size 200.

Housing material			
Motor series	Frame size	Housing material	Housing feet
1LE10, 1PC1 ²⁾	63 ... 160	Aluminum alloy	cast ¹⁾
	180 ... 200	Aluminum alloy	screwed on ¹⁾
1MB10	100 ... 160	Aluminum alloy	cast ¹⁾
1LE15 1MB15 1PC1301 ³⁾	71 ... 315	Cast iron	cast ¹⁾
1LE16 1MB16	100 ... 315	Cast iron	cast ¹⁾

Arrangement of lifting eyes/eyebolts (standard)

Frame size	Terminal box position	Cast-iron motors	Aluminum motors	Arrangement of eyebolts	Thread size
63	–	–	None	–	–
71	–	None	None	–	M8
80	Short housing	None	None	–	M8
	Top (long housing)	Two eyebolts		Left/right center	
	Left/right (long housing)	One eyebolt		Top center	
90	Top	Two eyebolts	None	Left/right center	M8
	Left/right	One eyebolt		Top center	
100		Depending on type of construction ⁴⁾	Lifting eyes	Top; Left DE side/ right NDE side ¹⁰⁾	M8
112					
132					
160					M10
180		Two eyebolts ¹⁰⁾			M12
200					M16
225		Two eyebolts ¹¹⁾	–	5) 6) 7)	M16
250					M20
280					
315 S/M ¹²⁾					M24
315 L		Four eyebolts		top; left/right DE and NDE side ^{8) 9)}	M30
315 L (1LE5)		Two eyebolts			
355 M/L (1LE5)					

¹⁾ Basic version, cast feet: Special version "Screwed-on feet (instead of cast)" with digits **5**, **6**, and **7** in the 16th position of Article No. or digit **4** with order code **H01**. Screwed-on feet as standard for 1LE10 motors in frame sizes 180 and 200 and motors with increased power.

²⁾ Aluminum motors in frame sizes 80 and 90 and 1PC10 motors in frame sizes 100 to 160 without lifting eyes. Aluminum motors in frame sizes 100 to 200 with cast lifting eyes (does not apply to 1PC10 and 1MB10 motors in frame sizes 180 and 200).

³⁾ 1LE16 motors frame size 100 and above, 1PC1301 motors frame size 180 and above.

⁴⁾ Two eyebolts for
- IM B5, IM B14, IM V1 or
- IM B34, IM B35 with **H01** or left/right, side terminal box position.
Lifting eyes for
- IM B3 or
- IM B34, IM B35 without **H01** or non-side left/right terminal box position.

⁵⁾ For IM B3; IM B5: top; DE side left / NDE side right.
With rotation of the terminal box through 180° (R12): top; NDE side left / DE side right.

⁶⁾ For IM V1: top; NDE side right; down; NDE side left.

⁷⁾ For IM V3: top; DE side left; down; DE side right.

⁸⁾ For IM V1: NDE side, left/right; top/bottom.

⁹⁾ For IM V3: DE side, left/right; top/bottom.

¹⁰⁾ With rotation of the terminal box through 180° (R12): top; NDE side left / DE side right.

¹¹⁾ Motors with brakes have four top eyebolts.
For IM V1: NDE side, left/right; top/bottom.
For IM V3: DE side, left/right; top/bottom.

¹²⁾ The assignment 315 L is used for 1000 kg and over.

Overview

Brakes as well as rotary encoders of the "modular and special technology" can be retrofitted. The motor must be prepared for this. This is possible for all 1LE1 motors (with the exception of 1LE1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover").

Preparation of the shaft extension at NDE can be ordered with the option "Prepared for mountings, only center hole", order code **G40** for the following frame sizes and mountings:

- Frame sizes 80 to 315: brakes with order code **F01**
- Frame sizes 71 and 90: only rotary encoders with order codes **G01**, **G02**, **G11**, or **G12** from the "modular technology" range
- Frame sizes 100 to 315: all rotary encoders from the "modular and special technology" ranges

Dimensions of center holes

Frame size	∅	L (drilling depth)
100	16 ^{H7}	34
112	16 ^{H7}	34
132	22 ^{H8}	39
160	28 ^{H8}	42

The length of the motor does not change because the shaft extension is still under the fan cover.

For motors ordered with order code **G40**, the following conversion combinations are possible:

- Frame sizes 71 and 90:
Either brakes with order code **F01** or rotary encoders with order code **G01** or **G02** from the "modular technology". The combination of brake (**F01**) and rotary encoder (**G01/G02**) is not possible.
- Frame sizes 100 to 315:
Brakes with order code **F01** or rotary encoders from the "modular and special technology". The combination of brake (**F01**) and rotary encoder is possible.

Conversion is performed exclusively by the authorized contractual partners of Siemens.

For motors of series 1LE15 and 1LE16 frame sizes 100 to 315, grounding brushes are available for converter operation. Order code **L52**. Please contact your local Siemens office for advice.

For mountings, such as rotary encoders, supplied by the customer, the following applies:

For the rotary encoders:

- 1XP8012-10, order code **G01**
- 1XP8012-20, order code **G02**
- Sendix 5020, order code **G11** and **G12**

from the "modular technology" this preparation of the shaft extension on NDE can be ordered with the option "Prepared for mounting with shaft D12".

Order code **G41**

The length of the motor increases by Δl due to option **G41**. For an explanation of the additional dimensions and weights, see "Modular technology" "Dimensions and weights".

For the rotary encoders:

- LL 861 900 220, order code **G04**
- HOG 9 DN 1024 I, order code **G05**
- HOG 10 D 1024 I, order code **G06**

from the "special technology" this preparation of the shaft extension on NDE can be ordered with the option "Prepared for mounting with shaft D16" for motors of frame sizes 100 to 160 only.

Order code **G42**

The length of the motor increases by Δl due to option **G42**. For an explanation of the additional dimensions and weights, see "Modular technology" "Dimensions and weights".

Motors that are prepared for mountings supplied by the customer (order codes **G41**, **G42**) are supplied without a protective cover as standard. These mountings can be installed by the customer.

If a protective cover is requested as a cover or mechanical protection for mountings provided by the customer, this can be ordered with order code **G43**.

This protective cover is designed and mounted differently as described below according to frame size:

Frame sizes 71 to 90 and 180 to 200:

Motors ordered with order code **G43** are fitted as standard with a screw-mounted cover (made of sheet metal or plastic depending on shaft height). The protective cover is mounted in the factory. To install the mountings supplied by the customer, the protective cover must be removed beforehand by unscrewing the external fixing screws and reattached afterwards. Protective covers for motors of these frame sizes are not suitable for mountings that correspond to the shape and size of the rotary encoders of the "special technology" (**G04**, **G05**, **G06**, see above).

Frame sizes 100 to 315:

The protective cover must be installed by the customer in accordance with the assembly instructions supplied. It has supports of varying length that can be used for installation according to the height of the planned mountings.

The standard protective cover (order code **H00**) is not suitable for protection of additional mountings, such as rotary encoders.

Order codes **G40**, **G41**, **G42** are not possible in conjunction with order code **L00** vibration severity grade B.

Order code **G43** is only appropriate in combination with order codes **G41** and **G42**, and not in combination with **G40**.

Introduction

Mounting technology

Modular technology

Overview

The 1LE and 1FP motors (with the exception of 1LE1 with option **F90** – version "Forced-air cooled motors without external fan and fan cover" and 1PC1) can be used in a much wider range of applications (e.g. as motors with brakes) if the following modules are mounted:

- Separately driven fan
- Brake
- Rotary pulse encoder

Separately driven fan

The use of a separately driven fan is recommended to increase motor utilization at low speeds and to limit noise generation at speeds significantly higher than the synchronous speed. Both of these results can only be achieved with converter operation. Please inquire about traction and vibratory operation.

The separately driven fan can be supplied already fitted, order code **F70**. There is no automatic adjustment of the voltage for the separately driven fan when ordering a "special voltage" for the motor. This must be specified in addition using the **Y81** option.

The brake must always be mounted in the factory for safety reasons. The rotary pulse encoder and/or the separately driven fan can also be retrofitted.

The degree of protection of the motors with modular technology is IP55. Higher degrees of protection on request.

Attaching rotary pulse encoder, brake, and separately driven fan increases the length of the motor by dimension Δl . For explanations of the additional dimension and weights, see "Mounting technology" and "Dimensions and weights" from page 1/106.

It can also be ordered separately and retrofitted. For selection information and article numbers, see the section "Accessories" (available soon). A rating plate listing all the important data is fitted to the separately driven fan. Please note the direction of rotation of the separately driven fan (axial-flow fan) when connecting it. Admissible coolant temperatures $CT_{min} -25\text{ °C}$, $CT_{max} +65\text{ °C}$ ¹⁾, lower/higher coolant temperatures are available on request. When the separately driven fan is mounted, the length of the motor increases by Δl . For explanations of the additional dimension and weights, see "Mounting technology" and "Dimensions and weights" from page 1/106.

**Technical specifications of forced ventilation
(according to tolerances of EN 60034-1)**

Frame size	Rated voltage range		Frequency	P_{max}	I_{max}
	V		Hz	kW	A
63	1 AC	230 to 277	50	0.027	0.11
	3 AC	200 to 303 Δ	50	0.028	0.12
	3 AC	346 to 525 Y	50	0.028	0.07
	1 AC	230 to 277	60	0.032	0.12
	3 AC	220 to 332 Δ	60	0.028	0.1
	3 AC	380 to 575 Y	60	0.028	0.06
71	1 AC	230 to 277	50	0.027	0.1
	3 AC	200 to 303 Δ	50	0.031	0.11
	3 AC	346 to 525 Y	50	0.031	0.06
	1 AC	230 to 277	60	0.033	0.12
	3 AC	220 to 332 Δ	60	0.029	0.1
	3 AC	380 to 575 Y	60	0.029	0.06
80	1 AC	230 to 277	50	0.029	0.11
	3 AC	200 to 303 Δ	50	0.031	0.11
	3 AC	346 to 525 Y	50	0.031	0.06
	1 AC	230 to 277	60	0.037	0.14
	3 AC	220 to 332 Δ	60	0.034	0.1
	3 AC	380 to 575 Y	60	0.034	0.06
90	1 AC	220 to 277	50	0.065	0.29
	3 AC	200 to 303 Δ	50	0.091	0.38
	3 AC	346 to 525 Y	50	0.091	0.22
	1 AC	220 to 277	60	0.065	0.25
	3 AC	220 to 332 Δ	60	0.077	0.33
	3 AC	380 to 575 Y	60	0.077	0.19
100	1 AC	220 to 277	50	0.066	0.28
	3 AC	200 to 303 Δ	50	0.091	0.37
	3 AC	346 to 525 Y	50	0.091	0.22
	1 AC	220 to 277	60	0.075	0.3
	3 AC	220 to 332 Δ	60	0.087	0.31
	3 AC	380 to 575 Y	60	0.087	0.18

**Technical specifications of forced ventilation
(according to tolerances of EN 60034-1)**

Frame size	Rated voltage range		Frequency	P_{max}	I_{max}
	V		Hz	kW	A
112	1 AC	220 to 277	50	0.071	0.28
	3 AC	200 to 303 Δ	50	0.097	0.35
	3 AC	346 to 525 Y	50	0.097	0.2
	1 AC	220 to 277	60	0.094	0.37
	3 AC	220 to 332 Δ	60	0.103	0.31
	3 AC	380 to 575 Y	60	0.103	0.18
132	1 AC	230 to 277	50	0.098	0.4
	3 AC	200 to 303 Δ	50	0.124	0.58
	3 AC	346 to 525 Y	50	0.124	0.33
	1 AC	230 to 277	60	0.149	0.57
	3 AC	220 to 332 Δ	60	0.148	0.44
	3 AC	380 to 575 Y	60	0.148	0.25
160 to 200	1 AC	230 to 277	50	0.253	0.97
	3 AC	200 to 303 Δ	50	0.247	0.87
	3 AC	346 to 525 Y	50	0.247	0.5
	3 AC	220 to 332 Δ	60	0.36	0.93
	3 AC	380 to 575 Y	60	0.36	0.56
	225 M to 280 M	3 AC	200 to 240 Δ	50	0.450
3 AC		380 to 420 Y	50	0.450	1.15
3 AC		440 to 480 Y	60	0.520	1.05
315 2-pole	3 AC	200 to 240 Δ	50	0.650	2.85
	3 AC	380 to 420 Y	50	0.650	1.64
	3 AC	440 to 480 Y	60	0.750	1.60
315 4, 6, 8-pole	3 AC	200 to 240 Δ	50	0.450	2.00
	3 AC	380 to 420 Y	50	0.450	1.15
	3 AC	440 to 480 Y	60	0.520	1.05
355 2 and 4-pole	3 AC	200 to 240 Δ	50	0.650	2.85
	3 AC	380 to 420 Y	50	0.650	1.64
	3 AC	440 to 480 Y	60	0.750	1.60

For article numbers and type details, see operating instructions.

¹⁾ For single-phase variants (1 AC) of frame size 160, the admissible coolant temperature CT_{max} is +50 °C.

Overview (continued)**Brakes**

The brakes with order code **F01** (**F02** brake for increased frequency of operation for SIMOTICS GP motors on request) are designed to be spring-operated brakes. When the brake is ordered, the supply voltage must be specified. For an explanation of the supply voltage, see the descriptions of each brake model in "Modular technology".

For the design of the braking time, run-on revolutions, braking energy per braking procedure as well as the lifetime of the brake linings, see "Configuration of motors with brakes" on page 1/92.

When a brake is mounted, the length of the motor increases by Δl . For explanations of the additional dimension and weights, see "Mounting technology" and "Dimensions and weights" from page 1/106.

*The brake can be retrofitted by authorized partners. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only" order code **G40** must be specified (see "Mechanical version and degrees of protection" on page 1/79).*

Ambient temperature

- -40°C to $+45^{\circ}\text{C}$ (with nominal excitation) for SFB-SH brake
- -40°C to $+75^{\circ}\text{C}$ (with double excitation) for SFB-SH brake
- -20 to $+40^{\circ}\text{C}$ holding/operating brake (standard 2LM8)
- up to $+60^{\circ}\text{C}$ only as holding brake
- -20 to $+60^{\circ}\text{C}$ holding/operating brake only for KFB and FDX brake

Definition of duty type

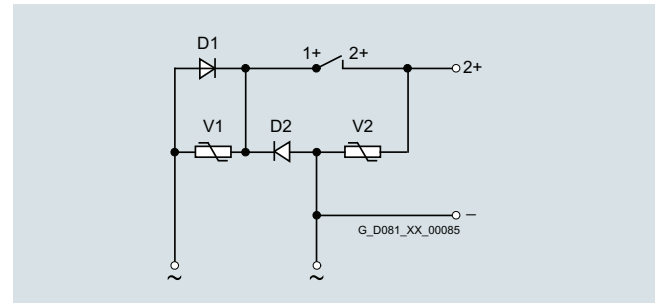
- **Operating brake:**
The motor shaft can be braked from full operating speed down to zero speed of the motor. All the kinetic energy produced by the drive train is converted to heat by friction during braking. Braking energy is produced at $n > 0$ rpm. The maximum permissible switching frequency must be taken into account. When this brake is used, installation of a separately driven fan is recommended in order to ensure adequate cooling when the motor is at a standstill. The operating brake is also capable of functioning as a holding brake.
- **Holding brake:**
The purpose of braking or "holding" the motor shaft is merely to suppress unintended rotation caused by externally applied torque forces, e.g. when a load is suspended from a crane rope drum. The holding brake is primarily deployed when the motor is at a standstill ($n = 0$ rpm) by holding the motor shaft or is close to $n = 0$ rpm and coasting down to a standstill. As a result, no additional braking energy or braking heat is transferred to the motor.

Note:

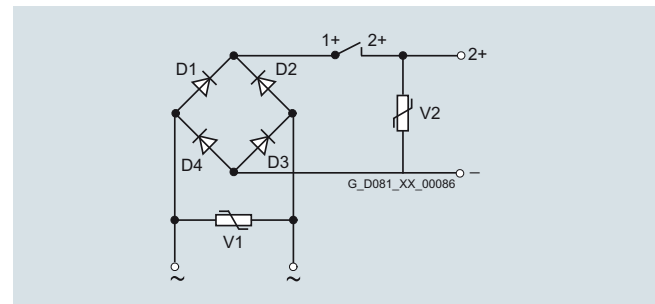
A holding brake must not be used as an operating brake as it could then cause danger to life and damage to property.

Bridge rectifier / half-wave rectifier

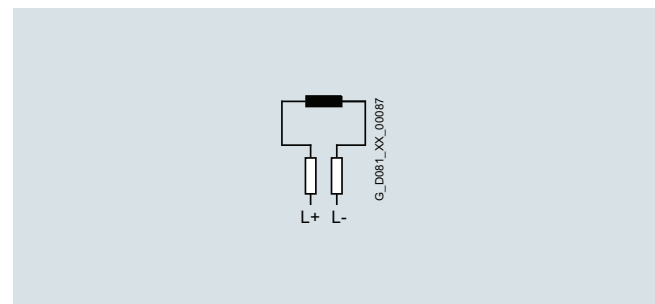
Brakes are connected through a standard bridge or half-wave rectifier or directly to the 2LM8/SFB-SH brake. See the circuit diagrams below.



Half-wave rectifier 400 V AC



Bridge rectifier 230 V AC



Brake connection for 24 V DC

Introduction

Mounting technology

Modular technology

1

Overview (continued)

2LM8 spring-operated disk brake

Motor series

This brake is the standard brake for 1LE1/1FP1 motors in frame sizes 63 to 225 (except for 1LE1 with order code **F90** version "Forced-air cooled motors without external fan and fan cover").

Other characteristics of the 2ML8 brake

The 2LM8 brake has IP55 degree of protection.

Please inquire if motors with brakes are to be operated below the freezing point or in conjunction with very humid environments (e.g. close to the sea) with long standstill times. Please also inquire if motors with brakes are to be used for low-speed converter operation.

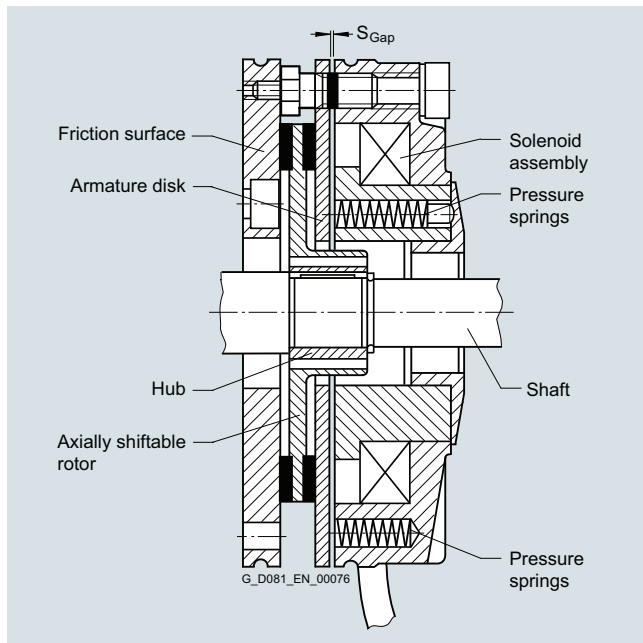
Design and mode of operation

The brake takes the form of a single-disk brake with two friction surfaces.

The braking torque is generated by friction when pressure is applied by one or more pressure springs in the de-energized state.

The brake is released electromagnetically.

When the motor brakes, the rotor which can be axially shifted on the hub or the shaft is pressed via the armature disk against the friction surface by means of the springs. In the braked state, there is a gap S_{Gap} between the armature disk and the solenoid component. To release the brake, the solenoid is energized with DC voltage. The resulting magnetic force pulls the armature disk against the spring force on to the solenoid component. The spring force is then no longer applied to the rotor, which can rotate freely.



Design of the 2LM8 spring-operated disk brake

Rating plate

The following brake data is specified on the motor rating plate:

- Brake type
- Supply voltage
- Frequency
- Current
- Temperature class
- Braking torque

Voltage and frequency

The solenoids and the brake rectifier are designed for connection to the following voltages or can be supplied for the following voltages:

- Brake supply voltage 24 V DC
Order code **F10**
- Brake supply voltage 230 V AC
Order code **F11**
- Brake supply voltage 400 V AC
(directly at the terminal strip)
Order code **F12**

When 60 Hz is used, the voltage for the brake must not be increased!

Order codes **F10**, **F11**, and **F12** must only be used in conjunction with order code **F01**.

Lifetime of the brake lining

The braking energy L_N until readjustment of the brake 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 it is not possible to specify a value for the friction energy until readjustment that is valid for all operating conditions.

When used as an operating brake, the specific frictional surface wear (wear volume for the frictional work) is approximately 0.05 to 2 cm³/kWh.

Overview (continued)

For motor frame size	Brake type	Rated braking torque at 100 rpm	Rated braking torque at 100 rpm in % at the following speeds			Supply voltage	Current/ power input ¹⁾		Brake application time t_2 ²⁾	Brake release time	Brake moment of inertia	Noise level L_p with rated air gap	Service capability of the brake	
			1500 rpm	3000 rpm	Max. speed		V	A					W	Lifetime L of the brake lining
63	2LM8 005-1NA10	5	87	80	65	AC 230	0.1	20	25	56	0.000013	77	105	16
	AC 400					0.11								
	DC 24					0.83								
71	2LM8 005-2NA10	5	87	80	65	AC 230	0.1	20	25	56	0.000013	77	105	16
	AC 400					0.11								
	DC 24					0.83								
80	2LM8 010-3NA10	10	85	78	65	AC 230	0.12	25	26	70	0.000045	75	270	29
	AC 400					0.14								
	DC 24					1.04								
90	2LM8 020-4NA10	20	83	76	66	AC 230	0.15	32	37	90	0.00016	75	740	79
	AC 400					0.17								
	DC 24					1.25								
100	2LM8 040-5NA10	40	81	74	66	AC 230	0.2	40	43	140	0.00036	80	1350	115
	AC 400					0.22								
	DC 24					1.67								
112	2LM8 060-6NA10	60	80	73	65	AC 230	0.25	53	60	210	0.00063	77	1600	215
	AC 400					0.28								
	DC 24					2.1								
132	2LM8 100-7NA10	100	79	72	65	AC 230	0.27	55	50	270	0.0015	77	2450	325
	AC 400					0.31								
	DC 24					2.3								
160	2LM8 260-8NA10	260	75	68	65	AC 230	0.5	100	165	340	0.0073	79	7300	935
	AC 400					0.47								
	DC 24					4.2								
180	2LM8 315-0NA10	315	75	68	65	AC 230	0.5	100	152	410	0.0073	79	5500	470
	AC 400					0.56								
	DC 24					4.2								
200, 225	2LM8 400-0NA10	400	73	68	65	AC 230	0.55	110	230	390	0.0200	93	9450	1260
	AC 400					0.61								
	DC 24					4.6								

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

²⁾ The specified switching times are valid for switching on the DC side with a rated release travel and with the coil already warm. They are average

values, which may vary depending on factors such as the rectifier type and the release travel. The brake application time for switching on the AC side, for example, is approximately 6 times longer than for switching on the DC side.

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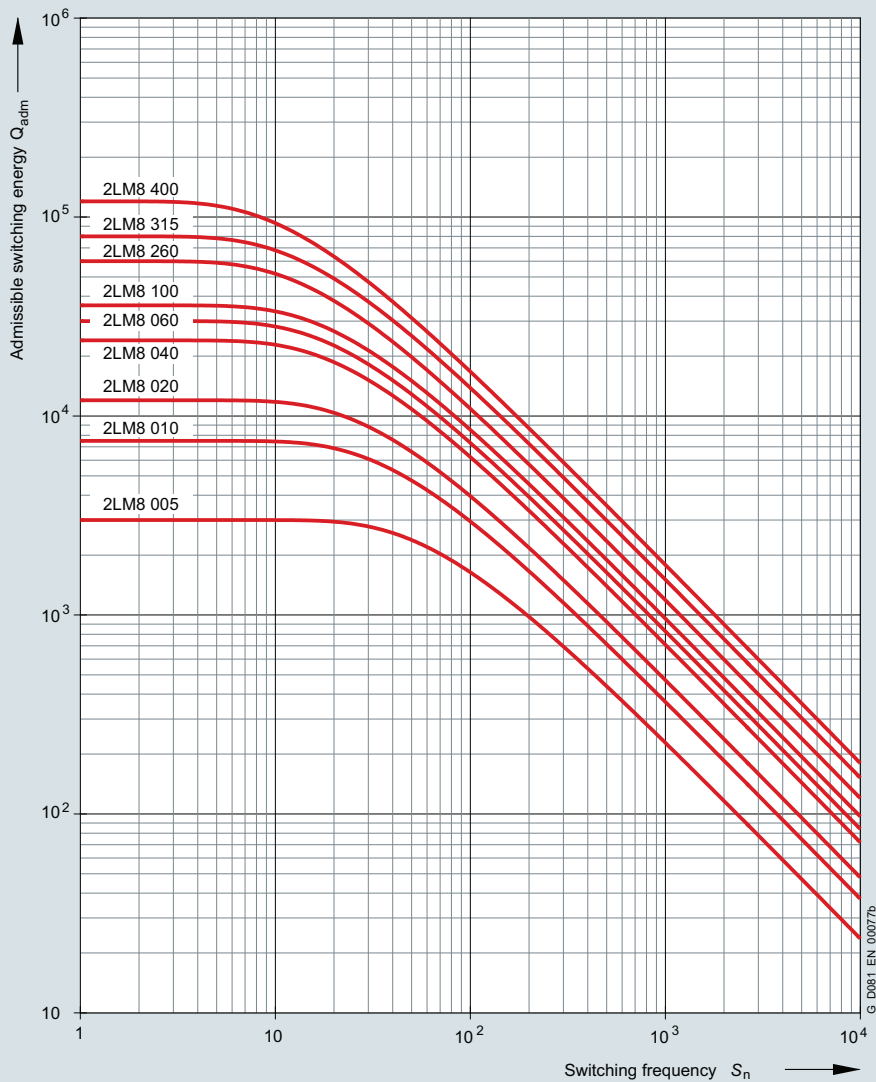
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Overview (continued)

Maximum admissible speeds

The maximum admissible speeds from which emergency stops can be made are listed in the next table. These speeds should be considered as guide values and must be checked for the specific operating conditions.

The maximum admissible friction energy depends on the switching frequency and is shown for the individual brakes in the following diagram. Increased wear can be expected when the brakes are used for emergency stops.



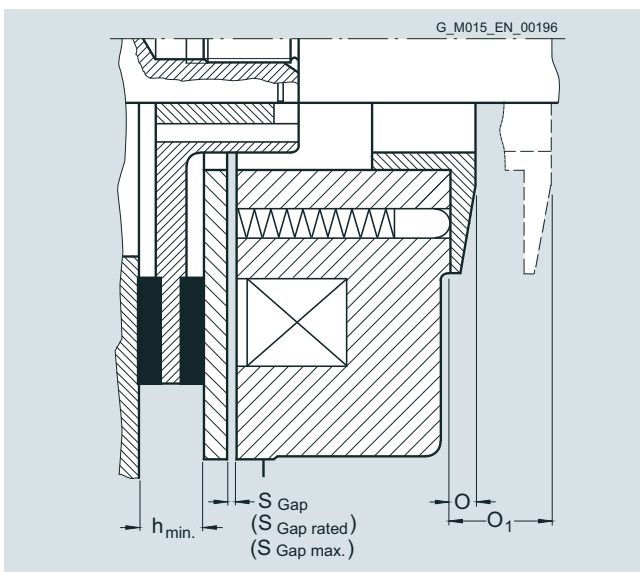
For motor frame size	Brake type	Maximum admissible speeds			Changing the braking torque			Readjusting the air gap		
		Max. adm. operating rpm if max. operating energy utilized	Max. adm. no-load rpm with emergency stop function for horizontal mounting position	Max. adm. no-load rpm with emergency stop function for vertical mounting position	Reduction per notch	Dimension "O ₁ "	Min. braking torque	Rated air gap S _{Gap rated}	Maximum air gap S _{Gap max.}	Minimum rotor thickness h _{min.}
		rpm	rpm	rpm	Nm	mm	Nm	mm	mm	mm
63	2LM8 005-1NA ..	3000	6000	6000	0.17	7	3.7	0.2	0.4	4.5
71	2LM8 005-2NA ..	3000	6000	6000	0.17	7	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
100	2LM8 040-5NA ..	3000	6000	6000	1.29	12.5	21.3	0.3	0.65	8.0
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
180	2LM8 315-0NA ..	1500	4400	3200	5.6	17.0	178.4	0.4	1.0	12.0
200, 225	2LM8 400-0NA ..	1500	3000	3000	6.15	21.0	248.7	0.5	1.5	15.5

Overview (continued)**Changing the braking torque**

The brake is supplied with the braking torque already set. For 2LM8 brakes, the torque can be reduced to the dimension O_1 by unscrewing the adjusting ring with a hook wrench. The braking torque changes by the values shown in the above table for each notch of the adjusting ring.

Readjusting the air gap

Under normal operating conditions, the brake is practically maintenance-free. The air gap S_{Gap} must only be checked at regular intervals if the application requires an extremely large amount of frictional energy and readjusted to the rated air gap $S_{\text{Gap rated}}$ at the latest when the maximum air gap $S_{\text{Gap max}}$ is reached.

**Connection**

Labeled terminals are provided in the main terminal box of the motor 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 by 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 rectifiers are 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.

For this purpose, see the circuit diagrams on page 1/81.

Fast brake application

If the brake is disconnected from the line supply, the brake is applied.

The application time for the brake disk is delayed as a result of the inductance of the solenoid (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, 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 contacts of an external switch.

For this purpose, see the circuit diagrams on page 1/81.

Mechanical manual brake release with lever

The brakes can be supplied with a mechanical manual release with lever.

Order code **F50**

The dimensions of the brake lever depend on the motor frame size and can be read from the dimensional drawing generator for motors in the DT Configurator tool for low-voltage motors.

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Overview (continued)

KFB spring-operated brake



KFB spring-operated brake

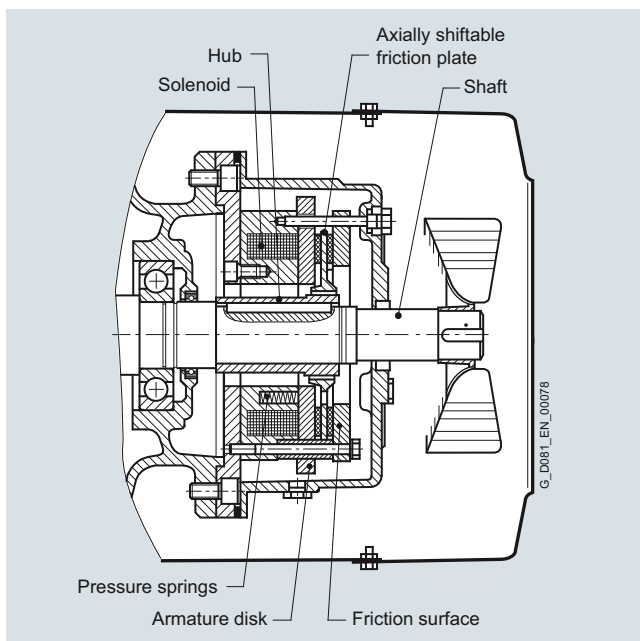
The KFB solenoid double-disk spring-operated brake is a safety brake that brakes the motor if the supply is disconnected (power failure, emergency stop). The KFB brake with degree of protection IP67 is mainly used for electric motors for traversing, cross-traversing and lifting gear in cranes as well as for special industrial applications.

Motor series

This brake is the standard brake for 1LE1 motors in frame sizes 250 to 315. For frame sizes 180 to 225, apart from the standard brake 2LM8, KFB brakes can also be supplied. Special brake selections are available on request.

Design and mode of operation

When the brake current is switched on, an electromagnetic field develops which overcomes the spring force of the brake. The corresponding modules, including the motor shaft, can rotate freely. The brake is released. If the brake current is switched off or if there is a power failure, the electromagnetic field of the brake disappears. The mechanical braking energy is transferred to the motor shaft. The motor is braked.



Design of KFB spring-operated brakes

Other characteristics of the KFB brake

- High degree of protection IP67.
- Corrosion-resistant in seawater and in the tropics.
- The brake is a dynamic brake, not simply a holding brake. For this reason there is less wear, especially in the case of emergency stops (commissioning).
- High wear reserves – repeated stepless air gap readjustment is possible. This results in extremely long operating times and low service and operating costs.
- The function and wear can be monitored with microswitches and proximity switches. Microswitch On/Off is standard for 1LE motors, frame size 250 to 315. Microswitch On/Off is not standard for 1LE motors, frame size up to 225. Anti-condensation heating is possible as an option.
- Fully functional brake for housing acceptance test. Visual inspection of brake is possible during operation.
- The brake (air gap) can be adjusted in the factory, for example, and mounted on the drive motor without further adjustments.
- The wear parts can be replaced without great outlay. After the housing has been opened (three screws), it is easy to replace the friction plate. It is not necessary to disassemble the entire brake.

Voltage and frequency

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

1 AC 50 Hz 230 V $\pm 10\%$

When 60 Hz is used, the voltage for the brake must not be increased!

The brake can also be supplied for other voltages:

- Brake supply voltage: 24 V DC
Order code **F10**
- Brake supply voltage: 230 V AC
Order code **F11**
- Brake supply voltage: 400 V AC
(directly at the terminal strip)
Order code **F12**

Order codes **F10** and **F12** may only be used in conjunction with order code **F01**.

Fast brake application

Not available for the KFB brake.

Mechanical manual brake release with lever

The brake can be released manually with screws as standard. Mechanical manual release with a lever can be ordered with order code **F50**.

The dimensions of the brake lever depend on the motor frame size and can be read from the dimensional drawing generator for motors in the DT Configurator tool for low-voltage motors. Up-to-date data are available from the brake manufacturer.

Overview (continued)**Connection**

Labeled terminals are provided in the main terminal box of the motor to connect the brake.
KFB brakes are connected through a standard bridge or half-wave rectifier.

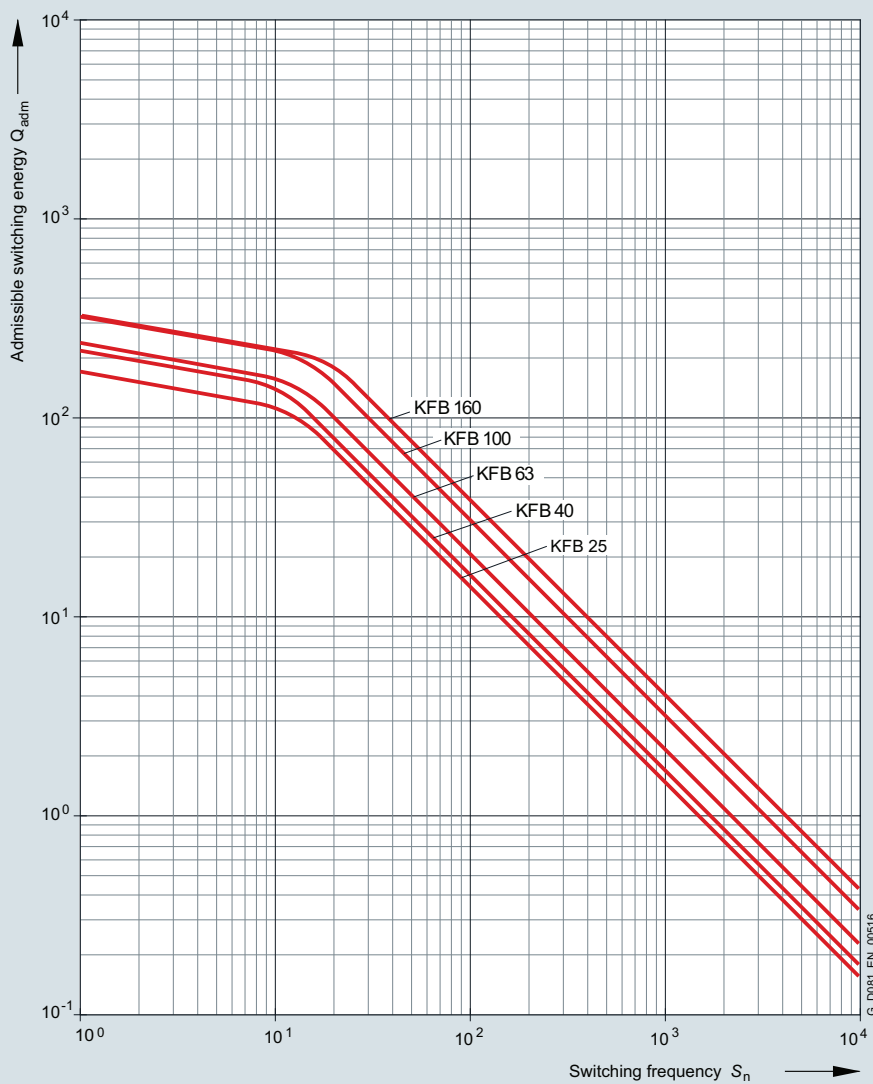
A special circuit is not required. Optimal switching times are achieved without the need to use special circuits.

For this purpose, see the circuit diagrams on page 1/81.

Maximum admissible speeds

The maximum admissible speeds from which emergency stops can be made are listed in the next table. These speeds should be considered as guide values and must be checked for the specific operating conditions.

The maximum admissible friction energy depends on the switching frequency and is shown for the individual brakes in the following diagram. Increased wear can be expected when the brakes are used for emergency stops.



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Overview (continued)

Overview of brake selection for 1LE1 motors		For motor frame sizes					
		180 ¹⁾	200 ¹⁾	225 ¹⁾	250 ²⁾	280 ²⁾	315 ²⁾
No. of poles		2 to 8	2 to 8	2 to 8	2 to 8	4 to 8	4 to 8
Flanged end shield NDE brake installation		A300	A350	A350	A400	A450	A550
Max. diameter of 2nd shaft extension		48 _{k6}	55 _{m6}	55 _{m6}	60 _{m6}	65 _{m6}	70 _{m6}
Brake type		KFB 25	KFB 40	KFB 40	KFB 63	KFB 100	KFB 160
Braking torque	Nm	225	360	360	567	900	1440
Nominal dynamic braking torque according to VDE 0580	Nm/rpm	250/127	400/117	400/117	630/92	1000/78	1600/69
Dynamic braking torque ³⁾	at 750 rpm	Nm	207	332	332	504	780
	at 1000 rpm	Nm	200	316	316	491	760
	at 1500 rpm	Nm	192	304	304	466	720
	at 3000 rpm	Nm	175	276	276	378	580
	at n_{max}	Nm	137	220	220	346	500
Maximum speed n_{max} – IM B3/V1	rpm	6000	5500	5500	4700	4000	3600
Power at 110 V DC	W	158	196	196	220	307	344
Power at 230 V AC	W	160	188	188	206	316	340
Current at 110 V DC	A	1.44	1.78	1.78	2	2.79	3.13
Current at 230 V AC (207 V DC coil voltage)	A	0.77	0.91	0.91	1	1.53	1.64
Current at 400 V AC (180 V DC coil voltage)	A	0.8	1.18	1.18	1.25	1.8	2.1
Current at 24 V DC	A	5.21	6.92	6.92	8.17	12.2	12.8
Weight, approx.	kg	42	55	55	74	106	168
Application time t_1	ms	70	80	80	112	126	183
Release time t_2	ms	240	250	250	342	375	500
Brake moment of inertia	kgm ²	0.0048	0.0068	0.0068	0.0175	0.036	0.05
Lifetime L of the brake lining	Nm · 10 ⁶	3600	3110	3110	4615	7375	10945
Air gap adjustment L_N required after braking energy	Nm · 10 ⁶	810	935	935	1185	2330	3485

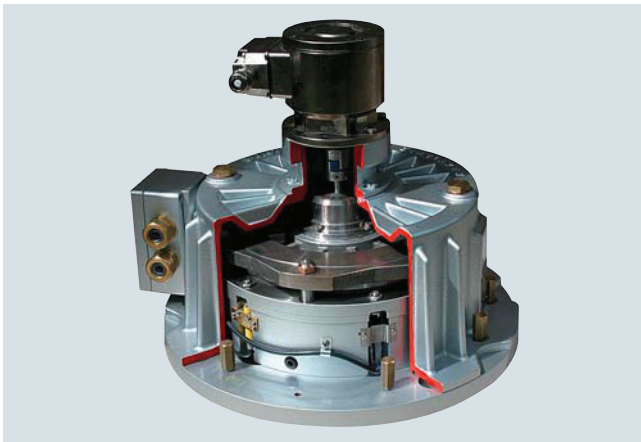
¹⁾ The standard brake for frame sizes 180 to 225 is the 2LM8 brake. KFB brake on request.

²⁾ The standard brake for frame sizes 250 to 315 is the KFB brake.

³⁾ The dynamic braking torque also depends on the load data; temperatures in excess of the maximum admissible lining surface temperatures must be avoided.

Overview (continued)**SFB-SH solenoid double-disk spring-operated brake****Motor series**

This brake is the standard brake for 1LE5 motors in frame sizes 315 to 355.
Special brake selections are available on request.



SFB-SH solenoid double-disk spring-operated brake

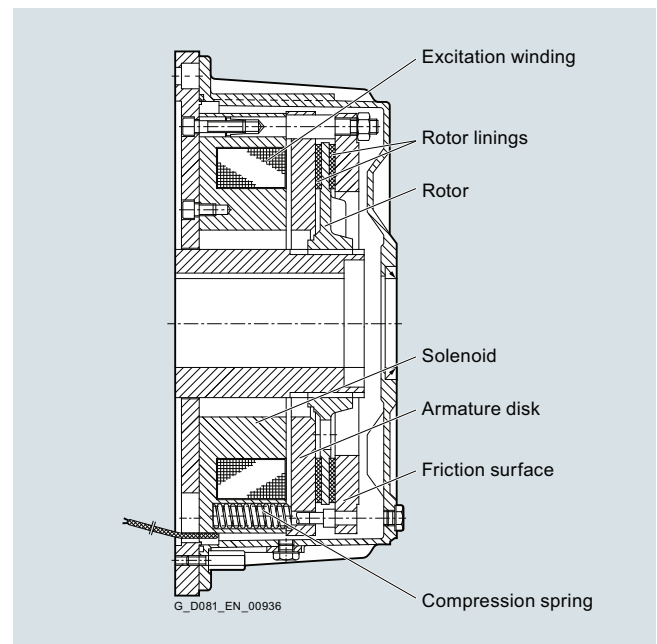
SFB-SH solenoid double-disk spring-operated brakes are safety brakes that are mechanically operated on a power failure. This ensures that the brake still works during a power failure. These brakes are designed for dry running, must only ever be operated in a safe state, and only installed, commissioned, operated, and maintained by specially trained installation personnel. The brakes of the SFB-SH type series have an increased braking torque due to use of a different friction material and are used for emergency stops as a dynamically loaded brake with a safety margin.

Other characteristics of the SFB-SH brake

- High degree of protection IP67.
- Corrosion-resistant in seawater and in the tropics.
- High wear margins – simple air-gap adjustment. This results in extremely long operating times and low service and operating costs.
- The function and wear can be monitored with microswitches and proximity switches. Microswitch On/Off is standard for 1LE5 motors. Anti-condensation heating is possible as an option.
- Fully functional brake for housing acceptance test. Visual inspection of brake is possible during operation.
- The brake (air gap) can be adjusted in the factory, for example, and mounted on the drive motor without further adjustments.
- The wear parts can be replaced without great effort. After the housing has been opened (three acorn nuts), it is easy to replace the friction plate. It is not necessary to disassemble the entire brake.

Design and mode of operation

When the brake current is switched on, an electromagnetic field develops which overcomes the spring force of the brake. The corresponding modules, including the motor shaft, can rotate freely. The brake is released. If the brake current is switched off or if there is a power failure, the electromagnetic field of the brake disappears. The mechanical braking energy is transferred to the motor shaft. The motor is braked.



Design of the SFB-SH solenoid double-disk spring-operated brake

Voltage and frequency

The solenoids and the brake rectifier can be connected to the following voltages:
1 AC 50 Hz 230 V $\pm 10\%$

When 60 Hz is used, the voltage for the brake must not be increased!

The brake can also be supplied for other voltages:

- Brake supply voltage: 24 V DC
Order code **F10**
- Brake supply voltage: 230 V AC
Order code **F11**
- Brake supply voltage: 400 V AC (directly at the terminal strip)
Order code **F12**

Order codes **F10** and **F12** may only be used in conjunction with order code **F01**.

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Overview (continued)

Connection

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

The AC voltage for the brake excitation winding is connected to the two free terminals of the rectifier block (~). The rectifier is located in the main terminal box and must be connected in the customer's switchboard.

The brake can be released when the motor is at a standstill by 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.

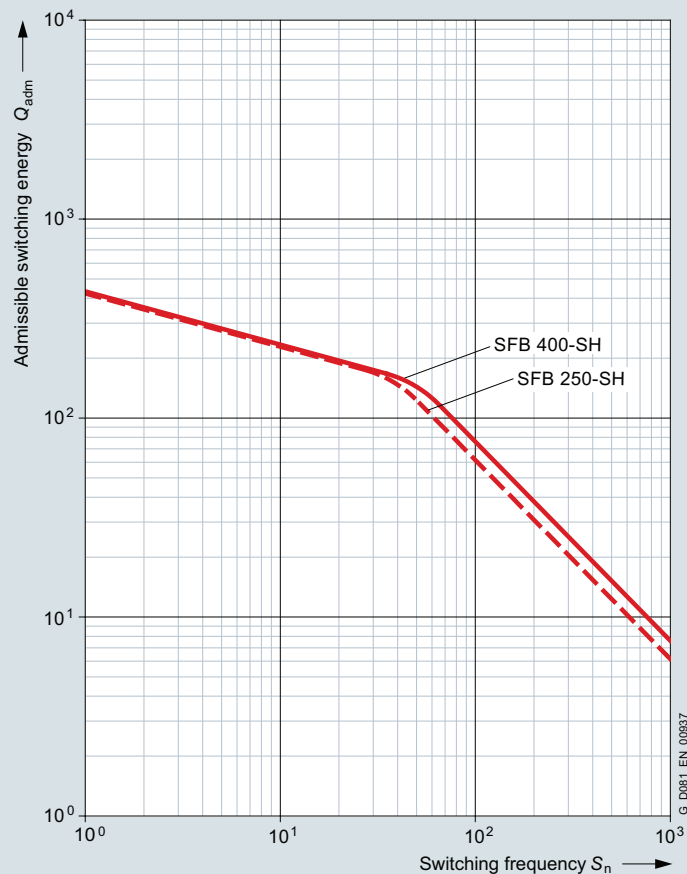
For 24 V DC brakes, the brake terminals are directly connected to the DC voltage source.

For this purpose, see the circuit diagrams on page 1/81.

Maximum admissible speeds

The maximum admissible speeds from which emergency stops can be made are listed in the next table. These speeds should be considered as guide values and must be checked for the specific operating conditions.

The maximum admissible friction energy depends on the switching frequency and is shown for the individual brakes in the following diagram. Increased wear can be expected when the brakes are used for emergency stops.



Overview (continued)

Overview of brake selection for 1LE5 motors		For motor frame sizes	
		315	355
No. of poles		4 to 8	4 to 8
Flanged end shield NDE brake installation		FF500 (A550) ¹⁾	FF600 (A660) ²⁾
Max. diameter of 2nd shaft extension		75 _{m6}	90 _{m6}
Brake type		SFB 250-SH	SFB 400-SH
Braking torque	Nm	2970	4680
Nominal dynamic braking torque according to VDE 0580	Nm/rpm	3300/54	5200/47
Dynamic braking torque ³⁾	at 750 rpm	Nm	2400
	at 1000 rpm	Nm	2200
	at 1500 rpm	Nm	1850
	at n_{max}	Nm	1580
Maximum speed n_{max} – IM B3/V1	rpm	2800	2500
Power at 110 V DC	W	495	553
Power at 230 V AC (207 V DC coil voltage)	W	511	–
Current at 110 V DC	A	4.5	5.03
Current at 230 V AC (207 V DC coil voltage)	A	2.47	–
Current at 400 V AC (180 V DC coil voltage)	A	2.98	3.36
Current at 24 V DC	A	19.93	–
Weight, approx.	kg	306	357
Application time t_1	ms	640	700
Release time t_2	ms	690	1100
Brake moment of inertia	kgm ²	0.14	0.325
Minimum air gap	mm	0.4	0.4
Maximum air gap	mm	2.5	2.5

¹⁾ External dimension increases to 560 mm.

²⁾ External dimension decreases to 640 mm.

³⁾ The dynamic braking torque also depends on the load data, temperatures in excess of the maximum admissible lining surface temperatures must be avoided.

⁴⁾ Value is guaranteed by the brake manufacturer. In practice, a higher braking torque can be expected. Restrictions are determined at the test station of the brake manufacturer. Information: www.pintschbubbenzer.de

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Overview (continued)

Configuration of motors with brakes

Braking time

The time it takes the motor to come to a standstill comprises two components:

- The application time of the brake t_2
- The braking time t_{Br}

$$t_{Br} = \frac{J \cdot n_{rated}}{9.55 \cdot (T_B \pm T_L)}$$

- t_{Br} Braking time in s
 J Total moment of inertia in kgm^2
 n_{rated} Rated speed of the motor with brake in rpm
 T_B Rated braking torque in Nm
 T_L Average load torque in Nm (If T_L supports the braking operation, T_L is positive)

Braking energy per braking operation Q_{adm}

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

$$Q_{adm} = Q_{Kin} + Q$$

- The energy of the moments of inertia in Nm

$$Q_{Kin} = \frac{J \cdot n_{rated}^2}{182.4}$$

- n_{rated} Rated speed before braking in rpm
 J Total moment of inertia in kgm^2 . The mass moment of inertia J specified in the formula corresponds to the total moment of inertia of all braked masses referred to the motor/brake speed.

- Braking energy on emergency trip

The braking energy for occasional emergency trips must be checked to ensure that it does not cause the brake to overheat. Please refer to table "Technical specifications of brakes" for admissible values. The braking energy produced for traversing gear can be calculated approximately with the following equation:

$$Q = \frac{J_{tot} \cdot n_{Br}^2}{182.4 \cdot 10^3} \cdot \frac{T_{Br}}{T_{Br} \pm T_L}$$

- Q Energy capability/braking energy in kJ
 T_{Br} Braking torque in Nm
 T_L Total of all load torques in Nm referred to the brake (motor) shaft
 n_{Br} Speed of brake (motor) shaft in rpm
 J_{tot} Total moment of inertia to be braked in kgm^2 reduced to the brake (motor) shaft
 T_L is positive if it supports braking (e.g. hoisting a load)
 T_L is negative if it counteracts braking (e.g. lowering a load)

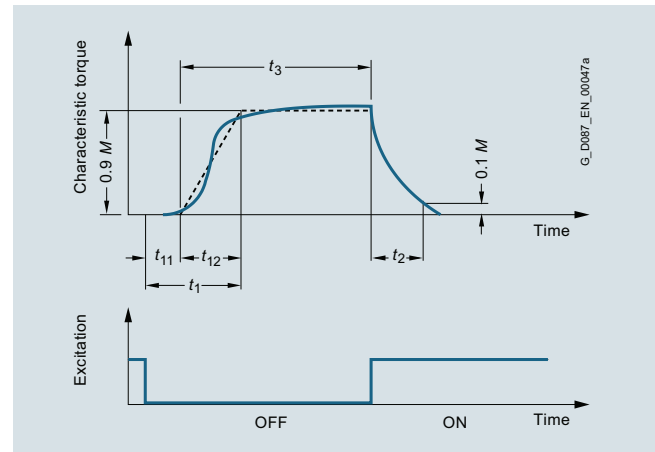
The total moment of inertia J_{tot} is the sum of the individual moments of inertia of the system components to be braked, reduced to the brake (motor) shaft, and the moments of inertia of the linear-motion masses. The equivalent mass inertia J_{Eqv} of a linear-motion mass m with velocity v , referred to the brake (motor) speed n_{Br} , is calculated as follows:

$$J_{Eqv} = 91.2 \cdot m \cdot \left(\frac{v}{n_{Br}}\right)^2$$

- m Mass of the linear-motion load in kg
 v Velocity of the linear-motion load in m/s
 n_{Br} Speed of brake (motor) shaft in rpm

The velocity and/or speed to be entered here must equal the maximum values in normal operation. An increase in velocity resulting from wind forces may also need to be taken into account.

Definition of switching times (VDI 2241)



Brake switching times

Switching times:

- t_1 Brake application time
 t_2 Disconnection time
 t_3 Slip time
 t_{11} Response delay
 t_{12} Rise time

Run-on revolutions U

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

$$U = \frac{n_{rated}}{60} \left(t_1 + \frac{t_{Br}}{2} \right)$$

- t_1 Brake application time in ms

Lifetime of the brake lining L and readjustment of the air gap

The brake lining wears due to friction which increases the air gap and the release time for the brake at standard excitation.

In order to calculate the lifetime of the brake lining in terms of operations S_{max} , the lifetime of the brake lining L in Nm must be divided by the braking energy Q_{adm} :

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

The interval between adjustments N can be calculated in terms of operations by dividing the braking energy L_N that the brake can output until it is necessary to readjust the working air gap by Q_{adm} :

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

Overview (continued)**FDX spring-operated brake****Motor series**

This brake is provided for 1LE1 motors in frame sizes 225 to 315.

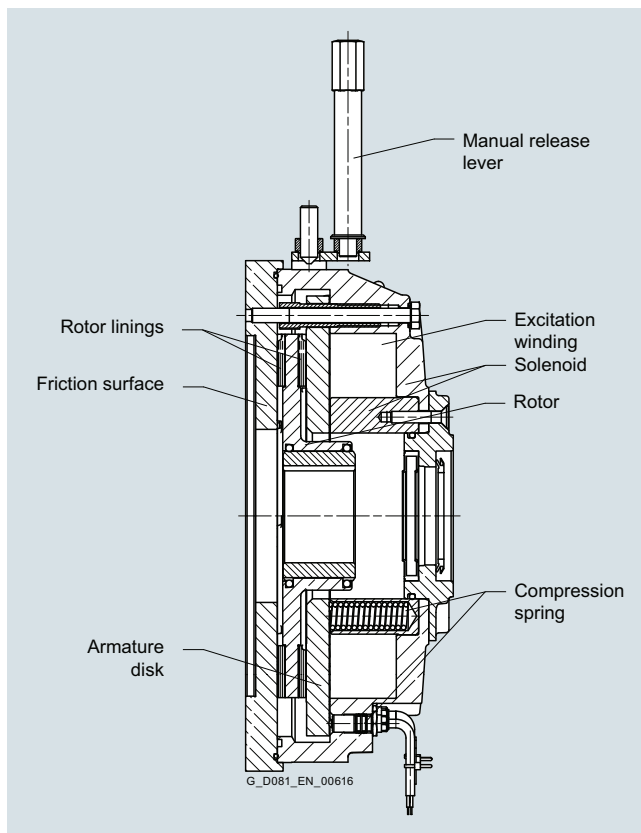
Mode of operation of FDX spring-operated brake (holding brake/operating brake)

The FDX solenoid spring-operated brakes (order code **F04**), with IP67 degree of protection, are quiescent current brakes, meaning that the braking torque is produced by spring force and increased by magnetic force in normal operation.

During the braking operation, the built-in compression springs apply pressure to the rotor that interlocks radially with the machine shaft using the axially moving armature disk. In turn, this applies pressure to the opposing side against the friction surface (→ motor label). The braking torque is produced from the linings of the rotor and the armature disk/friction surface being in contact.

During the brake release process, a magnetic force is produced by applying a direct current via the excitation winding in the solenoid. The armature disk is thereby pulled from the solenoid and the rotor is released.

During the manual brake release process (only available for the brake version with manual brake release), the armature disk is pressed mechanically against the solenoid by operating the manual release lever. The brake can therefore still be released in the event of a power failure, for example.

**Voltage and frequency**

The solenoids and the brake rectifier are designed for connection to the following voltages or can be supplied for the following voltages:

- Brake supply voltage 230 V AC
Order code **F11**
- Brake supply voltage 400 V AC
Order code **F12**

When 60 Hz is used, the voltage for the brake must not be increased!

Order codes **F11** and **F12** may only be used in conjunction with order code **F04**.

Connection

Labeled terminals are provided in the main terminal box of the motor 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 by 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 rectifiers are protected against overvoltages by varistors in the input and output circuits. The function and wear can be monitored with microswitches and proximity switches. Micro-switch On/Off is standard for 1LE1 motors. Anti-condensation heating is possible as an option.

Mechanical manual brake release with lever

The brake can be supplied with a mechanical manual release with lever.

Order code **F50**

The dimensions of the brake lever depend on the motor frame size and can be read from the dimensional drawing generator for motors in the DT Configurator tool for low-voltage motors.

Lifetime

The amount of frictional energy that can be transferred before the rotor must be replaced depends on various factors:

- Mass to be decelerated
- Switching frequency
- Speed
- Resulting temperature on the friction surfaces

As a result, only guide values can be specified for the frictional energy to be transferred until rotor replacement.

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Overview (continued)

Abbreviations and definitions used (with their units):

T_{LR} = Motor starting torque (Nm)

T_b = Braking torque (Nm)

T_{breq} = Required braking torque (Nm)

$T_{b, rated}$ = Rated torque of the spring-operated brake (Nm)

T_L = Load torque (Nm)

T_{tot} = Total torque (Nm)

F = Force (N)

r = Lever arm (m)

n = Speed (rpm)

K = Safety factor $K \geq 2$

P = Power (kW)

t = Overall braking time (ms)

t_{st} = Startup time (s)

t_B = Braking time (s)

t_2 = Disconnection time (ms)

t_1 = Application time (ms)

t_{11} = Response delay (ms)

P_R = Frictional power (J/s)

W_R = Friction energy (J)

S = Switching cycles (brake operations) per second (Hz)

J_E = Internal moment of inertia (kgm²)

J_{add} = Additional moment of inertia (kgm²)

$J_{2,3..}$ = Moment of inertia (kgm²)

J_{tot} = Total moment of inertia (kgm²)

n_1 = Motor speed (rpm)

$n_{2,3..}$ = Speeds (rpm)

Multiple moments of inertia with different speeds are converted into a moment of inertia relative to the motor shaft:

$$J_{add} = \frac{J_2 \cdot n_2^2 + J_3 \cdot n_3^2 \dots}{n_1^2} \quad (\text{kgm}^2)$$

Torque

A spring-operated brake is designed mainly in accordance with the required braking torque T_{breq} . If the moment of inertia, speed, and admissible braking time of the machine are known, the braking torque of the spring-operated brake can be calculated. If the masses that are to be decelerated by the spring-operated brake are running at a different speed from the shaft decelerated by the spring-operated brake, the moment of inertia of these masses (J_{add}) must be calculated relative to this shaft (see above). In addition, the moment of inertia of the rotor-hub system (J_E) must be taken into account.

Load torque (static loading)

Torque which is present when the system is at a standstill and must be held by the brake. The loading force is converted into the load torque via the relevant lever arm

$$T_L = F \cdot r \quad (\text{Nm})$$

Braking torque (dynamic loading)

A purely dynamic load is present when flywheels, rollers, etc., are to be delayed and the static load torque is negligibly small.

The required braking torque is calculated as follows:

$$T_b = 1.046 \cdot 10^2 \cdot J_{tot} \cdot \frac{n}{t - t_1} \quad (\text{Nm})$$

$$T_{breq} = T_b \cdot K \leq T_{b, rated} \quad (\text{Nm})$$

Dynamic and static loading

Most applications involve dynamic loading as well as static load torque:

$$T_{breq} = (T_b \pm T_L) \cdot K \quad (\text{Nm})$$

$$T_{breq} = (1.046 \cdot 10^2 \cdot J_{tot} \cdot \frac{n}{t - t_1} \pm T_L) \cdot K \quad (\text{Nm})$$

$$T_{breq} \leq T_{b, rated} \quad (\text{Nm})$$

Sign for T_L :

+ T_L = Load torque is applying force (in the direction of motion)

- T_L = Load torque is applying a decelerating force (opposite to the direction of motion)

If both cases occur, the specific configuration is always adapted to the larger torque.

Approximate determination of T_{breq}

If the moment of inertia is not known and if the input power has been defined, the required braking torque is determined as follows:

$$T_{breq} = 9.55 \cdot 10^3 \cdot \frac{P}{n} \cdot K \leq T_{b, rated} \quad (\text{Nm})$$

$K \geq 2$

Braking time

General

$$t = 1.046 \cdot 10^2 \cdot J_{tot} \cdot \frac{n}{T_{b, rated} \pm T_L} + t_1 \quad (\text{ms})$$

Sign for T_L :

- T_L = Load torque is applying force (in the direction of motion)

+ T_L = Load torque is applying a decelerating force (opposite to the direction of motion)

Calculation of the starting and braking time for motors

Startup time for motors with brakes

$$t_{st} = J_{tot} \cdot \frac{n_1}{9.55 \cdot (T_{LR} \pm T_L)} + \frac{t_2}{1000} \quad (\text{s})$$

$$J_{tot} = J_E + J_{add} \quad (\text{kgm}^2)$$

Sign for T_L :

+ T_L = Load torque is applying force (in the direction of motion)

- T_L = Load torque is applying a decelerating force (opposite to the direction of motion)

Overview (continued)**Braking time for motors with brakes**

$$t_B = J_{\text{tot}} \cdot \frac{n_1}{9.55 \cdot (T_{b, \text{rated}} \pm T_L)} + \frac{t_1}{1000} \quad (\text{s})$$

Sign for T_L :

- T_L = Load torque is applying force (in the direction of motion)
- + T_L = Load torque is applying a decelerating force (opposite to the direction of motion)

Thermal load

When braking, friction energy is applied during the slip phase, which releases thermal energy.

Friction energy per braking operation

$$W_R = J_{\text{tot}} \cdot n^2 \cdot \frac{T_{b, \text{rated}}}{182.5 \cdot (T_{b, \text{rated}} \pm T_L)} \quad (\text{J})$$

Sign for T_L :

- T_L = Load torque is applying force (in the direction of motion)
- + T_L = Load torque is applying a decelerating force (opposite to the direction of motion)

The friction energy per braking operation must be no greater than the admissible value $W_{R\text{max}}$

$$W_R \leq W_{R\text{max}} \quad (\text{J})$$

Frictional power

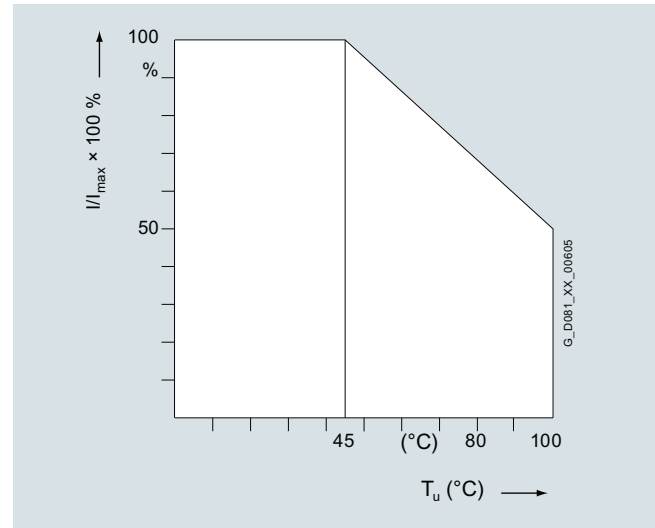
$$P_R = W_R \cdot S \quad (\text{J/s})$$

The friction energy must be no greater than the admissible value $P_{R\text{max}}$

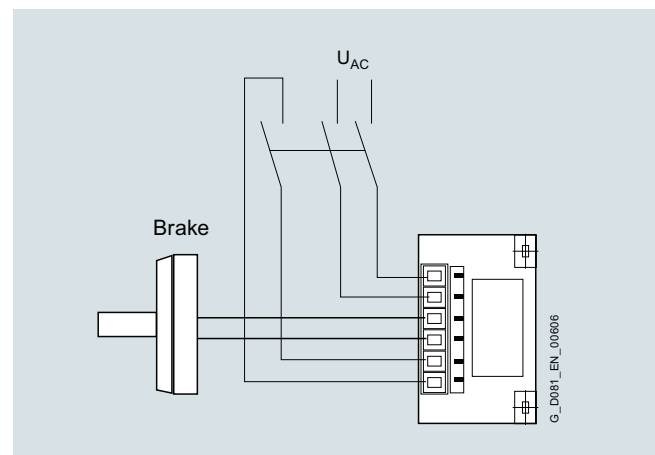
$$P_R \leq P_{R\text{max}} \quad (\text{J/s})$$

Connection

Load rating of the rectifier diodes as a function of the ambient temperature:



Block diagram:



The high-speed rectifier performs the following functions:

- The coil is first supplied with a voltage $U_2 = 0.9 \times U_1$: Over-excitation of the brake
- After excitation time t_1 the voltage is reduced to $U_3 = 0.45 \times U_1$: Non-release voltage of the brake

Designation	Supply voltage (V AC)	Output voltage (V DC)		Ambient temperature
Article No.:	U_1 at 50/60 Hz	U_2	U_3	°C
PMG 480	215 ... 500	$0.9 \times U_1$	$0.45 \times U_1$	-15 ... +80

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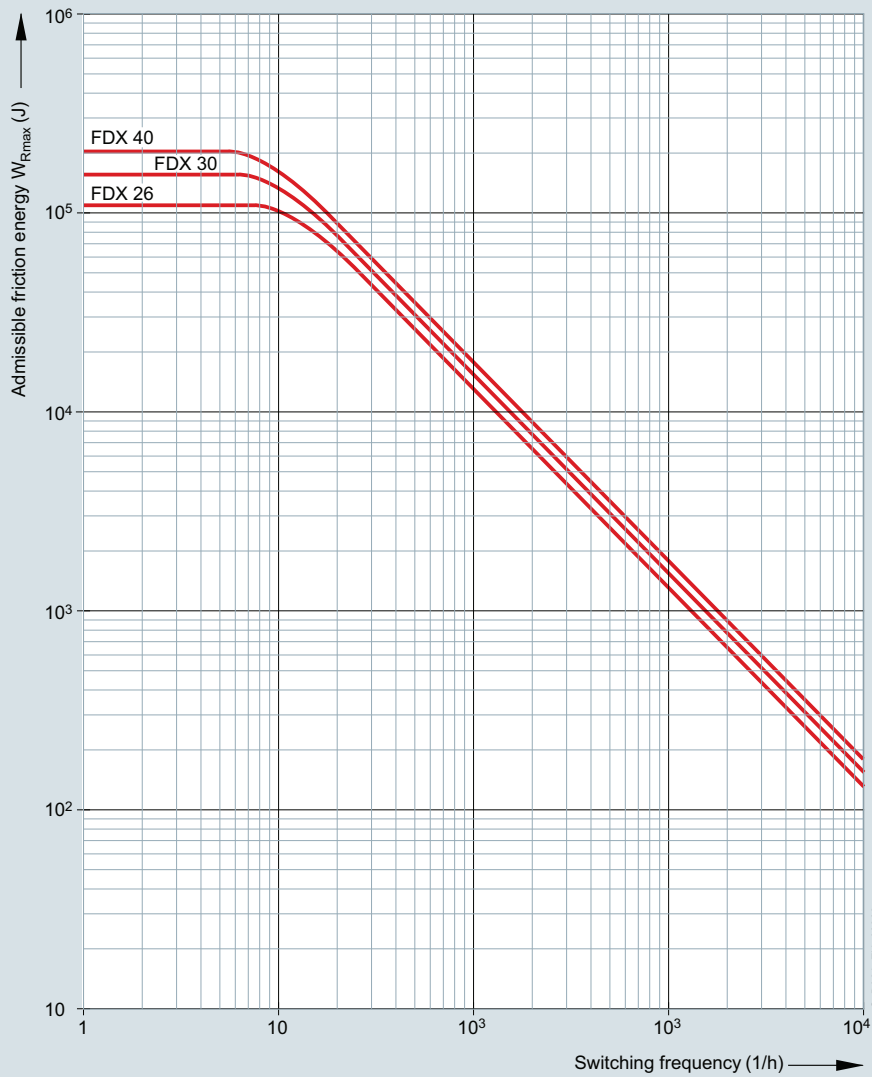
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Overview (continued)

Maximum admissible speeds

The maximum admissible speeds from which emergency stops can be made are listed in the next table. These speeds should be considered as guide values and must be checked for the specific operating conditions.

The maximum admissible friction energy depends on the switching frequency and is shown for the individual brakes in the following diagram. Increased wear can be expected when the brakes are used for emergency stops.



G_D081_EN_00602

Overview (continued)

Overview of brake selection for 1LE1 motors (option F04)		For motor frame sizes			
		225	250	280	315
No. of poles		2 to 8	2 to 8	2 to 8	2 to 8
Flange bearing plate for brake mounting on the NDE side		A350	A400	A450	A535
Max. diameter for the second shaft extensions		55m6	48m6	65m6	48m6
Brake type		FDX 30	FDX 30	FDX 40	FDX 40
Static braking torque	Nm	450	567	900	1440 ¹⁾
Dynamic rated braking torque acc. to DIN VDE 0580	Nm/rpm	500/88	630/88	1000/65	1600 ¹⁾ /65
	at 750 rpm	Nm	480	600	800
	at 1000 rpm	Nm	460	580	740
	at 1500 rpm	Nm	460	580	740
	at 3000 rpm	Nm	380	480	600
Admissible speed n_{max}	rpm	3000 ²⁾ /6000 ³⁾	3000 ²⁾ /6000 ³⁾	3000 ²⁾ /6000 ³⁾	3000 ²⁾ /6000 ³⁾
Power at 180 V DC	W	880/220	880/220	1080/270	1080/270
Power at 103 V DC	W	560/140	560/140	560/140	560/140
Rated current at 230 V AC (103 V DC coil voltage)	A	2.72/1.36	2.72/1.36	2.72/1.36	2.72/1.36
Rated current at 400 V AC (180 V DC coil voltage)	A	2.44/1.22	2.44/1.22	3/1.5	3/1.5
Weight, approx.	kg	45	45	80	80
Closing time t_1 (switching on the DC side)	ms	60	60	160	160
Release time t_2 (switching on the DC side)	ms	140	140	320	320
Brake moment of inertia	kgm ²	0.0195	0.0195	0.0445	0.0445
Lifetime L of brake lining	Nm · 10 ⁶	3700	3700	4900	4900

1) Limit: ON time S3 -50 %

2) Operating brake

3) Holding brake

Introduction

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Overview (continued)

1XP8 012 rotary pulse encoder

The rotary pulse encoder can be supplied already mounted in an HTL version as **1XP8 012-10** with order code **G01** or in a TTL version as **1XP8 012-20** with order code **G02**. In combination with the separately driven fan, rotary pulse encoders are supplied with a plug connector externally. The rotary pulse encoder can only be mounted on a standard non-drive end (NDE), i.e. a second shaft extension cannot be supplied.

The encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only" order code **G40** or the option "Prepared for mountings with shaft D12" order code **G41** must be specified (see "Mechanical version and degrees of protection" on page 1/79).

Attaching the rotary encoder increases the length of the motor by dimension Δl . For an explanation of the additional dimensions and weights, see "Special technology" "Dimensions and weights" from page 1/106. The rotary pulse encoders of "Modular technology" and "Special technology" are fitted as standard with a protective cover made of non-corrosive sheet steel.

Mounting of encoder for temperatures below -20 °C and higher than $+40\text{ °C}$ available on request.

Technical specifications of rotary pulse encoders	1XP8 012-10 (HTL version)	1XP8 012-20 (TTL version)
Supply voltage U_B	+10 V to +30 V	5 V $\pm 10\%$
Current input without load	150 mA	120 mA
Admissible load current per output	max. 100 mA	max. 20 mA
Pulses per revolution	1024	1024
Outputs	2 square-wave pulses A, B – 2 inverted square-wave pulses A, B Zero pulse and inverted zero pulse	2 square-wave pulses A, B – 2 inverted square-wave pulses A, B Zero pulse and inverted zero pulse
Pulse offset between the two outputs	90°	90°
Output amplitude	$U_{\text{High}} = U_B - 2.5\text{ V}$ $U_{\text{Low}} = 1.6\text{ V}$	$U_{\text{High}} > 2.5\text{ V}$ $U_{\text{Low}} < 0.5\text{ V}$
Edge interval	$\geq 0.43\text{ }\mu\text{s}$	$\geq 0.43\text{ }\mu\text{s}$
Sampling rate	$\leq 300\text{ kHz}$	$\leq 300\text{ kHz}$
Maximum speed	6000 rpm	6000 rpm
Transport/storage temperature range	$-30\text{ to }+80\text{ °C}$	$-30\text{ to }+80\text{ °C}$
Operating temperature range flange socket or fixed cable	$-40\text{ to }+100\text{ °C}$	$-40\text{ to }+100\text{ °C}$
Operating temperature range flexible cable	$-10\text{ to }+100\text{ °C}$	$-10\text{ to }+100\text{ °C}$
Degree of protection	IP66	IP66
Maximum admissible radial cantilever force	60 N	60 N
Maximum admissible axial force	40 N	40 N
Connection system	12-pin connector (mating connector is supplied)	
Certifications	CSA, UL	CSA, UL
Weight	0.3 kg	0.3 kg

Overview

"Special technology" comprises rotary pulse encoders of 1LE1 motors (with the exception of 1LE1 with order code **F90** – version "Forced-air cooled motors without external fan and fan cover" and 1PC1).

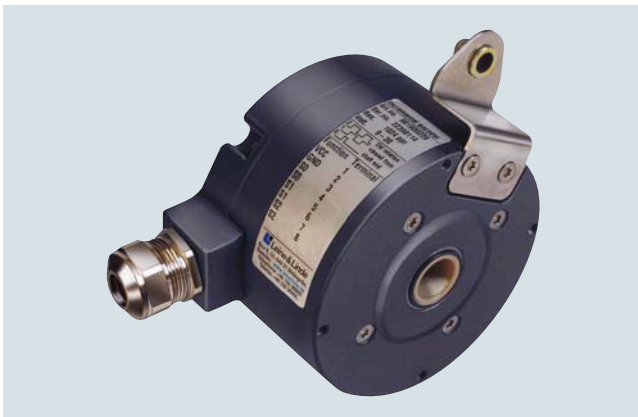
1LE1 motors with order codes **F70** (mounting of separately driven fan), **F01** (mounting of holding brake (standard arrangement)) and **F01 + F70** (mounting of brake and separately driven fan) from the modular mounting concept can be combined with rotary pulse encoders LL 861 900 220, HOG 9 DN 1024 I and HOG 10 D 1024 I from the "Special technology" range.

The length of the motor increases by Δl when the rotary pulse encoder is mounted. For an explanation of the additional dimensions and weights, please refer to "Mounting technology", "Dimensions and weights" from page 1/106.

The rotary pulse encoders of "Modular technology" and "Special technology" are fitted as standard with a protective cover made of non-corrosive sheet steel.

For mounting of rotary pulse encoders with order codes **G01** and **G02** for frame sizes 80 to 315, a protective cover is supplied as standard, with order codes **G04**, **G05**, and **G06** up to frame size 200.

LL 861 900 220 rotary pulse encoder



With its rugged construction, this rotary pulse encoder is also suitable for difficult operating environments. It is resistant to shock and vibration and has insulated bearings.

The LL 861 900 220 rotary pulse encoder can be supplied already mounted.

Order code **G04**

*The LL 861 900 220 rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/79). The rotary pulse encoder is not part of the scope of supply in this case.*

The version of the rotary pulse encoder with a diagnostics system (ADS) can be supplied by Leine and Linde.

Manufacturer:
Leine und Linde AG
Olivehällsvägen 8
SE-64542 Strängnäs
Phone +46 152 265 00
Fax +46 152 265 05

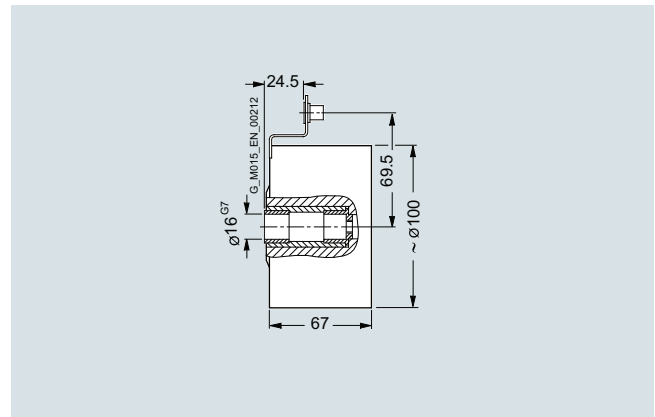
www.leinelinde.com
Email: info@leinelinde.se

For frame size 180 and above, a protective cover is not supplied as standard when rotary pulse encoders are mounted for order codes **G04**, **G05**, **G06**, **G07** and **G08**.

For mounting of rotary pulse encoders with order codes **G01**, **G02**, **G11**, **G12** + **F70** (mounting of separately driven fan): The cable end is connected to a connector that is located outside the fan cover. The fan cover does not have to be removed to connect the rotary pulse encoder. The rotary pulse encoder can be connected to the main terminal box or an auxiliary terminal box where necessary.

For mounting of rotary pulse encoders with order codes **G04**, **G05**, **G06** + **F70** (mounting of separately driven fan):

- Up to frame size 200, the fan cover has to be removed to connect the rotary pulse encoder. The rotary pulse encoder can also be connected to the main terminal box or an auxiliary terminal box where necessary.
- As of frame size 225, the fan cover does not have to be removed to connect the rotary pulse encoder. The rotary pulse encoder can be connected to the main terminal box and can be connected to the auxiliary terminal box where necessary.



Mounting dimensions of LL 861 900 220 rotary pulse encoder

Technical specifications for LL 861 900 220 (HTL version)

Mounting of encoder for temperatures below -20 °C and higher than $+40\text{ °C}$ available on request.

Supply voltage U_B	+9 V to +30 V
Current input without load	max. 80 mA
Admissible load current per output	40 mA
Pulses per revolution	1024
Outputs	6 short-circuit proof square-wave pulses A, A', B, B', 0, 0'
Pulse offset between the two outputs	$90^\circ \pm 25^\circ$ el.
Output amplitude	$U_{\text{High}} > 20\text{ V}$ $U_{\text{Low}} < 2.5\text{ V}$
Mark space ratio	1:1 $\pm 10\%$
Edge steepness	50 V/ μs (without load)
Maximum frequency	100 kHz for 350 m cable
Maximum speed	4000 rpm
Temperature range	-20 to $+80\text{ °C}$
Degree of protection	IP65
Maximum adm. radial cantilever force	300 N
Maximum adm. axial force	100 N
Connection system	Terminal strips in encoder cable connection M20 \times 1.5 radial
Weight	approx. 1.3 kg

Introduction

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Overview (continued)

HOG 9 DN 1024 I rotary pulse encoder



The encoder is fitted with insulated bearings.

The HOG 9 DN 1024 I rotary pulse encoder can be supplied already mounted.

Order code **G05**

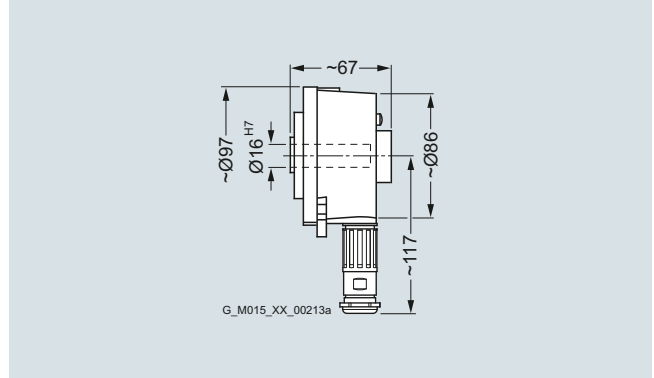
The HOG 9 DN 1024 I rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/79). The rotary pulse encoder is not part of the scope of supply in this case.

Manufacturer:

Baumer Hübner GmbH
Max-Dohrn-Str. 2+4
10589 Berlin, Germany
Phone +49 (30) 69003-0
Fax +49 (30) 69003-104

www.baumerhuebner.com

Email: info@baumerhuebner.com



Mounting dimensions of HOG 9 DN 1024 I rotary pulse encoder

Technical specifications for HOG 9 DN 1024 I (HTL version)

Mounting of encoder for temperatures below -20 °C and higher than $+40\text{ °C}$ available on request.

Supply voltage U_B	+9 V to +30 V
Current input without load	50 to 100 mA
Admissible load current per output	150 mA, 800 mA peak
Pulses per revolution	1024
Outputs	6 short-circuit-proof square-wave pulses A+, A-, B+, B-, R+, R-
Pulse offset between the two outputs	$90^\circ \pm 20\%$
Output amplitude	$U_{\text{High}} \geq U_B - 3.5\text{ V}$ $U_{\text{Low}} \leq 1.5\text{ V}$
Mark space ratio	1:1 $\pm 20\%$
Edge steepness	10 V/ μs
Maximum frequency	120 kHz
Maximum speed	7000 rpm
Temperature range	-30 to $+100\text{ °C}$
Degree of protection	IP56
Maximum adm. radial cantilever force	500 N
Maximum adm. axial force	400 N
Connection system	M23 flange socket, radial (mating connector is part of the scope of supply)
Mech. version acc. to Baumer Hübner Ident. No.	73 522 B
Weight	approx. 0.9 kg

Overview (continued)

POG 9 rotary pulse encoder



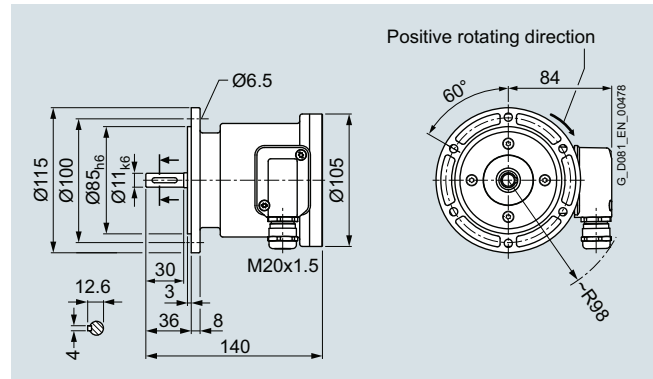
The POG 9 rotary pulse encoder can be supplied already mounted.

Order code **G08**

The POG 9 rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/79). The rotary pulse encoder is not part of the scope of supply in this case.

Manufacturer:
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Max-Dohrn-Str. 2+4
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Fax +49 (30) 69003-104

www.baumerhuebner.com
Email: info@baumerhuebner.com



Mounting dimensions of POG 9 rotary pulse encoder

Technical specifications for POG 9

Mounting of encoder for temperatures below -20 °C and higher than $+40\text{ °C}$ available on request.

Supply voltage U_B	+9 V to +30 V	+5 V $\pm 5\%$
Current input without load	< 100 mA	
Admissible load current per output	60 mA average 300 mA peak	25 mA average 75 mA peak
Pulses per revolution	300 ... 2500	
Output amplitude	$U_{High} \geq U_B - 3.5\text{ V}$ $U_{Low} \leq 1.5\text{ V}$	$U_{High} \geq 2.5\text{ V}$ $U_{Low} \leq 0.5\text{ V}$
Mark space ratio	1:1 $\pm 20\%$	
Operating speed	$\leq 12000\text{ rpm}$	
Switching rate	120 kHz	
Temperature range	$-30\text{ to }+100\text{ °C}$	
Degree of protection	IP56	
Maximum adm. radial cantilever force	150 N	
Maximum adm. axial force	80 N	
Connection system	Terminal box	
Weight	approx. 1.4 kg	

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Overview (continued)

POG 10 rotary pulse encoder



The POG 10 rotary pulse encoder can be supplied already mounted.

Order code **G07**

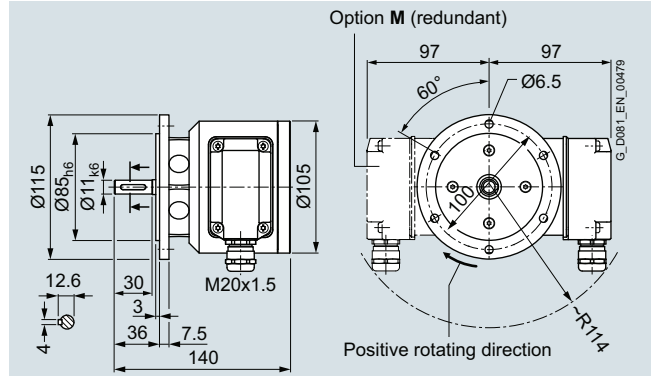
The POG 10 rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/79). The rotary pulse encoder is not part of the scope of supply in this case.

Manufacturer:

Baumer Hübner GmbH
 Max-Döhrn-Str. 2+4
 10589 Berlin, Germany
 Phone +49 (30) 69003-0
 Fax +49 (30) 69003-104

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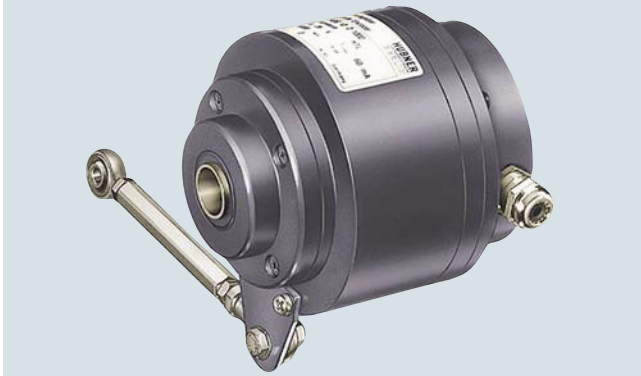


Mounting dimensions of POG 10 rotary pulse encoder

Technical specifications for POG 10

Mounting of encoder for temperatures below -20°C and higher than $+40^{\circ}\text{C}$ available on request.

Supply voltage U_B	+9 V to +30 V	
Current input without load	< 100 mA	
Admissible load current per output	60 mA average 300 mA peak	25 mA average 75 mA peak
Pulses per revolution	300 ... 2500	
Mark space ratio	40:60 ... 60:40	
Operating speed	≤ 12000 rpm	
Switching rate	120 kHz	
Temperature range	-40 to $+100^{\circ}\text{C}$	
Degree of protection	IP66	
Maximum adm. radial cantilever force	≤ 450 N	
Maximum adm. axial force	≤ 300 N	
Connection system	Terminal box	
Weight	approx. 1.9 kg	

Overview (continued)**HOG 10 D 1024 I rotary pulse encoder**

This encoder is extremely rugged and is therefore suitable for difficult operating conditions. It is fitted with insulated bearings.

The HOG 10 D 1024 I rotary pulse encoder can be supplied already mounted.

Order code **G06**

The HOG 10 D 1024 I rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/79). The rotary pulse encoder is not part of the scope of supply in this case. The letters FSL and ESL stand for the following terms:

FSL: (mechanical) centrifugal switch

ESL: electronic speed switch

Both switch types are suitable for tripping the motor when a critical limit speed is reached, or for accelerating the motor along a control ramp into the permissible speed range again, or for shutting down the motor completely (depending on the customer application).

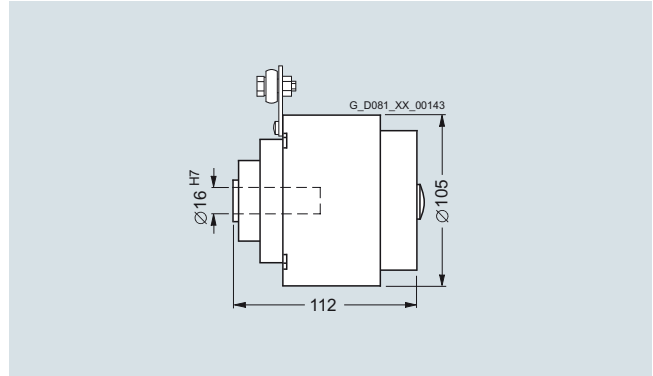
The electronic speed switch is particularly suitable for converter operation.

The critical limit rotational speed to be monitored for the customer's application must be specified in the order.

Further settings might also be necessary. These settings will be made at the Baumer & Hübner factory according to customer specifications.

Manufacturer:
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Max-Dohrn-Str. 2+4
10589 Berlin, Germany
Phone +49 (30) 69003-0
Fax +49 (30) 69003-104

www.baumerhuebner.com
Email: info@baumerhuebner.com



Mounting dimensions of HOG 10 D 1024 I rotary pulse encoder

Technical specifications for HOG 10 D 1024 I (HTL version)

Mounting of encoder for temperatures below -20 °C and higher than $+40\text{ °C}$ available on request.

Supply voltage U_B	+9 V to +30 V
Current input without load	approx. 100 mA
Admissible load current per output	600 mA, 300 mA peak
Pulses per revolution	1024
Outputs	4 short-circuit proof square-wave pulses A, B and A', B'
Pulse offset between the two outputs	$90\text{ °} \pm 20\text{ %}$
Output amplitude	$U_{\text{High}} \geq U_B - 3.5\text{ V}$ $U_{\text{Low}} \leq 1.5\text{ V}$
Mark space ratio	1:1 $\pm 20\text{ %}$
Edge steepness	10 V/ μs
Maximum frequency	120 kHz
Maximum speed	7000 rpm
Temperature range	$-40\text{ to }+100\text{ °C}$
Degree of protection	IP66
Maximum adm. radial cantilever force	150 N
Maximum adm. axial force	80 N
Connection system	Terminals, cable connection M20 \times 1.5
Mech. version acc. to Baumer Hübner Ident. No.	74 055 B
Weight	approx. 1.6 kg

Introduction

Mounting technology

Special technology

Overview (continued)

Sendix 5020 rotary pulse encoder



The Sendix 5020 rotary pulse encoder can be ordered completely assembled as an HTL version with order code **G11** or as a TTL version with order code **G12**.

Features of the **G11** and **G12** encoders:

- Use of insulation to avoid surge currents
- Safety-lock technology for high resistance to vibrations, shaft loads, and installation errors
- Cable lengths available up to 300 m

In combination with a separately driven fan, the rotary pulse encoders are supplied with an external plug connection. The rotary pulse encoder can only be attached to a standard NDE shaft extension, meaning that a second shaft extension will not be available.

*The encoder can be retrofitted. When the motor is ordered, the option "Prepared for mountings, center hole only" order code **G40** or the option "Prepared for mountings with D12 shaft" order code **G41** must be specified.*

The dimensions of the motor are increased by ΔI by mounting the rotary pulse encoder. The "Modular technology" and "Special technology" rotary pulse encoders are fitted with a protective cover made from corrosion-resistant sheet metal as standard. Mounted encoders for temperatures below -20 °C and above $+40\text{ °C}$ are available on request.

Technical specifications for Sendix 5020 (HTL/TTL version)

	Sendix 5020 (HTL version)	Sendix 5020 (TTL version)
Supply voltage	10 ... 30 V DC	5 V DC $\pm 5\%$
Energy consumption with inverted signal (no-load operation)	max. 100 mA	max. 90 mA
Admissible load/channel	max. ± 40 mA	max. ± 20 mA
Pulses per revolution	1024 (2048; 512)	
Outputs	2 square-wave pulses A, B – 2 inverted square-wave pulses A, B	
Pulse offset between the two outputs	90°	
Signal level	$U_{\text{High}} = \text{min. } U_{\text{B}} - 1\text{ V}$ $U_{\text{High}} = \text{min. } 2.5\text{ V}$ $U_{\text{Low}} = \text{max. } 0.5\text{ V}$	
Edge rise time t_r	max. 1 μs	max. 200 μs
Edge fall time t_f	max. 1 μs	max. 200 μs
Pulse frequency	max. 300 kHz	
Maximum speed	12000 rpm/6000 rpm (continuous)	
Working temperature range	$-40^{1)}$... $+100\text{ °C}$	
Degree of protection acc. to EN 60529	IP65	
Maximum admissible radial cantilever force	100 N	
Maximum admissible axial force	50 N	
Connection system	12-pin M23 connector (mating connectors are always supplied)	
Certificates	UL, CSA (ATEX on request)	
Weight	0.4 kg	
Explosion protection certificate for explosive areas	Available on request for Zones 2 and 22	
Shock resistance acc. to EN 60068-2-27	3000 m/s ² , 6 ms	
Vibration resistance acc. to EN 60068-2-6	300 m/s ² , 10 ... 2000 Hz	

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Schubertstrasse 47
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Email: info@kuebler.com

¹⁾ With connector: -40 °C , permanently installed cable: -30 °C , moving cable: -20 °C .

Overview (continued)**Backstop, counterclockwise/clockwise motion blocked**

The backstop (order code F40/F41) prevents the motor from moving while in de-energized state against its direction of rotation in the energized state.

The backstop is only available for SIMOTICS SD – 1LE15/1LE16, VSD10, VSD4000 motors.

- Counterclockwise motion blocked: Option **F40**
- Clockwise motion blocked: Option **F41**

Frame size	Order code	
	F40 Δl mm	F41 Δl mm
71	–	–
80	–	–
90	–	–
100	–	–
112	–	–
132	114	114
160	130	130
180	126	126
200	137	137
225	172	172
250	96	96
280	104	104
315	105	105

Protective cover diameter

Frame size	Protective cover for separately driven fan mm	Protective cover mm	Protective cover for encoder			Protective cover for encoder adapter mm	Protective cover mm
			H00 mm	G01/G02 mm	G04 ... G06 mm		
71	140	125	125	–	–	–	
80	157	155	155	–	155	160	
90	177	155	155	–	155	180	
100	210	195	195	195	195	195	
112	249	195	195	195	195	195	
132	300	260	260	260	260	260	
160	338	260	260	260	260	260	
180	340	340	340	340	340	340	
200	338	340	340	340	340	340	
225	470	425	165	250	165	–	
250	470	470	165	250	165	–	
280	525	525	165	250	165	–	
315	590	525	165	250	165	–	

Introduction

Mounting technology

Dimensions and weights of the mountings

1

Overview

Dimensions and weights

Fig. 1 Brake, order codes **F01/F04** [optionally with manual release, order code **F50**]

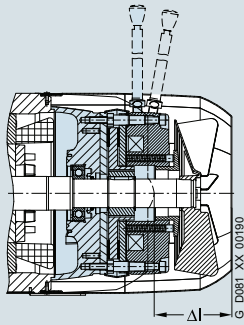
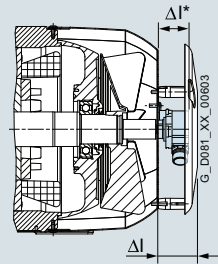


Fig. 2 Rotary pulse encoder (on cover), order code **G01/G02/G04/G05/G06/G11/G12** [**G01, G02, G11, G12** protective cover as standard]



Frame size	Assignment																						
	Fig. 1		Fig. 2																				
	Brake		Rotary pulse encoder including protective cover (G43)																				
Order codes	F01/F04		Order codes		1XP8 012		Order code		LL 861 900 220		Order code		HOG 9 DN 1024 I		Order code		HOG 10 D 1024 I		Order codes		Sendix 5020		
Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.
mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg
1LE1																							
80	60	3.5	68.5	0.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
90	77.5	5.3	68.5	0.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
100	81	5.9	56	0.9	83	1.9	83	1.5	126	2.2	–	–	–	–	–	–	–	–	–	–	–	–	–
112	88	7.8	56	0.8	83	1.9	83	1.5	126	2.2	–	–	–	–	–	–	–	–	–	–	–	–	–
132	114	11.9	60	1.3	87	2.4	87	2	130	2.7	–	–	–	–	–	–	–	–	–	–	–	–	–
160	130	30.7	60	1.5	87	2.7	87	2.3	130	3	–	–	–	–	–	–	–	–	–	–	–	–	–
180	126	28	87	2.1	136.5	2.3	136.5	1.9	136.5	2.6	–	–	–	–	–	–	–	–	–	–	–	–	–
200	137	38	87	2.3	136.5	2.5	136.5	2.1	136.5	2.8	–	–	–	–	–	–	–	–	–	–	–	–	–
225	135/199	63/49	87	0.9	135	2	135	1.6	135	2.3	87	1	–	–	–	–	–	–	–	–	–	–	–
250	225/185	83/54	87	0.9	135	2	135	1.6	135	2.3	87	1	–	–	–	–	–	–	–	–	–	–	–
280	297/192	118/92	87	0.9	135	2	135	1.6	135	2.3	87	1	–	–	–	–	–	–	–	–	–	–	–
315	308/188	256/167	87	0.9	135	2	135	1.6	135	2.3	87	1	–	–	–	–	–	–	–	–	–	–	–
1LE5																							
315	309	355	87	0.9	135	2	135	1.6	135	2.3	87	1	–	–	–	–	–	–	–	–	–	–	–
355	324	425	87	0.9	135	2	135	1.6	135	2.3	87	1	–	–	–	–	–	–	–	–	–	–	–

Frame size	Assignment																		
	Fig. 2																		
	Rotary pulse encoder without protective cover																		
Order codes	1XP8 012		Order code		LL 861 900 220		Order code		HOG 9 DN 1024 I		Order code		HOG 10 D 1024 I		Order codes		Sendix 5020		
Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.
mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg
1LE1																			
225	51	0.3	75	1.3	72	0.9	116	1.6	65	0.4	–	–	–	–	–	–	–	–	–
250	51	0.3	75	1.3	72	0.9	116	1.6	65	0.4	–	–	–	–	–	–	–	–	–
280	51	0.3	75	1.3	72	0.9	116	1.6	65	0.4	–	–	–	–	–	–	–	–	–
315	51	0.3	75	1.3	72	0.9	116	1.6	65	0.4	–	–	–	–	–	–	–	–	–

Overview (continued)

Fig. 3 Brake and rotary pulse encoder (on cover), order codes **F01/F04 + G01/G02/G04/G05/G06/G11/G12** [optionally with manual release, order code **F50**; **G01, G02, G11, G12** protective cover as standard]

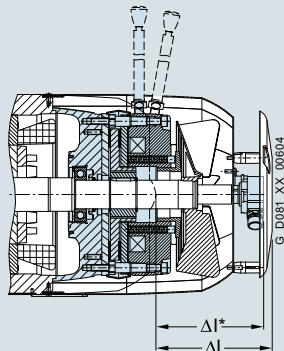
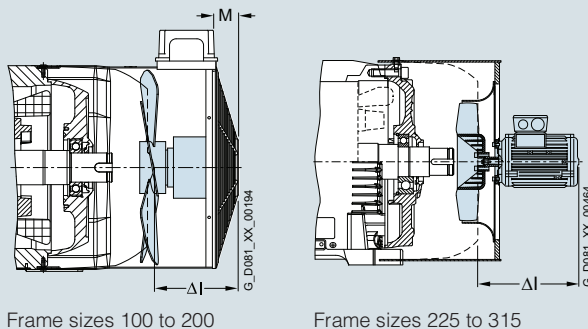


Fig. 4 Separately driven fan, order code **F70**



Frame size	Assignment Fig. 3 Brake and rotary pulse encoder (on cover)										Assignment Fig. 4 Separately driven fan		
	1XP8 012 Order codes F01 + G01/G02		LL 861 900 220 Order codes F01 + G04		HOG9 D 1024 I Order codes F01 + G05		HOG10 D 1024 I Order codes F01 + G06		Sendix 5020 Order codes F01 + G11/G12		F70		
	ΔI	Weight, approx.	ΔI*	Weight, approx.	ΔI*	Weight, approx.	ΔI*	Weight, approx.	ΔI	Weight, approx.	ΔI	M	Weight, approx.
	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	mm	kg
1LE1													
71	–	–	–	–	–	–	–	–	–	–	75	30	1.9
80	128.5	4.2	–	–	–	–	–	–	–	–	88	10	1.9
90	146	6	–	–	–	–	–	–	–	–	104	20	2.5
100	137	6.8	164	7.8	164	7.4	207	8.1	–	–	86.5	30	2.6
112	144	8.6	171	9.7	171	9.3	214	10	–	–	81.5	30	2.9
132	174	13.2	201	14.3	201	13.9	244	14.6	–	–	116	40	3.9
160	190	32.2	217	33.4	217	33	260	33.7	–	–	135.5	40	5.6
180	216	30.1	216	30.3	216	29.9	252	30.6	–	–	257	40	8.3
200	228	40.3	228	40.5	228	40.1	264	40.8	–	–	262	40	9.3
225	186	63.3	210	64.3	207	64.2	251	63.9	186	63.4	221	–	22
250	276	83.3	300	84.3	297	84.2	341	83.9	276	83.4	226	–	25
280	348	118.3	372	119.3	369	119.2	413	118.9	348	118.4	222	–	28
315	359	255.3	383	256.3	380	256.2	424	255.9	359	256.4	236 ¹⁾	–	36 ¹⁾
315	–	–	–	–	–	–	–	–	–	–	276 ²⁾	–	38.8 ²⁾
1LE5													
315 2-pole 4-pole	396	355.9	444	357	444	356.6	444	357.3	396	356	275	–	37.6
											235	–	35.3
355	411	425	459	427	459	426.6	459	427.3	411	426	248	–	27.5

Frame size	Assignment Fig. 3 Brake and rotary pulse encoder (on cover)									
	1XP8 012 Order codes F04 + G01/G02		LL 861 900 220 Order codes F04 + G04		HOG9 D 1024 I Order codes F04 + G05		HOG10 D 1024 I Order codes F04 + G06		Sendix 5020 Order codes F04 + G11/G12	
	ΔI	Weight, approx.	ΔI	Weight, approx.	ΔI	Weight, approx.	ΔI	Weight, approx.	ΔI	Weight, approx.
	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg
1LE1										
225	285.5	49.3	274	50.3	271	49.9	315	50.6	285.5	49.4
250	271.5	54.3	260	55.3	257	54.9	301	55.6	271.5	54.4
280	278.5	92.3	267	93.3	264	92.9	308	93.6	278.5	92.4
315	274.5	167.3	263	168.3	260	167.9	304	168.6	274.5	167.4

1) Valid for 4-pole, 6-pole, and 8-pole motors

2) Valid for 2-pole motors

Introduction

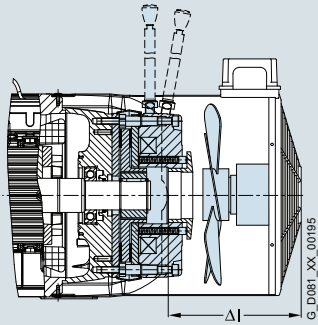
Mounting technology

Dimensions and weights of the mountings

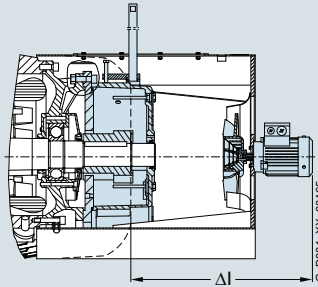
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Overview (continued)

Fig. 5 Brake and separately driven fan, order codes **F01/F04 + F70** [optionally with manual release, order code **F50**]

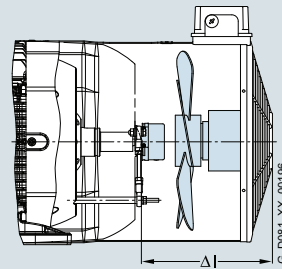


Frame sizes 100 to 200

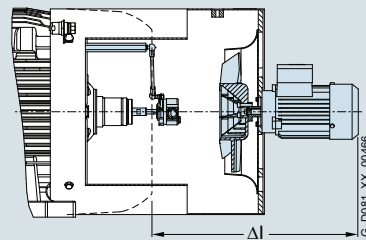


Frame sizes 225 to 355

Fig. 6 Rotary pulse encoder (under cover) and separately driven fan, order codes **F70 + G01/G02/G04/G05/G06/G11/G12**



Frame sizes 100 to 200



Frame sizes 225 to 355

Frame size	Assignment Fig. 5				Fig. 6									
	Brake and separately driven fan				Separately driven fan and rotary pulse encoder (under cover)									
	Order codes F01 + F70		Order codes F04 + F70		Order codes F70 + G01/G02		Order codes F70 + G04		Order codes F70 + G05		Order codes F70 + G06		Order codes F70 + G11/G12	
Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	
mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	
1LE1														
71	–	–	–	–	165	2.6	–	–	–	–	–	–	–	
80	161.5	5.4	–	–	161.5	2.9	–	–	–	–	–	–	–	
90	174	7.7	–	–	174	3.5	–	–	–	–	–	–	–	
100	161.5	8.3	–	–	161.5	3.8	161.5	4.8	161.5	4.4	246.5	5.3	–	
112	156.5	10.4	–	–	156.5	4	156.5	5.1	156.5	4.7	241.5	5.6	–	
132	186	15.7	–	–	186	5.7	186	6.8	186	6.4	291	7.4	–	
160	205.5	37.2	–	–	205.5	8.6	205.5	9.8	205.5	9.4	320.5	10.5	–	
180	257	40	–	–	257	10.4	257	10.6	257	10.2	400	10.9	–	
200	262	53	–	–	262	11.6	262	11.8	262	11.4	397	12.1	–	
225	563	87	440.5	60	410	25	410	26	410	26	410	26	410	25
250	609	110	409	79	425	27	425	28	425	28	425	28	425	27
280	571	149	402	120	429	30	429	31	429	31	429	31	429	30
315 (4-, 6-, and 8-pole)	540	296	432	203	432	41	432	42	432	42	432	42	432	41
315 (2-pole)	588	299	–	–	472	44	472	45	472	45	472	45	472	44
1LE5														
315 2-pole	633	415.7	–	–	425	400.9	633	402	633	401.6	633	402.3	633	401
315 4-pole	593	413.7	–	–	385	398.9	593	400	593	399.6	593	400.3	593	399
355	628	471.7	–	–	381	453.6	381	454.7	381	454.3	381	455	381	453.7

Overview (continued)

Fig. 7 Brake, rotary pulse encoder (under cover) and separately driven fan, order codes **F01/F04 + F70 + G01/G02/G04/G05/G06/G11/G12** [optionally with manual release, order code **F50**]

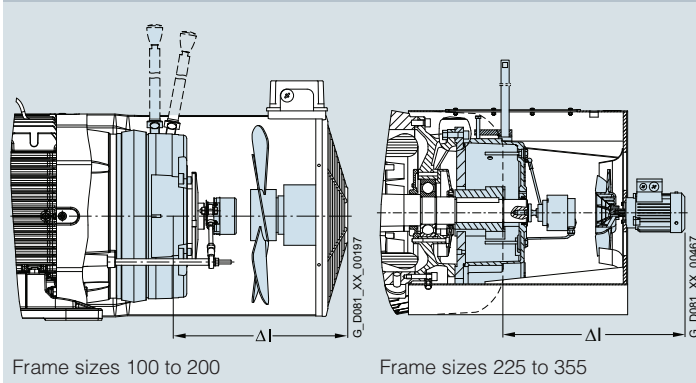
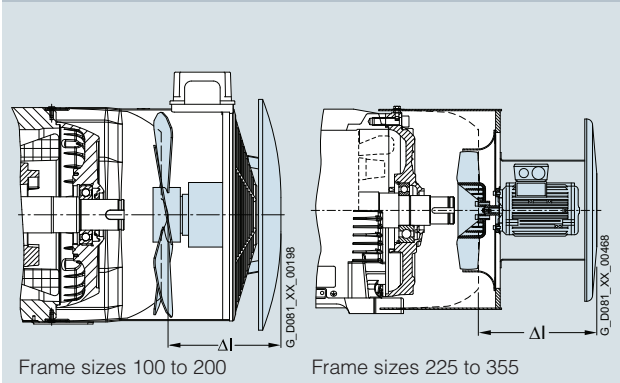


Fig. 8 Protective cover for separately driven fan, order code **H00**



Frame size	Assignment Fig. 7										Assignment Fig. 8		
	Order codes F01 + F70 + G01/G02		Order codes F01 + F70 + G04		Order codes F01 + F70 + G05		Order codes F01 + F70 + G06		Order codes F01 + F70 + G11/G12		Order codes H00		
	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Diameter of the separately-driven fan cover
	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm
1LE1													
80	186.5	6.6	-	-	-	-	-	-	-	-	124.5	0.2	157
90	199	8.9	-	-	-	-	-	-	-	-	141.5	0.2	177
100	196.5	9.9	196.5	10.9	196.5	10.5	246.5	11.5	-	-	124	1.4	210
112	191.5	12	191.5	13.1	191.5	12.7	241.5	13.6	-	-	122	1.8	249
132	241	17.9	241	19	241	18.6	291	19.6	-	-	149	2.4	300
160	270.5	39.7	270.5	40.9	270.5	40.5	320.5	41.6	-	-	177	3	338
180	257	38.4	257	38.6	257	38.2	400	40.6	-	-	288	1.7	338
200	262	49.6	262	49.9	262	49.1	397	51.5	-	-	293	1.7	338
225	563	87.3	563	88.3	563	88.2	563	88.9	563	87.4	305	2.5	210
250	609	110.3	609	111.3	609	111.2	609	111.9	609	110.4	311	2.5	249
280	571	149.3	571	150.3	571	150.2	571	150.9	571	149.4	307	2.5	300
315 (4, 6, 8-pole)	540	296.3	540	297.3	540	297.2	540	297.9	540	296.4	321 ¹⁾	2.5 ¹⁾	338 ¹⁾
315 (2-pole)	580	299.3	580	300.3	580	300.2	580	300.9	580	300.9	-	-	-
1LE5													
315 2-pole	-	-	-	-	-	-	-	-	-	-	402	46.1	690
315 4-pole	-	-	-	-	-	-	-	-	-	-	317	43.5	690
355	-	-	-	-	-	-	-	-	-	-	330	36	690

Frame size	Assignment Fig. 7									
	Order codes F04 + F70 + G01/G02		Order codes F04 + F70 + G04		Order codes F04 + F70 + G05		Order codes F04 + F70 + G06		Order codes F04 + F70 + G11/G12	
	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.
	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg
1LE1										
225	593.5	66.3	593.5	67.3	593.5	66.9	593.5	67.6	593.5	66.4
250	609	79.3	609	80.3	609	79.9	609	80.6	609	79.4
280	572	120.3	572	121.3	572	120.9	572	121.6	572	120.4
315	540	203.3	540	204.3	540	203.9	540	204.6	540	203.4
1LE5										
315 2-pole	633	416.6	633	417.7	633	417.3	633	418	633	416.7
315 4-pole	593	414.6	593	415.7	593	415.6	593	416	593	414.7
355	628	472.6	628	473.7	628	473.3	628	474	628	472.7

¹⁾ Valid for FS 315 (2, 4, 6, and 8-pole)

Introduction

Mounting technology

Dimensions and weights of the mountings

1

Overview (continued)

Fig. 9 Prepared for mountings, center hole only (for 2LM8 brake, order code **F01** and/or encoder order code **G01/G02/G04/G05/G06**), order code **G40** (up to frame size 160, standard with frame size 180 and above)

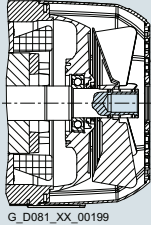
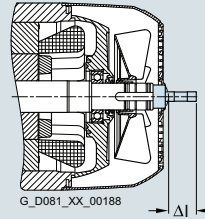


Fig. 10 Prepared for mountings with shaft D12/D16, order code **G41/G42**



Frame size	Assignment Fig. 9		Fig. 10			
	Prepared for mountings, center hole only (for brake, order code F01 and/or encoder order codes G01/G02/G04/G05/G06), order code G40		Prepared for mountings with shaft D12/D16, order code G41/G42			
	Order code		Order code		Order code	
	G40		G41		G42	
	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.
	mm	kg	mm	kg	mm	kg
1LE1						
71	–	–	–	–	–	–
80	0	0	22	0.1	52	0.1
90	0	0	22	0.1	52	0.1
100	0	0	18.3	0.15	54.3	0.2
112	0	0	14.5	0.15	54.3	0.2
132	0	0.1	18.8	0.3	58.8	0.4
160	0	0.2	18.6	0.4	55.6	0.7
180	0	0	18	0.27	57	0.33
200	0	0	17	0.27	56	0.27
225	0	0	23	0.27	58	0.33
250	0	0	23	0.27	58	0.33
280	0	0	23	0.27	58	0.33
315	0	0	23	0.27	58	0.33
1LE5						
315	0	0	23	0.27	58	0.33
355	0	0	23	0.27	58	0.33

Overview (continued)

Fig. 11 Standard protective cover for types of construction, order code **H00**

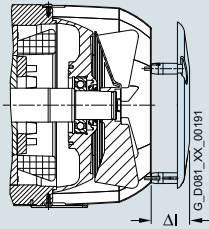
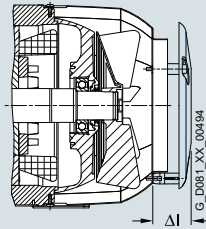


Fig. 12 Protective cover for textile industry, order code **F75**



Frame size	Assignment Fig. 11		Assignment Fig. 12	
	Order code	Weight, approx. kg	Order code	Weight, approx. kg
	H00		F75	
	Δl mm		Δl mm	
71	29	0.15	–	–
80	128	0.3	17	0.3
90	144	0.4	15	0.4
100	137	0.5	64	0.7
112	122	0.7	64	0.9
132	156	1.3	71	1.3
160	182.5	1.7	71	1.9
180	285	1.7	90	3.2
200	297	1.7	90	3.4
225	100	2.2	On request	On request
250	100	2.4	On request	On request
280	110	3.4	On request	On request
315	110	4	On request	On request
1LE5				
315	110	8	–	–
355	140	8.5	–	–

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Notes

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