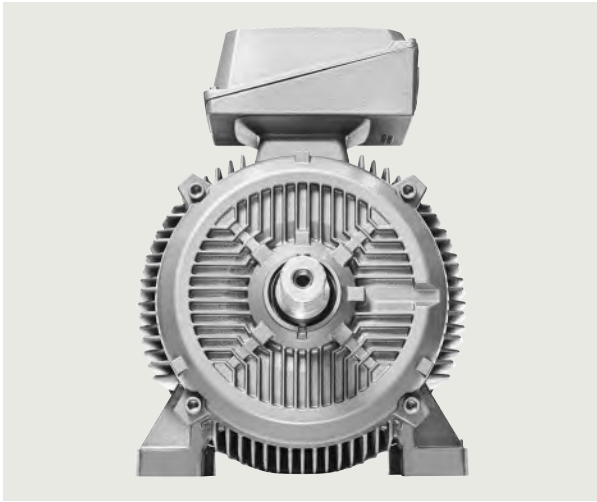


# Innomotics GP, SD, XP, DP Low-Voltage Motors

Type series 1FP1, 1LE1, 1LE5, 1MB1, 1MB5 and 1PC1

## Motors



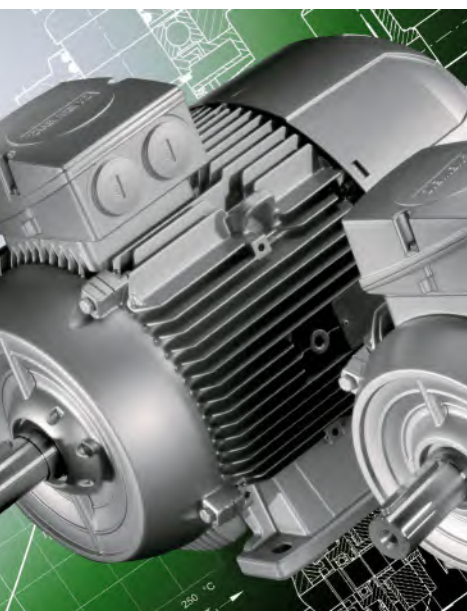
[Catalog D 81.1 · 04/2024](#)

Supersedes:  
[Catalog D 81.1 · 09/2023](#)

## Introduction

Information regarding efficiency in accordance with International Efficiency, Guide to selecting and ordering the motors, General information, Electrical design, Mechanical version, Mounting technology

## Introduction



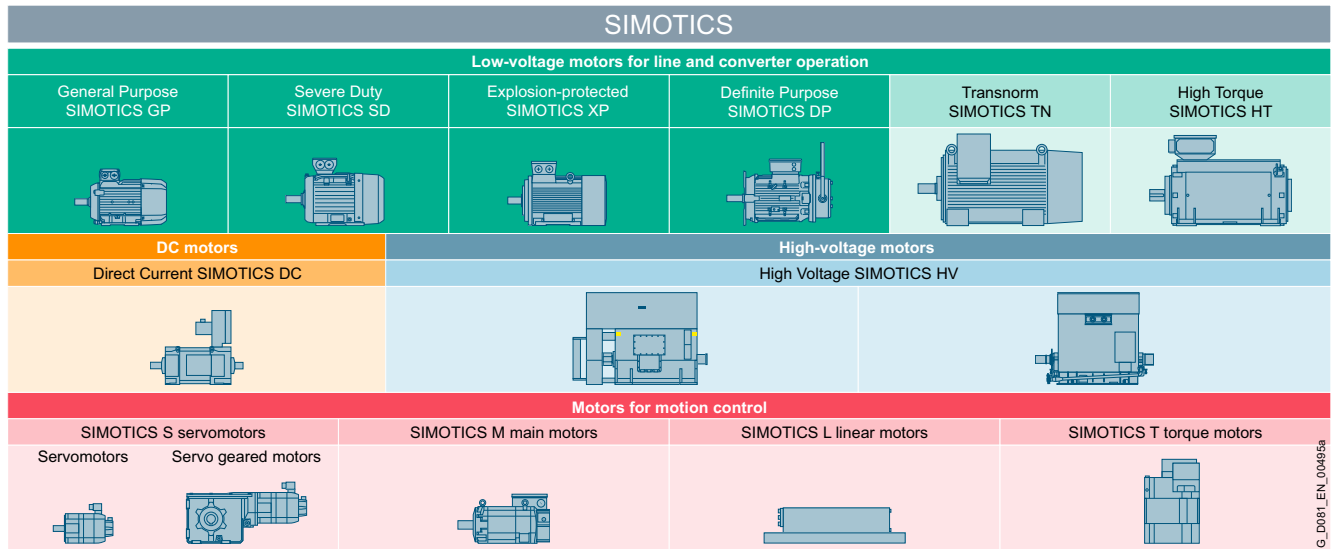
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## Introduction

Innometrics motors

Innovative drive technology for all industries, applications and power classes

### Overview



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### Innometrics motors

Innometrics 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 Innometrics motor portfolio:

- Innometrics Low-Voltage Motors for line and converter operation:  
For standard applications with low to high motor power ratings
- Innometrics Motion Control motors:  
For highly dynamic and extremely precise applications in mechanical engineering
- Innometrics DC motors:  
For DC applications
- Innometrics High-Voltage Motors:  
For line and converter operation in standard applications with high to very high motor power ratings.

### Innometrics Low-Voltage Motors for line and converter operation

Innometrics 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.

Innometrics 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.

Innometrics 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**

**Innomotics 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. Innomotics 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 Innomotics GP – VSD10 line induction motor
  - as a Innomotics 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.

**Innomotics SD – Severe Duty** motors have a rugged cast-iron housing, which means that they are also suitable for use in harsh to very harsh environments. With a wide power range from 0.09 to 1000 kW, Innomotics 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 Innomotics SD – VSD10 line induction motor
  - as a Innomotics 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.

**Innomotics SD – 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.

**Innomotics 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.

Innomotics XP motors are available in the power range from 0.09 to 460 kW.

Available motor variants:

- Motors for use in Zones 1, 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
- For 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.

**Innomotics 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.

Innomotics 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

**Innomotics 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.

**Innomotics 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

Innomatics motors

### Innomatics Digital Data App

#### Overview

The Innomatics Digital Data App provides access to technical data, spare part information, and operating instructions for Innomatics GP/SD motors any time any place. This gives our customers quick access to important contents of the digital twin. This simplifies our customers' processes.

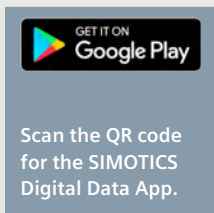
By scanning the data matrix code on the additional rating plate of the motor, the relevant electrical and mechanical data can be displayed for this motor.

- 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 Innomatics 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<sup>1)</sup> use the differing standards of NEMA MG1. Standard IEC 60034-30-1:2014 divides low-voltage induction motors into efficiency classes IE1 to IE4.

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):

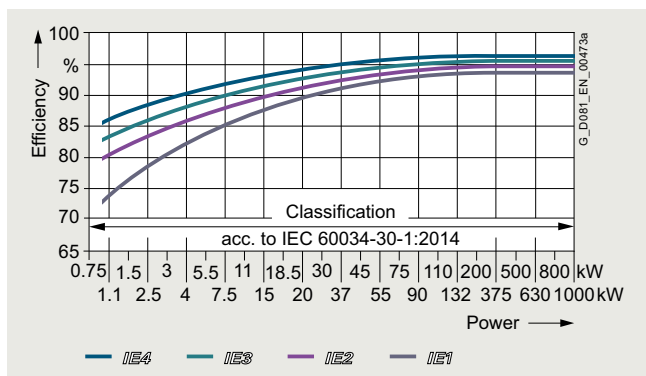
- IE1 (Standard Efficiency)
- IE2 (High Efficiency)
- IE3 (Premium Efficiency)
- IE4 (Super Premium Efficiency)

IEC 60034-30-1 EU and other countries	NEMA MG1 NAFTA (USA, Canada, Mexico <sup>1)</sup> )	GB 18613-2020 China
IE4		Grade 2 (IE4)
IE3	Premium Efficient (60 Hz)	Grade 3 (IE3)
IE2	Energy Efficient (60 Hz)	

Comparison of IE efficiency classes

Note:

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



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

Minimum Energy Performance Standard (MEPS)

see: <https://meps.siemens.com/en/>

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

Rated power $P_{rated, 50 Hz}$ kW	Efficiency $\eta$ 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 $\eta$ 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

<sup>1)</sup> Additionally required NOM certification.

## Introduction

Information regarding efficiency in accordance with International Efficiency

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

1

#### Overview

##### Background information

Comprehensive laws have been introduced in the European Union with the objective of reducing energy consumption and therefore CO<sub>2</sub> emissions. EU Regulations 640/2009 and 2019/1781 concern the energy consumption or efficiency of induction motors in the industrial environment. This regulation is in force in every country of the European Economic Area until June 30, 2021.

Effective July 1, 2021, the new regulation (EU) 2019/1781 will come into force. The main contents of and exceptions to both regulations are explained below.

##### Motor exclusively for use in transportation equipment for passenger and freight transportation corresponding to EVPG §1

To ensure that a "marine" motor (with "marine" option Exx and really use in a ship) will be considered as an exception from EU regulation it's necessary to add order code **D23** (Motor exclusively for use in transportation equipment for passenger and freight transportation corresponding to EVPG §1 dated February 27, 2008).

Train motors ( with order code L90, L91 and L92) are totally designed for use only in a rail vehicle, and therefore order code D23 is not needed.

For more information on internationally applicable standards and legal requirements, visit:

[www.siemens.com/international-efficiency](http://www.siemens.com/international-efficiency)

##### Regulation (EC) 640/2009

###### Exceptions

- 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 2014/34/EU of the European Parliament and Council;
- Brake motors

The following motors are not affected:

- 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 a power range from 7.5 to 375 kW (2-, 4-, 6-pole) or, as an alternative, IE2 motor plus frequency converter.

###### **From January 1, 2017:**

Compliance with the legally required minimum efficiency class IE3 for a power range from 0.75 to 375 kW (2-, 4-, 6-pole) or, as an alternative, IE2 motor plus frequency converter.

###### **From July 1, 2021:**

Compliance with the legally required minimum efficiency class IE2 for a power range from 0.12 to 0.75 kW (2-, 4-, 6-, and 8-pole), exception: Ex eb motors

Compliance with the legally required minimum efficiency class IE3 for a power range from 0.75 to 1000 kW (2-, 4-, 6- and 8-pole), exception: Ex eb motors

###### **From July 1, 2023:**

Compliance with the legally required minimum efficiency class IE2 for a power range from 0.12 to 1000 kW (2-, 4-, 6- and 8-pole) of Ex eb motors with increased safety and of single-phase motors with a rated output power of at least 0.12 kW.

Compliance with the legally required minimum efficiency class IE4 for a power range of 75 kW to 200 kW (2-, 4-, 6-pole). Exception: Motors with a brake, Ex eb motors with increased safety or other explosion-protected motors.

##### **Changes according to EU motor regulation 640/2009 Motor series Innomatics VSD10 (1LE1092/1LE1592) and VSD4000 (1FP10/1FP15) are the preferred motor types for converter operation.**

##### New regulation (EU) 2019/1781

###### Exceptions

- 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
  - Where ambient temperatures exceed 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 as defined in Directive 2014/34/EU of the European Parliament and Council that are designed and certified for underground mining applications
  - Motors with an integrated brake that is an integral part of the interior motor structure and can neither be removed or powered from a separate source during motor efficiency testing.
  - Motors with an integrated speed control (compact drives), whose energy efficiency cannot be tested independently of the speed control

The following motors are not affected:

- Pole-changing motors
- Synchronous motors
- Totally enclosed, naturally ventilated motors (TENV motors);
- Motors specially developed for converter operation in accordance with IEC 60034-25

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

###### 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 (EPAct) 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**

<b>Step 1</b>	<b>Orientation and general technical information</b>		
<b>Technical requirements for the motor</b>	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..	
<b>Step 2</b>	<b>Preselection in accordance with the application</b>		
<b>Determination of the installation conditions and definition of the application, if necessary</b>	Ambient temperature	$\leq 40$ °C	$> 40$ °C
	Installation altitude	$\leq 1000$ m	$> 1000$ m
	Factors for derating	None	Determine the factor for derating (for reduction factor, see "Coolant temperature and installation altitude" on page 1/30)
<b>Cross-reference to other motors</b>	These include motors for special requirements in the area of explosion protection and applications or motors according to the NEMA standard.		
<b>Step 3</b>	<b>Preliminary selection of the motor</b>		
<b>Determination of the range of possible motors</b>	Select the frame size and therefore the possible motors on the basis of the following parameters: efficiency class, cooling method, degree of protection, rated power, rated speed and rated torque range.		
	Note: 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					
<b>Table header – Meaning</b>																				
$P_{rated, 50 Hz}$	$P_{rated, 60 Hz}$	$P_{rated, 60 Hz}$	Frame size	$n_{rated, 50 Hz}$	$T_{rated, 50 Hz}$	Different IE class	CC No. CC032A	$\eta_{rated, 50 Hz, 4/4}$	$\eta_{rated, 50 Hz, 3/4}$	$\eta_{rated, 50 Hz, 2/4}$	$\cos\phi_{rated, 50 Hz, 4/4}$	$I_{rated, 50 Hz, 400 V}$	$T_{LR}/T_{rated}$	$I_{LR}/I_{rated}$	$T_B/T_{rated}$	$L_{p1A, 50 Hz}$	$L_{WA, 50 Hz}$	Article No.	$m$ IM B3	$J$
kW	kW	hp	FS	rpm	Nm			%	%	%		A				dB (A)	dB (A)		kg	kgm <sup>2</sup>
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.

<b>Step 4</b>	<b>Detailed selection of the motor in the selection and ordering data tables</b>		
<b>Determination of the basic Article No. of the motor</b>	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.		
	<b>Selection of the special versions or options</b>		
<b>Completing the motor Article No.</b>	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.).		
<b>Step 6</b>	<b>Additional information for motor selection</b>		
<b>Checking the required dimensions</b>	The dimensions are specified in each catalog section under the heading of "Dimensions".		
<b>Selection of the frequency converter, if required</b>	Article No. of the converter as well as its selection, see Catalogs D 11, D 18.1, D 21.3, D 31.1, D 31.2 and D 31.5.		



# Introduction

Guide to selecting and ordering the motors

## Catalog orientation and drive selection

1

### Overview

#### Steps for drive selection in the catalog

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• Aluminum series Innomotics GP 1LE1004 – self-ventilated or forced-air cooled						3/8
• Cast-iron series Innomotics SD 1LE1504 Basic Line – self-ventilated or forced-air cooled						3/9
• Cast-iron series Innomotics SD 1LE1604 Performance Line – self-ventilated or forced-air cooled						3/11
IE3 Premium Efficiency						3/13
• Aluminum series Innomotics GP 1LE1003 – self-ventilated						3/13
• Aluminum series Innomotics GP 1LE1003 with increased power – self-ventilated						3/17
• Aluminum series Innomotics GP 1LE1083 – self-ventilated						3/18
• Cast-iron series Innomotics SD 1LE1503 Basic Line – self-ventilated or forced-air cooled						3/19
• Cast-iron series Innomotics SD 1LE1603 Performance Line – self-ventilated or forced-air cooled						3/23
• Cast-iron series Innomotics SD 1LE1503 Basic Line with increased power – self-ventilated						3/27
• Cast-iron series Innomotics SD 1LE1603 Performance Line with increased power – self-ventilated						3/29
• Cast-iron series Innomotics SD 1LE1583 – self-ventilated						3/30
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• Aluminum series Innomotics GP 1LE1001 – self-ventilated or forced-air cooled						3/33
• Aluminum series Innomotics GP 1LE1001 with increased power – self-ventilated						3/37
• Cast-iron series Innomotics SD 1LE1501 Basic Line – self-ventilated or forced-air cooled						3/39
• Cast-iron series Innomotics SD 1LE1601 Performance Line – self-ventilated or forced-air cooled						3/43
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• Cast-iron series Innomotics SD 1LE1601 Performance Line with increased power – self-ventilated						3/49
IE1 Standard Efficiency						3/51
• Aluminum series Innomotics GP 1LE1002 – self-ventilated or forced-air cooled						3/51
• Aluminum series Innomotics GP 1LE1002 with increased power – self-ventilated						3/51
• Cast-iron series Innomotics SD 1LE1502 Basic Line – self-ventilated or forced-air cooled						3/55
• Cast-iron series Innomotics SD 1LE1502 Basic Line with increased power – self-ventilated or forced-air cooled						3/59
APAC Line - IE3 Premium Efficiency						3/61
• Aluminum series Innomotics GP 1LE1043 – self-ventilated or forced-air cooled						3/61
• Aluminum series Innomotics GP 1LE1043 with increased power – self-ventilated or forced-air cooled						3/64
• Cast-iron series Innomotics SD 1LE1543 Basic Line – self-ventilated or forced-air cooled						3/65
• Cast-iron series Innomotics SD 1LE1643 Performance Line – self-ventilated or forced-air cooled						3/68
• Cast-iron series Innomotics SD 1LE1543 Basic Line with increased power – self-ventilated						3/71
• Cast-iron series Innomotics SD 1LE1643 Performance Line with increased power – self-ventilated						3/73
APAC Line - IE2 High Efficiency						3/74
• Aluminum series Innomotics GP 1LE1041 – self-ventilated or forced-air cooled						3/74
• Aluminum series Innomotics GP 1LE1041 with increased power – self-ventilated or forced-air cooled						3/76
• Cast-iron series Innomotics SD 1LE1541 Basic Line – self-ventilated or forced-air cooled						3/77
• Cast-iron series Innomotics SD 1LE1541 Basic Line with increased power – self-ventilated or forced-air cooled						3/79
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• Cast-iron series Innomotics SD 1LE1573, 1LE5773 – self-ventilated or forced-air cooled						3/82
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• Aluminum series Innomotics GP 1LE1023 – self-ventilated or forced-air cooled						3/84
• Cast-iron series Innomotics SD 1LE1523 Basic Line – self-ventilated or forced-air cooled						3/87
• Cast-iron series Innomotics SD 1LE1623 Performance Line – self-ventilated or forced-air cooled						3/91
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• Aluminum series Innomotics GP 1LE1021 – self-ventilated or forced-air cooled						3/95
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• Cast-iron series Innomotics SD Add 1LE5634 Performance Line – self-ventilated or forced-air cooled						4/17
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• Cast-iron series Innomotics SD Add 1LE5533 Basic Line – self-ventilated or forced-air cooled						4/21
• Cast-iron series Innomotics SD Add 1LE5633 Performance Line – self-ventilated or forced-air cooled						4/23
• Cast-iron series Innomotics SD Pro 1LE5583 Basic Line – self-ventilated or forced-air cooled						4/24
• Cast-iron series Innomotics SD Pro 1LE5683 Performance Line – self-ventilated or forced-air cooled						4/25
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• Aluminum series Innomotics GP 1FP1014, line voltage 400 V, 50 Hz/480 V, 60 Hz/400 V, 87 Hz – self-ventilated, enclosed						5/46
• Cast-iron series Innomotics SD 1FP1514, line voltage 400 V, 50 Hz/460 V, 60 Hz/400 V, 87 Hz – self-ventilated, enclosed						5/48
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• Aluminum series Innomotics GP 1LE1092, line voltage 400 V, 50 Hz/460 V, 60 Hz/400 V, 87 Hz – self-ventilated, enclosed						5/92
• Aluminum series Innomotics GP 1LE1092, line voltage 500 V, 50 Hz/575 V, 60 Hz/500 V, 87 Hz – self-ventilated, enclosed						5/94
• Aluminum series Innomotics GP 1LE1092, line voltage 690 V, 50 Hz/690 V, 87 Hz – self-ventilated, enclosed						5/96
• Cast-iron series Innomotics SD 1LE1592, line voltage 400 V, 50 Hz/460 V, 60 Hz/400 V, 87 Hz – self-ventilated, enclosed						5/98
• Cast-iron series Innomotics SD 1LE1592, line voltage 500 V, 50 Hz/575 V, 60 Hz/500 V, 87 Hz – self-ventilated, enclosed						5/102
• Cast-iron series Innomotics SD 1LE1592, line voltage 690 V, 50 Hz/690 V, 87 Hz – self-ventilated, enclosed						5/106
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• Aluminum series 1MB10 – self-ventilated						6/29
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<b>Zones 21, 22, and 2 with types of protection Ex tb, Ex tc, Ex ec · IE2 High Efficiency</b>						6/39
• Aluminum series 1MB10 – self-ventilated						6/39
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• Cast-iron series 1MB1553/1MB1563 IIC – self-ventilated						6/53
1MB5553/1MB5563 IIB – self-ventilated						
• Cast-iron series 1MB1557/1MB1567 IIC – self-ventilated						6/60
1MB5557/1MB5567 IIC – self-ventilated						
• Cast-iron series 1MB1853/1MB1863 IIC – self-ventilated						6/63
1MB5853/1MB5863 IIB – self-ventilated						
with Premium Insulation for VSD up to 690 V						
<b>Zone 1 with types of protection Ex db, Ex db eb · IE2 High Efficiency</b>						6/57
• Cast-iron series 1MB1556/1MB1566/1MB5556/1MB5566 – self-ventilated						6/57
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• Cast-iron series 1LE15/1LE16 Basic/Performance Line						7/10
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• Aluminum series 1MB10, cast-iron series 1MB15/1MB16/1MB5						7/12

## Introduction

### Guide to selecting and ordering the motors

#### Catalog orientation and drive selection

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#### Overview

##### Innomatics GP/SD 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	
<b>Innomatics GP aluminum housing</b>																		
IEC	IE4 Super Premium Efficiency	2.2 ... 37 kW																3/8
	IE3 Premium Efficiency	0.12 ... 45 kW																3/13
		2.2 ... 37 kW																3/18
	IE2 High Efficiency	0.04 ... 37 kW																3/33
	IE1 Standard Efficiency	0.09 ... 37 kW																3/51
APAC Line	IE3 Premium Efficiency	0.12 ... 37 kW																3/61
	IE2 High Efficiency	0.75 ... 18,5 kW																3/74
ABNT Line	IR3 Rendimento Premium	0.25 ... 22 kW																3/80
Eagle Line	NEMA Premium Efficient	0.12 ... 37 kW 0.16 ... 50 hp																3/84
	NEMA Energy Efficient	0.18 ... 0.55 kW 0.25 ... 0.75 hp																3/95
Pole-changing	– For a constant load torque	0.55 ... 16 kW																3/97
		0.5 ... 28 kW																3/98
		0.6 ... 26 kW																3/98
<b>Innomatics SD cast-iron housing</b>																		
IEC	IE4 Super Premium Efficiency	– Basic Line	2.2 ... 90 kW															3/9
		– Performance Line	2.2 ... 90 kW															3/11
	IE3 Premium Efficiency	– Basic Line	0.09 ... 200 kW															3/19
		– Performance Line	0.75 ... 200 kW															3/23
			2.2 ... 200 kW															3/30
	IE2 High Efficiency	– Basic Line	0.09 ... 200 kW															3/39
		– Performance Line	0.75 ... 200 kW															3/43
	IE1 Standard Efficiency	– Basic Line	0.75 ... 200 kW															3/55
APAC Line		IE3 Premium Efficiency	– Basic Line	0.75 ... 200 kW														3/65
		– Performance Line	0.75 ... 200 kW															3/68
	IE2 High Efficiency	– Basic Line	15 ... 200 kW															3/77
ABNT Line	IR3 Rendimento Premium		9.2 ... 300 kW															3/82
Eagle Line	NEMA Premium Efficient	– Basic Line	0.09 ... 185 kW 0.12 ... 250 hp															3/87
		– Performance Line	0.75 ... 185 kW 1 ... 250 hp															3/91
	NEMA Energy Efficient	– Basic Line	0.09 ... 0.55 kW 0.12 ... 0.75 hp															3/96

##### Innomatics SD 1LE5 standard motors – next generation

Motor version	Efficiency class	Rated power at 50 Hz	Frame size – motor type													Page			
			63	71	80	90	100	112	132	160	180	200	225	250	280		315	355	400
<b>Innomatics SD cast-iron housing</b>																			
IEC	IE4 Super Premium Efficiency	– Basic Line	37 ... 315 kW																4/11
		– Performance Line	160 ... 500 kW																4/14
	IE3 Premium Efficiency	– Basic Line	160 ... 315 kW																4/19
		– Performance Line	160 ... 500 kW																4/20
<b>Innomatics SD Add cast-iron housing</b>																			
IEC	IE4 Super Premium Efficiency	– Basic Line	55 ... 315 kW																4/15
		– Performance Line	160 ... 1000 kW																4/17
	IE3 Premium Efficiency	– Basic Line	160 ... 315 kW																4/21
		– Performance Line	160 ... 1000 kW																4/23
<b>Innomatics SD Pro cast iron housing</b>																			
IEC	IE3 Premium Efficiency	– Basic Line	200 ... 980 kW																4/24
		– Performance Line	200 ... 500 kW																4/25

### Overview

#### Innomotics VSD motors for converter operation

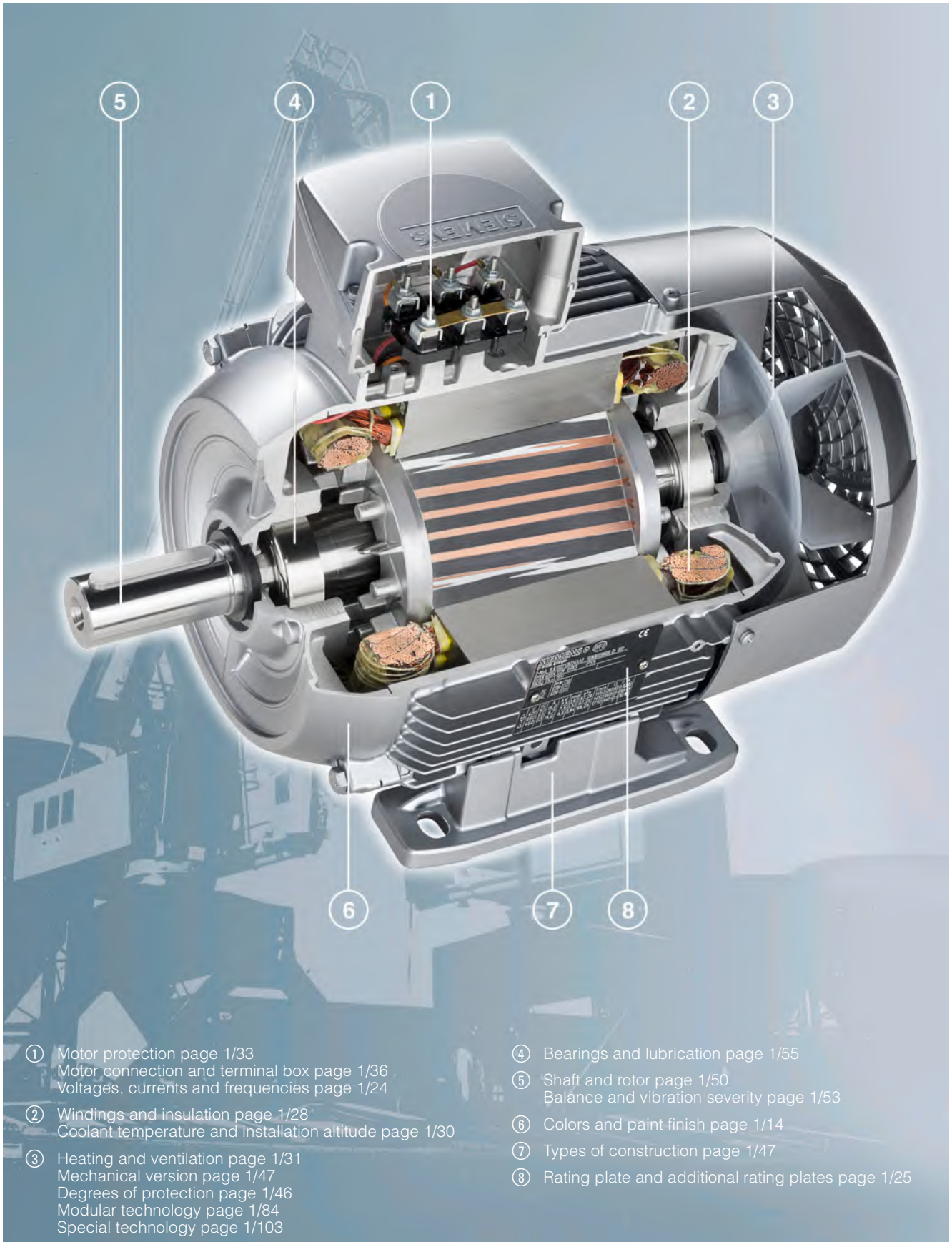
Innomotics GP/SD VSD4000 line reluctance motors for SINAMICS converters,  
Innomotics GP/SD VSD10 line standard motors for converter operation

Motor version	Efficiency class	Rated power	Frame size – motor type											Page		
			63	71	80	90	100	112	132	160	180	200	225		250	280
<b>Innomotics GP aluminum housing</b>																
VSD4000 line	Super Premium Efficiency	0.55 ... 30 kW														5/46
VSD10 line	Standard Efficiency	2.2 ... 18.5 kW														5/92
<b>Innomotics SD cast-iron housing</b>																
VSD4000 line	Super Premium Efficiency	0.55 ... 45 kW														5/48
VSD10 line	Standard Efficiency	2.2 ... 200 kW														5/98

#### Innomotics XP explosion-protected motors

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	
<b>Motors for Zones 21, 22, and 2 with types of protection Ex tb, Ex tc, Ex ec - aluminum housing Innomotics XP</b>																	
IEC	IE3 Premium Efficiency	0.37 ... 18.5 kW															6/29
	IE2 High Efficiency	0.37 ... 18.5 kW															6/39
	IE1 Standard Efficiency	0.75 ... 18.5 kW															6/45
<b>Motors for Zones 21, 22, and 2 with types of protection Ex tb, Ex tc, Ex ec - cast-iron housing Innomotics XP</b>																	
IEC	IE4 Super Premium Efficiency	355 ... 1000 kW														1MB55.4	6/27
	IE3 Premium Efficiency	0.18 ... 200 kW														1MB15.3	6/31
		1.5 ... 200 kW														1MB16.3	6/31
		355 ... 1000 kW														1MB55.3	6/36
		335 ... 980 kW														1MB58.3	6/36
	IE2 High Efficiency	0.09 ... 200 kW														1MB15.1	6/41
		0.75 ... 200 kW														1MB16.1	6/41
<b>Motors for Zone 1 with type of protection Ex eb - cast-iron housing Innomotics XP</b>																	
IEC	IE3 Premium Efficiency	0.25 ... 80 kW														1MB1543	6/47
		1.3 ... 80 kW														1MB1643	6/47
		64 ... 165 kW														1MB5543	6/47
		64 ... 165 kW														1MB5643	6/47
<b>Motors for Zone 1 with types of protection Ex db, Ex db eb - cast-iron housing Innomotics XP</b>																	
IEC	IE3 Premium Efficiency	0.09 ... 90 kW														1MB1553/1MB1563	6/53
		55 ... 460 kW														1MB5553/1MB5563	6/53
		0.12 ... 75 kW														1MB1557/1MB1567	6/60
		90 ... 355 kW														1MB5557/1MB5567	6/60
		2,2 ... 85 kW														1MB1853/1MB1863	6/63
		55 ... 450 kW														1MB5853/1MB5863	6/63
IEC	IE2 High Efficiency	0.12 ... 75 kW														1MB1556/1MB1566	6/57
		55 ... 315 kW														1MB5556/1MB5556	6/57



**Overview**


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 Motor connection and terminal box page 1/36  
 Voltages, currents and frequencies page 1/24
- ② Windings and insulation page 1/28  
 Coolant temperature and installation altitude page 1/30
- ③ Heating and ventilation page 1/31  
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- ④ Bearings and lubrication page 1/55
- ⑤ Shaft and rotor page 1/50  
 Balance and vibration severity page 1/53
- ⑥ Colors and paint finish page 1/14
- ⑦ Types of construction page 1/47
- ⑧ Rating plate and additional rating plates page 1/25

# Introduction

## General information

### Colors and paint finish









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#### Overview

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

Additional identification code <b>-Z</b> with order code							
<b>S00</b> <sup>7)</sup>	<b>S01</b>	Standard version <sup>6)</sup>	<b>S02</b> <sup>6)</sup>	<b>S03</b> <sup>6) 8)</sup>	<b>S04</b> <sup>6)</sup>	<b>S08</b> <sup>9)</sup>	<b>S09</b> <sup>9) 10)</sup>
Paint systems, suitability for atmospheric-corrosivity categories in accordance with EN ISO 12944-2:2017							
Unpainted, but unfinished cast-iron surfaces are primed	Unpainted, motor primed	C2 Standard paint system	C3 Special paint system	C4 Special paint system "sea air resistant"	C5 Special paint system "offshore"	C5mid Special paint system with durability "medium"	CX Special paint system for offshore with durability "high"

#### Use

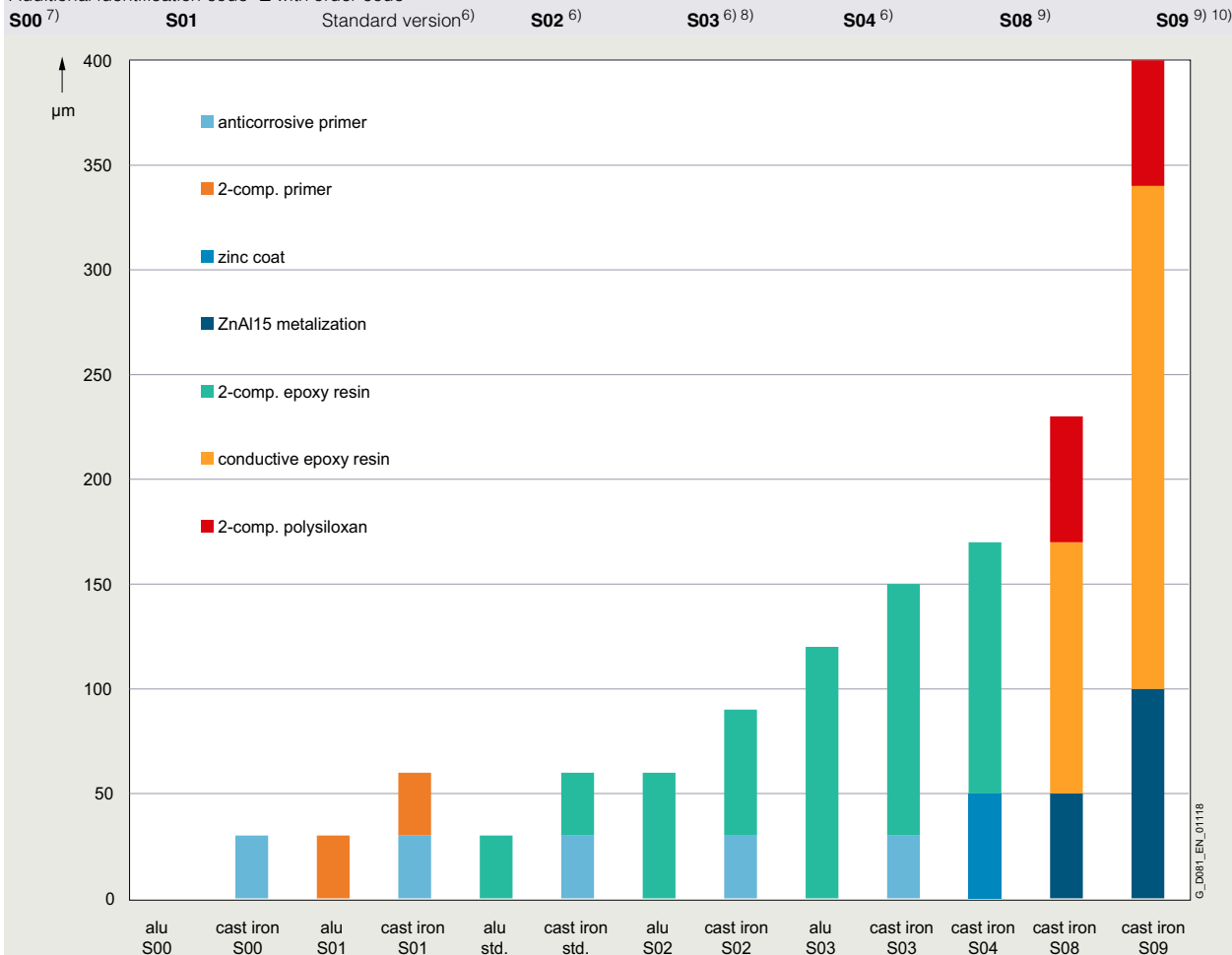
							
The motors can be supplied unpainted on request.	The motors can be supplied with just a primer coat on request.	Indoor unheated spaces with varying temperature and relative humidity, low frequency of condensation and low pollution. Outdoor in dry and cold zones with a short time of wetness, low pollution.	Moderate frequency of condensation and medium pollution (SO <sub>2</sub> or chlorides), urban areas, subtropical and tropical zone with low pollution. Standard paint system for VIK design (C02).	High frequency of condensation and high pollution, industrial processing plants, polluted urban areas, coastal areas without spray of salt water or exposure to strong effect of de-icing salts.	ISpaces with very high pollution from production process, outdoor installations exposed to direct weather conditions, significant effect of SO <sub>2</sub> or chlorides, offshore maritime climate.	Industrial areas with high frequency of condensation, humidity, pollution, and aggressive atmosphere. Coastal areas with high salinity, sheltered positions on coastlines, unventilated buildings in subtropical and tropical zone.	Offshore areas with high salinity, spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects. Industrial areas with extreme aggressive atmosphere with high pollution. Unventilated buildings in humid tropical zones exposed to outdoor factors to an extent that is particularly corrosion-stimulating.

Durability according to EN ISO 12944-1:2017							
-	-	C2 low	C3 low	C4 low	C5 low	C5 medium	C5 high
Also fulfills requirements of categories							
-	-	-	C2 medium	C2 high C3 medium	C3 high C4 medium	C4 high	C5 very high
Total film thickness for outer surface - nominal film thickness in µm - aluminum / cast iron <sup>2) 3)</sup>							
0 / 30 <sup>4) 5)</sup>	30 / 60	30 / 60	60 / 90	120 / 150	- / 170	- / 230	- / 400

- 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.
  - The film thickness may differ at inaccessible locations (pockets/recesses or bases of ribs).
- 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 GfÇ 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 „T 4 kV for explosion group III (dust only)
 

Note:  
Innomatics motors are optionally also certified in gas group IIC for a film thickness of more than 200 µm. 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.
- 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. The paint finish is therefore applied only for the purpose of coloring.
- 5) Aluminum motors with cast-iron components (e.g. DE bearing plate) have a primer coat of > 30 µm on cast-iron components.
- 6) Innomatics XP cast-iron motors suitable for dust hazardous areas (zone 21/22) are used conductive paint systems with color shades available.
- 7) Not possible for Innomatics XP cast-iron motors suitable for dust hazardous areas (zone 21/22).
- 8) Innomatics XP aluminum motors suitable for dust hazardous areas (zone 21/22) are used conductive paint systems with color shades available.
- 9) Conductive paint systems with color shades available according to tables in the page 1/16.
- 10) When ordering with order code S09, order code F74 and M11 included.

Additional identification code -Z with order code



**Other available order codes**

**S05** <sup>1)</sup> **Interior paint -finish**, all bare internal components primed with rust inhibitor. The motors can be supplied with internal paint finish on request. Recommended when there is a risk of heavy condensate formation.

**S06** <sup>6) 8)</sup> **Polyurethane-based top coat**, can only be ordered with **S03** and **S04** (with **S08** and **S09** included as standard with Polysiloxan). Exposure to direct sunlight (UV I22 ight) 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.

**Top coat colors**

Standard version: RAL 7030 (stone grey)  
 Available colors: Alternative standard and special RAL colors must be ordered with order code Y53, Y56 or Y66 and specification in plain text of the required RAL number (or another number when not RAL). (See tables for order codes Y53, Y56 and Y66 on the following page for selection of available numbers/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.

**Motors in frame sizes 400 and 450 - here the paint procedure is different**

S00	S01	Standard version	S02	S03	S04	S08	S09
<b>Paint systems, suitability for atmospheric-corrosivity categories in accordance with EN ISO 12944-2:2017 (frame sizes 400 and 450)</b>							
Unpainted, but unfinished cast-iron surfaces are primed	Unpainted, motor primed	C2 Standard paint system	C3 Special paint system	C4 Special paint system "sea air resistant"	SC5 Special paint system "offshore"	-	-
Synth. resin	Water-based 2-comp. polyurethane primer	Water-based 2-comp. polyurethane	Water-based 2-comp. polyurethane	Water-based 2-comp. polyurethane	Water-based 2-comp. polyurethane	-	-
<b>Durability according to EN ISO 12944-1:2017 (frame sizes 400 and 450)</b>							
-	-	C2 medium	C3 medium	C4 medium	C5 medium	-	-
<b>Total film thickness for outer surface - nominal film thickness in µm <sup>2) 3)</sup> (frame sizes 400 and 450)</b>							
60	120	120	180	240	320	-	-

Table continues on the next page.

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



## Introduction

### General information

### Colors and paint finish

1

#### Overview

##### 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
1015	Light ivory	7011	Iron grey
3000	Flame red	7016	Anthracite grey
5002	Ultramarine blue	7031	Blue grey
5009	Azure blue	7032	Pebble grey
5010	Gentian blue	7035	Light grey
5012	Light blue	7037	Dusty grey
5015	Sky blue	8012	Red brown
6011	Reseda green	9005	Jet black
7001	Silver grey	9010	Pure 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
1013	Oyster white	6020	Chrome green
2004	Pure orange	6021	Pale green
3002	Carmine red	6032	Signal green
3012	Beige red	7005	Mouse grey
3020	Traffic red	7012	Basalt grey
5000	Violet blue	7021	Black grey
5003	Sapphire blue	7022	Umbra grey
5005	Signal blue	7024	Graphite grey
5007	Brilliant blue	7038	Agate greyu
5014	Pigeon blue	7042	Traffic grey A
5017	Traffic blue	7045	Telegrey 1
5018	Turquoise blue	9001	Cream
5019	Capri blue	9002	Grey white
5021	Water blue	9003	Signal white
5024	Pastel blue	9006	White aluminum
6000	Patine green	9007	Grey aluminum
6002	Leaf green	9016	Traffic white
6010	Grass green	9018	Papyruswhite
6018	Yellow green	9023	Pearl dark grey

##### Pint finish in non-standard colors –

##### Orde code Y66 - rarely ordered RAL-colors, weakly opaque colors, non-RAL-colors

(color shade is required in plain text)

RAL-No.	Farbname	RAL-No.	Color name
1001	Beige	6017	May green
1002	Sand yellow	6019	Pastel green
1003	Signal yellow	6024	Traffic green
1004	Golden yellow	6025	Fern green
1005	Honey yellow	6026	Opal green
1006	Maize yellow	6027	Light green
1007	Daffodil yellow	6029	Mint green
1011	Brown beige	6033	Mint turquoise
1012	Lemon yellow	6034	Pastel turquoise
1014	Ivory	7000	Squirrel grey
1018	Zinc yellow	7004	Signal grey
1019	Grey beige	7009	Green grey
1021	Colza yellow	7010	Tarpaulin grey
1023	Traffic yellow	7013	Brown grey
1028	Melon yellow	7015	Slate grey
1033	Dahlia yellow	7023	Concrete grey
1036	Pearl gold	7026	Granite grey
2000	Yellow orange	7033	Cement grey
2001	Red orange	7034	Yellow grey
2002	Vermilio	7036	Platinum grey
2003	Pastel orange	7039	Quartz grey
2008	Bright red orange	7040	Window gre
2009	Traffic orange	7043	Traffic grey B
2010	Signal orange	7044	Silk grey
2011	Deep orange	7046	Telegrey 2
2012	Salmon orange	7047	Telegrey 4
3001	Signal red	7048	Pearl mouse grey
3003	Ruby red	8001	Ockerbraun
3004	Purple red	8002	Signal brown
3005	Wine red	8003	Clay brown
3007	Black red	8008	Olive brown
3011	Brown red	9004	Signal black
3013	Tomato red	9011	Graphite black
3015	Light pink	9017	Traffic black
3016	Coral red	AS2700_N52	
4005	Blue lilac	BS06_C39	
4006	Traffic purple	BS381C_637	
5001	Green blue	BS381C_355	
5011	Steel blue	BS4800_00E55	
5013	Cobalt blue	BS4800_06E51	
5020	Ocean blue	BS4800_14E53	
5022	Night blue	MAERSK 30070	
5023	Distant blue	MUN10B6/6	
6001	Emeral green	MUN10GY8/4	
6003	Olive green	MUN10R5/16	
6004	Blue green	MUN7,5BG7/2	
6005	Moos green	NCS_0502_B	
6007	Bottle green	NCS_S1000_N	
6009	Fir green	NCS_S_1502_B	
6012	Black green	NCS_S7500_N	
6013	Reed green	PROROT	
6016	Turquoise green		

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

**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 <b>1LE1...- 1PC1...- 1MB1...-</b>	For land transport			Types of construction IM B5, IM V1				
		Type of construction IM B3 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	<b>0B.2</b>	0.65	–	–	–	0.65	–	–	–
71 M	<b>0C.2</b>	0.65	–	–	–	0.65	–	–	–
80 M	<b>0D.2</b>	0.65	–	–	–	0.65	–	–	–
90 S	<b>0E.0</b>	0.65	–	–	–	0.65	–	–	–
100 L	<b>1A.4</b>	–	5.0	–	–	–	5.0	–	–
	<b>1A.5</b>	–	5.0	–	–	–	5.0	–	–
	<b>1A.6</b>	–	5.0	–	–	–	5.0	–	–
112 M	<b>1B.2</b>	–	5.0	–	–	–	5.0	–	–
	<b>1B.6</b>	–	5.0	–	–	–	5.0	–	–
132 S	<b>1C.0</b>	4.7	–	–	–	5.2	–	–	–
	<b>1C.1</b>	4.7	–	–	–	5.2	–	–	–
132 M	<b>1C.2</b>	4.7	–	–	–	5.2	–	–	–
	<b>1C.3</b>	4.7	–	–	–	5.2	–	–	–
	<b>1C.6</b>	8.7	–	–	–	9.2	–	–	–
	<b>1D.2</b>	4.8	–	–	–	5.7	–	–	–
160 M	<b>1D.3</b>	4.8	–	–	–	5.7	–	–	–
	<b>1D.4</b>	4.8	–	–	–	5.7	–	–	–
160 L	<b>1D.6</b>	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	<b>1LE5, 1MB5</b>	–	–	32.0	–	–	–	46.0	–
355	<b>1LE5, 1MB5</b>	–	–	58.0	–	–	–	78.0	–
315	<b>1LE5, 1MB5</b>	–	–	50.0	–	–	–	40.0	–
355	<b>1LE5, 1MB5</b>	–	–	60.0	–	–	–	50.0	–

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

**Safety notes**

Printed safety notes in German/English and safety notes in the language of the country of use are supplied as standard with each motor

**Operating instructions**

Operating instructions for all official EU languages as well as Norwegian, Russian, Turkish, and Chinese are provided in PDF format only at

<https://support.automation.siemens.com/WW/view/en/10803948/13330>

**Motor documentation**

Motor documentation is available online by selecting the motor in the SPC and by downloading the required documents.

Optional single documentation ordered with the motor, e.g.:

**B02**: Acceptance test certificate 3.1 in accordance with EN 10204,

**B60**: Electrical data sheet,

**B61**: Dimensional drawing

Optional documentation package ordered with the motor :

**B90**: Documentation package "Basic"

**B91**: Documentation package "Advanced"

**B92**: Documentation package "Projects"

For details see SIOS:

<https://support.industry.siemens.com/cs/ww/en/view/32466656>

**Test certificates**

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

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

The delivery time for the manufacturer's test certificate may differ from the delivery time for the motor and will be dispatched by E-mail.

**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.

## Introduction

### General information

#### Period of liability for defects

##### Overview

##### *Standard warranty and extension of liability for defects*

The standard warranty period is quoted in the standard conditions of supply and delivery and is 12 months.

This is valid if nothing else is stated. It is possible to obtain an extension of the liability for defects beyond the standard liability period.

Motors	Series	Standard warranty	Extension of the liability for defects
Innomotics GP	1LE10	12 months	Not available
Innomotics SD	1LE15 / 1LE55 Basic Line	12 months	1LE1 see page 3/131 1LE5 see page
Innomotics SD	1LE16 / 1LE56 Performance Line	36 months	1LE1 not available 1LE5 see page
Innomotics GP VSD4000	1FP10	36 months	Not available
Innomotics SD VSD4000	1FP15	36 months	Not available
Innomotics GP VSD10	1LE109	12 months	Not available
Innomotics SD VSD10	1LE159	12 months	see page 5/126
Innomotics XP	1MB10	12 months	Not available
Innomotics XP	1MB151 / 1MB551 / 1MB581 Basic Line (Ex tb), 1MB152 / 1MB552 / 1MB582 Basic Line (Ex tc), 1MB153 / 1MB553 / 1MB583 Basic Line (Ex ec)	12 months	1MB1 not available 1MB5 see page 6/113
Innomotics XP	1MB161 / 1MB561 Performance Line (Ex tb), 1MB162 / 1MB562 Performance Line (Ex tc), 1MB163 / 1MB563 Performance Line (Ex ec)	36 months	1MB1 not available 1MB5 see page 6/113
Innomotics XP	1MB154 / 1MB554 Basic Line (Ex eb)	12 months	see page 6/106
Innomotics XP	1MB164 / 1MB564 Performance Line (Ex eb)	36 months	Not available
Innomotics XP	1MB155 / 1MB555 (Ex db, Ex db eb)	12 months	see page 6/111

##### 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, 1MB15, 1LE5, and 1MB5 motors	
Additional identification code -Z with order code	Description
<b>Q80</b>	Extension of the liability for defects period by 12 months to a total of 24 months (2 years) from delivery
<b>Q81</b>	Extension of the liability for defects period by 18 months to a total of 30 months (2.5 years) from delivery
<b>Q82</b>	Extension of the liability for defects period by 24 months to a total of 36 months (3 years) from delivery
<b>Q83</b>	Extension of the liability for defects period by 30 months to a total of 42 months (3.5 years) from delivery
<b>Q84</b>	Extension of the liability for defects period by 36 months to a total of 48 months (4 years) from delivery
<b>Q85</b>	Extension of the liability for defects period by 48 months to a total of 60 months (5 years) from delivery

Wearing parts (bearings) are excluded from the warranty extension.

**Overview****Applicable standards and specifications**

The 1LE motors comply with the IEC 60034-1 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 <sup>1)</sup>	EN 60034-12 <sup>1)</sup>
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
Cooling methods 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
<b>In addition, the following applies to Ex motors:</b>		
General provisions	IEC/EN 60079-0	EN 60034-30-1
Flameproof enclosure "d"	IEC/EN 60079-1	EN 60079-1
Increased safety "e"	IEC/EN 60079-7	EN 60079-7
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-protected motors:**

Since the requirements of explosion-protected motors comply with the European standards EN 60079-0, EN 60079-1, EN 60079-7, 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 according to Area A (see diagram on page 1/24). If this is fully utilized, the admissible limit temperature of the temperature class may be exceeded by 10 K.

Efficiency  $\eta$  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  $\eta$  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  $\pm 10\%$

For more details, see section "Voltages, currents and frequencies" on page 1/24.

**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.

<sup>1)</sup> Only valid for 50 Hz and 60 Hz: Rated output power specified for 50 Hz and rated voltage. Rotor design letter according  $I_{LR}/I_{\text{rated}}$  ratio is not shown on the rating plate.

## Introduction

### General information

## Versions in accordance with standards and specifications

### Overview

Energy-saving motors for the European Economic Area in accordance with EU Regulation 640/2009 – valid until June 30, 2021 (from July 1, 2021, EU Regulation 2019/1781 comes into force)

Since January 2017, all low-voltage motors that fall within the scope of the EU Regulation must fulfill the specifications of international efficiency class IE3 or IE2.

- Line voltage  $\leq 1000$  V
- Line frequency 50 or 50/60 Hz and 60 Hz
- Power range 0.12 to 0.74 IE2  
Power range 0.75 to 1000 kW IE3
- Pole number 2-, 4-, 6- and 8-pole
- Continuous duty S1, S3 > 80 % and S6 > 80 %

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 EPA must also comply with NPE. The NPE requirements apply to motors with the following characteristics / operating conditions:

- Line voltage  $\leq 600$  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-protected motors are also included.

Exclusions from the EISA efficiency requirements:

- Brake motors
- Converter motors

Note:

Order code **D30**: el. acc. to NEMA

Order code **D31**: UL version

Order code **D40**: CSA 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**, **D31** and **D40** do not authorize operation within North America.

**NEMA**  
**Premium**

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 with following motor types are listed and marked with the certification number **CC032A**:

Fulfilling IE3 and NEMA Premium Efficiency MG1 Table 12-12

- GP/SD Eagle line (1LE1023/1LE1523)
- GP/SD with Premium Insulation (1LE1083/1LE1583) plus option code **D41**
- SD Add (1LE5533, 1LE5633)
- SD Pro with Premium Insulation (1LE5583, 1LE5683)

Fulfilling IE4 and NEMA Premium Efficiency MG1 Table 12-12

- SD (1LE5504 SH280) plus option code **D41**
- SD Add (1LE5534, 1LE5634) frame size 315 to 450
- SD Pro with Premium Insulation (1LE5584)

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

The above mentioned motor series remain certified up to a rated voltage of 600 V from Underwriters Laboratories Inc. and are marked accordingly ("Recognition Mark" = R/C).

 CC032A

UL approval does not apply to motors for Zones 1, 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. The above mentioned motor series 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.

Order code **D40** does not authorize importing into Canada.



Externally or internally mounted components which are used are listed by CSA or are used by manufacturers in accordance with regulations. Suitability in the final application must be verified.

Approval does not apply to 1MB1 motors for Zones 1, 2, 21 and 22 or marine motors.

NOM – Norma Oficial Mexicana

Motors which are delivered as stand-alone deliveries must comply with the standard NOM-016 ENER 2016 and be marked with the NOM logo. This is the responsibility of each importer and the certificate as such is the sole property of the importer and is not transferable.

**NOM**

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 became obligatory in Korea on 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, the Innomotics 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), was launched onto the market:

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

**Overview**

**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

**Korea Energy Label**

Order code **D33** KEA (Korea Energy Agency KEA) 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
- CO<sub>2</sub> emissions per hour
- Energy costs per annum



**Rating plate**

KEA-certified motors with order 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).

<b>SIEMENS</b>		<b>IE3</b>		<b>CE</b>			
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 KEA-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 order code **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-protected motors.

- Line voltage ≤ 1000 V
- Line frequency 50 Hz
- Power range 0.75 kW to 375 kW
- Number of poles: 2-, 4-, 6-, 8-pole
- Continuous duty S1

The minimum requirements for the efficiency classes previously defined in the Chinese standard GB 18613-2012 were classified in the new standard GB 18613-2020 (Minimum Allowable Values of Energy Efficiency and Energy Efficiency Grades for Small and Medium Three-Phase Asynchronous Motors) in accordance with International Efficiency IE3-5.



IEC IE class	<b>GB 18613-2020</b>
<b>IE5</b>	Grade 1
<b>IE4</b>	Grade 2
<b>IE3</b>	Grade 3

The 1LE1/5 motor series for IE3 and IE4, plus order code **D34** were previously certified for China Energy Label 20124421.

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

UKCA – UK Conformity Assessed

The UKCA marking is the product marking used for products being placed on the market in Great Britain (England, Scotland and Wales). The UKCA marking applies to most products previously subject to the CE marking and it's mandatory for products which are placed on the market after 31st of December 2022. All 1LE motors have the UKCA marking as standard.



## Introduction

### General information

## Versions in accordance with standards and specifications

### Overview

#### VIK version

VIK – German Association of the Energy and Power Supply Industry

- **VIK standard version** – 1LE1, 1LE5 + order code **C02**  
"VIK" identification on rating plate.  
→ Product range in Catalog Section 2.
- **VIK-Ex ec version** – 1MB1.3, 1MB5.3 + order code **C02**  
"VIK" and "Ex ec IIC T3 Gc" marking on the rating plate according to Directive 2014/34/EU (ATEX).  
→ Product range in catalog section 5.

Both versions include technology for Zone 2 with 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.

Design features for VIK version:

- Rating plate made of stainless steel
- Fan cover made of sheet steel
- Vertical motors with protective cover (order code **H00** must be ordered)
- Terminal box for direct cable connection (as 1MB... series) and with silicone seal
- Certified connection system in the terminal box
- Terminal box with certified sealing plugs
- External grounding
- Painting according to corrosivity category C3
- Second rating plate supplied loose

Minimum efficiency class:

- VIK standard version:  
IE3 in accordance with legal specifications.
- VIK-Ex ec version:  
IE3 in accordance with legal specifications.

#### Notes:

- For use in potentially explosive areas (e.g. zone 2), the motor must be marked accordingly (e.g. Ex ec).
- The modular equipment (brake, encoder, forced ventilation) of a normal motor (e.g. 1LE...) does not meet the requirements for use in potentially explosive areas.
- Before using 1LE motors in VIK version in Zone 2, a rating plate with type of protection and valid certificate number must be attached to the motor.

#### TR CU product safety certificate EAC for the Eurasian Customs Union (Kazakhstan, Armenia, Kyrgyzstan without Russia and Belarus)

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)

<https://support.industry.siemens.com/cs/ww/en/>  
and the Siemens Product Configurator  
[www.siemens.com/spc](http://www.siemens.com/spc)

- 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 fan cover (1LE10 aluminum motors in frame sizes 80 to 200) – Order code **L92** for cooling method IC418

- 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/ $\mu$ 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  
maximum coat thickness:  
primer coat 80  $\mu$ m  
top coat 80  $\mu$ m
- (Polyurethane-based paint, order code **S06**  
maximum coat thickness:  
primer coat 90  $\mu$ m  
top coat 140  $\mu$ m

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/ $\mu$ 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  
maximum coat thickness:  
primer coat 80  $\mu$ m  
top coat 80  $\mu$ m
- (Polyurethane-based paint, order code **S06**  
maximum coat thickness:  
primer coat 90  $\mu$ m  
top coat 140  $\mu$ m
- Including 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/ $\mu$ 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  
maximum coat thickness:  
primer coat 80  $\mu$ m  
top coat 80  $\mu$ m
- (Polyurethane-based paint, order code **S06**  
maximum coat thickness:  
primer coat 90  $\mu$ m  
top coat 140  $\mu$ m
- Including 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**)

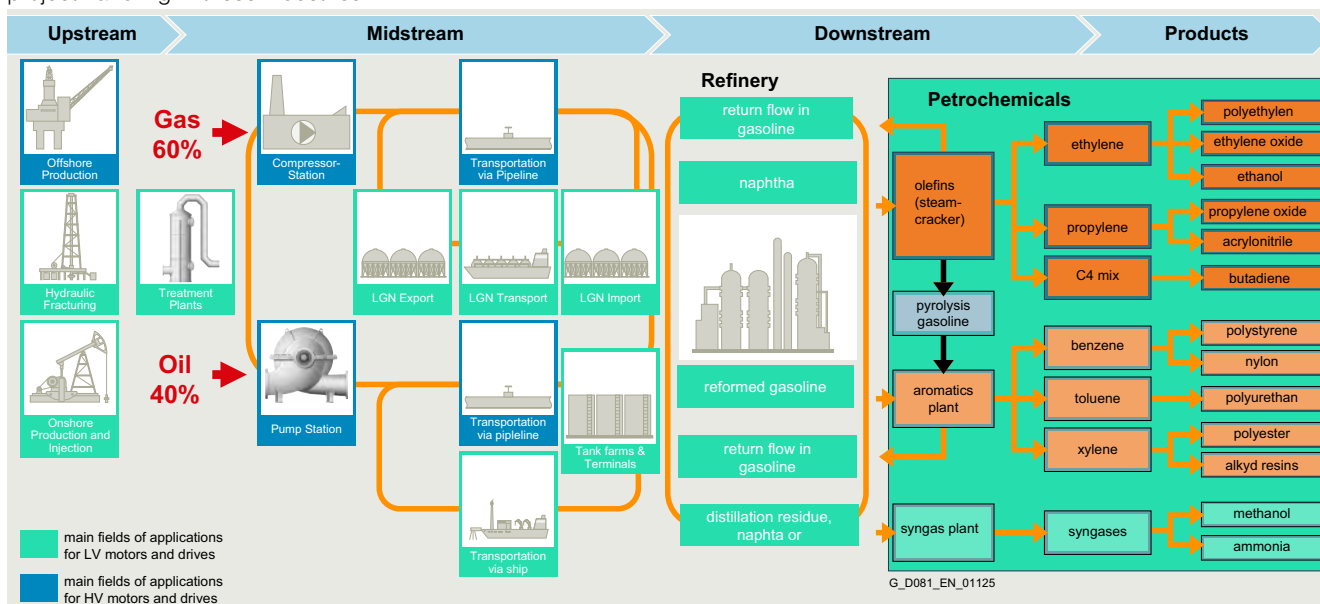
**Overview**

**Innomotics XP CHEMSTAR & Innomotics SD CHEMSTAR - The industry-specific motor solution for the Chemical, Petrochemical, and Oil & Gas sectors**

The proven industry-specific CHEMSTAR range has been setting standards for decades in terms of motor technology for the extreme operating conditions prevailing in the chemical industry as well as in the plants producing, transporting and processing oil and gas raw materials. The combination of these many years of experience and expertise on the one hand and the technology of the Innomotics motor platform on the other ensures maximum reliability, safety, high efficiency and simple project handling in these industries.

In the often complex processes and procedures of the chemical industry, many, though not all plant components are subject to explosion hazards due to flammable gases, liquids and dusts. The motor used must therefore function permanently and smoothly, even in chemically aggressive atmospheres.

The situation is similar in the application fields of the Oil & Gas sector. These are characterized by extreme demands placed on the drive technology used. This applies not only to the high explosion risk inherent in both commodities, but also to the place of deployment, whether it be offshore on the high seas, in the Arctic or in the Arabian desert.



With this in mind, we offer the explosion-protected Innomotics XP and Innomotics SD motors for harsh environments without the risk of explosion in the CHEMSTAR version. And this again in two industry-specific variants: One variant for the chemical industry and one for the Oil & Gas sector. The CHEMSTAR basic features are combined with chemical-specific or oil & gas-specific additional features

In the case of the "CHEMSTAR for Chemical Industry" variant, this ensures that the motor is precisely tailored to the specific ambient conditions of this industry, thus ensuring maximum reliability and safety in chemical processes.

With the "CHEMSTAR for Oil & Gas" version, the basic and additional features are combined in such a way that the motors ensure maximum safety and plant availability while simultaneously reducing lifecycle costs, even under the extreme conditions of oil and gas production and transport.

Innomotics motors for oil and gas applications in CHEMSTAR design meet the new standard of the IOGP specification.



The following overview shows the basic features and the industry-specific features of the two variants.

Variant	Chemice industry	Oil & gas
Sector options	C03	C04
<b>Options included in the package</b>		
Paint system	C4 Special paint system "sea air resistant"	C2 Standard paint system Optionally special paint system up to category CX offshore
Plate material	Plates made of stainless steel QR code plate made of stainless steel	
Screws	Standard version	Stainless steel screws
Fan cover	Fan cover made of sheet steel	
Grounding	External grounding	
Housing	IP66 Increased air humidity 40-60 g per m <sup>3</sup> of air <sup>1)</sup>	
Condensation drainage holes	Sealed <sup>2)</sup>	
Bearings	Bearings reinforced at both ends for DE and NDE, bearing size 63 from frame size 100	
Warranty	36 months from delivery	
Inspection certificate	Inspection certificate 3.1	
Included standard	VIK version	-
<b>Recommended options</b>		
Documentation	Documentation package "Advanced"	Documentation package "Projects"
Additional rating plate	Additional rating plate with customer specifications	

<sup>1)</sup> C04 in conjunction with corrosivity category C3 or higher

<sup>2)</sup> Ex db motors without drainage holes



# Introduction

## Electrical design

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### Voltagages, currents and frequencies · Powers

#### Overview

##### Voltagages, currents and frequencies

###### Standard voltagages

EN 60034-1 differentiates between Category A (combination of voltage deviation  $\pm 5\%$  and frequency deviation  $\pm 2\%$ ) and Category B (combination of voltage deviation  $\pm 10\%$  and frequency deviation  $+4/-6\%$ ) 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	$\pm 5\%$	$\pm 10\%$
Frequency deviation	$\pm 2\%$	$+4\%/-6\%$
Rating plate data stamped with rated voltage a (e.g. a=400 V)	a $\pm 5\%$ (e.g. 400 V $\pm 5\%$ )	a $\pm 10\%$ (e.g. 400 $\pm 10\%$ )
Rating plate data stamped with rated voltage ranges b to c (e.g. b=380 V to c=420 V)	b $-5\%$ to c $+5\%$ (e.g. 380 $-5\%$ to 420 $+5\%$ )	b $-10\%$ to c $+10\%$ (e.g. 380 $-10\%$ to 420 $+10\%$ )

For further details, see EN 60034-1.

According to the standard, longer operation is not recommended for Category B. 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  $\pm 10\%$  for line voltages of 230 V, 400 V, and 690 V.

Line voltages	Voltage code
<b>1LE1 motors</b>	
230 V $\Delta$ /400 VY, 50 Hz 460 VY, 60 Hz	22
400 V $\Delta$ /690 VY, 50 Hz 460 V $\Delta$ , 60 Hz	34
500 VY, 50 Hz 575 VY, 60 Hz	27
500 V $\Delta$ , 50 Hz 575 V $\Delta$ , 60 Hz	40

##### Non-standard voltagages and/or frequencies

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

For some non-standard voltagages 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.

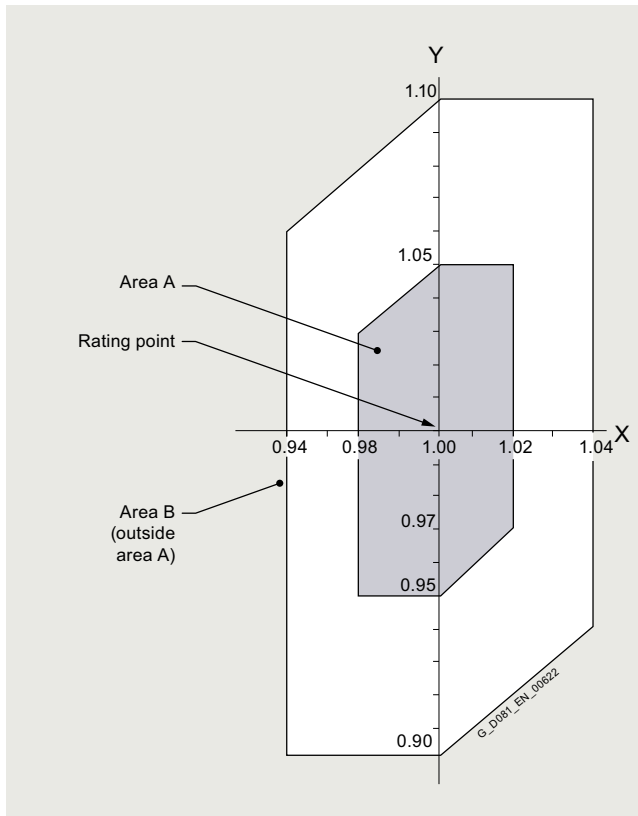
The lowest rated voltage for **M1Y** that can be delivered depends on factors including the circuit (delta connection 200 V/star (wye) connection 250 V) and frame size. The defined order codes for further rated voltagages provide an indication of the lowest rated voltage for **M1Y**.

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

##### Line voltagages 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



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

##### 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 in accordance with IEC 60072-1

The values specified for kW and hp are not precise conversion values. They are the approximate relationship between the values generally applied in the countries in which both units are used.

$P_{rated}$ 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	2.2	3	37	50	200	270	450	603	800	1072
0.09	0.12	3	3.7	45	60	220	300	475	637	850	1139
0.12	0.16	4	5	55	75	250	350	500	670	900	1206
0.18	0.25	5.5	7.5	75	100	280	375	530	710	950	1273
0.25	0.33	7.5	10	90	125	300	402	560	750	1000	1340
0.37	0.5	11	15	110	150	315	422	600	804		
0.55	0.75	15	20	132	175	335	476	630	845		
0.75	1	18.5	25	150	200	375	503	670	898		
1.1	1.5	22	30	160	220	400	536	710	952		
1.5	2	30	40	185	250	425	570	750	1005		

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

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.

- Extra (rating) plate(s) – Order code **M10**  
As adhesive label for frame sizes 80 and 90.
- Plate(s) with resistance to scratches, heat, cold and acid – Order code **M11**

As standard, the normal version of the rating plate is international (in English).

Other languages on request.

Examples of rating plates

<b>SIEMENS</b>		Made in Germany		<b>CE</b>			
3-MOT 1AV2092A 1LE10010EA422AA0		IEC/EN 60034		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

<b>SIEMENS</b>		D-90441 Nürnberg		<b>IE3</b>		<b>CE</b>	
3-Mot. 1AV314B 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		40g 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 KEA certification

<b>SIEMENS</b>		D-90441 Nürnberg		<b>IE3</b>		<b>CE</b>	
3-Mot. 1AV3164A 1LE10431DA434AA0-Z		E 1701/1410842 001 001					
IEC/EN 60034 160L IMB3		IP10=FAN COVER/IP55		Brake: 2LM8040-5NA10			
94kg	Th.Cl. 155(F)	-20°C ≤ TAMB ≤ 45°C		2000M		230V AC 50/60Hz 1.25A	
Bearing UNIREX-N3		20g INTERVAL: 2000h		TH.Cl. 155(F) 40Nm			
DE 6209-Z2C3	20g						
NE 6209-Z2C3	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
KDN. 12345678999111 MATN. 12345678 Space Heater 230V							

Rating plate (metal) for IEC motors (APAC Line) – maximum characteristics

<b>SIEMENS</b>		D-90441 Nürnberg		<b>IE3</b>		<b>CE</b>	
3-Mot. 1AV3164A 1LE10231DA434AA0-Z		E 1701/1410842 001 001					
IEC/EN 60034 160L IMB3		IP55		Brake: 2LM8040-5NA10			
94kg	Th.Cl. 155(F)	-20°C ≤ TAMB ≤ 45°C		2000M		230V AC 50/60Hz 1.25A	
Bearing UNIREX-N3		20g INTERVAL: 2000h		TH.Cl. 155(F) 40Nm			
DE 6209-Z2C3	20g						
NE 6209-Z2C3	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
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
KDN. 12345678999111 MATN. 12345678 Space Heater 230V							

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

## Introduction

### Electrical design

## Rating plate and additional rating plates

1

### Overview

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 YYYYMM  
 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 power, direction of rotation, rated torque

### Overview

#### Efficiency and power factor

The efficiency  $\eta$  for 4/4, 3/4 and 1/2 load and the power factor  $\cos \phi$  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 1/31).

#### Rated torque

The rated torque  $T$  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.

**Overview**

All motors in the Innomotics 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 Innomotics 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 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 $U_{\text{rated}}$						
	400 V		480 V		500 V		
Standard	IVIC C	Inno- motics	IVIC C	Inno- motics	IVIC C	Inno- motics <sup>1)</sup>	
$U_{\text{phase}} U_{\text{phase-to-ground}}$	$V_{\text{pk/pk}}$	1664	2200	1997	2200	2080	2800
$\hat{U}_{\text{phase-to-ground}}$	$V_{\text{pk}}$	832	1100	999	1100	1040	1400
$U_{\text{phase}} U_{\text{phase-to-phase}}$	$V_{\text{pk/pk}}$	2377	3000	2852	3000	2971	3200
$\hat{U}_{\text{phase-to-phase}}$	$V_{\text{pk}}$	1189	1500	1426	1500	1486	1600

	Line voltage $U_{\text{rated}}$				
	500 V		690 V		
PREMIUM	IVIC C	Inno- motics	IVIC C	Inno- motics	
$U_{\text{phase}} U_{\text{phase-to-ground}}$	$V_{\text{pk/pk}}$	2080	3000	2870	3000
$\hat{U}_{\text{phase-to-ground}}$	$V_{\text{pk}}$	1040	1500	1435	1500
$U_{\text{phase}} U_{\text{phase-to-phase}}$	$V_{\text{pk/pk}}$	2971	4400	4100	4400
$\hat{U}_{\text{phase-to-phase}}$	$V_{\text{pk}}$	1486	2200	2050	2200

Minimal to IEC60034-18 0.1  $\mu\text{s}$  (0.3+/-0.2).

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

**Insulation systems for converter operation > 480 V/500 V**

The Innomotics 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 (max. 690 V), a special insulation system of the motor (PREMIUM) is required.

This is available for converter motors, such as Innomotics GP/SD VSD10, Innomotics DP crane motors, Innomotics FD, and the converter-capable Innomotics SD Pro motors.

For IE3 standard motors, the PREMIUM insulation system is available depending on the type.

**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 converter operation and 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 "shaft grounding brush" option (order code **L52**) must also be selected to maintain 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.

When DE or NDE bearing insulation (order codes L50 or L51) is used together with shaft grounding brushes (order code L52), care must be taken - to avoid damage to the bearings of the driven machine - that the shaft grounding brushes are not mounted on the same side as the insulated bearing.

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).

<sup>1)</sup> Only for motors with voltage code 27 or 40.

## Introduction

### Electrical design

## Windings and insulation

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### Overview

#### Explosion-protected motors

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

#### 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, dusts, oils and increased air humidity. It can withstand the usual vibration stressing. The insulation is suitable up to an absolute air humidity of 30 g water per m<sup>3</sup> of air. Moisture condensation should be prevented from forming on the winding. For higher values, the **N30** and **N31** options are available – see page 1/29.

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

At rated power in line operation, the 1LE5/1MB5 motor series can be utilized in the following temperature class:

- For Innomotics SD Add <sup>1)</sup>: Temperature class 130 (B)
- For Innomotics XP <sup>1)</sup>: Temperature class 130 (B)
- For Innomotics SD Pro and Innomotics XP 1MB58: Temperature class 155 (F)

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

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 1LE./1PC1 motors in line operation have a service factor of 1.15. An exception are IE1 motors, which have a service factor of 1.1.

For the line operation, all motors with frame sizes 400 and 450 have a service factor of 1.05 at rated power.

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 %. For motors of frame sizes 400 and 450, for line operation, when utilized according to temperature class 155 (F), the rated power listed in the selection and ordering data can be increased by 5 %. In this case, the service factor is 1.0. 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, the coolant temperature is permitted to rise to 55 °C and, for motors of frame sizes 400 and 450, to 45 °C.

In this case, the service factor is 1.0.

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 %

For motor series 1LE1, 1MB. <sup>1)</sup>, Innomotics SD Add <sup>1)</sup>, a version 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 %

For motor series 1LE1, 1MB. <sup>1)</sup>, Innomotics SD Add <sup>1)</sup> a version 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 %

For motor series 1LE1, 1MB. <sup>1)</sup>, Innomotics SD Add <sup>1)</sup> a version 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 %

For motor series 1LE1, 1MB. <sup>1)</sup>, Innomotics SD Add <sup>1)</sup> a version 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)

Order code **N10** <sup>2)</sup>

Order code **N10** provides an insulation system corresponding to temperature class 180 (H).

Order code **N10** does not change power and utilization of motor.

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

Order code **N11**

Order code **N11** provides an insulation system corresponding to the temperature class 180 (H) for a coolant temperature of 60 °C with rated power.

Utilization according to temperature class can be changed.

For motors of frame sizes 225 to 355, utilization according to H/H is not permissible due to the bearing temperature rise.

In this case, the service factor is 1.0.

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.

<sup>1)</sup> Not applicable for 8-pole motors, frame size 450. Utilization in accordance with temperature class 130 (B) only possible on request, specifying order code Y50.

<sup>2)</sup> Order code for Ex motors of the 1MB5, Innomotics XP motor series not available.

**Overview**

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**<sup>1)</sup>

Increased air humidity/temperature with 30 to 60 g water per m<sup>3</sup> of air

With motor series 1LE1, 1LE5, 1MB1, 1MB5 and 1PC1, motors are available in a version designed for increased air humidity in the range of 30 to 60 g water per m<sup>3</sup> of air, depending on the temperature, as shown in the table below. This version has condensation drainage holes (sealed). Not possible for 1MB...5 Ex db motors. Order code **N30** (includes order code **H03**<sup>2)</sup>, **M11**, stainless bolts in the terminal box cover, and **S02** standard/special paint finish for Performance Line cast-iron motors). Please inquire before combining order code **N30** with mountings (e.g. rotary pulse encoder, brakes)!

Increased air humidity/temperature with over 60 to 100 g water per m<sup>3</sup> air

With motor series 1LE1, 1LE5, 1MB1, 1MB5 and 1PC1, motors are available in a version designed for increased air humidity of over 60 to 100 g water per m<sup>3</sup> of air, depending on the temperature, as shown in the table below. This version has condensation drainage holes. Not possible for 1MB...5 Ex db motors. Order code **N31** (includes order code **H03**<sup>2)</sup>, **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 m<sup>3</sup> 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 m<sup>3</sup> 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 m<sup>3</sup> of air).

**Note:**

- The coolant temperature and installation altitude can be found from page 1/30 onwards!
- The sheet metal fan cover is available in combination with order code **F74** (not standard). For 1LE5/1MB5 motors with frame sizes 400 and 450 and for cast-iron motors of the Performance Line (1LE16), the metal fan cover is always standard.
- 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.

<sup>1)</sup> Order code for Ex motors of the 1MB5, Innomatics XP motor series not available.

<sup>2)</sup> Order code for Ex motors of the 1MB.553, Innomatics XP motor series not available.

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## Coolant temperature and installation altitude

### 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, 1LE5, 1MB1, 1MB5 and 1PC1 motors for ambient temperatures exceeding 40 °C are equipped with various types of seal. Mountings such as brake, terminal box at NDE, flange-mounted motors 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 highest 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.

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 1/28.

### 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.
- 1LE5 motors are used in accordance with temperature class 155 (F) up to 40 °C occurs with a service factor of 1.05, i.e. the motor can be continuously overloaded with 5 % of the 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.

**Overview****Anti-condensation heating**

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

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

Supply voltage 400 V (1AC)  
Order code **Q06**

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; XP)	≤ 200	1 × M16 × 1.5
Cast-iron motors (SD; XP)	≤ 180	1 × M16 × 1.5
	200	1 × M20 × 1.5
	225 ... 315	2 × M20 × 1.5
	355 ... 450	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)	400 V (1AC)
	Order code <b>Q02</b>	Order code <b>Q03</b>	Order code <b>Q06</b>
	W	W	W
<b>1LE1/1LE5/1PC1 motors</b>			
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	200
400 ... 450	240	240	370
<b>1MB1, 1MB5 motors</b>			
80 ... 112	7	7	–
132 ... 160	12	12	–
180 ... 200	57	57	–
225 ... 250	92	92	–
280 ... 315	109	109	–
355	218	218	200
400 ... 450	240	240	370

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 and 1LE5 and 1MB5 motors with 4 poles or more have radial-flow fans in the standard version (with the exception of order code **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). In the standard version, 1LE5 motors with 2 poles are cooled with unidirectional axial-flow fans. 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 63 to 450, see also "Separately driven fans" on page 1/84.

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 1/84.

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
400 ... 450	150

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

Motor-series	Frame size	11th position of the Article No.:	Version	Fan material	Fan cover material	
<b>1LE10</b>	63 ... 71	alle		Plastic	Metal	
	80 ... 200				Plastic <sup>1)</sup>	
<b>1LE15</b>	71 ... 90		Basic Line	Plastic	Metal	
	100 ... 315				Plastic	
<b>1LE16</b>	100 ... 315		Performance Line	Plastic	Metal	
<b>1LE55</b>	315 Standard power	0, 2, 4, 5, 6 <sup>1)</sup>	Basic Line	Plastic	Plastic	
	315 Extended power				Performance Line	Metal
	355 Extended power				Basic Line	Metal
<b>1LE55</b>	400 ... 450 2-polig	only for 2-pole		Metal	Metal	
	400 ... 450 4-... 8-polig				only for 4-... 8-pole	Plastic
<b>1LE56</b>	315 ... 355			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 the motors (with the exception of 1LE1 with order code **F90** – version "Forced-air cooled motors without external fan and fan cover"). In versions with a unidirectional axial-flow fan, the metal external fan is already included. Up to frame size 160 and for the 1LE5/1MB5 motor series, the metal external fan impeller is made of aluminum.

Order code **F76**

<sup>1)</sup> 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 order code **H03** (condensation drainage holes). Mounted separately driven fans or brakes are only available in sheet metal version.



## Introduction

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## Heating and ventilation

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### Overview

#### Fan cover for textile industry

For 1LE1 motors (with the exception of 1LE1 with order code **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 order code **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 1/119, Figure 12.

Order code **F75**

The special requirements of the textile industry regarding the sheet metal cover open up the possibility that a finger may be inserted between the cover and housing. The customer must implement appropriate measures to ensure that the installed system is "finger-safe".

#### Sheet metal fan cover

In place of the plastic fan cover, a sheet metal fan cover can be ordered for motor series 1LE1 and 1LE5 (not in combination with order code **F90** – version "Forced-air cooled motors without 1LE1 motors

external fan and fan cover").

Order code **F74**

The sheet metal fan cover is supplied as standard for

- Cast-iron series Performance Line (1LE16, 1LE56, 1LE55 with order code **C06**)
- Cast-iron series 1LE5 frame size 355, 400 and 450
- Explosion-protected 1MB1 and 1MB5 motors

#### 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.

Frame size	Required cooling air flow for number of poles							
	2		4		6		8	
	<b>IE2</b>							
	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min
63	0.83	1.02	0.41	0.48	0.27	0.32	0.08	0.21
71	1.36	1.66	0.66	0.8	0.42	0.51	0.3	0.38
80	2.86	3.41	1.34	1.7	0.87	1.06	0.3	0.38
90	3.3	4.03	1.64	2.01	1.11	1.31	0.76	0.94
	<b>IE3/IE2/IE1</b>		<b>IE3/IE2</b>		<b>IE1</b>		<b>IE3/IE2/IE1</b>	
	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min
80	1.36	1.66	0.66	0.8	0.6	0.73	0.3	0.38
90	2.86	3.41	1.34	1.7	1.11	1.31	0.65	0.8
100	3.8	4.4	2.1	2.6	1.5	1.8	1.2	1.3
112	5.0/5.4 <sup>1)</sup>	5.7/6.1 <sup>1)</sup>	2.9	3.5	2.9	3.5	1.9	2.3
132	6.3	7.2	4.6	5.7	4.6	5.7	3.1	3.8
160	10.9	13.3	6.7	8.1	7.6	9.1	5	6.1
180	12.4	14.8	7.8	9.4	7.8	9.4	5.2	6.2
200	14.3	17.2	10.4	12.5	10.4	12.5	7.9	9.5
	<b>IE2</b>							
	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /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
	<b>IE4/IE3</b>							
	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min
180	10.3	12.3	7	8.3	5.2	6.2	4.8	5.8
200	10.4	12.5	7.6	9.1	6.5	7.8	6	7.2
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

#### 1LE5 motors

Frame size	Required cooling air flow for number of poles							
	2		4		6		8	
	<b>IE3/IE4</b>							
	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /min	50 Hz m <sup>3</sup> /min	60 Hz m <sup>3</sup> /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/-	-	-
400	72	84	78	96	102	120	78	96
450	90	108	126	150	90	108	72	84

<sup>1)</sup> Value: IE2/IE1

**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).

Note:

**Insulation of winding components**

All sensors for winding protection, which can be selected under the Article No. supplements and options for motor protection meet the requirements of basic insulation.

The basic insulation is tested in accordance with Innomatics Product Standard 60034-1 and 60034-18-41 and relates to all sensors and built-in components that are installed in the winding, such as PTC, NTC, KTY, Pt100 and bimetal switch.

For example, by ordering with letter **B** in the 15th position of the Article No or as an option with order code **Q11** "1 or 3 PTC thermistors – for tripping".

The Pt100/1000 already meets the requirements for electrically protective separation according to IEC 61800-5-1.

For PTC elements, a request via quotation center is required after secure separation

**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), e.g. with SIRIUS industrial controls and protection relays. 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 cannot 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**.

The following applies to 1LE1 motors:

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.

The following applies to 1MB1 motors:

The motor protection is implemented with the 15th position of the Article No. letter **B** with three PTC thermistors.

The motor protection is implemented with the 15th position of the Article No. letter **C** with six 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](http://www.siemens.com/product?3RN2).

# Introduction

## Electrical design

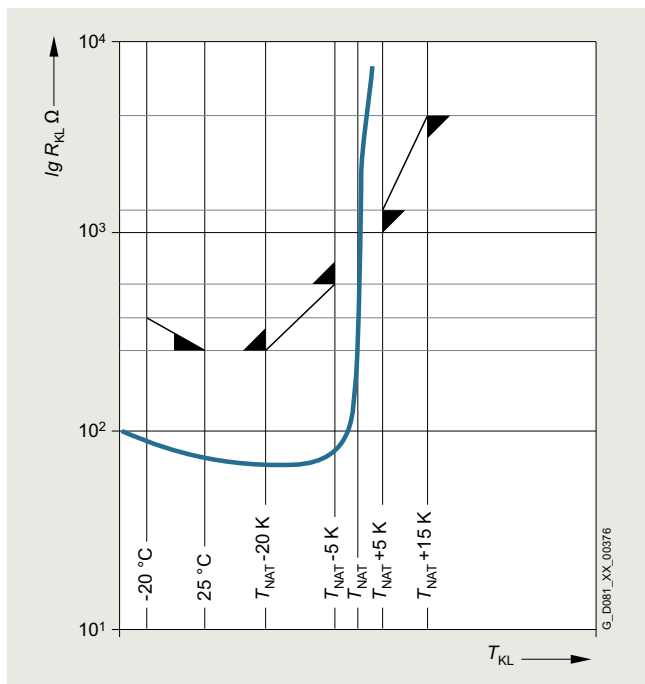
### Motor protection

1

#### Overview

##### PTC thermistor 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

##### 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.

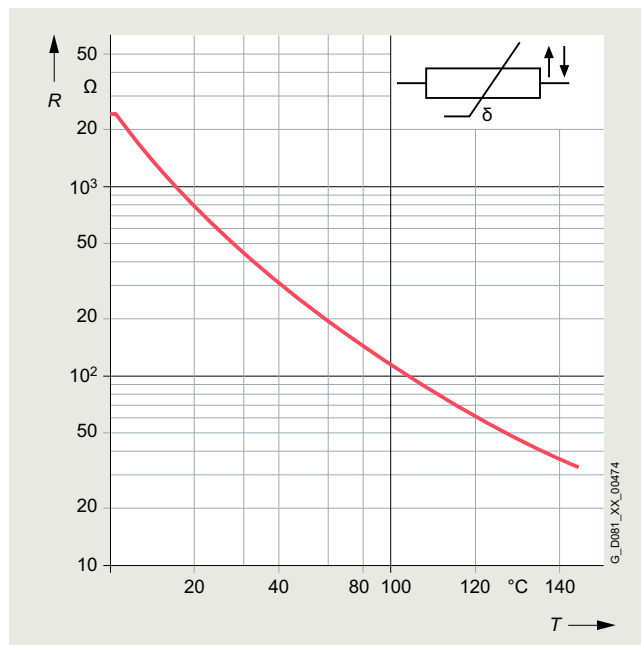
Motor temperature monitoring and shutdown using NTC thermistors is unusual, but it is technically possible. The tripping temperature can be set when using suitable tripping devices of this type.

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

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

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

##### NTC thermistor characteristic



**Overview**KTY 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.

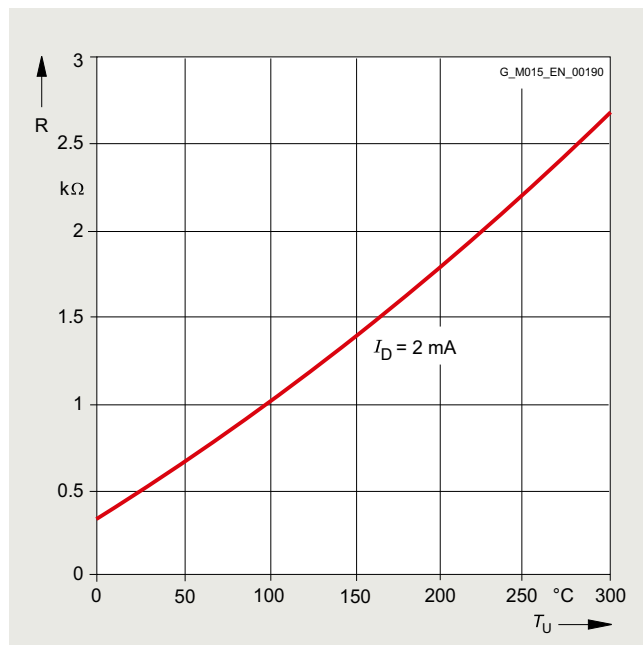
Motor temperature detection with embedded KTY 84-130 temperature sensor: In the terminal box, two auxiliary terminals are required.

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 relay, which forms part of the protection equipment, can be ordered separately.

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

KTY 84-130 temperature sensor characteristicPt100/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  $\pm 0.3$  °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.

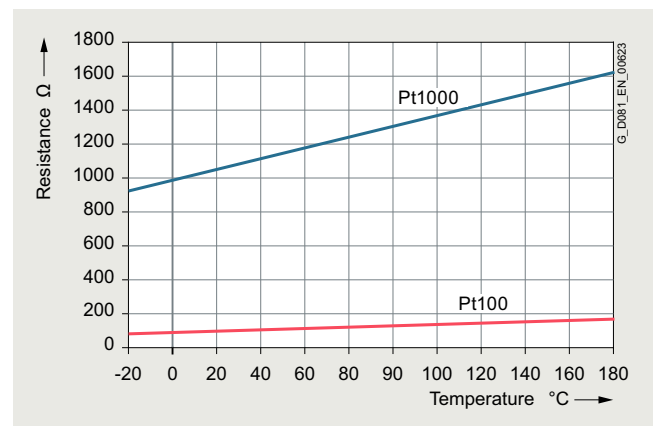
Pure metals undergo larger changes in resistance than alloys and have a relatively constant temperature coefficient.

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, Q67, Q68, 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](http://www.siemens.com/product?3RS1).

Pt100/Pt1000 resistance thermometer characteristics

## Introduction

### Electrical design

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## Connection, circuit and terminal boxes

### Overview

#### Location 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".

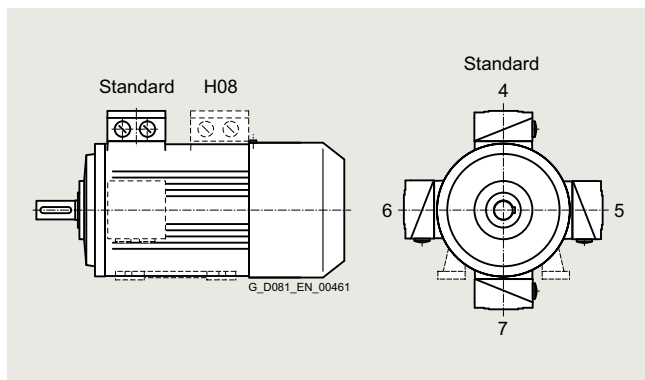
The aluminum series motors 1LE10 and 1PC10 with feet and standard power range have cast feet in the standard version in frame sizes up to 160, e.g. IM B3, IM B6, etc. (applies only to IE3 and IE4 motors with standard housing; IE3 and IE4 motors with long housing always have screwed-on feet). Motors from 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 screwed-on 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.

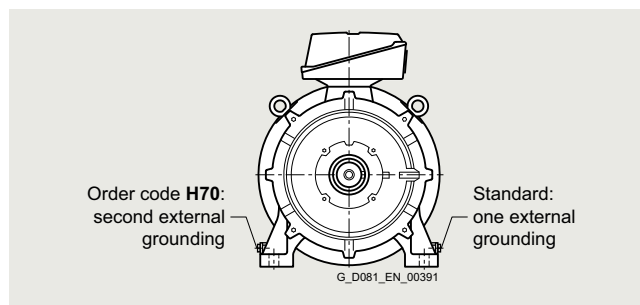
Labeled terminals are provided to connect the protective conductor.

A PE terminal is provided in the terminal box for grounding. A grounding terminal is provided on the outside of the motor housing – 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 and for 1LE5/1MB5 motors of frame sizes 400 and 450.

A second external grounding connection can also be ordered. Order code **H70** (must be ordered in combination with order code **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:

For configuration, note that, 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 Siemens Product Configurator. Order code **H08**

**Overview****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,
- The requirements according to IEC/EN 60204-1,
- The requirements according to IEC/EN 60079-14 for 1MB motors.

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 Siemens Product 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).

Order code **R09**

**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.

Location of the cable entries with the corresponding order codes

Motor	Frame size	Terminal box position					Retrofitting possible Article No. with	Rotation of the terminal box and cable entry			Retrofitting possible
		Top 16th position of the Article No.	Right-hand side	Left-hand side	Bottom	4		-90° -Z and order code	+90° code	180°	
Type		4	5	6	7	4	H01	R10	R11	R12	
1FP10, 1LE10, 1MB10, 1PC10	63 ... 71	✓	-	-	-	-	-	✓	✓	✓	Yes
	80 ... 90	✓	✓	✓	-	-	-	✓	✓	✓	Yes
	100, 112	✓	✓	✓	✓	-	-	✓	✓	✓	Yes
	132	✓	✓	✓	✓	-	-	✓	✓	✓	Yes
	160	✓	✓	✓	✓	-	-	✓	✓	✓	Yes
	180	✓	✓	✓	✓	-	-	✓	✓	✓	Yes
1FP15, 1LE15, 1MB15 <sup>6)</sup>	71	✓	✓	✓	-	-	-	✓	✓	✓	Yes
	80, 90	✓	✓	✓	-	-	-	✓	✓	✓	Yes
1FP15, 1LE15/6, 1MB15/6 <sup>6)</sup>	100 ... 160	✓	✓	✓	✓	-	-	✓	✓	✓	Yes
	180 ... 315	✓	✓	✓	✓	-	-	✓	✓	✓	Yes
1LE5 <sup>7)</sup>	315	✓	✓	✓	-	-	-	✓	✓	✓	Yes
1PC13	80, 90	✓	✓	✓	-	✓	✓	✓	✓	✓	Yes
	100 ... 160	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
	180 ... 315	✓	✓	✓	-	✓	✓	✓	✓	✓	Yes

**Cable entry on the 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°.

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 3/173 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**).

<sup>1)</sup> 1MB15/6 also applies to 1MB154, 1MB164; 1MB5 also applies to 1MB554.

<sup>2)</sup> 11th position of Article No. for all number of poles **0, 2, 4, 5**; for 6-, 8-pole **6**.

## Introduction

### Electrical design

## Connection, circuit and terminal boxes

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### Overview

Motor Type	Frame size	Terminal box position									Rotation of the terminal box and cable entry			Retrofitting possible
		Top left 16th position of the Article No.	Top right	45° left	45° right	Top	90° right	90° left	Bottom	-90° Article No.	+90° with -Z	180° and order code		
		0	1	2	3	4	5	6	9 <sup>1) 2)</sup>	R10	R11	R12		
1LE5 <sup>8)</sup> , 1MB5 <sup>6)</sup>	225	-	-	-	-	✓	✓	✓	-	✓	✓	✓	Yes	
	250	-	-	-	-	✓	✓	✓	-	✓	✓	✓	Yes	
	280	-	-	-	-	✓	✓	✓	-	✓	✓	✓	Yes	
	315	-	-	-	-	✓	✓	✓	-	✓	✓	✓	Yes	
	315 increased power	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	No	
	355	✓	✓	✓	✓	-	✓	✓	✓	✓ <sup>3)</sup>	✓	✓	No	
400 ... 450	✓	✓	✓	✓	-	✓	✓	✓	✓ <sup>5)</sup>	✓	✓	No <sup>4)</sup>		
1MB..5, 1MB..6	315 ... 355	-	-	-	-	✓	-	-	-	✓	✓	✓	No	



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 63 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**

When ordering with order code **R70** and **R71**, order code **R50** is included.

- 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 connectors			
	HAN3A-Q12		HAN10B-10E	
Degree of pollution	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](http://www.harting.com)

or <https://b2b.harting.com/ebusiness/de/industrie-steckverbinder-han/100382>.

1) Article No with the following order code:  
**R5L** – terminal box on left-hand side (base below)  
**R6R** – terminal box on right-hand side (base below)  
**R7L** – terminal box bottom left  
**R7R** – terminal box bottom right

2) Only possible in combination with type of construction IM B5.

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

4) Only possible with order code **R09**.

5) With a flange, only possible with order code **H08**.

6) 1MB15/6 also applies to 1MB154, 1MB164; 1MB5 also applies to 1MB554.

7) 11th position of Article No. for all number of poles **0**, **2**, **4**, **5**; for 6-, 8-pole **6**.

8) 11th position of Article No. for all number of poles **7**, **8**; for 2-, 4-pole **6**.

**Overview**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<sup>1)</sup>  
Order code **R20**
- 3 cables protruding, 1.5 m long<sup>1)</sup>  
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.

In Combination with motor protection (15th position of the Article No.) or anti-condensation heating on request.

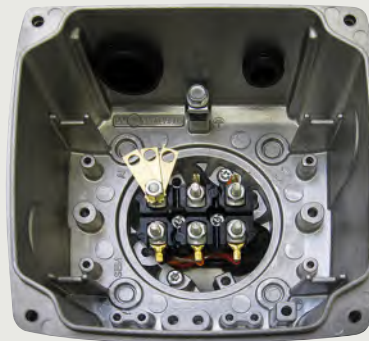
Terminal box type TB1B00



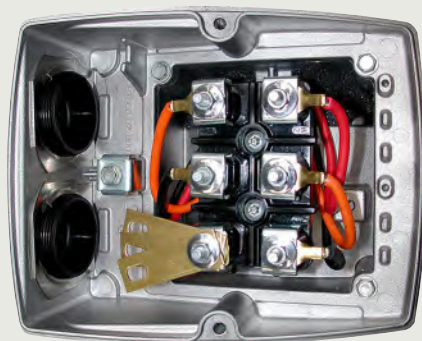
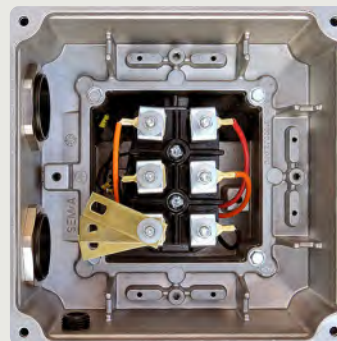
Terminal box type TB1B10



Terminal box type TB1E00

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

Terminal box types TB1F00, TB1H00, TB1J00

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

<sup>1)</sup> 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

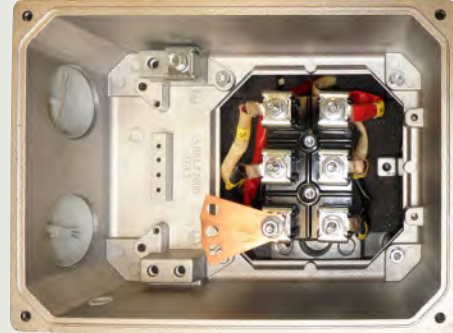
1

#### Overview

Terminal box type TB1L00



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



Terminal box type TB1J01



Terminal box type TB1L01



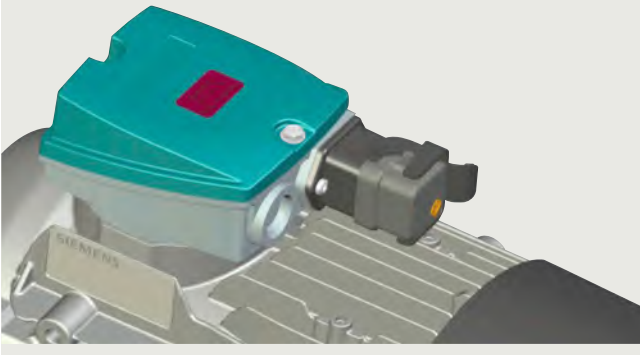
Terminal box type TB1N01



Terminal box type TB1Q01



Motor connector type HAN3A-Q12

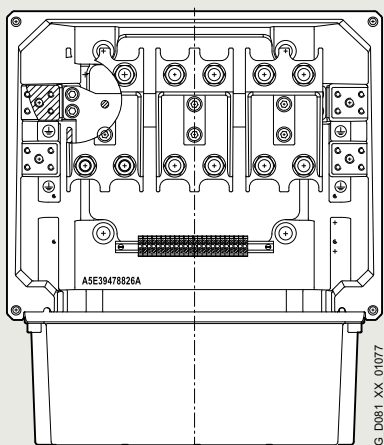


Motor connector type HAN10B-10E

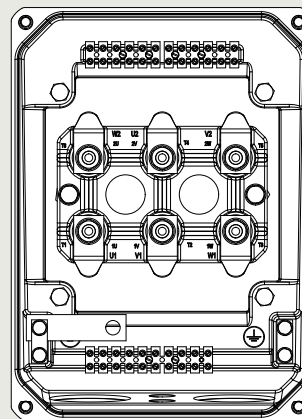


Overview

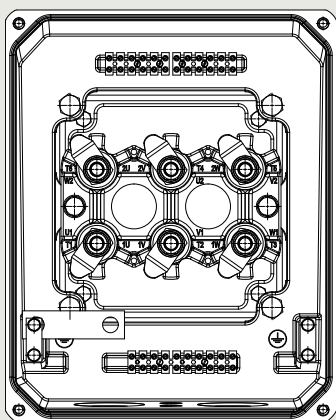
Terminal box type TB3R61



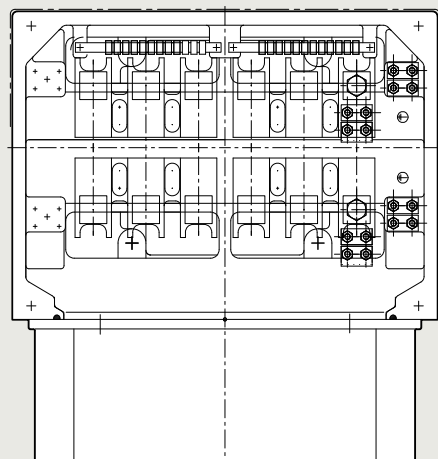
Terminal box type TB4N01



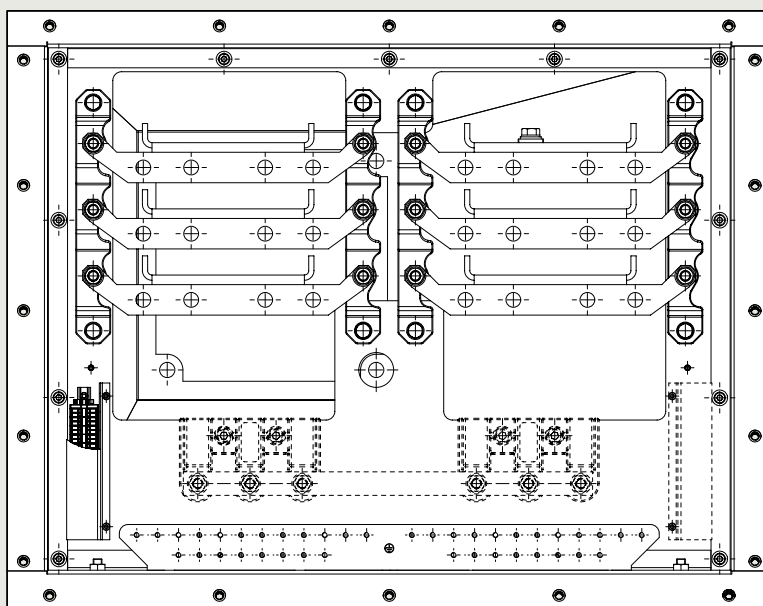
Terminal box type TB4Q01



Terminal box type 1XB1631



Terminal box type 1XB7750



## Introduction

### Electrical design

#### Connection, circuit and terminal boxes

1

#### Overview

##### Basic data for terminal boxes for 1LE1, 1MB1, 1PC1, 1LE5, and 1MB5 motors

Motor	Frame size	Terminal box	Cable entries/locking	Terminal box material	Feeder connection
<b>1LE10/1MB10/1PC10</b>					
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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
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 in place	Aluminum alloy	<ul style="list-style-type: none"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
1LE10 1MB10 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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
<b>1LE15/1LE16/1LE5/1MB15/1MB16/1MB5</b>					
1LE15/ 1MB15	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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
1LE15/ 1LE16/ 1MB15/ 1MB16	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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
1LE5 <sup>2)</sup> , 1MB5	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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
1LE5 <sup>1)</sup>	315	TB1Q01	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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
1LE5, 1MB5	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"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>
1LE5/ 1MB5	400 ... 450	TB3R61 1XB1631 1XB7750	4 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place 8 entries complete with sealing plugs, thread in terminal box, terminal box mounted and screwed in place	Sheet steel	<ul style="list-style-type: none"> <li>• Cable lug</li> <li>• Rigid cable, no cable lug</li> </ul>

#### Note:

Optional cable entries are available for the main connection of the motor for standard cables (order code **R15**) and EMC shielded cables (order code **R14**). These options also include cable glands for the accessories connected in the main terminal box. Alternatively, cable glands are optionally available in maximum configuration for standard cables (order code **R18**) or EMC shielded cables (order code **R16**); thus motors in frame sizes 100 to 450 are supplied with 2 cable glands for the main connection and all necessary cable glands (also auxiliary terminal box) for the accessories. For explosion-protected motors, cable glands for armored cables are optionally available for the main connection (order codes **R45**, **R46**).

Optional cable glands are not possible for flame proof motors with optional Ex db terminal box (order codes **R48**, **R49**).

#### Technical specifications for terminal boxes for 1LE1, 1LE5, 1MB1, 1MB5, and 1PC1 motors

Frame size	Terminal box <sup>3)</sup> Standard/larger (order code <b>R50</b> )	Number of terminals	Thread of the contact screw	Max. connectable cable mm <sup>2</sup>	Outer cable diameter (sealing range) mm	Cable entry <sup>4) 5)</sup>
<b>1LE10/1MB10/1PC1</b>						
63 ... 71	TB1B00/TB1B10	6	M4	4	9 ... 17 / 4,5 ... 10 + 9 ... 17	1 × M25 × 1,5/ 1 × M16 × 1,5 + 1 × M25 × 1,5
80 and 90	TB1E00/TB1E10 <sup>6)</sup>	6	M4	4	9 ... 17 / 4,5 ... 10 + 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
160 180	TB1J00/TB1J10	6	M5	16	19 ... 28	2 × M40 × 1,5
200	TB1L00/TB1L10	6	M6	25	27 ... 35	2 × M50 × 1,5
<b>1LE15/1MB15</b>						
71 ... 90	TB1D01	6	M4	1,5/2,5 with cable lug	4,5 ... 10 + 9 ... 17	1 × M16 × 1,5 + 1 × M25 × 1,5

<sup>1)</sup> 11th position of Article No. for all number of poles **0, 2, 4, 5**; for 6-, 8-pole **6**.

<sup>2)</sup> 11th position of Article No. for all number of poles **7, 8**; for 2-, 4-pole **6**.

<sup>3)</sup> 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.

<sup>4)</sup> Designed for cable glands with O-ring.

<sup>5)</sup> NPT threads can be ordered with order code **Y61**.

<sup>6)</sup> For 1LE1021, 1LE1023, and 1MB10, terminal box TB1E10 normal version.

## Overview

Technical specifications for terminal boxes for 1LE1, 1LE5, 1MB1, 1MB5, and 1PC1 motors

Frame size	Terminal box <sup>1)</sup> Standard/larger (order code <b>R50</b> )	Number of terminals	Thread of the contact screw	Max. connectable cable mm <sup>2</sup>	Outer cable diameter (sealing range) mm	Cable entry <sup>2) 3)</sup>
<b>1LE15/1LE16/1MB15/1MB16</b>						
100	TB1F01/TB1J01	6	M4	4	11 ... 21	2 × M32 × 1.5/ 2 × M40 × 1.5
112						
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	TB1N01/TB1Q01	6	M10/M12	2 × (3 × 150)	34 ... 45	2 × M63 × 1.5
280						2 × M63 × 1.5
315	TB1Q01/TB1R01	6	M12/M16	2 × (3 × 150)	38 ... 45/ 44 ... 54	2 × M63 × 1.5 2 × M63 × 1.5
<b>1LE55/1LE56/1MB5</b>						
250	TB4N01/TB4Q01	6	M10/M12	120/150	34 ... 45	2 × M63 × 1.5
280						2 × M63 × 1.5
315 <sup>4)</sup>	TB1Q01/TB1R01	6	M12/M16	150	34 ... 45	2 × M63 × 1.5
	TB3Q01/TB3R01			240	63 ... 70 <sup>8)</sup>	2 × M80 × 2
315 <sup>5)</sup>	TB3Q61/TB3R01	6	M12/M16	185	44 ... 55	2 × M63 × 1.5
				240	63 ... 70 <sup>8)</sup>	2 × M80 × 2
355 <sup>6)</sup>	TB3R01	6	M16	240	63 ... 70 <sup>9)</sup>	2 × M80 × 2
		12	2 × M16			4 × M80 × 2
355 <sup>7)</sup>	TB3R01	12	2 × M16	240	63 ... 70 <sup>8)</sup>	4 × M80 × 2
	TB3R61					
400 ... 450	TB3R61/1XB7750	12	M16	240	56 ... 64.5	4 × M80 × 2
	1XB1631/1XB7750		M16	300	56 ... 64.5	4 × M80 × 2
	-/1XB7750	48	M12	300	41 ... 57	8 × M72 × 2

Technical specifications for auxiliary terminal boxes Ex e order code R54 for 1MB1.5, 1MB1.6, 1MB5.5, 1MB5.6

Frame size	Thread of the contact screw	Conductor cross-section max. mm <sup>2</sup>	Add-on terminals in the main terminal box max.	Cable entry	Order code R62	Add-on terminals (R62) max.	Order code R63	Add-on terminals (R63) max.	Order code R67	Add-on terminals (R67) max.
<b>Innomatics XP 1MB1.5/1MB1.6/1MB5.5, 1MB5.6</b>										
71	6 × M5	16	11	2 × M40 × 1,5	ja	12	nein	–	ja	12
80										
90										
100	6 × M5									
112										
132	6 × M6	35	20	2 × M50 × 1,5						
160	6 × M6	50	18							
180										
200	6 × M10	120	24	2 × M63 × 1,5			ja	25		

## Terminal connection

The terminal board accommodates the terminals that are connected to the leads to the motor windings. The terminals are designed so that 1LE1-motor types for frame sizes 71 to 315 and for all 1MB-motor types, the external (line) connections can be made without the need for cable lugs.

The description of the connection system applies to 1MB for all types of protection, except in conjunction with terminal box Ex db (order code **R48**).

## Note:

Cable entry thread for accessories  
FS 63 to 180: M16 × 1.5, FS 200 to 450: M20 × 1.5

<sup>1)</sup> 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.  
<sup>2)</sup> Designed for cable glands with O-ring.  
<sup>3)</sup> NPT threads can be ordered with order code **Y61**.  
<sup>4)</sup> 11th position of Article No. for all number of poles **0, 2, 4, 5**; for 6-, 8-pole **6, 7**; for 8-pole **8**.

<sup>5)</sup> 11th position of Article No. for all number of poles **7, 8**; for 2-, 4-pole **6**.  
<sup>6)</sup> 11th position of Article No. for all number of poles **1, 2, 3, 4**.  
<sup>7)</sup> 11th position of Article No. for 2-, 4-pole **5**.  
<sup>8)</sup> Sealing range of outer cable diameter for 1MB is 59 ... 64 mm.

## Introduction

### Electrical design

## Connection, circuit and terminal boxes

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### Overview

		Auxiliary terminal box			Option code				
		R60 (not for 1LE15/6)			R62		R63		
Frame size		200 to 315			160 to 315		250 to 315		
Terminal box typ		1XB3020			TB2J01		TB2N01		
Material		Aluminum			Cast iron		Cast iron		
Number of terminals max.	ks	6	10	8	12	12	14	30	36
Terminal typ of aux. Terminals		AKZ4	AKZ2,5	SN71104-B	SN71104-A	AKZ4	AKZ2,5	AKZ4	AKZ2,5
Nominal circuit voltage acc. to IEC	V	275	175	400	400	275	175	275	175
Max. connectable cable	mm <sup>2</sup>	4	2.5	2.5	2.5	4	2.5	4	2.5
Rated current	A	21	15	–	–	21	15	21	15
Maximum permissible current potential VSD	kV	6	4	–	–	6	4	6	4
Cable entry – standard		1 x M20 x 1.5			1 x M20 x 1.5		2 x M20 x 1.5		
Outer cable diameter (sealing range)	Ø mm	7 ... 13			7 ... 13		7 ... 13		
Cable entry – max.		2 x M25 x 1.5			2 x M25 x 1.5		4 x M25 x 1.5		
Outer cable diameter (sealing range) max.	Ø mm	9 ... 17			9 ... 17		9 ... 17		
Maximum dimension B x H x L	mm	75 x 57 x 80			77 x 62 x 112		86 x 72 x 206		
Volume	cm <sup>3</sup>	245			310				

#### Number of auxiliary terminal boxes for main terminal box

Number of auxiliary terminal boxes TB2J01, TB2N01 in combination with standard terminal box											
Frame size		100, 112	132	160	180	200	225	250	280	315	355
Terminal box											
Auxiliary terminal box											
Type	Order code	TB1F01	TB1H01	TB1J01	TB1L01/TB4L01	TB1N01/TB4N01	TB1Q01	TB3Q01	TB3R01		
TB2J01	<b>R62</b>	–	–	✓	✓	✓	✓	✓	✓	✓	✓
TB2N01	<b>R63</b>	–	–	–	–	✓	✓	✓	✓	✓	✓
2 x TB2J01	<b>R67</b>	–	–	✓	✓	✓	✓	✓	✓	✓	✓
2 x TB2N01	<b>R68</b>	–	–	–	–	✓	✓	✓	✓	✓	✓

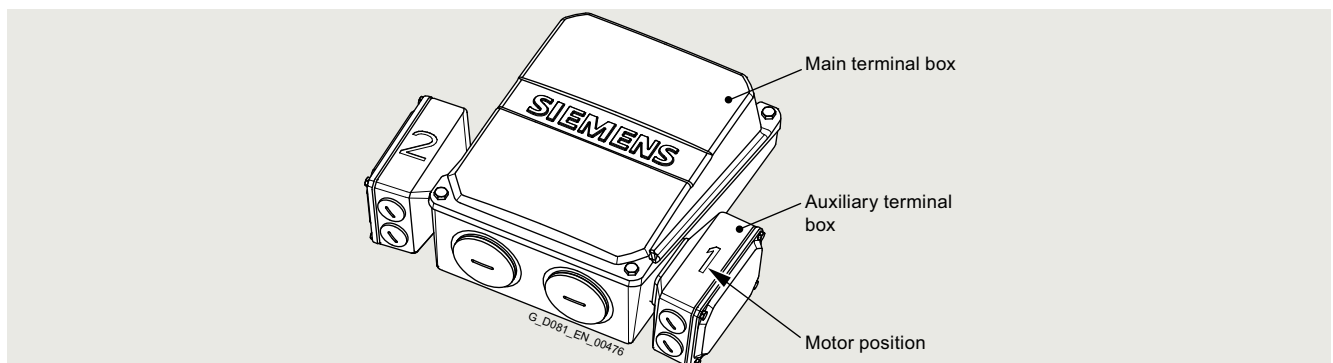
Maximum number of auxiliary terminal boxes TB2J01, TB2N01 in combination with large terminal box (order code R50)									
Frame size		100, 112, 132	160	180	200	225	250	280	315
Terminal box									
Auxiliary terminal box									
Type	Order code	TB1J01	TB1K01	TB1L01	TB1N01/ TB4N01	TB1Q01/TB4Q01	TB1R01	TB3R01	
TB2J01	<b>R62</b>	✓	✓	✓	✓	✓	✓	✓	✓
TB2N01	<b>R63</b>	–	–	–	✓	✓	✓	✓	✓
2 x TB2J01	<b>R67</b>	✓	✓	✓	✓	✓	✓	✓	✓
2 x TB2N01	<b>R68</b>	–	–	–	✓	✓	✓	✓	✓

Maximum number of auxiliary terminal boxes TB2J01, TB2N01 in combination with universal terminal box (order code R52 or R53)									
Frame size		100 ... 160	180	200	225	250	280	315	355
Terminal box									
Auxiliary terminal box									
Type	Order code	TB1J61	TB1L61/TB4L61	TB1N61/TB4N61	TB1Q61	TB3Q41	TB3R41		
TB2J01	<b>R62</b>	Not available	✓	✓	✓	✓	✓	✓	✓
TB2N01	<b>R63</b>	Not available	–	–	✓	✓	✓	✓	✓
2 x TB2J01	<b>R67</b>	Not available	✓	✓	✓	✓	✓	✓	✓
2 x TB2N01	<b>R68</b>	Not available	–	–	✓	✓	✓	✓	✓

#### Note:

The type code of the main or auxiliary terminal box change for explosion proof motors 1MB... by ending ...02 (e.g. TB2J02). The universal terminal box is not available for explosion proof motors 1MB...

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

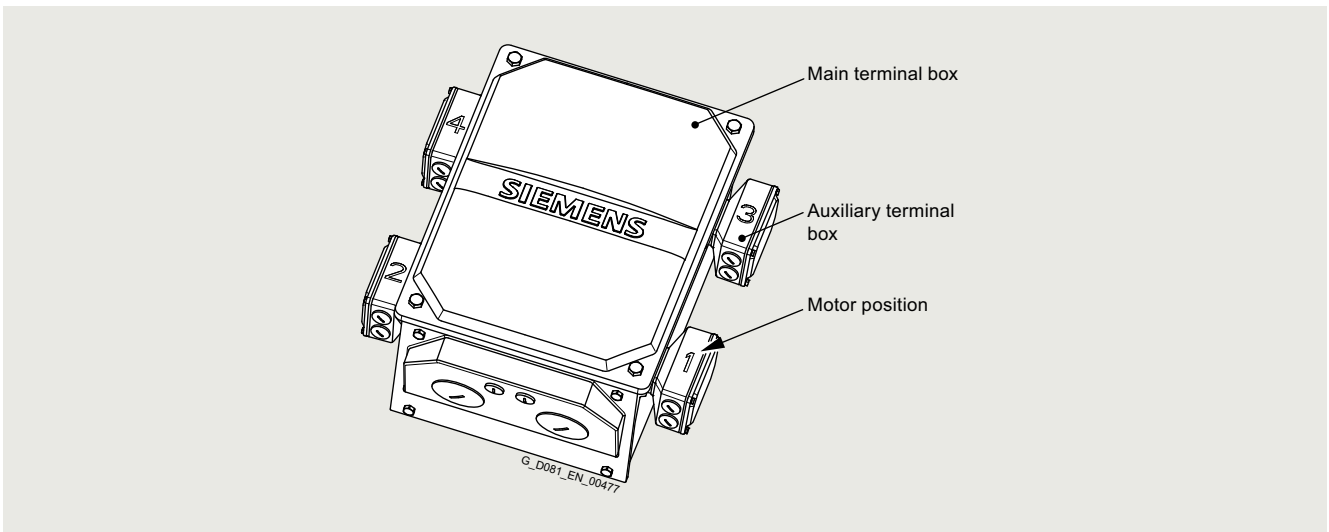


**Overview**

**Auxiliary terminal box TB2J01 (order code R62) in combination with TB1J01, TB1L01, TB1N01, TB1Q01, TB1K01 main terminal box**

Position of the main terminal box		Right-hand side						Left-hand side								
Top		4						6								
16th position of Article No. and when ordering with order code, Article No. with -Z		5						6								
Rotation of terminal box		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	-	R10	R11	R12
Number of auxiliary terminal boxes		Positions of auxiliary terminal boxes – see Figure														
1	1	1	1	2	1	2	1	2	2	1	2	1	2	2	1	1
2	1+2	1+2	1+2	1+2	1+2	-	-	1+2	1+2	-	-	1+2	1+2	-	-	1+2

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		Right-hand side						Left-hand side								
Top		4						6								
16th position of Article No. and when ordering with order code, Article No. with -Z		5						6								
Rotation of terminal box		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	-	R10	R11	R12
Number of Auxiliary terminal boxes		Positions of auxiliary terminal boxes – see Figure														
1	1	1	1	2	1	2	1	2	2	1	2	1	2	2	1	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	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	1+2+3	-	-	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	-	-	1+2+3+4

## Introduction

### Electrical design

## Degrees of protection

1

### Overview

All motors are designed to IP55 degree of protection. 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 1/29).

#### 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 BFK458 (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 BFK458 (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 1/47.


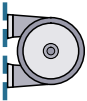
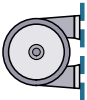



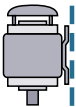
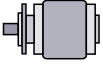
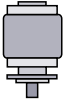
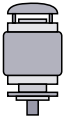

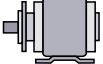
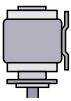
With flange-mounted motors, for IM V3 type of construction, collection of fluid in the flange basin can be prevented by drainage holes (on request).

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 <b>-Z</b> with order code
<b>Without flange</b>				
IM B3/IM 1001		63 to 450	<b>A</b>	-
IM B6/IM 1051		63 to 355	<b>T</b>	-
IM B7/IM 1061		63 to 355	<b>U</b>	-
IM B8/IM 1071		63 to 355	<b>V</b>	-
IM V5/IM1011 without protective cover		63 to 450	<b>C</b> <sup>1)</sup>	-
IM V6/IM 1031		63 to 450	<b>D</b>	-
IM V5/IM 1011 with protective cover		71 to 450	<b>C</b>	<b>+ H00</b> <sup>2)</sup>
<b>With flange</b>				
IM B5/IM 3001		63 to 450	<b>F</b>	-
IM V1/IM 3011 without protective cover		63 to 450	<b>G</b> <sup>1)</sup>	-
IM V1/IM 3011 with protective cover		71 to 450	<b>G</b>	<b>+ H00</b> <sup>2)</sup>
IM V3/IM 3031		63 to 355	<b>H</b>	-
IM B35/IM 2001		63 to 450	<b>J</b>	-
IM V15/IM 2011		71 to 315	<b>W</b>	-

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

For footnotes, see next page.













## Introduction

Mechanical version

### Types of construction

1

#### Overview

Type of construction acc. to EN 60034-7		Frame size	Letter of the 14th position of the Article No.	Additional identification code <b>-Z</b> with order code
<b>With flange</b>				
IM B14/IM 3601		63 to 160	<b>K</b>	–
IM V19/IM 3631		80 to 315	<b>L</b>	–
IM V18/IM 3611 without protective cover		80 to 315	<b>M</b> <sup>1)</sup>	–
IM V 18/IM 3611 with protective cover		80 to 315	<b>M</b>	<b>+ H00</b> <sup>2)</sup>
IM B34/IM 2101		80 to 315	<b>N</b>	–
<b>With flange – next largest</b>				
IM B14/IM 3601		80 to 315	<b>K</b>	<b>+ P01</b>
IM B34/IM 2101		80 to 315	<b>N</b>	<b>+ P01</b>
IM V18/IM 3611 without protective cover		80 to 315	<b>M</b> <sup>1)</sup>	<b>+ P01</b>
IM V 18/IM 3611 with protective cover		80 to 315	<b>M</b>	<b>+ P01</b> <b>+ H00</b> <sup>2)</sup>
IM V19/IM 3631		80 to 315	<b>L</b>	<b>+ P01</b>

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 slings (EN 1492-1) and/or lashings (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).

<sup>1)</sup>  The following applies for explosion-protected 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.

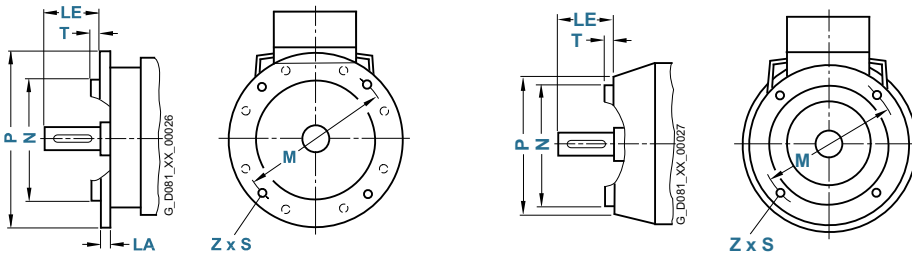
With motors that have a vertical shaft extension, the end user must prevent an ingress of fluid along the shaft. In the case of all types of construction with shaft extension pointing downwards, the version "with protective cover" is urgently recommended, see section "Degrees of protection" on page 1/46 – housing version.

Motors with feet, in some cases, have two fixing holes at the non-drive end (NDE), see dimension tables on pages 3 to 3/173.

A screwed-on cover (made of sheet metal or plastic) 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**.

<sup>2)</sup> Standard cylindrical shaft extension (second shaft extension), order code **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 DIN 42948 (invalid since September 2003) are also listed for information purposes. See the table below. (Z = the number of retaining holes)

Frame size	No. of poles	Type of construction	Flange type – possibly with order code	Flange with • Through holes (FF/A) • Tapped holes (FT/C) Acc. to EN 50347	Dimension designation acc. to IEC								
					Acc. to DIN 42948	LA	LE	M	N	P	S	T	Z
63 M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF115</b>	A 140	–	23	115	95	140	10	3	4
			Next smallest flange – P02	<b>FF100</b>	A 120	–	23	100	80	120	7	3	4
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT75</b>	C 90	–	23	75	60	90	M6	2.5	4	
		Next largest flange <sup>1)</sup> – P01	<b>FT100</b>	C 120	–	23	100	80	120	M6	3	4	
71 M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF130</b>	A 160	5	30	130	110	160	10	3.5	4
			Next smallest flange – P02	<b>FF115</b>	A 140	–	30	115	95	140	10	3	4
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT85</b>	C 105	–	30	85	70	105	M6	2.5	4	
		Next largest flange <sup>1)</sup> – P01	<b>FT115</b>	C 140	–	30	115	95	140	M8	3	4	
80 M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF165</b>	A 200	10	40	165	130	200	12	3.5	4
			Next smallest flange – P02	<b>FF130</b>	A 160	–	40	130	110	160	10	3.5	4
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT100</b>	C 120	–	40	100	80	120	M6	3	4	
		Next largest flange <sup>1)</sup> – P01	<b>FT130</b>	C 160	–	40	130	110	160	M8	3.5	4	
90 S/L	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF165</b>	A 200	10	50	165	130	200	12	3.5	4
			Next largest flange – P01	<b>FF215</b>	A 250	–	50	215	180	250	14.5	4	4
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT115</b>	C 140	–	50	115	95	140	M8	3	4	
		Next largest flange – P01	<b>FT130</b>	C 160	–	50	130	110	160	M8	3.5	4	
100 L	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF215</b>	A 250	11	60	215	180	250	14.5	4	4
			Next largest flange – P01	<b>FF265</b>	A 300	12	60	265	230	300	14.5	4	4
	IM B14, IM B34, IM V18, IM V19	Next smallest flange – P02	<b>FF165</b>	A 200	11	60	165	130	200	12	3.5	4	
		Flange	<b>FT130</b>	C 160	–	60	130	110	160	M8	3.5	4	
	IM B14, IM B34, IM V18, IM V19	Next largest flange – P01	<b>FT165</b>	C 200	–	60	165	130	200	M10	3.5	4	
		Next smallest flange – P02	<b>FT115</b>	C 140	–	60	115	95	140	M8	3	4	
112 M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF215</b>	A 250	11	60	215	180	250	14.5	4	4
			Next largest flange – P01	<b>FF265</b>	A 300	12	60	265	230	300	14.5	4	4
	IM B14, IM B34, IM V18, IM V19	Next smallest flange – P02	<b>FF165</b>	A 200	11	60	165	130	200	12	3.5	4	
		Flange	<b>FT130</b>	C 160	–	60	130	110	160	M8	3.5	4	
	IM B14, IM B34, IM V18, IM V19	Next largest flange – P01	<b>FT165</b>	C 200	–	60	165	130	200	M10	3.5	4	
		Next smallest flange – P02	<b>FT115</b>	C 140	–	60	115	95	140	M8	3	4	
132 S/M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF265</b>	A 300	12	80	265	230	300	14.5	4	4
			Next largest flange – P01	<b>FF300</b>	A 350	13	80	300	250	350	18.5	5	4
	IM B14, IM B34, IM V18, IM V19	Next smallest flange – P02	<b>FF215</b>	A 250	11	80	215	180	250	14.5	4	4	
		Flange	<b>FT165</b>	C 200	–	80	165	130	200	M10	3.5	4	
	IM B14, IM B34, IM V18, IM V19	Next largest flange – P01	<b>FT215</b>	C 250	–	80	215	180	250	M12	4	4	
		Next smallest flange – P02	<b>FF265</b>	A 300	12	110	265	230	300	14.5	4	4	
160 M/L	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF300</b>	A 350	13	110	300	250	350	18.5	5	4
			Next smallest flange – P02	<b>FF265</b>	A 300	12	110	265	230	300	14.5	4	4
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT215</b>	C 250	–	110	215	180	250	M12	4	4	
		Next smallest flange – P02	<b>FF265</b>	A 300	12	110	265	230	300	14.5	4	4	
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FF300</b>	A 350	13	110	300	250	350	18.5	5	4	
		Next smallest flange – P02	<b>FF265</b>	A 300	12	110	265	230	300	14.5	4	4	
200 L	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF350</b>	A 400	15	110	350	300	400	18.5	5	4
			Next smallest flange – P02	<b>FF300</b>	A 350	13	110	300	250	350	18.5	5	4
225 S/M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF400</b>	A 450	16	110	400	350	450	18.5	5	8
			Next smallest flange – P02	<b>FF350</b>	A 400	15	110	350	300	400	18.5	5	4
250 M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF500</b>	A 550	18	140	500	450	550	18.5	5	8
			Next smallest flange – P02	<b>FF400</b>	A 450	16	140	400	350	450	18.5	5	8
280 S/M	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF500</b>	A 550	18	140	500	450	550	18.5	5	8
			Next smallest flange – P02	<b>FF400</b>	A 450	16	140	400	350	450	18.5	5	8
315 S/M/L	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF600</b>	A 660	22	140	600	550	660	24	6	8
			Next smallest flange – P02	<b>FF500</b>	A 550	18	140	500	450	550	18.5	5	8
315 L for 1LE5	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF740</b>	A 800	25	140	740	680	800	24	6	8
			Next smallest flange – P02	<b>FF600</b>	A 660	22	140	600	550	660	24	6	8
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT300</b>	C 300	–	25	140	140	170	170	170	170	170
		Next smallest flange – P02	<b>FT215</b>	C 250	–	25	140	140	170	170	170	170	170
355 M/L for 1LE5	2 ... 8	IM B5, IM B35, IM V1, IM V3	Flange	<b>FF840</b>	A 900	25	140	840	780	900	24	6	8
			Next smallest flange – P02	<b>FF740</b>	A 800	25	140	740	680	800	24	6	8
	IM B14, IM B34, IM V18, IM V19	Flange	<b>FT350</b>	C 350	–	25	140	140	170	170	170	170	170
		Next smallest flange – P02	<b>FT265</b>	C 265	–	25	140	140	170	170	170	170	170
400 for 1LE5/1MBS	2 ... 8	IM B5, IM B35, IM V1	Flange	<b>FF940</b>	A1000	28	170	940	880	1000	22	6	8
			Next smallest flange – P02	<b>FF840</b>	A 900	25	170	840	780	900	22	6	8
450 for 1LE5/1MBS	2 ... 8	IM B5, IM B35, IM V1	Flange	<b>FF1080</b>	A1150	30	170	1080	1000	1150	26	6	8
			Next smallest flange – P02	<b>FF940</b>	A 900	25	170	940	880	1000	22	6	8

<sup>1)</sup> With reference to standard EN 50347, flanges that are 2 levels larger are used with order code P01 in the frame sizes 63 to 80.

## Introduction

### Mechanical version

## Shaft and rotor

1

### 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 mm	Thread 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, 1LE5, 1MB1, 1MB5, 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 for the 1LE1, 1LE5, 1MB1, 1MB5, and 1PC1 motor series (e.g. 1.4021). This is only possible for shaft extensions of standard dimensions.

Order code **L06**

Special non-rusting materials are only available on request.

#### 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	min. up to max.	Standard	min. up to max. <sup>1)</sup>
<b>1LE1, 1MB1</b> <sup>2)</sup>	63	2 ... 8	23	12 ... 46 (step 1 mm)	11	9 ... 12 (step 1 mm)
	71		30	15 ... 60 (step 1 mm)	14	11 ... 15 (step 1 mm)
	80		40	20 ... 80 (step 1 mm)	19	12 ... 20 (step 1 mm)
	90		50	25 ... 100 (step 1 mm)	24	12 ... 25 (step 1 mm)
<b>1LE1, 1MB1</b> <sup>2)</sup> , <b>1PC1</b>	100	2 ... 8	60	30 ... 120 (step 1 mm)	28	19 ... 30 (step 1 mm)
	112					
	132		80	40 ... 160 (step 1 mm)	38	24 ... 40 (step 1 mm)
	160		110	55 ... 160 (step 1 mm)	42	28 ... 45 (step 1 mm)
<b>1LE1, 1MB1</b> <sup>2)</sup>	160	2 ... 8		160 ... 220 (step 5 mm)		
	180		110	55 ... 160 (step 5 mm)	48	38 ... 50 (step 1 mm)
	180			160 ... 220 (step 1 mm)		
	200			55 ... 160 (step 1 mm)	55	38 ... 60 (step 1 mm)
<b>1LE15, 1LE16, 1MB15</b> <sup>2)</sup> , <b>1MB16</b>	200	2 ... 8		160 ... 220 (step 5 mm)		
	250		140	70 ... 280 (step 5 mm)	60	55 ... 75 (step 1 mm)
	280				65	
			2			75
<b>1LE5</b>	315	2			65	55 ... 80 (step 1 mm)
			4 ... 8		80	65 ... 95 (step 1 mm)
	225	2		85 ... 280 (step 5 mm)	80	65 ... 95 (step 1 mm)
			4 ... 8	110	55 ... 220 (step 5 mm)	55
250	2	4 ... 8	140	70 ... 280 (step 5 mm)	60	
					65	55 ... 70 (step 1 mm)
					70	65 ... 80 (step 1 mm)
					70	65 ... 80 (step 1 mm)
<b>1LE5, 1MB5</b>	280	2			70	65 ... 80 (step 1 mm)
			4 ... 8		70	65 ... 80 (step 1 mm)
	315	2		70 ... 280 (step 5 mm)	65	55 ... 80 (step 1 mm)
			4 ... 8	140	85 ... 280 (step 5 mm)	85
355	2	4 ... 8	140	70 ... 280 (step 5 mm)	75	55 ... 85 (step 1 mm)
			170	85 ... 280 (step 5 mm)	95	65 ... 100 (step 1 mm)

#### 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.

When motors are ordered that have a longer or shorter shaft extension than normal, the required position and length of the feather keyway must be specified in a sketch. It must be ensured that only feather keys in accordance with EN 50347, Form A are used. The feather keyway is positioned centrally on the shaft extension. The length is defined by the manufacturer in accordance with the appropriate standard. Not valid for: Conical shafts, non-standard threaded journals, non-standard shaft tolerances, friction welded journals, extremely "thin" shafts, special geometry dimensions (e.g. square journals), hollow shafts. Valid for non-standard shaft extensions DE or NDE. The feather keys are supplied in every case.

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

## Overview

**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 **Y59** non-standard shaft dimensions NDE.

For the 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

When motors are ordered that have a longer or shorter shaft extension than normal, the required position and length of the feather keyway must be specified in a sketch. It must be ensured that only feather keys in accordance with EN 50347, Form A are used. The feather keyway is positioned centrally on the shaft extension. The length is defined by the manufacturer in accordance with the appropriate standard. Not valid for: Conical shafts, non-standard threaded journals, non-standard shaft tolerances, friction welded journals, extremely "thin" shafts, special geometry dimensions (e.g. square journals), hollow shafts. Valid for non-standard shaft extensions DE or NDE. The feather keys are supplied in every case.

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	min. up to max.	Standard	min. up to max. <sup>1)</sup>
<b>1LE1, 1MB1</b> <sup>2)</sup>	63	2 ... 8	23	12 ... 46 (step 1 mm)	11	9 ... 12 (step 1 mm)
	71		30	15 ... 60 (step 1 mm)	14	11 ... 15 (step 1 mm)
	80		40	20 ... 80 (step 1 mm)	19	12 ... 20 (step 1 mm)
	90					
<b>1LE1, 1MB1</b> <sup>2)</sup> , <b>1PC1</b>	100	2 ... 8	50	25 ... 120 (step 1mm)	24	19 ... 25 (step 1 mm)
	112					
	132		60	30 ... 160 (step 1 mm)	28	24 ... 35 (step 1 mm)
	160		110	55 ... 160 (step 1 mm)	42	24 ... 45 (step 1 mm)
<b>1LE1, 1MB1</b> <sup>2)</sup>	160			160 ... 220 (step 5 mm)		
	180	2 ... 8	110	55 ... 160 (step 1 mm)	48	38 ... 48 (step 1 mm)
	180			160 ... 220 (step 5 mm)		
	200			55 ... 160 (step 1 mm)	55	38 ... 58 (step 1 mm)
<b>1LE15, 1LE16, 1MB15</b> <sup>2)</sup> , <b>1MB16</b>	200			160 ... 220 (step 5 mm)		
	225	2	110	55 ... 220 (step 5 mm)	48	48 ... 58 (step 1 mm)
	250	4 ... 8	140	70 ... 280 (step 5 mm)	55	55 ... 73 (step 1 mm)
		2				60
<b>1LE5</b>	280	4 ... 8			65	65 ... 73 (step 1 mm)
	315	2		85 ... 280 (step 5 mm)	60	55 ... 78 (step 1 mm)
		4 ... 8	170	85 ... 280 (step 5 mm)	70	65 ... 78 (step 1 mm)
	250	2	110	55 ... 220 (step 5 mm)	55	55 ... 62 (step 1 mm)
<b>1LE5</b>	280	4 ... 8	140	70 ... 280 (step 5 mm)	60	
		2				55 ... 73 (step 1 mm)
	315	2	140	70 ... 280 (step 5 mm)	60	55 ... 78 (step 1 mm)
		4 ... 8				70
<b>1LE5, 1MB5</b> <sup>2)</sup>	355	2		70 ... 280 (step 5 mm)	60	55 ... 92 (step 1 mm)
		4 ... 8	170	85 ... 280 (step 5 mm)	80	65 ... 92 (step 1 mm)

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.

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

<sup>2)</sup> For explosion-protected motors Ex db, Ex eb (Zone 1) on request.

## Introduction

Mechanical version

### Shaft and rotor

1

#### Overview

**Shaft extension run-out, concentricity and perpendicularity in accordance with IEC 60072-1 precision class for flange-mounted motors**

In IEC 60072-1, normal class (normal) and precision class (reduced) are defined:

1. Circular run-out tolerances for the shaft extension
2. Concentricity tolerances for the shaft extension and flange centering
3. Perpendicularity tolerances for the shaft extension and flange surface

The shaft extension run-out, concentricity and perpendicularity according to IEC 60072-1 precision class 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.

The shaft extension run-out can be ordered according to IEC 60072-1 precision class for types of construction without flange with order code **L07**.

#### Circular run-out tolerance for the shaft extension

Diameter of the cylindrical shaft extension D	Circular run-out tolerance	
	Normal class	Precision class (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

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

Flange FF/FT	Dimension designation acc. to IEC		Concentricity and perpendicularity tolerance	
	N mm	P mm	Normal class mm	Precision class mm
55	40	70	0.08	0.04
65	50	80	0.08	0.04
75	60	90	0.08	0.04
85	70	105	0.08	0.04
100	80	120	0.08	0.04
115	95	140	0.08	0.04
130	110	160	0.1	0.05
165	130	200	0.1	0.05
215	180	250	0.1	0.05
265	230	300	0.1	0.05
300	250	350	0.125	0.063
350	300	400	0.125	0.063
400	350	450	0.125	0.063
500	450	550	0.125	0.063
600	550	660	0.16	0.08
740	680	800	0.16	0.08
940	880	1000	0.2	0.1
1080	1000	1150	0.2	0.1

### Measures for gear mounting

#### 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.

**Overview**

All rotors are dynamically balanced with an inserted half key. This corresponds to vibration severity grade A (normal or standard). DIN EN 60034-14 Aug. 2018 regulates the vibrational behavior of machinery. Based on ISO 21940-32, 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 Order code **L00**

Conditions:

Not possible in combination with cylindrical roller bearings.  
Order code **L22**

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) have cast-iron feet.

For converter operation vibration severity grade B is guaranteed only at rated Direct On Line (DOL) speed at 50 Hz or 60 Hz.

Motors in type of protection Ex db eb IIB or Ex db eb IIC reach limits of grade B up to rated speed (DOL frequency).

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

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

The rating plate (with DOL data) of the motor is marked with vibration severity grade B.

For converter operation with frequencies higher than 60 Hz, special measures e.g. 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 Siemens Product Configurator.

Limits (rms values) for max. vibration severity in terms of vibration displacement (s) and vibration velocity (v) for the shaft height H

Vibration severity grade	Machine installation	Shaft height H in mm			
		56 ≤ H ≤ 132		H > 132	
		$s_{rms}$ μm	$v_{rms}$ mm/s	$s_{rms}$ μm	$v_{rms}$ mm/s
A	Free suspension	45	2.8	45	2.8
	Rigid clamping	–	–	37	2.3
B	Free suspension	18	1.1	29	1.8
	Rigid clamping	–	–	24	1.5

For details, see standard EN 60034-14 Aug. 2018, EN 60034-14:2004 + A1:2007

If the type tests for machines with shaft height H > 132 mm demonstrate a determining component with twice the line frequency, the limit for maximum vibration severity in the Table (for grade A) can be increased from 2.3 mm/s (rms value) to 2.8 mm/s (rms value) or (for grade B) from 1.5 mm/s (rms value) to 1.8 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 70 % of 2.3 mm/s (rms value) (for grade A) or 70 % of 1.5 mm/s (rms value) (for grade B).

## Introduction

### Mechanical version

## Noise levels for line operation

### 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 from frame size 132 S to frame size 355 and higher can optionally be equipped with a unidirectional axial-flow fan.

For frame sizes 400 and 450, the axial-flow fan is standard. 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 except for 1MB.553 motors.

Low-noise version			
Motor series	Frame size	2-pole motors	
		$L_{pFA}$ dB (A)	$L_{WA}$ dB (A)
<b>1LE1</b> <sup>1)</sup>	132	60	72
<b>1MB1</b> <sup>1)</sup>	160	60	72
<b>1LE10, 1LE15/6,</b> <b>1MB15/6</b> <sup>2)</sup>	180	63	76
	200	64	77
<b>1LE15/6,</b> <b>1MB15/6</b> <sup>2)</sup>	225	72	86
	250	73	87
<b>1LE5</b>	280	72	85
	315	76	90
<b>1LE5, 1MB5</b>	400	74	90
	450	75	91

For the motor types 1LE5 and 1MB5 of frame sizes 315 and 355, the noise level is reduced by 1 to 2 dB with the low-noise version.

<sup>1)</sup> With the exception of 1LE1 and 1MB1 motors with order code **F90** – version "Forced-air cooled motors without external fan and fan cover".

<sup>2)</sup> 1MB15/6 also applies to 1MB154, 1MB164, and 1MB155.

**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 order code **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). For motors of the 1MB.553 series, the located bearing DE is the standard version.

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 1/63).

From frame size 160 upwards, the located bearing is axially secured at the non-drive end (NDE).

For the 1LE5 and 1MB5 motors of frame sizes 400 and 450, the located bearing is situated at the drive end (DE) and the floating bearing is situated at the non-drive end (NDE).

The bearing system on these motors is axially preloaded with a spring element at the non-drive end (NDE) to ensure smooth running of the motor without any play (see Figs. 6 and 7 under the bearing diagrams on page 1/63).

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 under the diagrams of bearings on page 1/63) or, for frame sizes 400 and 450, the located bearing can be supplied at the non-drive end (NDE).

Order code **L21**

Depending on the specific installation conditions (axial forces, cantilever forces and type of construction), testing of additional measures for the bearing version is recommended. The located bearing can also be supplied at the drive end (DE) (see Fig. 3 under the diagrams of bearings on page 1/63). A located bearing at the drive end (DE) is recommended when gearing is installed, for a shaft extension pointing downwards, 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).

Versions with cylindrical roller bearings are not axially preloaded, and must always operate under adequate radial loads (it is not permissible that motors are operated on a test stand without additional radial loads). The locating bearing is located at the non-drive end (NDE) when cylindrical roller bearings are fitted.

Order code **L22**

1LE1, 1LE5, 1MB1, 1MB5, 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). Standard for motors of the 1MB.553 series from frame size 100 upwards.

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 plug. 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 1/59) – for the maximum axial load, see page 1/74 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. For frame sizes 400 and 450 (for converter operation), the bearing insulation is indispensable.

- **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.
- In combination of order code **L50** with **L22**, it is necessary to reduce the radial load.

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.



## Introduction

Mechanical version

### Bearings and lubrication

1

#### Overview

##### 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).
- Frame sizes 400 to 450: M10 × 1-5.8-A 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 conical lubricating nipple to DIN 71412-A can be optionally provided for frame sizes 180 to 450.

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  $f_{\max}$ ".

## Overview

**Mechanical limit speeds  $n_{max}$  at maximum supply frequency  $f_{max}$  (standard values) for 1LE1, 1LE5, 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
<b>1LE10 motors, basic version</b>									
<b>1LE10..-</b>									
63	<b>0B...</b>	6000	100	4200	140	3600	180	3000	200
71	<b>0C...</b>	6000	100	4200	140	3600	180	3000	200
80 M	<b>0D...</b>	6000	100	4200	140	3600	180	3000	200
90 S/L	<b>0E...</b>	6000	100	4200	140	3600	180	3000	200
<b>1LE15 Basic Line motors – bearings for increased cantilever forces – order code L22</b>									
<b>1LE15 Basic Line motors – bearings reinforced at both ends – order code L25</b>									
<b>1LE15..-</b>									
71 M	<b>0C...</b>	6000	100	4200	140	3600	180	3000	200
80 M	<b>0D...</b>	6000	100	4200	140	3600	180	3000	200
90 S/L	<b>0E...</b>	6000	100	4200	140	3600	180	3000	200
<b>1LE10, 1PC1 motors, basic version</b>									
<b>1LE15 Basic Line and 1LE16 Performance Line – bearings for increased cantilever forces – order code L22</b>									
<b>1LE15 Basic Line and 1LE16 Performance Line – bearings reinforced at both ends – order code L25</b>									
<b>1LE1...-</b>									
<b>1PC1...-</b>									
100 L	<b>1A...</b>	6000	100	4200	140	3600	180	3000	200
112 M	<b>1B...</b>	6000	100	4200	140	3600	180	3000	200
132 S/M	<b>1C...</b>	5600	93	4200	140	3600	180	3000	200
160 M/L	<b>1D...</b>	4800	80	4200	140	3600	180	3000	200
180 M/L	<b>1E...</b>	4600	77	4200	140	3600	180	3000	200
200 L	<b>2A...</b>	4500	75	4200	140	3600	180	3000	200
<b>1LE15 Basic Line and 1LE16 Performance Line – basic version</b>									
<b>1LE15 Basic Line and 1LE16 Performance Line – bearings for increased cantilever forces – order code L22</b>									
<b>1LE15 Basic Line and 1LE16 Performance Line – bearings reinforced at both ends – order code L25</b>									
<b>1LE15 Basic Line and 1LE16 Performance Line – DE cylindrical roller bearings and NDE reinforced bearings – order code L28</b>									
<b>1LE15..-</b>									
<b>1LE16..-</b>									
180 M/L	<b>1E...</b>	4600	77	4200	140	3600	180	3000	200
200 L	<b>2A...</b>	4500	75	4200	140	3600	180	3000	200
225 S/M	<b>2B...</b>	4500	75	4500	150	4400	220	4400	293
250 M	<b>2C...</b>	3900	65	3700	123	3700	185	3700	247
280 S/M	<b>2D...</b>	3600	60	3000	100	3000	150	3000	200
315 S/M/L	<b>3A...</b>	3600	60	2600	87	2600	130	2600	173
<b>1LE55 Basic Line and 1LE56 Performance Line – basic version</b>									
<b>1LE55 Basic Line and 1LE56 Performance Line – bearings for increased cantilever forces – order code L22</b>									
<b>1LE55..-</b>									
<b>1LE56..-</b>									
250	<b>2C...</b>	3900	65	3700	123	3000	150	3000	150
280	<b>2D...</b>	3600	60	3000	100	3000	150	3000	200
315 L	<b>3A...</b>	3600	60	2600	87	2600	130	2600	173
355 M/L	<b>3B...</b>	3600	60	2600	87	2600	130	2600	173
400	<b>4A...</b>	IMB3	3600	60	2200	73	2200	110	2200
450	<b>4B...</b>	IMB3	3000/3600 <sup>1)</sup>	50	2100	70	2100	105	2100
400	<b>4A...</b>	IMV1	–	–	2100	70	2100	105	2100
450	<b>4B...</b>	IMV1	–	–	1800	60	1800	90	1800

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.

## Note:

Mechanical limit speeds for Innomotics XP 1MB motors, see Chapter 5.

<sup>1)</sup> Order on request.

## Introduction

Mechanical version

## Bearings and lubrication

1

### Overview

#### Grease lifetime and regreasing intervals for horizontal installation

Motor series	Frame size	No. of poles	Grease lifetime up to CT 40 °C <sup>2)</sup>			
<b>Permanent lubrication<sup>1)</sup></b>						
<b>1LE1/1MB1/1PC1</b>	63 ... 250	2 ... 8	20000 h or 40000 h <sup>3)</sup>			
<b>Regreasing<sup>1)</sup></b>						
			Lubrication interval ISO CI F 155 °C		Lubrication interval ISO CI H 180 °C	
			CT ≤ 40 °C	40 °C < CT ≤ 80 °C	40 °C < CT ≤ 60 °C	60 °C < CT ≤ 80 °C
<b>1LE1/1MB1/1PC1</b>	100 ... 160	2 ... 8	8000 h	4000 h <sup>2)</sup>	4000 h	2000 h <sup>2)</sup>
	180 ... 280	2	4000 h	2000 h <sup>2)</sup>	1000 h	1000 h <sup>2)</sup>
		4 ... 8	8000 h	4000 h <sup>2)</sup>	2000 h	2000 h <sup>2)</sup>
	315	2	3000 h	1500 h <sup>2)</sup>	1000 h	1000 h <sup>2)</sup>
		4 ... 8	6000 h	3000 h <sup>2)</sup>	1500 h	1500 h <sup>2)</sup>
			CT ≤ 40 °C	40 °C < CT ≤ 80 °C	CT ≤ 40 °C	40 °C < CT ≤ 80 °C
<b>1LE5/1MB5</b>	250	2	–	–	–	–
		4 ... 8	–	–	–	–
	280	2	4000	2000	4000	2000
		4,	8000	4000	8000	4000
	315, 355	2	3000 h	1500 h <sup>2)</sup>	3000 h	1500 h <sup>2)</sup>
		4, 6	6000 h	3000 h <sup>2)</sup>	6000 h	3000 h <sup>2)</sup>
	400	2	4000 h	2000 h	4000 h	2000 h
		4 ... 8	6000 h	3000 h	6000 h	3000 h
450	2	3000 h	1500 h	3000 h	1500 h	
	4 ... 8	6000 h	3000 h	6000 h	3000 h	

#### 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 1/63.

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

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

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

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

<sup>4)</sup> Deep-groove bearings with a side plate are used for regreasable versions (**L23**).

<sup>5)</sup> Deep-groove bearings without a side plate are used for regreasable versions (**L23**).

**Overview****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		Non-drive end (NDE) bearing		Fig. No. on page 1/63
		Horizontal and vertical types of construction		Horizontal and vertical types of construction		
<b>1LE10/1MB10</b>						
80	2 ... 8	6304 2ZC3		6204 2ZC3		–
90	2 ... 8	6305 2ZC3		6204 2ZC3		–
<b>1LE10/1MB10/1PC10</b>						
100 L	2 ... 8	6306 2ZC3		6206 2ZC3		<b>Fig. 1</b>
112 M	2 ... 8	6306 2ZC3		6206 2ZC3		
132 S/M	2 ... 8	6308 2ZC3 <sup>1)</sup>		6208 2ZC3 <sup>1)</sup>		
160 M/L	2 ... 8	6309 2ZC3 <sup>1)</sup>		6209 2ZC3 <sup>1)</sup>		<b>Fig. 2</b>
<b>1LE10</b>						
180 M/L	2 ... 8	6310 2ZC3 <sup>2)</sup>		6210 2ZC3 <sup>2)</sup>		<b>Fig. 4</b>
200 L	2 ... 8	6312 2ZC3 <sup>2)</sup>		6212 2ZC3 <sup>2)</sup>		<b>Fig. 4</b>

**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 1/63
		Horizontal and vertical types of construction		Horizontal and vertical types of construction		
<b>1LE10/1MB10</b>						
80	2 ... 8	6304 2ZC3		6304 2ZC3		–
90	2 ... 8	6305 2ZC3		6304 2ZC3		–
<b>1LE10/1MB10/1PC10</b>						
100 L	2 ... 8	6306 2ZC3		6306 2ZC3		<b>Fig. 1</b>
112 M	2 ... 8	6306 2ZC3		6306 2ZC3		
132 S/M	2 ... 8	6308 2ZC3 <sup>1)</sup>		6308 2ZC3 <sup>1)</sup>		
160 M/L	2 ... 8	6309 2ZC3 <sup>1)</sup>		6309 2ZC3 <sup>1)</sup>		<b>Fig. 2</b>
<b>1LE10</b>						
180 M/L	2 ... 8	6310 2ZC3 <sup>2)</sup>		6310 2ZC3 <sup>2)</sup>		<b>Fig. 4</b>
200 L	2 ... 8	6312 2ZC3 <sup>2)</sup>		6312 2ZC3 <sup>2)</sup>		<b>Fig. 4</b>

**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 1/63
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
<b>1LE15, 1MB15 – Basic Line</b>						
71 M	2 ... 8	6202 2ZC3		6202 2ZC3		<b>Fig. 1</b>
80 M	2 ... 8	6204 2ZC3		6204 2ZC3		<b>Fig. 1</b>
90 S/L	2 ... 8	6205 2ZC3		6204 2ZC3		<b>Fig. 1</b>
100 L	2 ... 8	6206 2ZC3 <sup>1)</sup>		6206 2ZC3 <sup>1)</sup>		<b>Fig. 1</b>
112 M	2 ... 8	6206 2ZC3 <sup>1)</sup>		6206 2ZC3 <sup>1)</sup>		
132 S/M	2 ... 8	6208 2ZC3 <sup>1)</sup>		6208 2ZC3 <sup>1)</sup>		
160 M/L	2 ... 8	6209 2ZC3 <sup>1)</sup>		6209 2ZC3 <sup>1)</sup>		<b>Fig. 2</b>
180 M/L	2 ... 8	6210 2ZC3 <sup>2)</sup>		6210 2ZC3 <sup>2)</sup>		<b>Fig. 4</b>
200 L	2 ... 8	6212 2ZC3 <sup>2)</sup>		6212 2ZC3 <sup>2)</sup>		
225 S/M	2 ... 8	6213 ZC3 <sup>2)</sup>		6213 ZC3 <sup>2)</sup>		<b>Fig. 1</b>
250 M	2 ... 8	6215 ZC3 <sup>2)</sup>		6215 ZC3 <sup>2)</sup>		
280 S/M	2	6315 C3		6315 C3		<b>Fig. 8</b>
	4 ... 8	6317 C3		6317 C3		
315 S/M/L	2	6316 C3		6316 C3		
	4 ... 8	6319 C3		6319 C3		

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

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

## Introduction

Mechanical version

## Bearings and lubrication

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### Overview

#### 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 1/63
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
<b>1LE16, 1MB16 – Performance Line</b>						
100 L	2 ... 8	6306 2ZC3		6306 2ZC3		<b>Fig. 1</b>
112 M	2 ... 8	6306 2ZC3		6306 2ZC3		
132 S/M	2 ... 8	6308 2ZC3		6308 2ZC3		<b>Fig. 2</b>
160 M/L	2 ... 8	6309 ZC3		6309 ZC3		
180 M/L	2 ... 8	6310 C3		6310 C3		<b>Fig. 4</b>
200 L	2 ... 8	6312 C3		6312 C3		
225 S/M	2 ... 8	6313 C3		6313 C3		<b>Fig. 4</b>
250 M	2 ... 8	6315 C3		6315 C3		
280 S/M	2	6315 C3		6315 C3		<b>Fig. 8</b>
	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	
<b>1LE5, 1MB5</b>						
250	2 ... 8	6214 ZC3		6214 ZC3		
280	2	6315 C3 S0		6315 C3 S0		
	4 ... 8	6316 C3 S0		6316 C3 S0		<b>Fig. 9, Fig. 10</b>
315 L	2	6316 C3 <sup>1)/C4<sup>2)</sup></sup>		6316 C3 <sup>1)/C4<sup>2)</sup></sup>		
	4 ... 8	6319 C3 <sup>1)/C4<sup>2)</sup></sup>		6319 C3 <sup>1)/C4<sup>2)</sup></sup>		
355 M/L	2	6317 C4		6317 C4		
	4 ... 8	6320 C4		6320 C4		
400	2	6218 C3		6218 C3		<b>Fig. 6, Fig. 7</b>
	4 ... 8	6224 C3		6224 C3		
450	2	6220 C3		6220 C3		<b>Fig. 6</b>
	4 ... 8	6226 C3		6226 C3		

#### Bearing assignment for 1MB1/1MB5 motors with types of protection Ex db, Ex db eb (basic version)

Frame size	No. of poles	Drive end (DE) bearing		Non-drive end (NDE) bearing		Fig. No. on page 1/63
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
<b>1MB1, 1MB5 with type of protection Ex db, Ex db eb</b>						
71	2 ... 8	6202-2Z C3		6202-2Z C3		–
80	2 ... 8	6204-2Z C3		6204-2Z C3		–
90	2 ... 8	6205-2Z C3		6205-2Z C3		–
100	2 ... 8	6306-2Z C3		6306-2Z C3		–
112	2 ... 8	6306-2Z C3		6306-2Z C3		–
132	2 ... 8	6308-2Z C3		6308-2Z C3		–
160	2 ... 8	6309 C3		6309 C3		–
180	2 ... 8	6310 C3		6310 C3		–
200	2 ... 8	6312 C3		6312 C3		–
225	2 ... 8	6313 C3		6313 C3		–
250	2 ... 8	6315 C3		6315 C3		–
280	2	6315 C3		6315 C3		–
280	4 ... 8	6317 C3		6317 C3		–
315	2	6316 C3		6316 C3		–
315	4 ... 8	6319 C3		6319 C3		–
355	2	6317 C4		6320 C4		–
355	4 ... 8	6320 C4		6320 C4		–

<sup>1)</sup> Only for frame size 315 if 11th position of Article No. for all poles 0, 2, 4, 5; for 6-, 8-pole motors 6.

<sup>2)</sup> Only for frame size 315 if 11th position of Article No. for 2-, 4-pole motors 6, 7, for 6-, 8-pole motors 7, 8.

## Overview

**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 or for brief periods of no-load operation without cantilever forces..

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

Frame size	No. of poles	Drive end (DE) bearing		Non-drive end (NDE) bearing		Fig. No. on page 1/63
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
<b>1LE15/1MB15 – Basic Line</b>						
71 M	2 ... 8	6302 2ZC3		6202 2ZC3 <sup>3)</sup>		
80 M	2 ... 8	6304 2ZC3		6204 2ZC3 <sup>3)</sup>		
90 S/L	2 ... 8	6305 2ZC3		6204 2ZC3		
100 L	2 ... 8	6306 2ZC3 <sup>1)</sup>		6206 2ZC3 <sup>1)3)</sup>		
112 M	2 ... 8	6306 2ZC3 <sup>1)</sup>		6206 2ZC3 <sup>1)3)</sup>		
132 M	2 ... 8	6308 2ZC3 <sup>1)</sup>		6208 2ZC3 <sup>1)3)</sup>		
160 M/L	2 ... 8	6309 2ZC3 <sup>1)</sup>		6209 2ZC3 <sup>1)3)</sup>		
180 M/L	2 ... 8	NU 210		6210 2ZC3 <sup>4)</sup>		Fig. 5
200 L	2 ... 8	NU 212		6212 2ZC3 <sup>4)</sup>		
225 M	2 ... 8	NU 213		6213 C3		
250 M	2 ... 8	NU 215		6215 C3		
280 M	2	NU 315		6315 C3 <sup>3)</sup>		
	4 ... 8	NU 317		6317 C3 <sup>3)</sup>		
315 M/L	2	NU 316		6316 C3 <sup>3)</sup>		
	4 ... 8	NU 319		6319 C3 <sup>3)</sup>		
<b>1LE16/1MB16 – Performance Line</b>						
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 <sup>3)</sup>		
200 L	2 ... 8	NU 312		6312 C3 <sup>3)</sup>		
225 M	2 ... 8	NU 313		6313 C3 <sup>3)</sup>		Fig. 5
250 M	2 ... 8	NU 315		6315 C3 <sup>3)</sup>		
280 M	2	NU 315		6315 C3 <sup>3)</sup>		
	4 ... 8	NU 317		6317 C3 <sup>3)</sup>		
315 M/L	2	NU 316		6316 C3 <sup>3)</sup>		
	4 ... 8	NU 319		6319 C3 <sup>3)</sup>		
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
<b>1LE5, 1MB5</b>						
250	2	NU214	NU214	6214 ZC3	6214 ZC3	
	4 ... 8	NU214	NU214	6214 ZC3	6214 ZC3	
280	2	NU315 C3	NU315 C3	NU315 C3	NU315 C3	
	4 ... 8	NU316 C3	NU316 C3	NU316 C3	NU316 C3	
315 L	2	NU316	NU316	6316 C3 <sup>5)/C4<sup>6)</sup></sup>	O. R.	Fig. 5
	4 ... 8	NU319	NU319	6319 C3 <sup>5)/C4<sup>6)</sup></sup>	O. R.	
355 M/L	2	NU317	NU317	6317 C4	O. R.	
	4 ... 8	NU320	NU320	6320 C4	O. R.	
400	2	O. R.	–	O. R.	–	–
	4 ... 8	O. R.	O. R.	O. R.	O. R.	–
450	2	O. R.	–	O. R.	–	–
	4 ... 8	O. R.	O. R.	O. R.	O. R.	–

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

<sup>2)</sup> Not permitted.

<sup>3)</sup> As for basic version.

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

<sup>5)</sup> Only for frame size 315 if 11th position of Article No. for all poles 0, 2, 4, 5; for 6-, 8-pole motors 6.

<sup>6)</sup> Only for frame size 315 if 11th position of Article No. for 2-, 4-pole motors 6, 7, for 6-, 8-pole motors 7, 8.

## Introduction

### Mechanical version

## Bearings and lubrication

### Overview

#### **Bearing assignment for 1MB1/1MB5 motors with types of protection Ex db, Ex db eb (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 1/63
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
<b>1MB1, 1MB5 with type of protection Ex db, Ex db eb</b>						
160	2 ... 8	NU309	NU309	6309 C3	6309 C3	–
180	2 ... 8	NU310	NU310	6310 C3	6310 C3	–
200	2 ... 8	NU312	NU312	6312 C3	6312 C3	–
225	2 ... 8	NU313	NU313	6313 C3	6313 C3	–
250	2 ... 8	NU315	NU315	6315 C3	6315 C3	–
280	2	NU315	NU315	6315 C3	6315 C3	–
280	4 ... 8	NU317	NU317	6317 C3	6317 C3	–
315	2	NU316	NU316	6316 C3	6319 C3	–
315	4 ... 8	NU319	NU319	6319 C3	6319 C3	–
355	2	NU317	NU317	6317 C4	6320 C4	–
355	4 ... 8	NU320	NU320	6320 C4	6320 C4	–

#### **Bearing assignment for 1LE15/1MB15 and 1LE16/1MB16 motors and 1LE5 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 1/63
		Horizontal and vertical type of construction		Horizontal and vertical type of construction		
<b>1LE15, 1MB15 – Basic Line</b>						
71 M	2 ... 8	6302 2ZC3		6302 2ZC3		
80 M	2 ... 8	6304 2ZC3		6304 2ZC3		
90 S/L	2 ... 8	6305 2ZC3		6304 2ZC3		
100 L	2 ... 8	6306 2ZC3 <sup>1)</sup>		6306 2ZC3 <sup>1)</sup>		
112 M	2 ... 8	6306 2ZC3 <sup>1)</sup>		6306 2ZC3 <sup>1)</sup>		
132 M	2 ... 8	6308 2ZC3 <sup>1)</sup>		6308 2ZC3 <sup>1)</sup>		
160 M/L	2 ... 8	6309 2ZC3 <sup>1)</sup>		6309 2ZC3 <sup>1)</sup>		
180 M/L	2 ... 8	6310 2ZC3 <sup>3)</sup>		6310 2ZC3 <sup>3)</sup>		
200 L	2 ... 8	6312 2ZC3 <sup>3)</sup>		6312 2ZC3 <sup>3)</sup>		
225 M	2 ... 8	6313 ZC3 <sup>3)</sup>		6313 ZC3 <sup>3)</sup>		<b>Fig. 4</b>
250 M	2 ... 8	6315 ZC3 <sup>3)</sup>		6315 ZC3 <sup>3)</sup>		
280 M	2	6315 C3 <sup>2)</sup>		6315 C3 <sup>2)</sup>		<b>Fig. 8</b>
	4 ... 8	6317 C3 <sup>2)</sup>		6317 C3 <sup>2)</sup>		
315 M/L	2	6316 C3 <sup>2)</sup>		6316 C3 <sup>2)</sup>		
	4 ... 8	6319 C3 <sup>2)</sup>		6319 C3 <sup>2)</sup>		
<b>1LE16, 1MB16 – Performance Line – bearing version as for Performance Line basic version</b>						
		Type of construction		Type of construction		
		Horizontal	Vertical	Horizontal	Vertical	
<b>1LE5</b>						
250	2 ... 8	6314 ZC3	6314 ZC3	6314 ZC3	6314 ZC3	
280 S/M	2	6315 C3 S0	6315 C3 S0	6315 C3 S0	6315 C3 S0	
	4 ... 8	6316 C3 S0	6316 C3 S0	6316 C3 S0	6316 C3 S0	
315 L	2	6316 C3	6316 C3	6316 C3	6316 C3	<b>Fig. 9, Fig. 10</b>
	4 ... 8	6319 C3	6319 C3	6319 C3	6319 C3	
355 M/L	2	6317 C4	6317 C4	6317 C4	7317 BEP	
	4 ... 8	6320 C4	6320 C4	6320 C4	7320 BEP	
400	2	O. R.	O. R.	O. R.	O. R.	<b>Fig. 6, Fig. 7</b>
	4 ... 8	6326 C3	O. R.	6326 C3	O. R.	
450	2	O. R.	–	O. R.	–	<b>Fig. 6</b>
	4 ... 8	6326 C3	O. R.	6326 C3	O. R.	

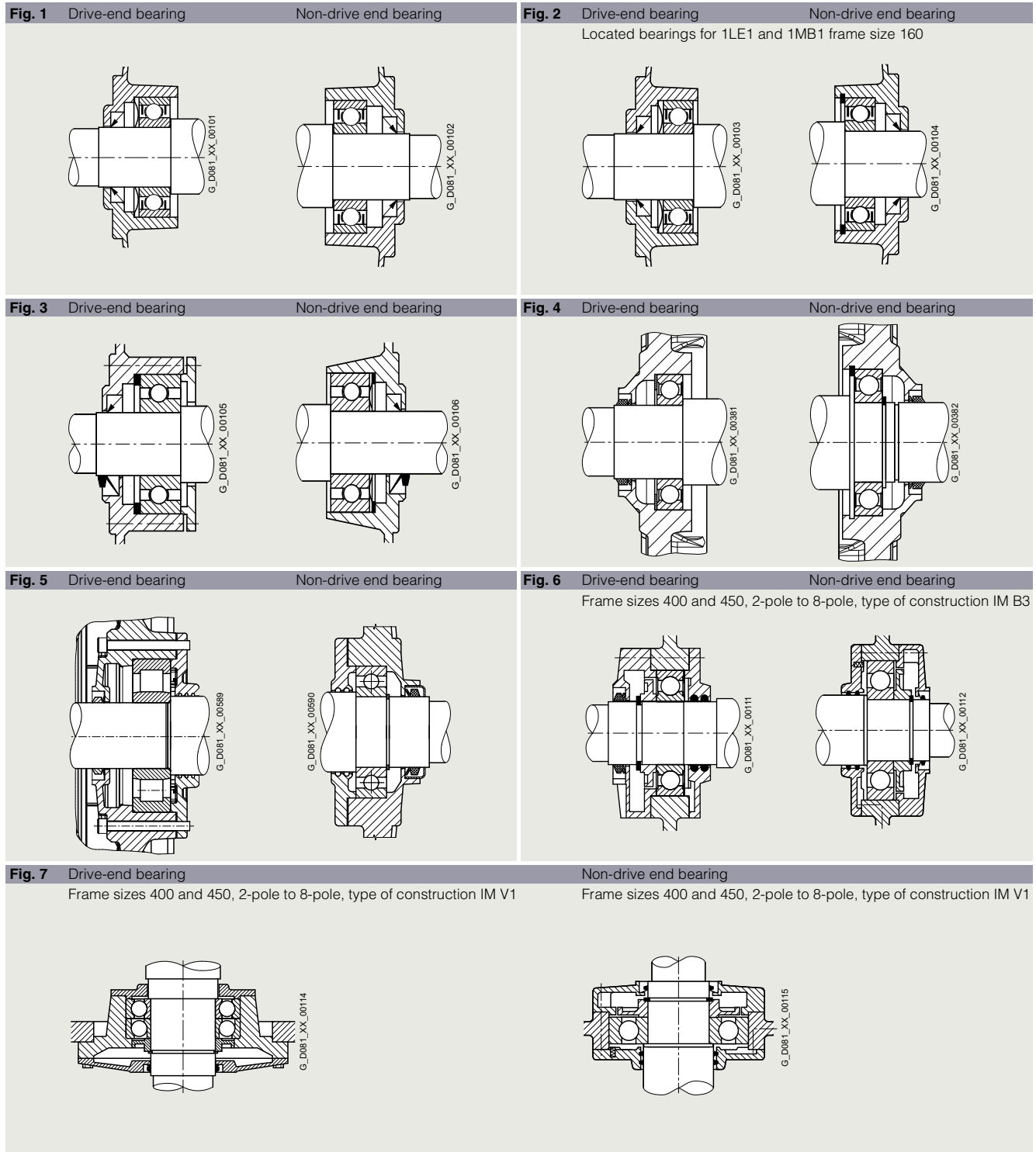
<sup>1)</sup> Deep-groove bearings with a side plate are used for regreasable versions (**L23**).

<sup>2)</sup> As for basic version.

<sup>3)</sup> Deep-groove bearings without a side plate are used for regreasable versions (**L23**).

**Overview**

*Diagrams of bearings*





# Introduction

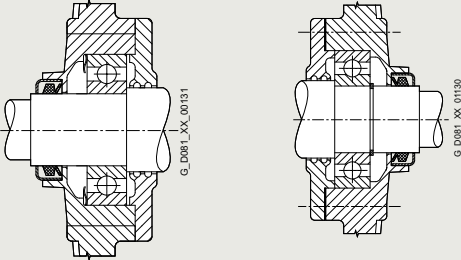
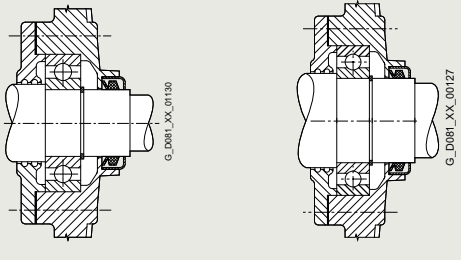
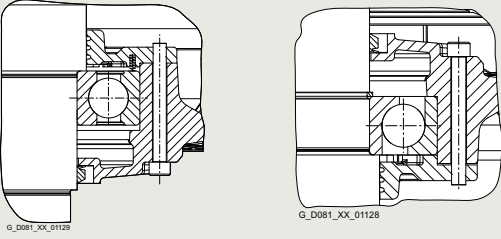
## Mechanical version

### Bearings and lubrication

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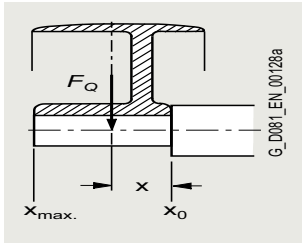
#### Overview

##### Diagrams of bearings

Fig. 8 Drive-end bearing	Non-drive end bearing	Fig. 9 Drive-end bearing	Non-drive end bearing
<p>Frame size 280 and 315</p> 		<p>Frame sizes 315 and 355, Type of construction IM B3/IM B5</p> 	
<p>Frame sizes 315 and 355, 2- and 4-pole, type of construction IM V1</p> 			

**Overview**

**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

Admissible cantilever forces – basic version

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

Note:

1PC10 only for frame sizes 100 to 160.

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

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

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

## Introduction

Mechanical version

### Bearings and lubrication

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#### Overview

##### 1LE15, 1MB15<sup>1)</sup>, 1LE55, and 1MB55 motors<sup>1)</sup> at 50 Hz

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

For motors		Admissible cantilever force at $x_0$	Admissible cantilever force at $x_{max}$
Frame size	No. of poles	N	N
<b>1LE1501/03/21/23, 1MB15 – Basic Line</b>			
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
	8	2980	2480
200	2	2460	2070
	4	3180	2630
	6	3600	2980
	8	4500	3500
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	7 000
	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

##### 1LE16, 1MB16, 1LE56, and 1MB56 motors at 50 Hz

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

For motors		Admissible cantilever force at $x_0$	Admissible cantilever force at $x_{max}$
Frame size	No. of poles	N	N
<b>1LE1601/03/21/23, 1MB16 – Performance Line</b>			
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	8700	6900
250	2	6000	4800
	4	7600	6200
	6	8750	7350
	8	9500	8 000
280	2	5200	4200
	4	8500	7 000
	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

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

<sup>1)</sup> Not valid for 1MB.55 motors with type of protection Ex db eb.

## Overview

**1LE55, and 1MB55 motors <sup>1)</sup> at 50 Hz**Valid are:  $x_0$  values for  $x = 0$  and  $x_{max}$  values for  $x = l$  ( $l$  = shaft extension)

For motors		Admissible cantilever force	
		at $x_0$	at $x_{max}$
Frame size	No. of poles	N	N
<b>1LE5504/34/03/33, 1MB55</b>			
250	2	3200	2600
	4	4000	3250
	6	4600	3800
	8	5250	4200
280 S/M	2	5300	4200
	4	8600	7700
	6	10000	8250
	8	11200	9300
315 L	2	5800	5200
	4	9300	8 000
	6	10600	9200
	8	12000	9200
400	2	2910	2570
	4	6830	5870
	6	6520	5610
	8	7860	6760
450	2	3820	3410
	4	7130	6220
	6	6970	6080
	8	8110	7070

**1LE56, and 1MB56 motors at 50 Hz**Valid are:  $x_0$  values for  $x = 0$  and  $x_{max}$  values for  $x = l$  ( $l$  = shaft extension)

For motors		Admissible cantilever force	
		at $x_0$	at $x_{max}$
Frame size	No. of poles	N	N
<b>1LE5604/34/03/33, 1MB56 – Performance line</b>			
315 L	2	5800	5200
	4	9300	8 000
	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".

<sup>1)</sup> Not valid for 1MB.55 motors with type of protection Ex db eb.

# Introduction

Mechanical version

## Bearings and lubrication

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### Overview

#### 1MB1, 1MB5 motors for types of protection Ex db and Ex db eb at 50 Hz

Valid are:  $x_0$  values for  $x = 0$ ,  $x_{0.5}$  for  $x = 0.5 \times l$  and  $x_{max}$  values for  $x = l$  ( $l$  = shaft extension)

Frame size	No. of poles	Admissible cantilever force		
		at $x_0$	at $x_{0.5}$	at $x_{max}$
<b>1MB1/1MB5 – for types of protection Ex db and Ex db eb</b>				
71	2	360	340	300
	4	410	380	300
	6	490	390	300
80	8	530	390	300
	2	570	530	420
	4	700	570	430
90	6	800	580	430
	8	810	560	420
	2	520	480	440
100	4	660	660	490
	6	850	690	510
	8	940	700	520
100	2	1340	1110	830
	4	1620	1110	820
	6	1690	1120	830
	8	1550	1030	760
112	2	1300	1150	860
	4	1630	1300	970
	6	1800	1190	880
	8	1820	1200	890
132	2	1980	1790	1420
	4	2460	1830	1290
	6	2810	1880	1330
	8	3050	2000	1420
160	2	2770	2510	1950
	4	3430	2850	1940
	6	3700	3290	2230
	8	4300	2570	1750
180	2	3070	2800	2570
	4	3780	3440	2880
	6	4380	3990	2940
	8	4860	4430	3700
200	2	3960	3640	3360
	4	5010	4610	4260
	6	5630	5170	4390
	8	6190	5690	5250
225	2	4500	4170	3890
	4	5590	5090	4660
	6	6260	5690	5220
	8	7230	6580	4770
250	2	5430	4930	4510
	4	6720	6100	5580
	6	7650	6950	6360
	8	8720	7920	6250
280	2	4690	4330	4000
	4	7430	6580	6330
	6	8940	8240	7070
	8	8860	8170	6790
315 S/M	2	5480	5210	4970
	4	8300	7360	5530
	6	9280	6910	4780
	8	9210	5700	4120
315 L	2	4050	3800	3580
	4	5350	4920	4030
	6	6830	5800	4210
	8	8600	5350	3880
355	2	3900	3700	3520
	4	3930	3570	2610
	6	O. R.	O. R.	O. R.
	8	O. R.	O. R.	O. R.

#### Admissible cantilever forces – bearings for increased cantilever forces – order code L22

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

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

Frame size	Type	No. of poles	Admissible cantilever force $F_Q$	
			at $x_0$	at $x_{max}$
<b>1LE10 motors – values for motors with increased power <sup>1)</sup></b>				
100	1LE10..-1AA	2	1585	1300
	1LE10..-1AB	4	1960	1610
	1LE10..-1AC	6	2270	1865
112	1LE10..-1BA	2	1545	1250
	1LE10..-1BB	4	1960	1585
	1LE10..-1BC	6	2270	1835
132	1LE10..-1CA	2	2285	1840
	1LE10..-1CB	4	2860	2300
	1LE10..-1CC	6	3320	2670
160	1LE10..-1DA	2	2800	2240
	1LE10..-1DB	4	3450	2270
	1LE10..-1DC	6	4000	3200
<b>1LE1 motors – standard values <sup>1)</sup></b>				
<b>1MB10 motors – standard values <sup>1)</sup></b>				
<b>1PC10 motors – standard values <sup>1)</sup></b>				
100	1LE10..-1AA	2	1585	1270
	1MB10..-1AA			
	1PC10..-1AA			
	1LE10..-1AB	4	1960	1575
	1MB10..-1AB			
	1PC10..-1AB			
	1LE10..-1AC	6	2270	1815
	1MB10..-1AC			
	1PC10..-1AC			
	1LE10..-1AD	8	2520	2015
1MB10..-1AD				
1PC10..-1AD				
112	1LE10..-1BA	2	1545	1240
	1MB10..-1BA			
	1PC10..-1BA			
	1LE10..-1BB	4	1960	1555
	1MB10..-1BB			
	1PC10..-1BB			
	1LE10..-1BC	6	2270	1800
	1MB10..-1BC			
	1PC10..-1BC			
	1LE10..-1BD	8	2510	1990
1MB10..-1BD				
1PC10..-1BD				
132	1LE10..-1CA	2	2285	1795
	1MB10..-1CA			
	1PC10..-1CA			
	1LE10..-1CB	4	2860	2250
	1MB10..-1CB			
	1PC10..-1CB			
	1LE10..-1CC	6	3320	2580
	1MB10..-1CC			
	1PC10..-1CC			
	1LE10..-1CD	8	3700	2870
1MB10..-1CD				
1PC10..-1CD				
160	1LE10..-1DA	2	2800	2170
	1MB10..-1DA			
	1PC10..-1DA			
	1LE10..-1DB	4	3450	2750
	1MB10..-1DB			
	1PC10..-1DB			
	1LE10..-1DC	6	4000	3160
	1MB10..-1DC			
	1PC10..-1DC			
	1LE10..-1DD	8	4510	3500
1MB10..-1DD				
1PC10..-1DD				
180	1LE10..-1EA	2	3250	2610
		4	4110	3270
		6	4720	3740
		8	5130	4050
		8	5130	4050
200	1LE10..-2AA	2	4320	3550
		4	5480	4500
		6	6220	5110
		8	6870	5640

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

## Overview

**1LE15 and 1MB15<sup>1)</sup> 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 $x_{max}$
<b>1LE1501/03/21/23, 1MB15 – Basic Line</b>				
71	1LE15..-0CA	2	400	340
	1MB15..-0CA			
	1LE15..-0CB	4	490	420
	1MB15..-0CB			
	1LE15..-0CC	6	570	490
	1MB15..-0CC			
80	1LE15..-0CD	8	640	540
	1MB15..-0CD			
	1LE15..-0DA	2	680	570
	1MB15..-0DA			
	1LE15..-0DB	4	840	720
	1MB15..-0DB			
90	1LE15..-0DC	6	970	820
	1MB15..-0DC			
	1LE15..-0DD	8	1090	910
	1MB15..-0DD			
	1LE15..-0EA	2	720	605
	1MB15..-0EA			
100	1LE15..-0EB	4	920	775
	1MB15..-0EB			
	1LE15..-0EC	6	1060	910
	1MB15..-0EC			
	1LE15..-0ED	8	1200	1030
	1MB15..-0ED			
112	1LE15..-1AA	2	1585	1270
	1MB15..-1AA			
	1LE15..-1AB	4	1960	1575
	1MB15..-1AB			
	1LE15..-1AC	6	2270	1815
	1MB15..-1AC			
132	1LE15..-1AD	8	2520	2015
	1MB15..-1AD			
	1LE15..-1BA	2	1545	1240
	1MB15..-1BA			
	1LE15..-1BB	4	1960	1555
	1MB15..-1BB			
160	1LE15..-1BC	6	2270	1800
	1MB15..-1BC			
	1LE15..-1BD	8	2510	1990
	1MB15..-1BD			
	1LE15..-1CA	2	2285	1795
	1MB15..-1CA			
180	1LE15..-1CB	4	2860	2250
	1MB15..-1CB			
	1LE15..-1CC	6	3320	2580
	1MB15..-1CC			
	1LE15..-1CD	8	3700	2870
	1MB15..-1CD			
200	1LE15..-1DA	2	2800	2170
	1MB15..-1DA			
	1LE15..-1DB	4	3450	2750
	1MB15..-1DB			
	1LE15..-1DC	6	4000	3160
	1MB15..-1DC			
250	1LE15..-1DD	8	4510	3500
	1MB15..-1DD			
	1LE15..-1EA	2	4520	3630
	1MB15..-1EA			
	1LE15..-1EB	4	5560	4050
	1MB15..-1EB			
315	1LE15..-1EC	6	6280	4050
	1MB15..-1EC			
	1LE15..-1ED	8	6790	4050
	1MB15..-1ED			
	1LE15..-2AA	2	6840	5610
	1MB15..-2AA			
355	1LE15..-2AB	4	8440	6000
	1MB15..-2AB			
	1LE15..-2AC	6	9480	6000
	1MB15..-2AC			
	1LE15..-2AD	8	10100	6000
	1MB15..-2AD			

Note: 1PC10 and 1MB10 not for frame sizes 180 to 200.

<sup>1)</sup> Not valid for 1MB155 motors with type of protection Ex db eb.

**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 $x_{max}$
<b>1LE1501/03/21/23, 1MB15 – Basic Line (continued)</b>				
225	1LE15..-2BA	2	8 000	6800
	1MB15..-2BA			
	1LE15..-2BB	4	9800	7250
	1MB15..-2BB			
	1LE15..-2BC	6	11100	7300
	1MB15..-2BC			
250	1LE15..-2BD	8	11300	7300
	1MB15..-2BD			
	1LE15..-2CA	2	9500	7400
	1MB15..-2CA			
	1LE15..-2CB	4	12500	9400
	1MB15..-2CB			
280 <sup>2)</sup>	1LE15..-2CC	6	13500	9700
	1MB15..-2CC			
	1LE15..-2CD	8	14700	9700
	1MB15..-2CD			
	1LE15..-2DA	2	16500	9800
	1MB15..-2DA			
315 <sup>2)</sup>	1LE15..-3AA	2	18400	7600
	1MB15..-3AA			

**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 $x_{max}$
<b>1LE1601/03/21/23, 1MB16 – Performance Line</b>			
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 <sup>2)</sup>	2	16500	9800
315 S, M <sup>2)</sup>	2	18400	7600
315 L <sup>2)</sup>	2	18400	7600

Admissible cantilever forces – Bearing for increased cantilever forces – For all motors of frame sizes 400 and 450 at 50 Hz in the horizontal and vertical types of construction (order code **L22**) on request.

Please specify cantilever force and lever arm.

## Introduction

Mechanical version

### Bearings and lubrication

#### Overview

Admissible cantilever forces – bearings for increased cantilever forces – order code **L22** and **L50**

##### Motors 1LE15 bei 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)

For motors Admissible cantilever force  
at  $x_0$  at  $x_{max}$

Frame size	No. of poles	N	N
<b>1LE15</b>			
225	2	8000	5300
	4, 6, 8	9800	5300
250	2	9500	6500
	4, 6, 8	12500	7700
280	2	13500	7300
	4, 6, 8	20000	10500
315	2	18400	7600
	4, 6, 8	25500	10000

##### Motors 1LE16 bei 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)

For motors Admissible cantilever force  
at  $x_0$  at  $x_{max}$

Frame size	No. of poles	N	N
<b>1LE16</b>			
225	2	10700	5300
	4, 6, 8	12700	5300
250	2	15000	6500
	4, 6, 8	19000	7700
280	2	13500	7300
	4, 6, 8	20000	10500
315	2	18400	7600
	4, 6, 8	25500	10000

##### Motors 1LE55 bei 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)

For motors Admissible cantilever force  
at  $x_0$  at  $x_{max}$

Frame size	No. of poles	N	N
<b>1LE55</b>			
250	2	9550	7450
	4	12200	9300
	6	13500	9300
	8	14750	9300
280	2	21000	8100
	4	27000	10500
	6	31500	10300
	8	33000	10100
315	2	18400	7600
	4	31000	10500
	6	34000	10500
	8	35000	10500
355	2	–	–
	4	–	–
	6	–	–
	8	–	–
400	2	2910	2570
	4	6830	5870
	6	6520	5610
	8	7860	6760
450	2	3820	3410
	4	7130	5220
	6	6970	6080
	8	8110	7070

##### Motors 1LE56 bei 50 Hz with reinforced cylindrical roller bearings DE

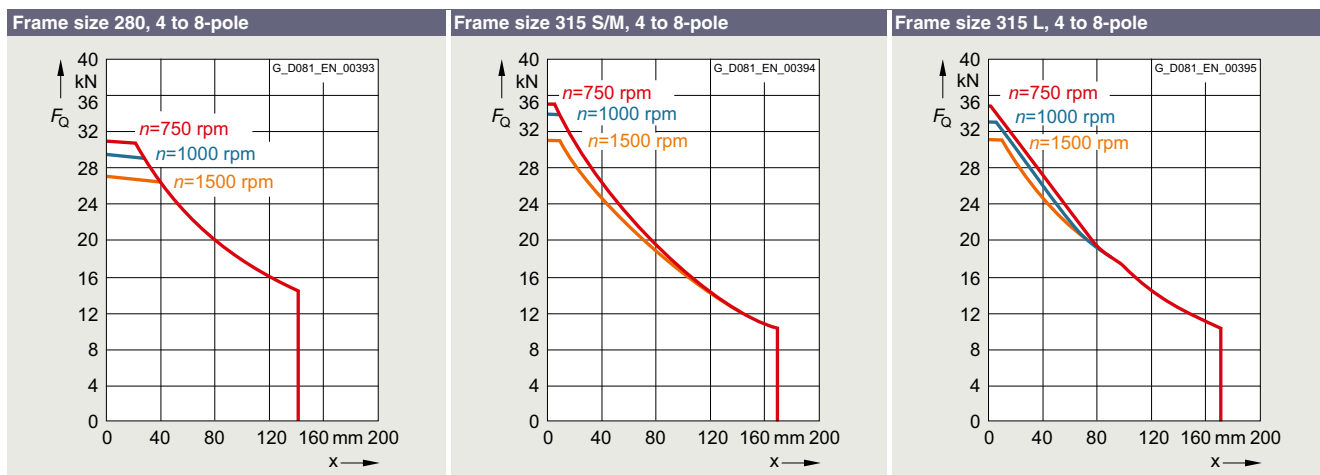
Valid are:  $x_0$  values for  $x = 0$  and  $x_{max}$  values for  $x = l$  ( $l =$  shaft extension)

For motors Admissible cantilever force  
at  $x_0$  at  $x_{max}$

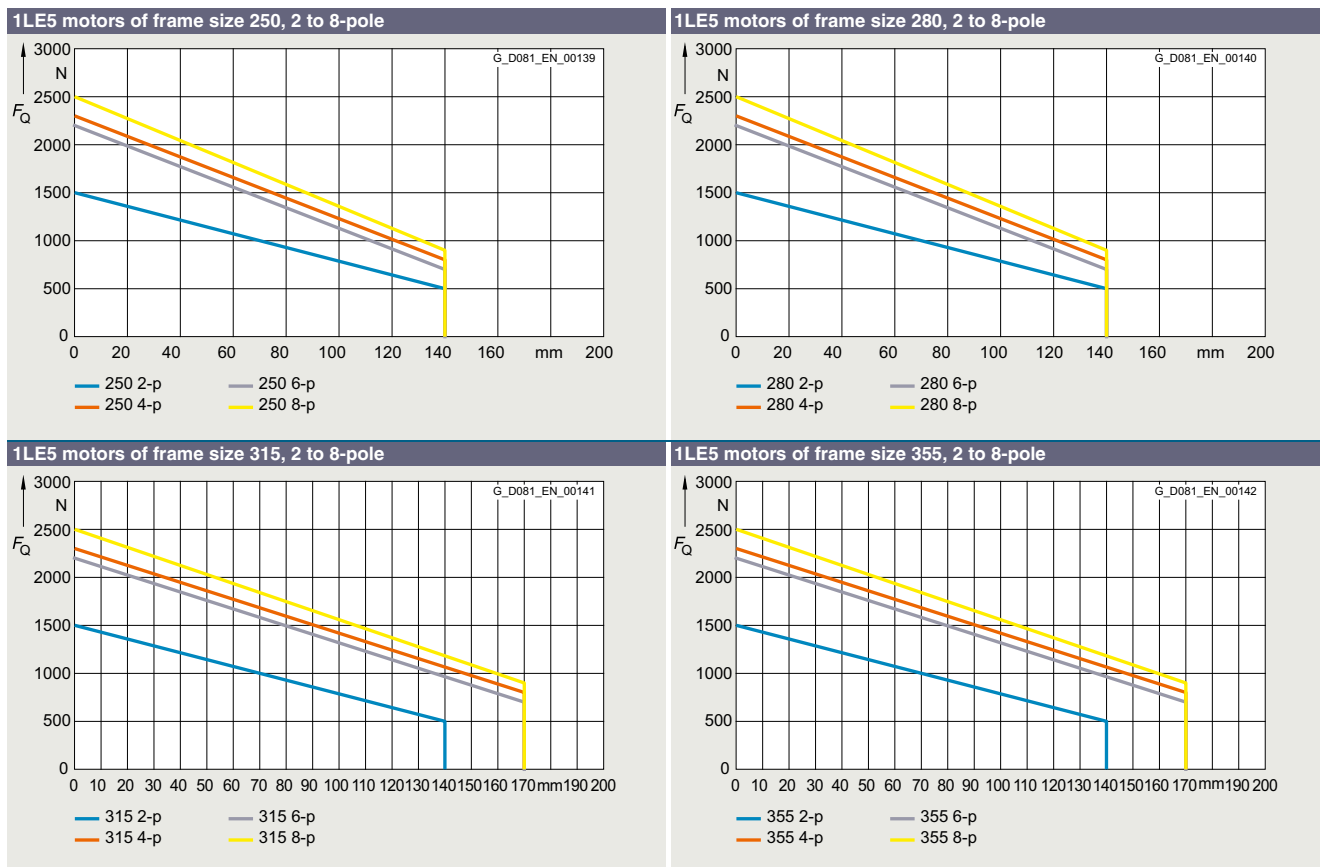
Frame size	No. of poles	N	N
<b>1LE56</b>			
315	2	21300	7600
	4	34000	15000
	6	38500	15000
	8	42000	15000
355	2	23700	11300
	4	39700	16000
	6	44600	16000
	8	44600	16000

Overview

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



1LE5, 1MB5 motors for 50 Hz with cylindrical roller bearings DE for frame sizes 250 to 355 in 2 to 8-pole version



<sup>1)</sup> Not valid for 1MB155 motors with type of protection Ex db eb.



## Introduction

Mechanical version

### Bearings and lubrication

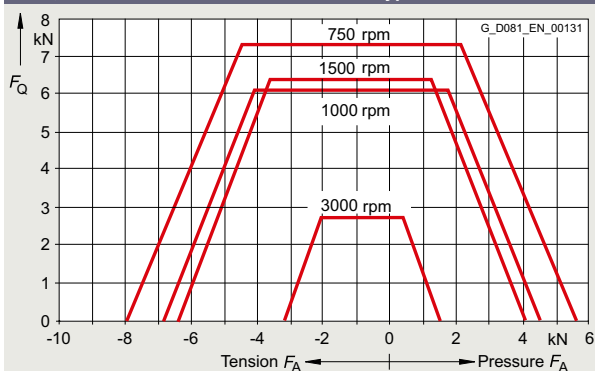
1

#### Overview

##### Admissible cantilever forces at 50 Hz – basic version

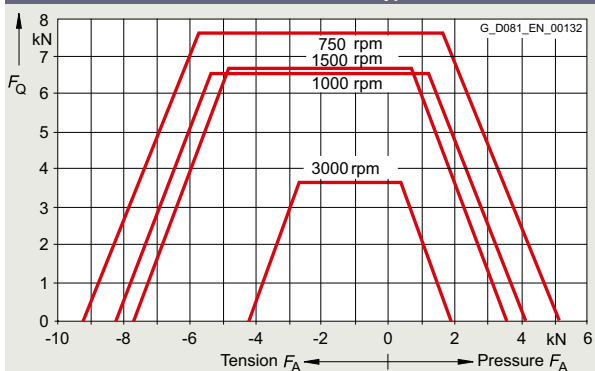
For motors in a horizontal type of construction, the maximum cantilever forces are specified as a function of the axial forces. See diagrams below.

1LE5, 1MB5 motors with frame size 400 – type of construction IM B3



Cantilever force  $F_Q$  at  $x = l$  (shaft extension) via axial force  $F_A$  at nominal bearing service life  $L_{h10} = 20000$  h

1LE5, 1MB5 motors with frame size 450 – type of construction IM B3



Cantilever force  $F_Q$  at  $x = l$  (shaft extension) via axial force  $F_A$  at nominal bearing service life  $L_{h10} = 20000$  h

## Overview

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 N	Admissible cantilever force	
		at $x_0$	at $x_{max}$
<b>1LE1501/03/21/23, 1MB15 – Basic Line</b>			
<b>1LE10, 1MB10, 1PC10</b>			
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 <sup>1)</sup>	2, 4, 6, 8	–	–
315 <sup>1)</sup>	2, 4, 6, 8	–	–

Note:

1PC10 only for frame sizes 100 to 160,  
1MB10 only for frame sizes 80 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 and 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 N	Admissible cantilever force	
		at $x_0$	at $x_{max}$
<b>1LE1501/03/21/23, 1MB15 – Basic Line</b>			
100, 112, 132, 160	2, 4, 6, 8	–	–
	2	8150	4050
	4	9800	4050
180	6	9800	4050
	2	11200	6000
	4, 6	13600	6000
200	2	12700	7900
	4	15700	7250
	6, 8	15700	7300
225	2	17000	7750
	4	21000	9400
	6, 8	21000	9700
250	2	17000	7750
	4	21000	9400
	6, 8	21000	9700
280, 315 S, M, L <sup>1)</sup>	2, 4, 6, 8	–	–

Admissible cantilever forces – bearings for increased cantilever forces – order code **L22**

**1MB1 and 1MB5 motors at 50 Hz with cylindrical roller bearings DE**

**Valid are:  $x_0$  values for  $x = 0$ ;  $x_{0.5}$  values for  $x = 0.5 \times l$  and  $x_{max}$  values for  $x = l$  ( $l$  = shaft extension)**

Frame size	No. of poles N	Admissible cantilever force		
		at $x_0$	at $x_{0.5}$	at $x_{max}$
<b>1MB1/1MB5</b>				
160	2	5380	2870	1950
	4	5340	2850	1940
	6	6150	3290	2230
	8	4820	2570	1750
180	2	8150	4370	2980
	4	8100	4340	2960
	6	7930	4440	3030
	8	9950	5570	3810
200	2	11030	6140	4240
	4	11410	6350	4390
	6	11010	6130	4230
	8	13450	7490	5180
225	2	14990	8530	5940
	4	14640	8200	5480
	6	16110	8200	5480
	8	14010	7130	4770
250	2	18190	9950	6830
	4	19210	10510	7220
	6	18710	10240	7030
	8	17340	9490	6510
280	2	16480	9640	6710
	4	18070	10480	7270
	6	16800	9740	6750
	8	16140	9350	6490
315 S/M	2	21250	12930	9270
	4	12970	6870	4980
	6	12100	6450	4810
	8	10590	5970	4170
315 L	2	15960	9820	7130
	4	10300	5560	4030
	6	10740	5800	4210
	8	9920	5350	3880
355	2	18700	11400	8200
	4, 6, 8	Values on request		

<sup>1)</sup> For values for frame sizes 280 to 315, see page 1/66. For frame sizes 280 to 315, bearings of size 63 are standard.

## Introduction

### Mechanical version

## Bearings and lubrication

### Overview

#### Admissible axial load

1LE10, 1MB10, <sup>1)</sup> and 1PC10 <sup>1)</sup> 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 3/145 in the respective section of the catalog.

Please inquire if the load direction alternates.

1LE10, 1MB10, <sup>1)</sup> and 1PC10 <sup>1)</sup> 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	
	N	X <sub>0</sub> N	X <sub>max.</sub> N	N	N	X <sub>0</sub> N	X <sub>max.</sub> N	N	N	N	X <sub>0</sub> N	X <sub>max.</sub> N	N	N	X <sub>0</sub> N	X <sub>max.</sub> N
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 3/145.

Please inquire if the load direction alternates.

1MB5 motors for Ex db, Ex db eb with a vertical type of construction – basic version

Frame size	3000 rpm		1500 rpm		1000 rpm		750 rpm	
	Shaft extension pointing down		Shaft extension pointing down		Shaft extension pointing down		Shaft extension pointing down	
	Load down N	up N	down N	up N	down N	up N	down N	up N
160	1790	2390	2460	3170	2730	3730	3420	4260
180	2020	2780	2760	3760	3350	4410	3770	5050
200	2910	4150	4070	5370	4840	6360	5460	7200
225	2570	4230	3590	5740	4250	6690	6110	8190
250	3470	5530	4770	7410	5880	8700	7260	9760
280	2440	5520	4300	8570	5860	9680	6920	10740
315 S/M	1190	6350	4250	10130	5240	11980	6340	13080
315 L	970	7250	3150	11170	3730	13070	4570	14130
355	270	10510	Values on request		Values on request		Values on request	

<sup>1)</sup> 1MB10 motors only available with frame sizes 80 to 160 and 1PC10 motors only available with frame sizes 100 to 160.

## Overview

1LE15, 1MB15, 1LE16, 1MB16, 1LE55, and 1LE56 motors in vertical type of construction – basic version

Frame size	Type	2-pole – 3000 rpm				4-pole – 1500 rpm				6-pole – 1000 rpm				8-pole – 750 rpm			
		Shaft extension down		Shaft extension 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
<b>1LE15, 1MB15 – Basic Line</b>																	
71	<b>1..1501-0C.2</b>	220	100	80	240	210	220	180	240	210	300	260	250	–	–	–	–
	<b>1..1501-0C.3</b>	220	90	70	240	210	210	170	250	210	300	260	250	–	–	–	–
	<b>1..1503-0C.2</b>	220	90	70	240	210	210	170	250	210	300	260	250	–	–	–	–
	<b>1..1503-0C.3</b>	210	100	60	250	200	200	150	260	200	290	230	260	–	–	–	–
80	<b>1..1501-0D.2</b>	240	280	240	280	230	460	400	290	230	600	540	290	–	–	–	–
	<b>1..1501-0D.3</b>	230	270	220	280	230	450	390	290	220	590	510	300	–	–	–	–
	<b>1..1503-0D.2</b>	230	270	220	280	230	450	390	290	220	590	510	300	–	–	–	–
90	<b>1..1501-0E.0</b>	210	300	230	280	210	480	400	290	210	620	540	290	–	–	–	–
	<b>1..1501-0E.4</b>	210	300	220	290	200	480	380	300	200	620	520	300	–	–	–	–
	<b>1..1503-0E.4</b>	210	290	210	290	200	460	360	300	200	610	510	300	–	–	–	–
100	<b>1..15.1-1A.4</b>	300	450	340	410	280	720	570	430	260	930	740	450	280	1100	940	440
	<b>1..15.1-1A.5</b>	–	–	–	–	270	710	540	440	–	–	–	–	260	1100	910	450
	<b>1..15.1-1A.6</b>	290	440	310	420	250	710	500	460	240	920	690	470	–	–	–	–
	<b>1..15.3-1A.4</b>	290	440	310	420	250	710	500	460	–	–	–	–	–	–	–	–
	<b>1..15.3-1AB5</b>	–	–	–	–	250	710	500	460	–	–	–	–	–	–	–	–
112	<b>1..15.1-1B.2</b>	280	460	310	430	260	730	540	450	250	940	730	460	250	1110	900	460
	<b>1..15.1-1B.6</b>	260	460	270	450	250	730	510	470	240	930	700	470	–	–	–	–
	<b>1..15.3-1B.2</b>	260	460	270	450	250	730	510	470	240	930	700	470	–	–	–	–
132	<b>1..15.1-1C.0</b>	510	600	370	740	490	1000	730	760	490	1310	1040	760	480	1570	1280	770
	<b>1..15.1-1C.1</b>	490	610	340	760	–	–	–	–	–	–	–	–	–	–	–	–
	<b>1..15.1-1C.2</b>	–	–	–	–	460	1000	670	790	470	1310	1000	780	450	1580	1220	810
	<b>1..15.1-1C.3</b>	–	–	–	–	–	–	–	–	440	1310	940	810	–	–	–	–
	<b>1..15.1-1C.6</b>	450	610	260	800	410	1010	580	840	390	1320	850	860	–	–	–	–
	<b>1..15.3-1C.0</b>	490	610	340	760	410	1010	580	840	440	1310	940	810	–	–	–	–
	<b>1..15.3-1C.1</b>	450	610	260	800	–	–	–	–	–	–	–	–	–	–	–	–
	<b>1..15.3-1C.2</b>	–	–	–	–	410	1010	580	840	440	1310	940	810	–	–	–	–
<b>1..15.3-1C.3</b>	–	–	–	–	–	–	–	–	400	1320	850	860	–	–	–	–	
160	<b>1..15.1-1D.2</b>	1560	890	500	1950	1930	1340	870	2400	2190	1700	1130	2760	2540	1990	1480	3050
	<b>1..15.1-1D.3</b>	1510	900	450	1960	–	–	–	–	–	–	–	–	2430	1980	1370	3040
	<b>1..15.1-1D.4</b>	1470	900	410	1960	1840	1350	780	2410	2070	1710	1010	2770	2350	2000	1290	3060
	<b>1..15.1-1D.6</b>	1370	900	310	1960	1760	1380	700	2440	1930	1720	870	2780	–	–	–	–
	<b>1..15.1-1D.7</b>	–	–	–	–	1640	1400	580	2460	–	–	–	–	–	–	–	–
	<b>1..15.3-1D.2</b>	1510	900	450	1960	1840	1350	780	2410	2070	1710	1010	2770	–	–	–	–
	<b>1..15.3-1D.3</b>	1470	900	410	1960	–	–	–	–	–	–	–	–	–	–	–	–
<b>1..15.3-1D.4</b>	1370	900	310	1960	1760	1380	700	2440	1930	1720	870	2780	–	–	–	–	
180	<b>1..15...-1E.2</b>	1290	1220	530	1980	1680	1750	920	2500	–	–	–	–	–	–	–	–
	<b>1..15...-1E.4</b>	–	–	–	–	1610	1760	850	2520	1920	2120	1160	2880	2270	2440	1510	3200
	<b>1..15...-1E.6</b>	1260	1230	500	1990	1600	1770	840	2530	1920	2150	1160	2900	2050	2500	1290	3260
200	<b>1..15...-2A.4</b>	1920	1680	760	2830	–	–	–	–	2880	2970	1720	4120	–	–	–	–
	<b>1..15...-2A.5</b>	1810	1700	660	2860	2410	2450	1260	3600	2770	3010	1620	4160	3240	3450	2090	4600
	<b>1..15...-2A.6</b>	1810	1720	660	2870	2410	2480	1260	3630	2700	3050	1550	4200	3060	3510	1910	4660
225	<b>1..15...-2B.0</b>	–	–	–	–	2200	2800	1180	3830	–	–	–	–	3200	3750	2180	4770
	<b>1..15...-2B.2</b>	1720	2000	630	3020	2100	2850	1070	3900	2340	3470	1300	4480	3090	3800	2070	4820
	<b>1..15...-2B.6</b>	1720	2000	630	3020	2100	2850	1070	3900	2300	3500	1280	4480	2780	3950	1770	4970
250	<b>1..15...-2C.2</b>	1630	2600	830	3400	1980	3580	1180	4390	2440	4210	1650	5020	3180	4760	2380	5560
	<b>1..15...-2C.6</b>	1630	2650	830	3450	1940	3740	1140	4530	2440	4320	1640	5120	2950	4850	2150	5650
280	<b>1..15...-2D.0</b>	3540	4280	1950	5850	5320	6930	3640	8500	6630	7990	5000	9570	7930	9030	6200	10500
	<b>1..15...-2D.2</b>	3250	4390	1650	5950	4790	6990	3170	8580	6350	8150	4700	9700	7690	9180	6000	10600
	<b>1..15...-2D.6</b>	3180	4540	1580	6100	4770	7170	3150	8750	6230	8400	4600	9900	7370	9300	5700	10700
315	<b>1..15...-3A.0</b>	3580	4710	1450	6850	5640	7790	3600	9850	6800	9100	4700	11100	8500	10150	6450	11800
	<b>1..15...-3A.2</b>	3180	4960	1050	7100	4780	7920	2700	9900	6080	9300	4000	11300	8150	10400	6100	11900
	<b>1..15...-3A.4</b>	2890	5080	770	7200	4820	7580	2750	9600	5400	9750	3350	11700	7250	10650	5200	12000
	<b>1..15...-3A.5</b>	2240	5480	100	7600	3720	7620	1650	9650	4800	10150	2750	11800	6500	10900	4450	12300
	<b>1..15...-3A.6</b>	–	–	–	–	–	–	–	–	4550	10000	2500	11800	5900	11000	3900	12500

## Introduction

Mechanical version

## Bearings and lubrication

## Overview

Frame size	Type	2-pole – 3000 rpm				4-pole – 1500 rpm				6-pole – 1000 rpm				8-pole – 750 rpm							
		Shaft extension pointing				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	N	N	N	
<b>1LE55 – Basic Line</b>																					
250	<b>1LE55...-2C.2</b>	2600	1630	4040	760	3580	1980	5150	1080	4210	2440	5100	1600	3180	4760	2380	5560				
280	<b>1LE55...-2D.0</b>	4500	4100	6600	2000	6930	5320	9700	3130	7800	6630	10900	4450	9000	7930	11500	5800				
	<b>1LE55...-2D.2</b>	4600	4000	6700	1900	6990	4790	9800	2800	4600	4000	11000	4200	9180	7690	11700	5500				
315	<b>1LE55...-3A.0</b>	3800	4700	6100	1700	5500	7700	8800	3200	6500	9500	9600	4300	7800	10800	10000	5500				
	<b>1LE55...-3A.2</b>	3600	5800	6300	1500	5000	8400	9500	2700	6200	9800	10100	4000	7500	11100	10900	5200				
	<b>1LE55...-3A.4</b>	2900	6400	7000	800	4800	8700	9600	2400	5700	10400	10700	3500	7200	11400	11200	4900				
	<b>1LE55...-3A.5</b>	2800	6800	7100	700	4400	9100	1000	2000	5300	10800	11000	3100	6700	11800	11700	4400				
	<b>1LE55...-3A.6</b>	12500	1800	10100	622	191000	2293	16700	4633	5100	11100	11300	2800	6400	12100	12000	4100				
	<b>1LE55...-3A.7</b>	12000	2300	9600	622	19000	2353	16600	4693	22000	3014	19600	5534	24700	3393	22300	5733				
	<b>1LE55...-3A.8</b>	–	–	–	–	–	–	–	–	21000	4054	18600	6394	23700	4423	21300	6763				
<b>1LE16, 1MB16 – Performance Line</b>																					
100	<b>1..16.1-1A.4</b>	220	930	820	330	200	1330	1180	350	180	1640	1450	370	200	1900	1740	360				
	<b>1..16.1-1A.5</b>	–	–	–	–	190	1320	1150	360	–	–	–	–	–	–	–	–				
	<b>1..16.1-1A.6</b>	210	930	800	340	170	1320	1110	380	160	1640	1410	390	180	1900	1710	370				
	<b>1..16.3-1A.4</b>	210	930	800	340	170	1320	1110	380	–	–	–	–	–	–	–	–				
	<b>1..16.3-1A.5</b>	–	–	–	–	170	1320	1110	380	–	–	–	–	–	–	–	–	–			
112	<b>1..16.1-1B.2</b>	200	940	790	350	180	1340	1150	370	170	1650	1440	380	–	–	–	–				
	<b>1..16.1-1B.6</b>	180	940	750	370	170	1340	1120	390	160	1640	1410	390	170	1910	1700	380				
	<b>1..16.3-1B.2</b>	180	940	750	370	170	1340	1120	390	160	1640	1410	390	–	–	–	–				
132	<b>1..16.1-1C.0</b>	540	1120	890	770	520	1700	1430	790	520	2150	1880	790	510	2530	2240	800				
	<b>1..16.1-1C.1</b>	520	1130	860	790	–	–	–	–	–	–	–	–	–	–	–	–				
	<b>1..16.1-1C.2</b>	–	–	–	–	490	1710	1380	820	500	2150	1840	810	480	2540	2180	840				
	<b>1..16.1-1C.3</b>	–	–	–	–	–	–	–	–	470	2150	1780	840	–	–	–	–				
	<b>1..16.1-1C.6</b>	480	1130	780	830	440	1710	1280	870	420	2160	1690	890	–	–	–	–				
	<b>1..16.3-1C.0</b>	520	1130	860	790	440	1710	1280	870	470	2150	1780	840	–	–	–	–				
	<b>1..16.3-1C.1</b>	480	1130	780	830	–	–	–	–	–	–	–	–	–	–	–	–				
	<b>1..16.3-1C.2</b>	–	–	–	–	440	1710	1280	870	470	2150	1780	840	–	–	–	–				
	<b>1..16.3-1C.3</b>	–	–	–	–	–	–	–	–	420	2160	1690	890	–	–	–	–				
160	<b>1..16.1-1D.2</b>	2200	1870	1480	2590	2860	2610	2140	3330	3320	3170	2600	3890	3830	3620	3110	4340				
	<b>1..16.1-1D.3</b>	2150	1880	1430	2600	–	–	–	–	–	–	–	–	3730	3620	3010	4340				
	<b>1..16.1-1D.4</b>	2120	1890	1400	2610	2760	2610	2040	3330	3200	3180	2480	3900	3650	3640	2930	4360				
	<b>1..16.1-1D.6</b>	2020	1890	1300	2610	2680	2640	1960	3360	3050	3180	2330	3900	–	–	–	–				
	<b>1..16.1-1D.7</b>	–	–	–	–	2570	2670	1850	3390	–	–	–	–	–	–	–	–				
	<b>1..16.3-1D.2</b>	2150	1880	1430	2600	2760	2610	2040	3330	3200	3180	2480	3900	–	–	–	–				
	<b>1..16.3-1D.3</b>	2120	1890	1400	2610	–	–	–	–	–	–	–	–	–	–	–	–				
<b>1..16.3-1D.4</b>	2020	1890	1300	2610	2680	2640	1960	3360	3050	3180	2330	3900	–	–	–	–					
180	<b>1..16...-1E.2</b>	2510	2050	1360	3200	3240	2920	2090	4070	–	–	–	–	–	–	–	–				
	<b>1..16...-1E.4</b>	–	–	–	–	3180	2930	2020	4090	3740	3560	2580	4710	4300	4090	3150	5240				
	<b>1..16...-1E.6</b>	2490	2060	1330	3220	3160	2950	2010	4100	3740	3570	2580	4730	4090	4140	2940	5290				
200	<b>1..16...-2A.4</b>	2920	3030	2110	3840	–	–	–	–	4570	5010	3760	5820	–	–	–	–				
	<b>1..16...-2A.5</b>	2810	3060	2000	3870	3820	4210	3010	5020	4470	5060	3660	5870	5200	5750	4390	6560				
	<b>1..16...-2A.6</b>	2810	3060	2000	3870	3820	4230	3010	5040	4400	5090	3590	5900	5010	5800	4200	6610				
225	<b>1..16...-2B.0</b>	–	–	–	–	4200	4750	3150	5800	–	–	–	–	5900	6400	4850	7650				
	<b>1..16...-2B.2</b>	3100	3400	2050	4450	4100	4850	3000	5850	4700	5800	3650	6850	5800	6450	4700	7500				
	<b>1..16...-2B.6</b>	3100	3400	2050	4450	4100	4850	3000	5850	4650	5850	3600	6900	5500	6600	4400	7650				
250	<b>1..16...-2C.2</b>	3850	4100	2250	5600	4850	5650	3250	7250	5750	6750	4200	8350	6900	7700	5300	9200				
	<b>1..16...-2C.6</b>	3850	4100	2250	5600	4800	5750	3200	7400	5750	6750	4200	8450	6700	7800	5000	9300				
280	<b>1..16...-2D.0</b>	3540	4280	1950	5850	5320	6930	3640	8500	6630	7990	5000	9570	7930	9030	6200	10500				
	<b>1..16...-2D.2</b>	3250	4390	1650	5950	4790	6990	3170	8580	6350	8150	4700	9700	7690	9180	6000	10600				
	<b>1..16...-2D.6</b>	3180	4540	1580	6100	4770	7170	3150	8750	6230	8400	4600	9900	7370	9300	5700	10700				
315	<b>1..16...-3A.0</b>	3580	4710	1450	6850	5640	7790	3600	9850	6800	9100	4700	11100	8500	10150	6450	11800				
	<b>1..16...-3A.2</b>	3180	4960	1050	7100	4780	7920	2700	9900	6080	9300	4000	11300	8150	10400	6100	11900				
	<b>1..16...-3A.4</b>	2890	5080	770	7200	4820	7580	2750	9600	5400	9750	3350	11700	7250	10650	5200	12000				
	<b>1..16...-3A.5</b>	2240	5480	100	7600	3720	7620	1650	9650	4800	10150	2750	11800	6500	10900	4450	12300				
	<b>1..16...-3A.6</b>	–	–	–	–	–	–	–	–	4550	10000	2500	11800	5900	11000	3900	12500				

## Overview

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
<b>1LE56 – Performance Line</b>																	
315	<b>1LE56...3A.6</b>	10500	1800	10500	1800	17500	2500	17500	2500	–	–	–	–	–	–	–	–
	<b>1LE56...3A.7</b>	10000	2300	10000	2300	17000	3000	17000	3000	2000	3000	20000	3000	22500	3400	22500	3400
	<b>1LE56...3A.8</b>	–	–	–	–	–	–	–	–	19000	4000	19000	4000	21500	4400	21500	4400
355	<b>1LE56...3B.3</b>	9700	2900	9700	2900	20000	3600	20000	3600	–	–	–	–	–	–	–	–
	<b>1LE56...3B.4</b>	9300	3500	9300	3500	19500	3800	19500	3800	–	–	–	–	–	–	–	–
	<b>1LE56...3B.5</b>	9000	3700	9000	3700	18500	4600	18500	4600	–	–	–	–	–	–	–	–
	<b>1LE56...3BC2</b>	–	–	–	–	–	–	–	–	21500	5000	21500	5000	–	–	–	–
	<b>1LE56...3BC3</b>	–	–	–	–	–	–	–	–	21000	5500	21000	5500	–	–	–	–
	<b>1LE56...3BC4</b>	–	–	–	–	–	–	–	–	21000	5500	21000	5500	–	–	–	–
	<b>1LE56...3BD1</b>	–	–	–	–	–	–	–	–	–	–	–	–	23000	5500	23000	5500
	<b>1LE56...3BD2</b>	–	–	–	–	–	–	–	–	–	–	–	–	22000	5800	22000	5800

## 1MB15 and 1MB55 motors for Ex db, Ex db eb with a vertical type of construction – basic version

Frame size	2-pole – 3000 rpm				4-pole – 1500 rpm				6-pole – 1000 rpm				8-pole – 750 rpm			
	Shaft extension pointing up		Shaft extension pointing down		up		down		up		down		up		down	
	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
71	510	220	190	550	600	340	280	660	700	440	380	760	780	510	450	840
80	830	350	290	890	1000	540	460	1080	1130	690	590	1230	1220	780	680	1320
90	860	380	270	980	1050	590	450	1180	1210	760	610	1350	1310	860	720	1450
100	1660	1000	770	1890	2010	1380	1120	2270	2400	1740	1510	2630	2700	2020	1810	2910
112	1680	980	790	1860	2070	1430	1180	2320	2380	1760	1490	2640	2620	2030	1730	2920
132	2410	1480	1140	2750	2930	2100	1660	3370	3370	2580	2100	3850	3740	2970	2470	4240
160	2810	2310	1710	3420	3560	3170	2460	4270	3930	3820	2820	4920	4590	4320	3480	5430
180	2980	2620	1860	3740	3700	3580	2580	4700	4370	4310	3250	5430	4850	5010	3730	6130
200	3850	3380	2140	5080	4940	4540	3240	6250	5650	5460	3940	7160	6260	6300	4560	8010
225	4240	3950	2290	5900	5230	5430	3280	7380	5970	6460	4020	8400	7150	7280	5200	9230
250	5140	4820	2760	7200	6350	6610	3970	8990	7400	7840	5020	10220	8710	8830	6330	11210
280	4510	5210	2130	7590	6510	7980	3710	10780	8190	9210	5390	12010	8160	9180	5360	11980
315 S/M	4700	7260	2100	9860	7650	10350	4470	13530	8290	11850	5110	15030	9500	13060	6320	16240
315 L	4770	8450	2170	11050	6090	10930	2910	14110	6880	13040	3700	16220	7740	14120	4560	17300
355	5160	12600	2360	15400	6210	15170	2730	18650	O. R.	O. R.	O. R.	O. R.	O. R.	O. R.	O. R.	O. R.

## Introduction

Mechanical version

## Bearings and lubrication

1

## Overview

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

For frame sizes &gt; 250 standard version.

## Overview

1LE15, 1MB15, 1LE16, 1MB16, 1LE55, 1MB55, 1LE56, and 1MB56 motors in horizontal type of construction – basic version

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		Tension		Thrust		Tension		Thrust			Load		Tension		Thrust		Tension		Thrust	
		N	N	N	N	N	N	N	N	N	N		N	N	N	N	N	N	N	N	N	N
<b>1LE15, 1MB15 – Basic Line</b>											<b>1LE16, 1MB16 – Performance Line</b>											
71	<b>1..1501-0C.2</b>	230	90	230	200	230	280	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1501-0C.3</b>	230	80	230	190	230	280	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1503-0C.2</b>	230	80	230	190	230	280	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1503-0C.3</b>	230	80	230	180	230	260	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
80	<b>1..1501-0D.2</b>	260	260	260	430	260	570	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1501-0D.3</b>	260	250	260	420	260	550	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1503-0D.2</b>	260	250	260	420	260	550	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1503-0D.3</b>	260	240	260	400	260	540	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
90	<b>1..1501-0E.0</b>	250	270	250	440	250	580	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1501-0E.4</b>	250	260	250	430	250	570	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1503-0E.0</b>	250	260	250	430	250	570	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	<b>1..1503-0E.4</b>	250	250	250	410	250	560	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
100	<b>1..15.1-1A.4</b>	1120	400	1370	650	1560	840	1740	1020	<b>1..16.1-1A.4</b>	1440	880	1820	1260	2110	1550	2380	1820	–	–	–	
	<b>1..15.1-1A.5</b>	–	–	1350	630	–	–	1730	1010	<b>1..16.1-1A.5</b>	–	–	1800	1240	–	–	2370	1810	–	–	–	
	<b>1..15.1-1A.6</b>	1000	380	1330	610	1530	810	–	–	<b>1..16.1-1A.6</b>	1430	870	1780	1220	2090	1530	–	–	–	–		
	<b>1..15.3-1A.4</b>	1000	380	1330	610	–	–	–	–	<b>1..16.3-1A.4</b>	1430	870	1780	1220	–	–	–	–	–	–		
	<b>1..15.3-1A.5</b>	–	–	1330	610	–	–	–	–	<b>1..16.3-1A.5</b>	–	–	1780	1220	–	–	–	–	–	–		
112	<b>1..15.1-1B.2</b>	1110	390	1360	640	1560	840	1730	1010	<b>1..16.1-1B.2</b>	1430	870	1810	1250	2110	1550	2370	1810	–	–	–	
	<b>1..15.1-1B.6</b>	1090	370	1340	620	1540	820	–	–	<b>1..16.1-1B.6</b>	1410	850	1790	1230	2090	1530	–	–	–	–		
	<b>1..15.3-1B.2</b>	1090	370	1340	620	1540	820	–	–	<b>1..16.3-1B.2</b>	1410	850	1790	1230	2090	1530	–	–	–	–		
	<b>1..15.3-1B.6</b>	–	–	–	–	–	–	–	–	<b>1..16.3-1B.6</b>	–	–	–	–	–	–	–	–	–	–		
132	<b>1..15.1-1C.0</b>	1750	490	2130	870	2440	1180	2690	1430	<b>1..16.1-1C.0</b>	2330	1010	2890	1570	3340	2020	3710	2390	–	–	–	
	<b>1..15.1-1C.1</b>	1740	480	–	–	–	–	–	–	<b>1..16.1-1C.1</b>	2320	1000	–	–	–	–	–	–	–	–		
	<b>1..15.1-1C.2</b>	–	–	2100	840	2420	1160	2660	1400	<b>1..16.1-1C.2</b>	–	–	2870	1550	3320	2000	3680	2360	–	–		
	<b>1..15.1-1C.3</b>	–	–	–	–	2390	1130	–	–	<b>1..16.1-1C.3</b>	–	–	–	–	3290	1970	–	–	–	–		
	<b>1..15.1-1C.6</b>	1700	440	2060	800	2350	1090	–	–	<b>1..16.1-1C.6</b>	2280	960	2820	1500	3250	1930	–	–	–	–		
	<b>1..15.3-1C.0</b>	1740	480	2060	800	2390	1130	–	–	<b>1..16.3-1C.0</b>	2320	1000	2820	1500	3290	1970	–	–	–	–		
	<b>1..15.3-1C.1</b>	1700	440	–	–	–	–	–	–	<b>1..16.3-1C.1</b>	2280	960	–	–	–	–	–	–	–	–		
	<b>1..15.3-1C.2</b>	–	–	2060	800	2390	1130	–	–	<b>1..16.3-1C.2</b>	–	–	2820	1500	3290	1970	–	–	–	–		
<b>1..15.3-1C.3</b>	–	–	–	–	2350	1090	–	–	<b>1..16.3-1C.3</b>	–	–	–	–	3250	1930	–	–	–	–			
160	<b>1..15.1-1D.2</b>	1760	700	2170	1110	2480	1420	2800	1740	<b>1..16.1-1D.2</b>	2400	1680	3100	2380	3610	2890	4090	3370	–	–	–	
	<b>1..15.1-1D.3</b>	1740	680	–	–	–	–	2740	1680	<b>1..16.1-1D.3</b>	2380	1660	–	–	–	–	4040	3320	–	–		
	<b>1..15.1-1D.4</b>	1720	660	2130	1070	2420	1360	2710	1650	<b>1..16.1-1D.4</b>	2370	1650	3050	2330	3550	2830	4010	3290	–	–		
	<b>1..15.1-1D.6</b>	1670	610	2100	1040	2360	1300	–	–	<b>1..16.1-1D.6</b>	2320	1600	3020	2300	3480	2760	–	–	–	–		
	<b>1..15.1-1D.7</b>	–	–	2050	990	–	–	–	–	<b>1..16.1-1D.7</b>	–	–	2980	2260	–	–	–	–	–	–		
	<b>1..15.3-1D.2</b>	1740	680	2130	1070	2420	1360	–	–	<b>1..16.3-1D.2</b>	2380	1660	3050	2330	3550	2830	–	–	–	–		
	<b>1..15.3-1D.3</b>	1720	660	–	–	–	–	–	–	<b>1..16.3-1D.3</b>	2370	1650	–	–	–	–	–	–	–	–		
	<b>1..15.3-1D.4</b>	1670	610	2100	1040	2360	1300	–	–	<b>1..16.3-1D.4</b>	2320	1600	3020	2300	3480	2760	–	–	–	–		
180	<b>1..15.-1E.2</b>	1640	880	2100	1340	–	–	–	–	<b>1..16.-1E.2</b>	2860	1710	3660	2510	–	–	–	–	–	–		
	<b>1..15.-1E.4</b>	–	–	2070	1310	2420	1660	2740	1980	<b>1..16.-1E.4</b>	–	–	3630	2480	4230	3080	4770	3620	–	–		
	<b>1..15.-1E.6</b>	1630	870	2070	1310	2420	1660	2660	1900	<b>1..16.-1E.6</b>	2850	1700	3630	2480	4230	3080	4690	3540	–	–		
200	<b>1..15.-2A.4</b>	2380	1230	–	–	3510	2360	–	–	<b>1..16.-2A.4</b>	3390	2580	–	–	5210	4400	–	–	–	–		
	<b>1..15.-2A.5</b>	2340	1190	3020	1870	3470	2320	3920	2770	<b>1..16.-2A.5</b>	3340	2530	4430	3620	5170	4360	5880	5070	–	–		
	<b>1..15.-2A.6</b>	2340	1190	3020	1870	3450	2300	3860	2710	<b>1..16.-2A.6</b>	3340	2530	4430	3620	5150	4340	5810	5000	–	–		
225	<b>1..15.-2B.0</b>	–	–	3020	1980	–	–	3950	2950	<b>1..16.-2B.0</b>	–	–	4950	3900	–	–	6600	5550	–	–		
	<b>1..15.-2B.2</b>	2350	1300	3020	1980	3400	2400	3900	2900	<b>1..16.-2B.2</b>	3800	2750	4950	3900	5750	4700	6550	5500	–	–		
	<b>1..15.-2B.6</b>	2350	1300	3020	1980	3400	2400	3800	2800	<b>1..16.-2B.6</b>	3800	2750	4900	3850	5700	4650	6500	5450	–	–		
250	<b>1..15.-2C.2</b>	2600	1750	3200	2400	3750	3000	4350	3550	<b>1..16.-2C.2</b>	4750	3150	6050	4450	7100	5500	8100	6500	–	–		
	<b>1..15.-2C.6</b>	2550	1700	3200	2400	3750	3000	4300	3500	<b>1..16.-2C.6</b>	4750	3150	6050	4450	7100	5500	8000	6400	–	–		
280	<b>1..15.-2D.0</b>	4500	2900	6700	5100	7900	6350	8800	7200	<b>1..16.-2D.0</b>	4500	2900	6700	5100	7900	6350	8800	7200	–	–		
	<b>1..15.-2D.2</b>	4450	2850	6600	5000	7850	6300	8800	7200	<b>1..16.-2D.2</b>	4450	2850	6600	5000	7850	6300	8800	7200	–	–		
	<b>1..15.-2D.6</b>	4450	2850	6600	5000	7850	6300	8800	7200	<b>1..16.-2D.6</b>	4450	2850	6600	5000	7850	6300	8800	7200	–	–		
315	<b>1..15.-3A.0</b>	5000	2900	7550	5500	8900	6850	9800	7800	<b>1..16.-3A.0</b>	5000	2900	7550	5500	8900	6850	9800	7800	–	–		
	<b>1..15.-3A.2</b>	4800	2700	7300	5250	8900	6850	9800	7800	<b>1..16.-3A.2</b>	4800	2700	7300	5250	8900	6850	9800	7800	–	–		
	<b>1..15.-3A.4</b>	4750	2650	7300	5250	8550	6500	9500	7500	<b>1..16.-3A.4</b>	4750	2650	7300	5250	8550	6500	9500	7500	–	–		
	<b>1..15.-3A.5</b>	4700	2600	7050	5000	8250	6200	9300	7300	<b>1..16.-3A.5</b>	4700	2600	7050	5000	8250	6200	9300	7300	–	–		
	<b>1..15.-3A.6</b>	–	–	–	–	8250	6200	9100	7100	<b>1..16.-3A.6</b>	–											



# Introduction

Mechanical version

## Bearings and lubrication

1

### Overview

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	
<b>1LE55 and 1MB55 – Basic Line</b>										<b>1LE56 and 1MB56 – Performance Line</b>									
250	<b>1LE55..-2C.2</b>	2630	1720	3200	2400	3750	3000	4350	3550	–	–	–	–	–	–	–	–	–	
280	<b>1LE55..-2D.0</b>	4500	2900	6700	4700	7900	5950	8800	7050	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-2D.2</b>	4450	2850	6600	4650	7850	5900	8800	7000	–	–	–	–	–	–	–	–	–	
315	<b>1LE55..-3A.0</b>	5800	3400	8000	5600	9600	7200	9700	7300	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-3A.2</b>	5700	3300	8200	5800	9500	7300	9800	7400	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-3A.4</b>	5600	3200	7900	5400	9400	7400	9900	7500	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-3A.5</b>	5500	3100	7800	5400	9300	7500	10000	7600	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-3A.6</b>	5400	3000	7750	5400	9200	7600	10100	7700	<b>1LE56..-3A.6</b>	5400	3000	7750	5400	–	–	–	–	
	<b>1LE55..-3A.7</b>	5200	2800	7750	5400	9100	6750	10200	7850	<b>1LE56..-3A.7</b>	9100	6750	10200	7850	5200	2800	7750	5400	
	<b>1LE55..-3A.8</b>	–	–	–	–	9000	6650	10500	7700	<b>1LE56..-3A.8</b>	–	–	–	–	9000	6650	10050	7700	
355	–	–	–	–	–	–	–	–	–	<b>1LE56..-3B.1</b>	–	–	–	–	–	–	5000	3200	
	–	–	–	–	–	–	–	–	–	<b>1LE56..-3B.2</b>	–	–	–	–	8800	5000	9900	6000	
	–	–	–	–	–	–	–	–	–	<b>1LE56..-3B.3</b>	11000	7100	5000	3200	8750	4950	–	–	
	–	–	–	–	–	–	–	–	–	<b>1LE56..-3B.4</b>	9800	5900	10900	7000	5000	3200	–	–	
	–	–	–	–	–	–	–	–	–	<b>1LE56..-3B.5</b>	8700	4900	9800	5900	–	–	–	–	
400	<b>1LE55..-4A.3</b>	3200	1600	6500	4200	7300	5000	8700	6400	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-4A.5</b>	3100	1500	6400	4100	7100	4800	8400	6100	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-4A.7</b>	3000	1300	6200	3900	6900	4600	8100	5800	–	–	–	–	–	–	–	–	–	
450	<b>1LE55..-4B.3</b>	4300	2000	7500	3400	850	4400	10000	5900	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-4B.5</b>	4100	1800	7400	3300	8300	4200	9700	5600	–	–	–	–	–	–	–	–	–	
	<b>1LE55..-4B.7</b>	3900	1600	7100	3000	8100	4000	9300	5200	–	–	–	–	–	–	–	–	–	

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

For frame sizes > 250 standard version.

**Overview**

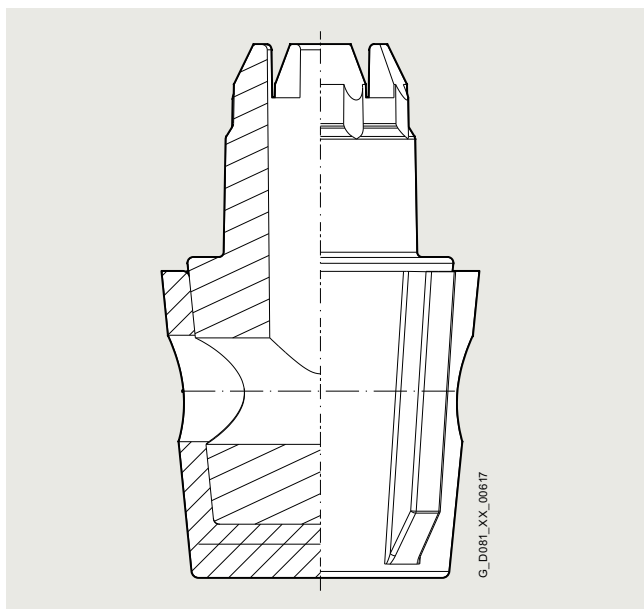
The drainage of condensed water is an important aspect of proper motor maintenance.

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

If there are condensation 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 IP55/IP56 degree of protection.

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

**Note:**

Condensation drain holes are not possible in motors with the types of protection Ex db and Ex db eb.

A screwed-on cover (made of sheet metal or plastic depending on the 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 **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
<b>1LE10, 1PC1</b> <sup>2)</sup>	63 ... 160	Aluminum alloy	cast <sup>1)</sup>
	180 ... 200	Aluminum alloy	screwed on <sup>1)</sup>
<b>1MB10</b>	100 ... 160	Aluminum alloy	cast <sup>1)</sup>
<b>1LE15</b> <b>1MB15</b> <b>1PC1301</b> <sup>3)</sup>	71 ... 315	Cast iron	cast <sup>1)</sup>
<b>1LE5</b> <b>1MB5</b>	250 ... 450	Cast iron	cast
<b>1LE16</b> <b>1MB16</b>	100 ... 315	Cast iron	cast <sup>1)</sup>

### Motor screws:

**H06:** External screws, bolts and unpainted materials made of stainless steel (V4A) including rating plate, outer screws, grounding, and options with order codes L19, L23, Q01.

**H07:** Rust-resistant screws (externally) including outer motor screws made of common stainless steel.

**H30:** Adjustment screws for feet in horizontal installation including 4 threads in the motor feet; adjustment screws not in the scope of supply.

### 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 <sup>4)</sup>	Lifting eyes	Top; Left DE side/ Right NDE side <sup>10)</sup>	M8
112					
132					
160					M10
180		Two eyebolts <sup>10)</sup>			M12
200					M16
225		Two eyebolts <sup>11)</sup>	–	5) 6) 7)	M16
250					M20
280					
315 S/M <sup>12)</sup>					M24
315 L		Four eyebolts		Top; Left/right DE and NDE side <sup>8) 9)</sup>	M30
315 L (1LE5)		Two eyebolts			
355 M/L (1LE5)					
400					
450					

<sup>1)</sup> 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.

<sup>2)</sup> 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).

<sup>3)</sup> 1LE16 motors frame size 100 and above, 1PC1301 motors frame size 180 and above.

<sup>4)</sup> 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.

<sup>5)</sup> 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.

<sup>6)</sup> For IM V1: top; NDE side right; down; NDE side left.

<sup>7)</sup> For IM V3: top; DE side left; down; DE side right.

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

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

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

<sup>11)</sup> 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.

<sup>12)</sup> 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 1LE. motors (with the exception of 1LE1 with order code **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 450: brakes with order code **F01** and **F04**
- Frame sizes 71 and 90: only rotary encoders with order codes **G11** or **G12** from the "modular technology" range
- Frame sizes 100 to 450: all rotary encoders from the "modular and special technology" ranges

**Dimensions of center holes**

Frame size	∅	L (drilling depth)
100	16 <sup>H7</sup>	34
112	16 <sup>H7</sup>	34
132	22 <sup>H8</sup>	39
160	28 <sup>H8</sup>	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** and **F04** or rotary encoders from the "modular technology" range. The combination of brake (**F01**) and rotary encoder is not possible.
- Frame sizes 100 to 450: Brakes with order code **F01** or rotary encoders from the "modular and special technology" range. The combination of brake (**F01**) and rotary encoder is possible.

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

For motors of series 1LE15, 1LE16, and 1LE5 frame sizes 100 to 450, grounding brushes are available for converter operation. Order code **L52**. Please contact your local Innomatics office for advice.

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

For the Sendix 5020 rotary encoders, 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  $\Delta l$  due to order code **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  $\Delta l$  due to order code **G42**. For an explanation of the additional dimensions and weights, see "Modular technology" "Dimensions and weights" from page 1/114.

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 screwed-on 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 450:

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

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#### Overview

The 1LE and 1FP motors (with the exception of 1LE1 and 1LE5 with order code **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. It can also be ordered separately and retrofitted. For selection information and article numbers, see the section "Accessories"

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  $\Delta l$ . For explanations of the additional dimension and weights, see "Mounting technology" and "Dimensions and weights" from page 1/114.

(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  $CT_{min} -25\text{ °C}$ ,  $CT_{max} +65\text{ °C}$ <sup>1)</sup>, for frame sizes 400 and 450 coolant temperatures  $CT_{min} -30\text{ °C}$ ,  $CT_{max} +40\text{ °C}$ , lower/higher coolant temperatures are available on request.

When the separately driven fan is mounted, the length of the motor increases by  $\Delta l$ . For explanations of the additional dimension and weights, see "Mounting technology" and "Dimensions and weights" from page 1/114.

**Technical specifications of separately driven fans (according to tolerances of EN 60034-1)**

Motor series	Frame size	Rated voltage range	Frequency	$P_{max}$	$I_{max}$
		V	Hz	kW	A
1LE1	63	1 AC 230 to 277	50	0.046	0.18
		3 AC 200 to 303 $\Delta$	50	0.028	0.15
		3 AC 346 to 525 Y	50	0.028	0.09
		1 AC 230 to 277	60	0.054	0.21
		3 AC 220 to 332 $\Delta$	60	0.029	0.14
		3 AC 380 to 575 Y	60	0.029	0.08
1LE1	71	1 AC 230 to 277	50	0.048	0.18
		3 AC 200 to 303 $\Delta$	50	0.029	0.15
		3 AC 346 to 525 Y	50	0.029	0.09
		1 AC 230 to 277	60	0.056	0.21
		3 AC 220 to 332 $\Delta$	60	0.028	0.13
		3 AC 380 to 575 Y	60	0.028	0.07
1LE1	80	1 AC 230 to 277	50	0.048	0.19
		3 AC 200 to 303 $\Delta$	50	0.033	0.16
		3 AC 346 to 525 Y	50	0.033	0.09
		1 AC 230 to 277	60	0.059	0.22
		3 AC 220 to 332 $\Delta$	60	0.036	0.13
		3 AC 380 to 575 Y	60	0.036	0.07
1LE1	90	1 AC 220 to 277	50	0.059	0.29
		3 AC 200 to 303 $\Delta$	50	0.078	0.39
		3 AC 346 to 525 Y	50	0.078	0.22
		1 AC 220 to 277	60	0.061	0.23
		3 AC 220 to 332 $\Delta$	60	0.071	0.32
		3 AC 380 to 575 Y	60	0.071	0.18
1LE1	100	1 AC 220 to 277	50	0.062	0.29
		3 AC 200 to 303 $\Delta$	50	0.08	0.37
		3 AC 346 to 525 Y	50	0.08	0.21
		1 AC 220 to 277	60	0.073	0.28
		3 AC 220 to 332 $\Delta$	60	0.08	0.3
		3 AC 380 to 575 Y	60	0.08	0.18
1LE1	112	1 AC 220 to 277	50	0.064	0.27
		3 AC 200 to 303 $\Delta$	50	0.087	0.35
		3 AC 346 to 525 Y	50	0.087	0.2
		1 AC 220 to 277	60	0.088	0.36
		3 AC 220 to 332 $\Delta$	60	0.093	0.29
		3 AC 380 to 575 Y	60	0.093	0.17
1LE1	132	1 AC 230 to 277	50	0.121	0.52
		3 AC 200 to 303 $\Delta$	50	0.153	0.67
		3 AC 346 to 525 Y	50	0.153	0.39
		1 AC 230 to 277	60	0.150	0.56
		3 AC 220 to 332 $\Delta$	60	0.161	0.56
		3 AC 380 to 575 Y	60	0.161	0.33

**Technical specifications of separately driven fans (according to tolerances of EN 60034-1)**

Motor series	Frame size	Rated voltage range	Frequency	$P_{max}$	$I_{max}$
		V	Hz	kW	A
1LE1	160 to 200	1 AC 230 bis 277	50	0.249	1.03
		3 AC 200 bis 303 $\Delta$	50	0.301	1.33
		3 AC 346 bis 525 Y	50	0.301	0.77
		1 AC 230 bis 277	60	0.367	1.45
		3 AC 220 bis 332 $\Delta$	60	0.364	1.10
		3 AC 380 bis 575 Y	60	0.364	0.64
1LE1/ 1MB1	225 to 315	3 AC 230 $\Delta$	50	0.75	2.7
		3 AC 400 Y	50	0.75	1.56
		3 AC 460 Y	60	0.86	1.63
1LE5	250 M to 280 M	3 AC 230 $\Delta$	50	0.75	2.7
		3 AC 400 Y	50	0.75	1.56
		3 AC 460 Y	60	0.86	1.63
1LE5	315	3 AC 230 $\Delta$	50	1.1	3.95
		3 AC 400 Y	50	1.1	2.25
		3 AC 460 Y	60	1.27	2.25
1LER5	315	3 AC 230 $\Delta$	50	0.75	2.7
		3 AC 400 Y	50	0.75	1.56
		3 AC 460 Y	60	0.86	1.63
1LE5	355	3 AC 230 $\Delta$	50	1.1	3.95
		3 AC 400 Y	50	1.1	2.25
		3 AC 460 Y	60	1.27	2.25
1LE5	400	3 AC 200 bis 240 $\Delta$	50	2.20	7.70
		3 AC 380 bis 420 Y	50	2.20	4.45
		3 AC 440 bis 480 Y	60	2.54	4.35
1LE5	450	3 AC 200 bis 240 $\Delta$	50	4.00	14.00
		3 AC 380 bis 420 Y	50	4.00	8.00
		3 AC 440 bis 480 Y	60	4.55	7.90

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

## Overview

For article numbers and type details, see operating instructions.

### Sound-power level of the motors under a load, 50 Hz

Frame size	2-pole	4-pole	6-pole	8-pole
	$L_{WA}$ dB (A)	$L_{WA}$ dB (A)	$L_{WA}$ dB (A)	$L_{WA}$ dB (A)
63	70	70	70	70
71	72	72	72	72
80	79	79	79	79
90	79	79	79	79
100	84	84	84	84
112	84	84	84	84
132	84	84	84	84
160	87	87	87	87
180	87	87	87	87
200	87	87	87	87
225	90	87	87	87
250	90	87	87	87
280	90	87	87	87
315	92	92	95	95

## Brakes

The brakes with order code **F01** (**F02** brake for increased frequency of operation for Innomatics 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 1/96.

When a brake is mounted, the length of the motor increases by  $\Delta l$ . For explanations of the additional dimension and weights, see "Mounting technology" and "Dimensions and weights" from page 1/114.

*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 1/83).*

### Ambient temperature

- $-40\text{ }^{\circ}\text{C}$  to  $+45\text{ }^{\circ}\text{C}$  (with nominal excitation) for SFB-SH brake
- $-40\text{ }^{\circ}\text{C}$  to  $+75\text{ }^{\circ}\text{C}$  (with double excitation) for SFB-SH brake
- $-20\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$  holding/operating brake (standard BFK458)
- up to  $+60\text{ }^{\circ}\text{C}$  only as holding brake
- $-20\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$  holding/operating brake only for FDX brake
- $-30\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$  holding/operating brake only for KFB brake

### Definition of duty type

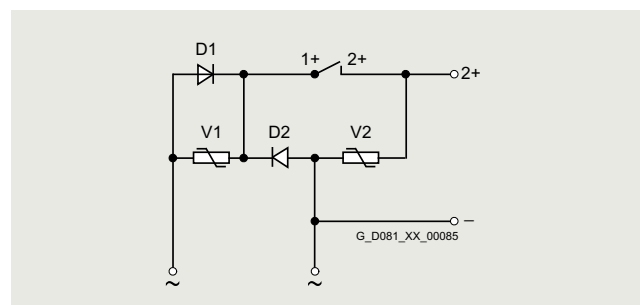
- **Operating brake:**  
The motor shaft can be braked from full operating speed down to zero speed of the motor. All the kinetic energy produced by the drive train is converted to heat by friction during braking. Braking energy is produced at  $n > 0$  rpm. The maximum permissible switching frequency 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:

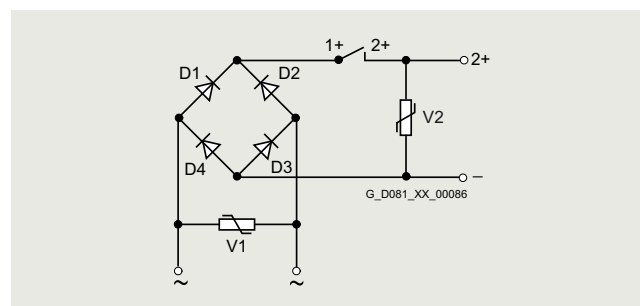
A holding brake must not be used as an operating brake as it could then cause danger to life and damage to property.

### Bridge rectifier / half-wave rectifier

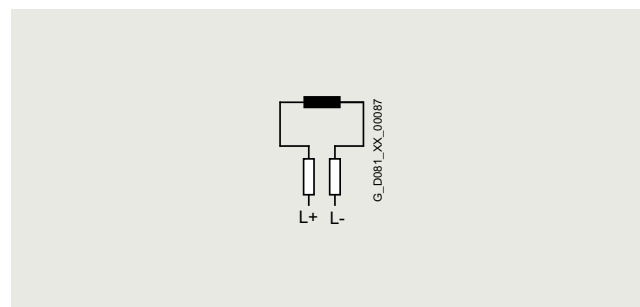
Brakes are connected through a standard bridge or half-wave rectifier or directly to the BFK458-/SFB-SH brake. See the circuit diagrams below.



Half-wave rectifier 400 V AC



Rectifier bridge 230 V AC



Brake connection for 24 V DC

## Introduction

### Mounting technology

## Modular technology

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### Overview

#### BFK458 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 BFK458 brake

The BFK458 brake has IP55 degree of protection.

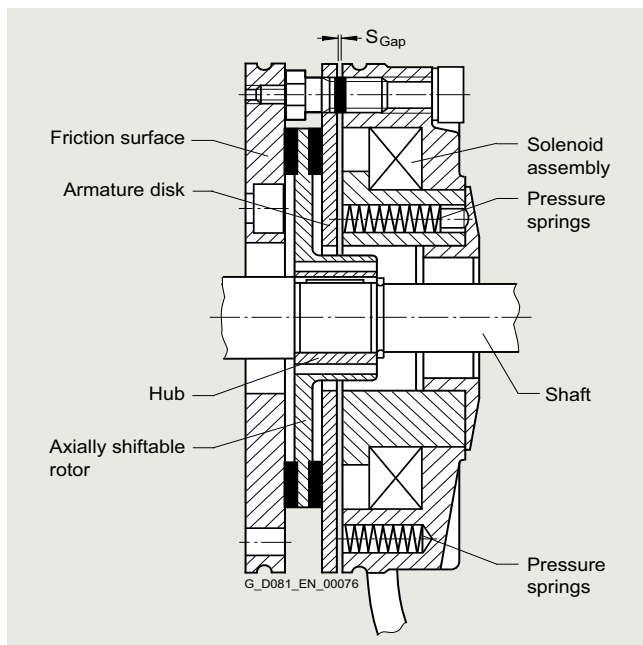
Please inquire if motors with brakes are to be operated below the freezing point or in conjunction with very humid environments (e.g. close to the sea) with long standstill times. Please also inquire if motors with brakes are to be used for low-speed converter operation.

##### 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  $S_{\text{Gap}}$  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 BFK458 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**
- Brake supply voltage 180 V DC  
Order code **F17**
- Brake supply voltage 205 V DC  
Order code **F18**

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

Order codes **F10**, **F11**, **F12**, **F17**, and **F18** 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 cm<sup>3</sup>/kWh.

## Overview

Operating values for spring-operated brakes with standard excitation													Service capability of the brake		
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 <sup>1)</sup>		Brake application time $t_2$ <sup>2)</sup>	Brake release time	Brake moment of inertia	Noise level $L_p$ with rated air gap	Lifetime $L$ of the brake lining	Air gap $S_{Gap}$ adjustment required after braking energy $L_N$	
			Nm	%	%		%	V							A
63	<b>BFK458-06</b>	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	<b>BFK458-06</b>	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	<b>BFK458-08</b>	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	<b>BFK458-10</b>	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	<b>BFK458-12</b>	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	<b>BFK458-14</b>	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	<b>BFK458-16</b>	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	<b>BFK458-20</b>	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	<b>BFK458-20</b>	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 <sup>3)</sup>	<b>BFK458-25</b>	400	73	68	65	AC 230	0.55	110	230	390	0.0200	93	9450	1260	
						AC 400	0.61								
						DC 24	4.6								

<sup>1)</sup> 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.

<sup>2)</sup> 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.

<sup>3)</sup> Not possible in combination with order code **D02** and **D03** for SH225.



# Introduction

## Mounting technology

### Modular technology

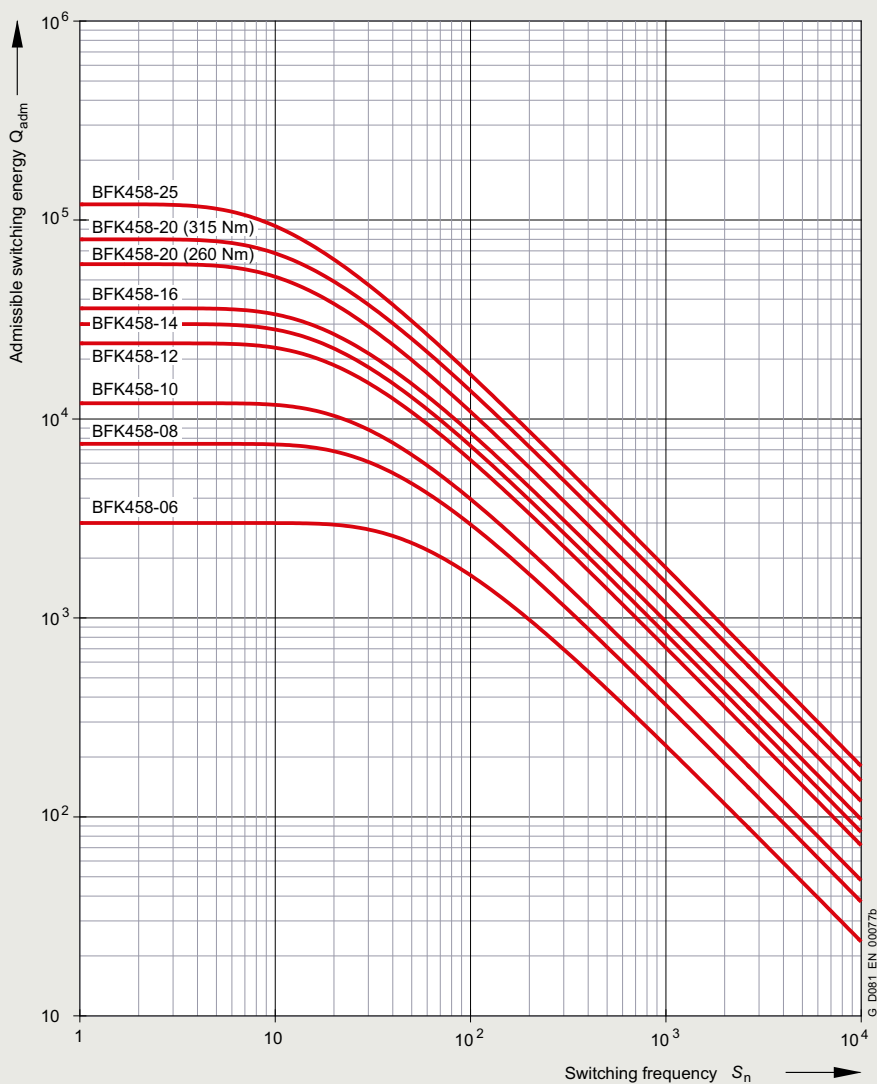
1

#### Overview

##### 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.



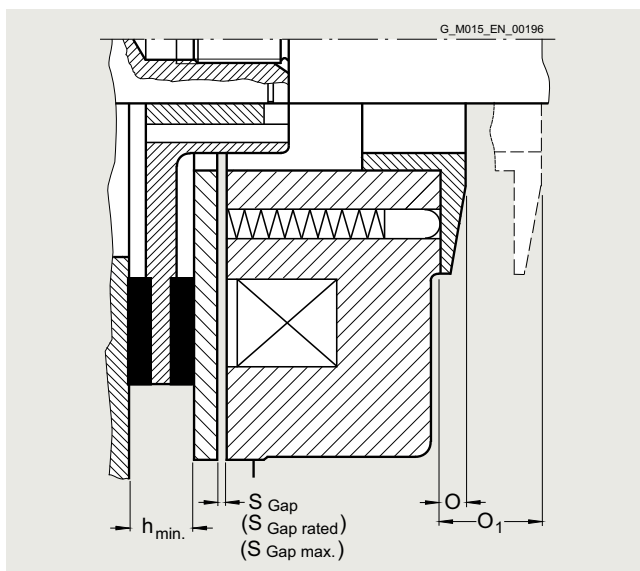
For motor frame size	Brake type	Maximum admissible speeds			Changing the braking torque			Readjusting the air gap		
		Max. adm. operating rpm if max. operating energy utilized	Max. adm. no-load rpm with emergency stop function for horizontal mounting position	Max. adm. no-load rpm with emergency stop function for vertical mounting position	Reduction per notch	Dimension "O <sub>1</sub> "	Min. braking torque	Rated air gap S <sub>Gap rated</sub>	Maximum air gap S <sub>Gap max.</sub>	Minimum rotor thickness h <sub>min.</sub>
		rpm	rpm	rpm	Nm	mm	Nm	mm	mm	mm
63	<b>BFK458-06</b>	3000	6000	6000	0.17	7	3.7	0.2	0.4	4.5
71	<b>BFK458-06</b>	3000	6000	6000	0.17	7	3.7	0.2	0.4	4.5
80	<b>BFK458-08</b>	3000	6000	6000	0.35	8.0	7.0	0.2	0.45	5.5
90	<b>BFK458-10</b>	3000	6000	6000	0.76	7.5	18.2	0.2	0.55	7.5
100	<b>BFK458-12</b>	3000	6000	6000	1.29	12.5	21.3	0.3	0.65	8.0
112	<b>BFK458-14</b>	3000	6000	6000	1.66	11.0	32.8	0.3	0.75	7.5
132	<b>BFK458-16</b>	3000	5300	5000	1.55	13.0	61.1	0.3	0.75	8.0
160	<b>BFK458-20</b>	1500	4400	3200	5.6	17.0	157.5	0.4	1.2	12.0
180	<b>BFK458-20</b>	1500	4400	3200	5.6	17.0	178.4	0.4	1.0	12.0
200, 225	<b>BFK458-25</b>	1500	3000	3000	6.15	21.0	248.7	0.5	1.5	15.5

**Overview****Changing the braking torque**

The brake is supplied with the braking torque already set. For BFK458 brakes, the torque can be reduced to 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  $S_{\text{Gap}}$  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 1/85.

**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 1/85.

**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 Siemens Product Configurator tool for low-voltage motors.

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#### KFB spring-operated brake



KFB spring-operated brake

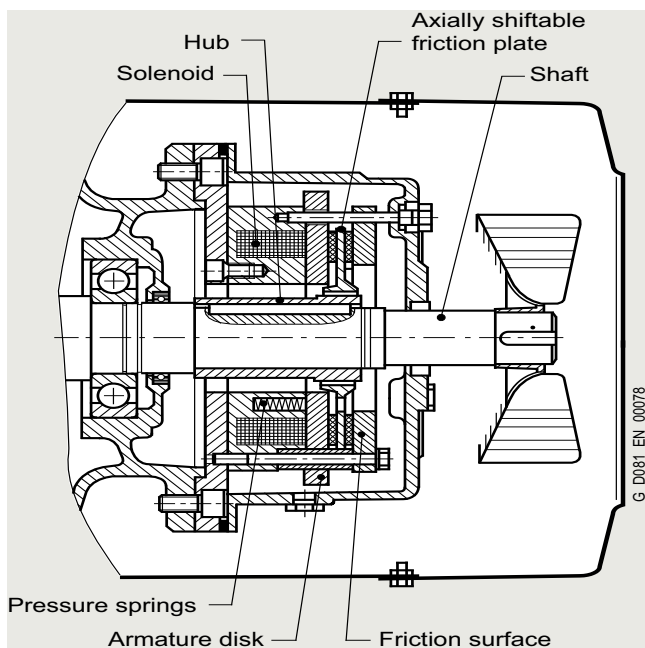
The KFB solenoid double-disk spring-operated brake is a safety brake that brakes the motor if the supply is disconnected (power failure, emergency stop). The KFB brake with IP67 degree of protection is mainly used for electric motors for traversing, cross-traversing and lifting gear in cranes as well 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 BFK458, 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 wearing parts can be replaced without great effort. 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 dimension sheet generator for motors in the Siemens Product Configurator tool for low-voltage motors.

Up-to-date data are available from the brake manufacturer.

**Overview****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.

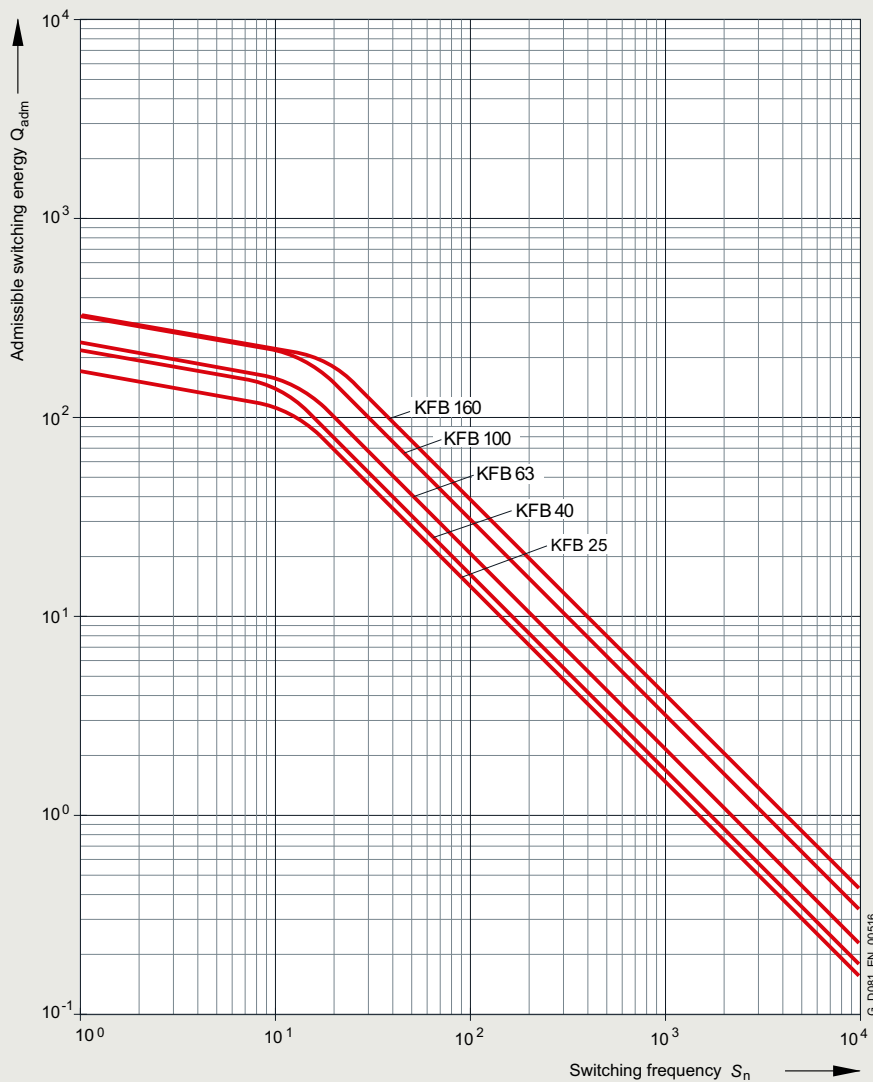
A special circuit is not required. Optimal switching times are achieved without the need to use special circuits.

For this purpose, see the circuit diagrams on page 1/85.

**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 of brake selection for 1LE1 motors		For motor frame sizes					
		180 <sup>1)</sup>	200 <sup>1)</sup>	225 <sup>1)</sup>	250 <sup>2)</sup>	280 <sup>2)</sup>	315 <sup>2) 4)</sup>
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	mm	48 <sub>k6</sub>	55 <sub>m6</sub>	55 <sub>m6</sub>	60 <sub>m6</sub>	65 <sub>m6</sub>	70 <sub>m6</sub>
Brake type		<b>KFB 25</b>	<b>KFB 40</b>	<b>KFB 40</b>	<b>KFB 63</b>	<b>KFB 100</b>	<b>KFB 160</b>
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 <sup>3)</sup>	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 <sup>2</sup>	0.0048	0.0068	0.0068	0.0175	0.036	0.05
Lifetime $L$ of the brake lining	Nm · 10 <sup>6</sup>	3600	3110	3110	4615	7375	10945
Air gap adjustment $L_N$ required after braking energy	Nm · 10 <sup>6</sup>	810	935	935	1185	2330	3485

<sup>1)</sup> The standard brake for frame sizes 180 to 225 is the BFK458 brake. KFB brake on request.

<sup>2)</sup> The standard brake for frame sizes 250 to 315 is the KFB brake.

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

<sup>4)</sup> 1LE5 standard power outputs 1LE5...-3A.0; 3A.4; 3A.5; 3AC6; 3AD6.

**Overview****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

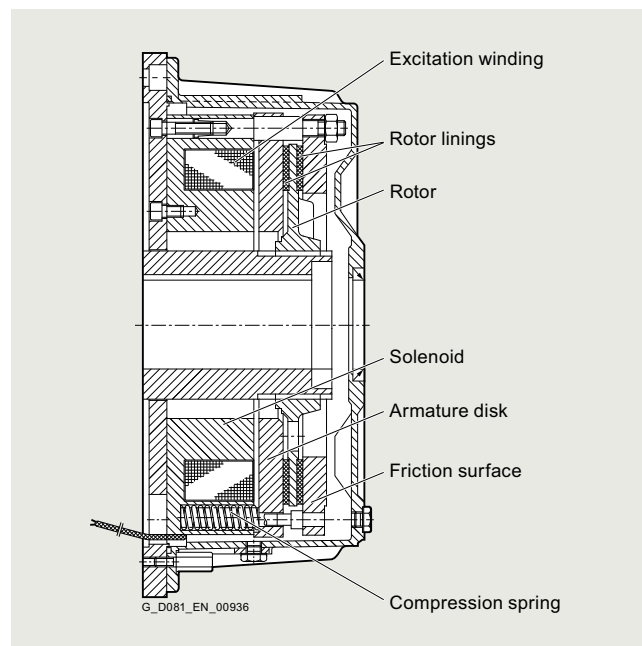
SFB-SH solenoid double-disk spring-operated brakes are safety brakes that are mechanically operated on a power failure. This ensures that the brake still works during a power failure. These brakes are designed for dry running, must only ever be operated in a safe state, and only installed, commissioned, 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 wearing 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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#### 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.

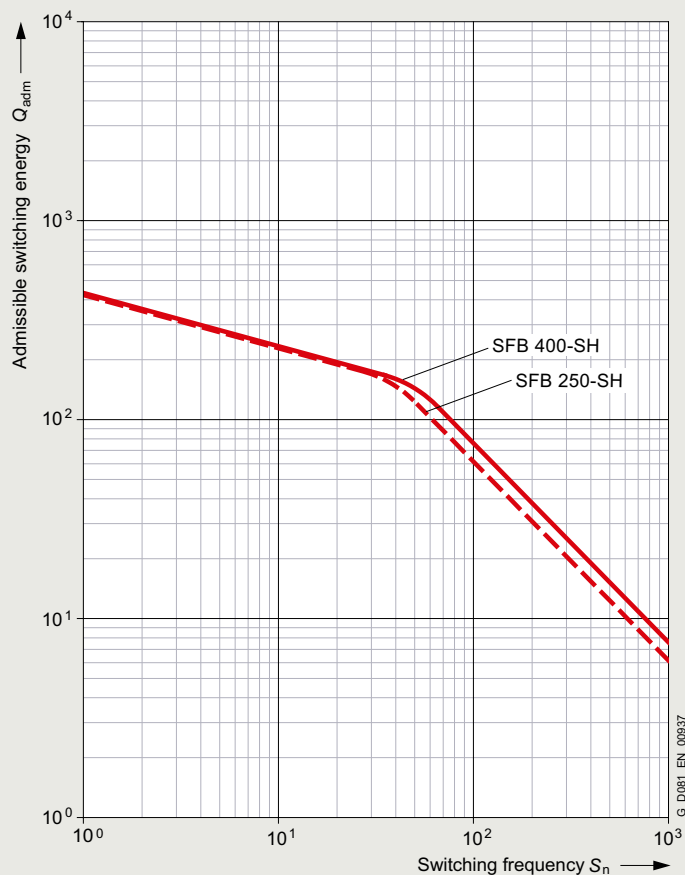
For 24 V DC brakes, the brake terminals are directly connected to the DC voltage source.

For this purpose, see the circuit diagrams on page 1/85.

#### 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

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) <sup>1)</sup>	FF600 (A660) <sup>2)</sup>
Max. diameter of 2nd shaft extension	mm	75 <sub>m6</sub>	90 <sub>m6</sub>
Brake type		<b>SFB 250-SH</b>	<b>SFB 400-SH</b>
Braking torque	Nm	2970	4680
Nominal dynamic braking torque according to VDE 0580	Nm/rpm	3300/54	5200/47
Dynamic braking torque <sup>3)</sup>	at 750 rpm	Nm	2400
	at 1000 rpm	Nm	2200 <sup>4)</sup>
	at 1500 rpm	Nm	2100 <sup>4)</sup>
	at $n_{max}$	Nm	2100 <sup>4)</sup>
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	2.79	3.14
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 <sup>2</sup>	0.14	0.325
Minimum air gap	mm	0.4	0.4
Maximum air gap	mm	2.5	2.5

<sup>1)</sup> External dimension increases to 560 mm.

<sup>2)</sup> External dimension decreases to 640 mm.

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

<sup>4)</sup> 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](http://www.pintschbubbenzer.de)



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#### 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  $\text{kgm}^2$

$n_{rated}$  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  $\text{kgm}^2$ . 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  $\text{kgm}^2$  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:

$$J_{Eqv} = 91.2 \cdot m \cdot \left(\frac{v}{n_{Br}}\right)^2$$

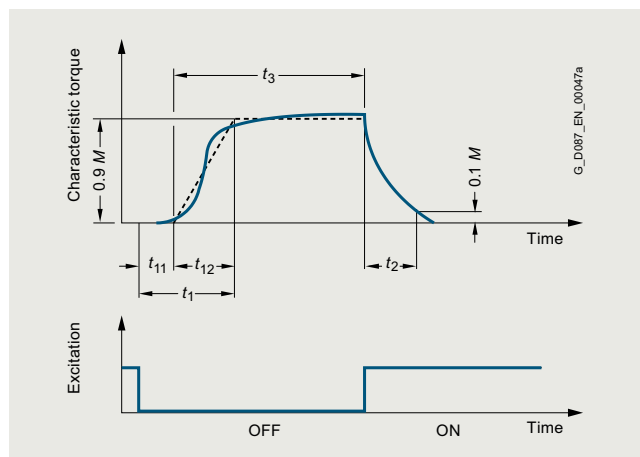
$m$  Mass of the linear-motion load in kg

$v$  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****FDW/FDX spring-operated brake****Motor series**

This FDW/FDX brake is provided for 1LE1 motors (FDW for frame size 100 to 200; FDX for frame size 225 to 315; 100 to 200 on request).

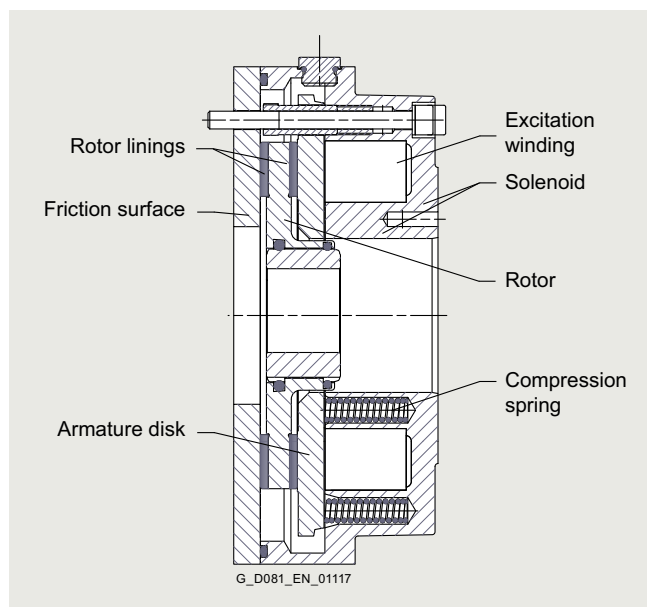
**Mode of operation of FDW/FDX spring-operated brake (holding brake/operating brake)**

The solenoid spring-operated brakes (order code **F04**), FDW with IP66 and FDX 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.



Design of spring-operated brake FDW

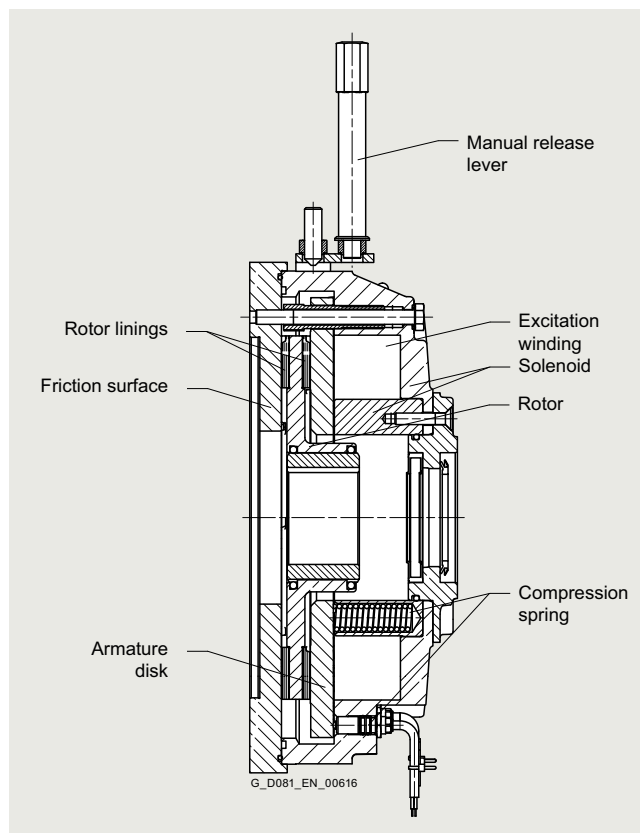
**Voltage and frequency**

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**
- Brake supply voltage 180 V DC      Order code **F17**
- Brake supply voltage 205 V DC      Order code **F18**

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

Order codes **F11**, **F12**, **F17** and **F18** may only be used in conjunction with order code **F04**.



Design of spring-operated brake FDX

**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. Microswitch On/Off is standard for 1LE1 motors (only possible for FDW spring-operated brake). 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 Siemens Product Configurator tool for low-voltage motors.

[www.siemens.com/spc](http://www.siemens.com/spc)

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#### Ambient temperature and operating mode of brake (only for FDW spring-operated brake):

- 20°C ≥ 40°C no action required
- 20°C ≥ 60°C S3/60% or power reduction with fast excitation rectifier
- 20°C ≥ 80°C S3/60% and power reduction with fast excitation rectifier
- under - 20°C heating necessary

#### Accessories

- microswitches
- heating
- paint finish up to C3
- special fast response rectifier is needed (due to higher temperatures)

#### 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.

#### 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 ( $\text{kgm}^2$ )

$J_{add}$  = Additional moment of inertia ( $\text{kgm}^2$ )

$J_{2,3..}$  = Moment of inertia ( $\text{kgm}^2$ )

$J_{tot}$  = Total moment of inertia ( $\text{kgm}^2$ )

$n_1$  = 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:

$$T_{breq} = 9.55 \cdot 10^3 \cdot \frac{P}{n} \cdot K \leq T_{b, rated} \quad (\text{Nm})$$

$$K \geq 2$$

**Overview****Braking time****General information**

$$t = 1.046 \cdot 10^2 \cdot J_{\text{tot}} \cdot \frac{n}{T_{b, \text{rated}} \pm T_L} + t_1 \quad (\text{ms})$$

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**

$$t_{\text{st}} = J_{\text{tot}} \cdot \frac{n_1}{9.55 \cdot (T_{LR} \pm T_L)} + \frac{t_2}{1000} \quad (\text{s})$$

$$J_{\text{tot}} = J_E + J_{\text{add}} \quad (\text{kgm}^2)$$

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)

**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**

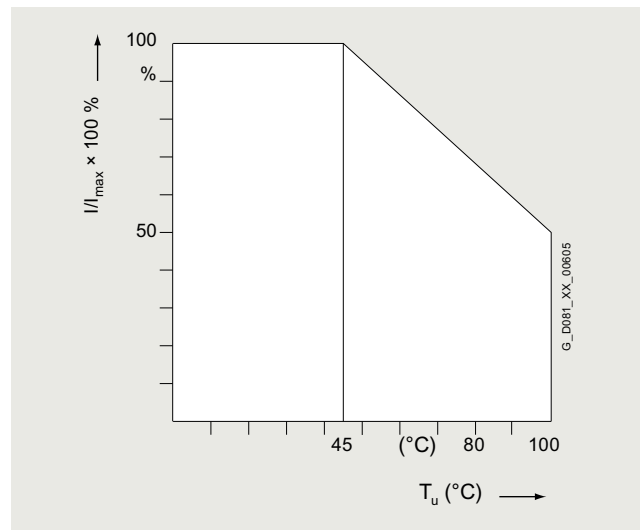
$$P_R = W_R \cdot S \quad (\text{J/s})$$

The friction energy must be no greater than the admissible value  $P_{R\text{max}}$

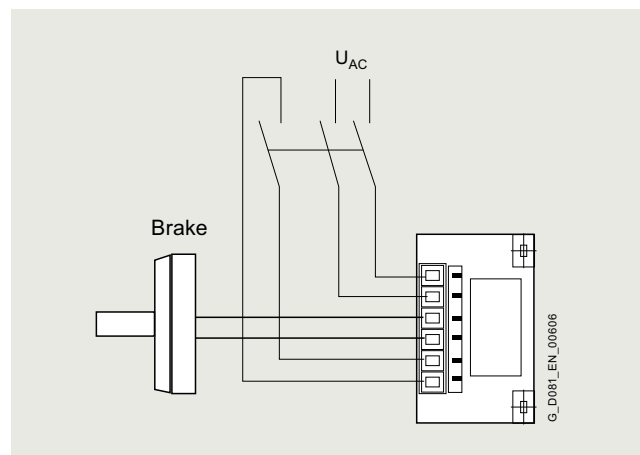
$$P_R \leq P_{R\text{max}} \quad (\text{J/s})$$

**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

## Introduction

### Mounting technology

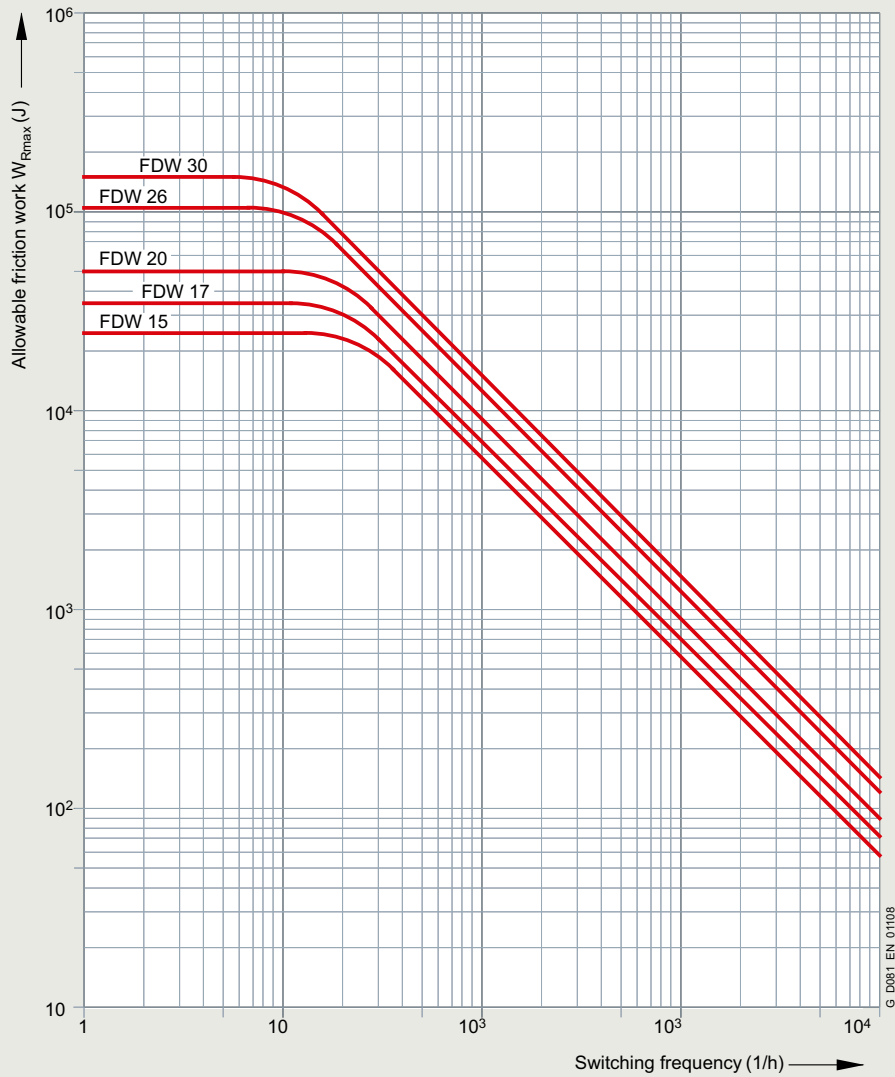
### Modular technology

### Overview

#### 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.

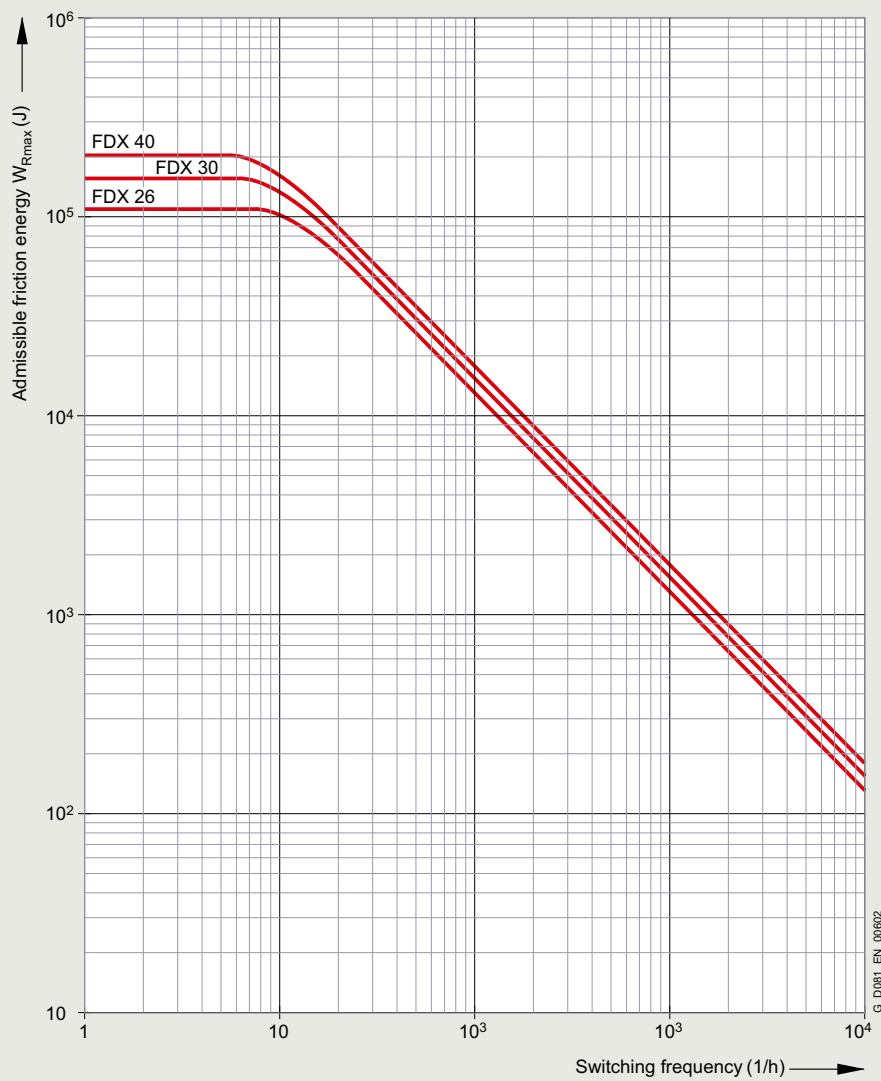
The maximum admissible friction energy depends on the switching frequency and is shown for the individual brakes in the following diagram. Increased wear can be expected when the brakes are used for emergency stops.



G\_D081\_EN\_01108

Spring-operated brake FDW

Overview



Spring-operated brake FDX

# Introduction

## Mounting technology

### Modular technology

1

#### Overview

Overview of brake selection for 1LE1 motors (order code F04)		For motor frame sizes					
		100	112	132	160	180	200
No. of poles		2 to 8	2 to 8	2 to 8	2 to 8	2 to 8	2 to 8
Max. diameter for the second shaft extensions	mm	25	25	35	45	48	55
Brake type		<b>FDW 15</b>	<b>FDW 17</b>	<b>FDW 20</b>	<b>FDW 26</b>	<b>FDW 26</b>	<b>FDW 30</b>
Static braking torque	Nm	36 (26/21/15) <sup>1)</sup>	54 (39/31/23) <sup>1)</sup>	90 (64/51/38) <sup>1)</sup>	225 (169/112) <sup>1)</sup>	225 (169/112) <sup>1)</sup>	360 (270/180) <sup>1)</sup>
Dynamic rated braking torque acc. to DIN VDE 0580	Nm/rpm	40 (28/23/17) <sup>1)</sup> /194	60 (43/34/26) <sup>1)</sup> /181	100 (70/57/42) <sup>1)</sup> /149	250 (187/125) <sup>1)</sup> /108	250 (187/125) <sup>1)</sup> /108	400 (300/200) <sup>1)</sup> /88
	at 750 rpm	Nm	38	58	95	240	380
	at 1000 rpm	Nm	37	55	90	230	370
	at 1500 rpm	Nm	37	55	90	230	370
	at 3000 rpm	Nm	30	45	75	190	300
Admissible speed $n_{max}$	rpm	6000	6000	6000	3000	3000	3000
Rated current at 205 V DC coil voltage	A	0,28	0,44	0,59	0,68	0,68	0,89
Rated current at 180 V DC coil voltage	A	0,33	0,46	0,59	0,78	0,78	1,16
Rated current at 103 V DC coil voltage	A	0,55	0,82	1,05	1,4	1,4	1,77
Rated current at 24 V DC coil voltage	A	2,67	3,69	4,3	5,7	5,7	7,27
Weight, approx.	kg	6,7	9,2	13,6	30,3	30,3	44,9
Closing time $t_1$ (switching on the DC side)	ms	70	82	115	178	178	195
Release time $t_2$ (switching on the DC side)	ms	100	120	150	300	300	400
Brake moment of inertia	kg m <sup>2</sup>	0,00045	0,00086	0,00122	0,00665	0,00665	0,0195
Lifetime $L$ of brake lining	Nm · 10 <sup>6</sup>	350	500	850	1400	1400	1850
Overview of brake selection for 1LE1 and 1LE5 <sup>5)</sup> motors (order code 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	mm	55m6	48m6	65m6	48m6		
Brake type		<b>FDX 30</b>	<b>FDX 30</b>	<b>FDX 40</b>	<b>FDX 40</b>		
Static braking torque	Nm	450	567	900	1440 <sup>2)</sup>		
Dynamic rated braking torque acc. to DIN VDE 0580	Nm/rpm	500/88	630/88	1000/65	1600 <sup>2)</sup> /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 <sup>3)</sup> /6000 <sup>4)</sup>	3000 <sup>3)</sup> /6000 <sup>4)</sup>	3000 <sup>3)</sup> /6000 <sup>4)</sup>	3000 <sup>3)</sup> /6000 <sup>4)</sup>		
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	2.76/1.38	2.76/1.38		
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 <sup>2</sup>	0.0195	0.0195	0.0445	0.0445		
Lifetime $L$ of brake lining	Nm · 10 <sup>6</sup>	3700	3700	4900	4900		

<sup>1)</sup> Reduced brake torque by decreasing the number of springs

<sup>2)</sup> Limit: ON time S3 -50 %

<sup>3)</sup> Operating brake

<sup>4)</sup> Holding brake

<sup>5)</sup> 1LE5 standard power outputs 1LE5...-3A.0; 3A.4; 3A.5; 3AC6; 3AD6.

**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 86E TP DN 1024, HOG 9 DN 1024 I and HOG 10 D 1024 I from the "Special technology" range.

The length of the motor increases by  $\Delta l$  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 1/114.

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 **G11** and **G12** for frame sizes 71 to 315 and with order codes **G03**, **G04**, **G05**, and **G06** up to frame size 160, a protective cover (order code **G43**) is supplied as standard.

**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 1/83). 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

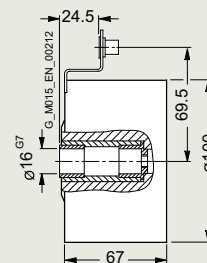
[www.leinelinde.com](http://www.leinelinde.com)  
Email: [info@leinelinde.de](mailto:info@leinelinde.de)

For frame size 180 and above, a protective cover is **not** supplied as standard when rotary pulse encoders are mounted for order codes **G03**, **G04**, **G05**, **G06**, **G07** and **G08**.

For mounting of rotary pulse encoders with order codes **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 **G03**, **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  $-20\text{ °C}$  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/ $\mu\text{s}$ (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

### Mounting technology

### Special technology

1

### Overview

#### 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**

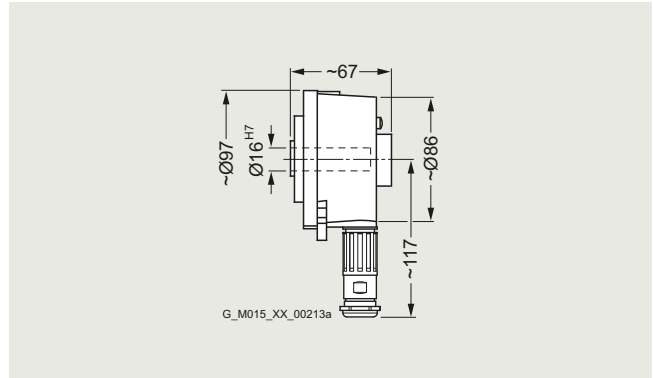
*The HOG 9 DN 1024 I rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/83). 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.baumer.com](http://www.baumer.com)

Email: [sales@baumerhuebner.com](mailto:sales@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  $-20\text{ °C}$  and higher than  $+40\text{ °C}$  available on request.

<b>Supply voltage <math>U_B</math></b>	<b>+9 V to +30 V</b>
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/ $\mu\text{s}$
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

## HOG 86E TP6 DN 1024 I rotary pulse encoder



The HOG 86E TP6 DN 1024 I rotary pulse encoder can be supplied already mounted.

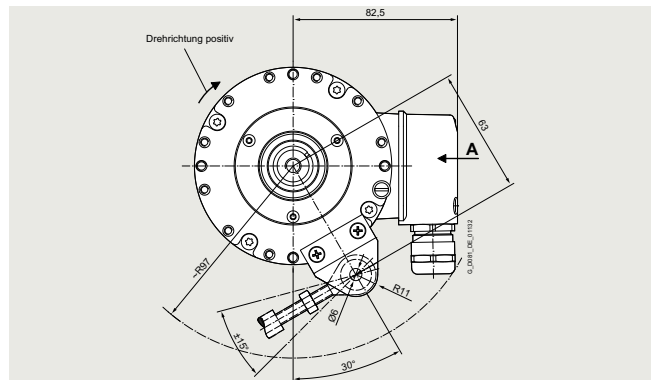
Order code **G03**

The HOG 86E TP6 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 1/83). 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.baumer.com](http://www.baumer.com)  
Email: [sales@baumerhuebner.com](mailto:sales@baumerhuebner.com)



Mounting dimensions of HOG 9 DN 1024 I rotary pulse encoder

## Technical specifications for HOG 86E TP6 DN 1024 I

Supply voltage $U_B$	<b>+9 V to +30 V</b>
Current input without load	≤100 mA
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° ±20 %
Maximum frequency	≤170 kHz
Maximum speed	10000 rpm
Temperature range	-40 bis +100 °C
Degree of protection	IP66
Maximum adm. radial cantilever force	≤450 N
Maximum adm. axial force	≤350 N
Connection system	Terminal box with cable gland M16
Weight	approx. 1.3 kg

## Introduction

Mounting technology

### Special technology

#### Overview

##### POG 9 rotary pulse encoder



The POG 9 rotary pulse encoder can be supplied already mounted.

Order code **G08**

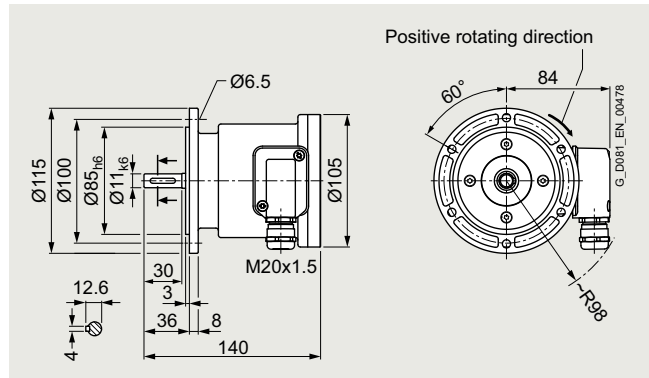
*The POG 9 rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/83). The rotary pulse encoder is not part of the scope of supply in this case.*

Manufacturer:

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Mounting dimensions of POG 9 rotary pulse encoder

#### Technical specifications for POG 9

Mounting of encoder for temperatures below  $-20^\circ\text{C}$  and higher than  $+40^\circ\text{C}$  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	$U_{\text{High}} \geq U_B - 3.5\text{ V}$ $U_{\text{Low}} \leq 1.5\text{ V}$	$U_{\text{High}} \geq 2.5\text{ V}$ $U_{\text{Low}} \leq 0.5\text{ V}$
Mark space ratio	1:1 $\pm 20\%$	
Operating speed	$\leq 12000\text{ rpm}$	
Switching rate	120 kHz	
Temperature range	$-30\text{ to }+100^\circ\text{C}$	
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	

## Overview

## POG 10 DN 1024 I rotary pulse encoder



The POG 10 DN 1024 I rotary pulse encoder can be supplied already mounted.

Order code **G07**

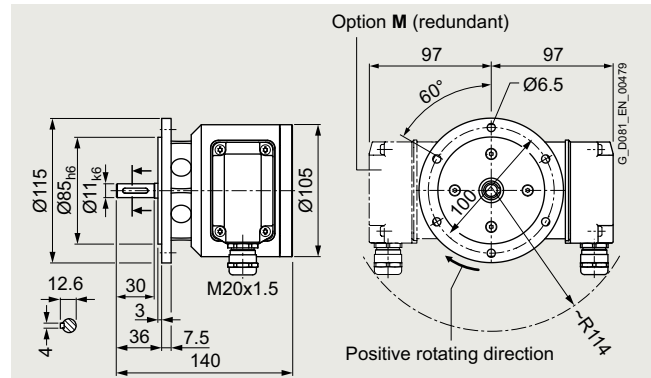
The POG 10 DN 1024 I rotary pulse encoder can be retrofitted. The motor must be prepared for this. When the motor is ordered, the option "Prepared for mountings, center hole only", order code **G40**, or the option "Prepared for mountings with shaft D16", order code **G42**, must be specified (see "Mechanical version and degrees of protection" on page 1/83). 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  
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[www.baumer.com](http://www.baumer.com)

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Mounting dimensions of POG 10 DN 1024 I rotary pulse encoder

## Technical specifications for POG 10 DN 1024 I

Mounting of encoder for temperatures below  $-20\text{ °C}$  and higher than  $+40\text{ °C}$  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	$\leq 12000$ rpm	
Switching rate	120 kHz	
Temperature range	$-40$ to $+100\text{ °C}$	
Degree of protection	IP66	
Maximum adm. radial cantilever force	$\leq 450$ N	
Maximum adm. axial force	$\leq 300$ N	
Connection system	Terminal box	
Weight	approx. 1.9 kg	

## Introduction

### Mounting technology

### Special technology

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### Overview

#### 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 1/83). 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:

Baumer Hübner GmbH

Max-Dohrn-Str. 2+4

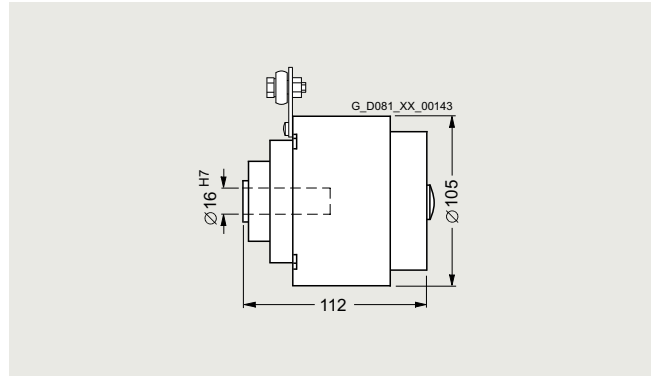
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Mounting dimensions of HOG 10 D 1024 I rotary pulse encoder

#### Technical specifications for HOG 10 D 1024 I (HTL version)

Mounting of encoder for temperatures below  $-20\text{ °C}$  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	$90^\circ \pm 20\%$
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	$10\text{ V}/\mu\text{s}$
Maximum frequency	120 kHz
Maximum speed	7000 rpm
Temperature range	$-40$ 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 x 1.5
Mech. version acc. to Baumer Hübner Ident. No.	74 055 B
Weight	approx. 1.6 kg

## Overview

## 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  $\Delta I$  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  $-20\text{ °C}$  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. $\pm 40$ mA	max. $\pm 20$ mA
Pulses per revolution	1024 (2048 and 512 on request)	
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 $\mu\text{s}$	max. 200 $\mu\text{s}$
Edge fall time $t_f$	max. 1 $\mu\text{s}$	max. 200 $\mu\text{s}$
Pulse frequency	max. 300 kHz	
Maximum speed	12000 rpm/6000 rpm (continuous)	
Operating temperature range	$-40$ <sup>1)</sup> ... $+100\text{ °C}$	
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 <sup>2</sup> , 6 ms	
Vibration resistance acc. to EN 60068-2-6	300 m/s <sup>2</sup> , 10 ... 2000 Hz	

Manufacturer:  
Fritz Kübler GmbH  
Schubertstrasse 47  
78054 Villingen-Schwenningen, Germany  
Phone +49 (7720) 3903-0  
Fax +49 (7720) 21564

[www.kuebler.com/drehgeber](http://www.kuebler.com/drehgeber)  
Email: [info@kuebler.com](mailto:info@kuebler.com)

<sup>1)</sup> With connector:  $-40\text{ °C}$ , permanently installed cable:  $-30\text{ °C}$ , moving cable:  $-20\text{ °C}$ .

## Introduction

### Mounting technology

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### Overview

#### Rotary pulse encoders for SIL2, SIL3 safety applications

The rotary pulse encoders with order codes **G21**, **G22**, **G25**, and **G27** are suitable for SIL2 and SIL3 safety applications and can be used subject to consideration of the mechanical installation conditions. The rotary pulse encoders from Baumer, Leine&Linde, and Kübler are designed for the implementation of safety-related functions, such as speed, direction of rotation, and position.

#### Functional safety

The safety integrity level SIL2 or SIL3 of the rotary pulse encoders is certified by the manufacturers Baumer, Leine&Linde, and Kübler. To ensure correct functioning of the rotary pulse encoder, various mounting measures are defined that are certified by TÜV and must correspond to safety applications up to levels PLD, category 3, SIL2 and PL e, category 4, SIL3.

The EC Declaration of Conformity complies with the Machinery Directive 42/2006/EC with consideration of EN 61800-5-2.

- Functional safety can only be ensured with the use of a suitable control and evaluation unit. It is mandatory to perform a function test in the safety circuit after initial installation, conversion, repair or modification.
- Installation, first commissioning and service requiring replacement of a rotary encoder on the customer's site must only be performed by qualified persons. If this requirement is not observed, the manufacturer's warranty will be voided.
- Upgrading with the functional safety rotary encoder for the defined Innomatics products that were originally manufactured without it is permissible on request provided that the upgrade is performed only in lead repair centers.
- Before you commission the motor with the functional safety encoder, read the information in the operating instructions.

#### General technical features

- The standard version of the motor is supplied with the order code **G43** (mechanical protection for encoder) and with a torque arm fitted between the encoder and motor.
- The functional safety encoders cannot be combined with the order codes **G40**, **G41**, and **G42** (prepared for externally mounted components) and can only be mounted at the non-drive end (NDE), i.e. a second shaft extension cannot be supplied.
- The safety rotary encoders with order code **G21** or **G22** are mounted with their cable and connector.
- The overall length of the motor and weight of the motor must be considered, see "Dimensions and weights".

#### Sendix 5834FS2/FS3 rotary pulse encoder



The Sendix 5834 rotary pulse encoder from Kübler in the version SinCos can be used in compliance with safety integrity level SIL2 when mounted complete on motors with the order code **G21** or SIL3 with the order code **G22** for frame sizes 71 to 315.

#### Technical specifications for Sendix 5834FS2/FS3

	Sendix 5834FS2/FS3
Supply voltage	5 V DC $\pm$ 5 %
Current input without load	max. 70 mA
Pulses per revolution	1024
Outputs	Sine signal: B, B_inv Cosine signal: A, A_inv
Maximum frequency	400 kHz
Signal level	1 Vpp
Maximum speed	9000 rpm/6000 rpm (continuous)
Operating temperature range	-40 ... +90 °C
Degree of protection acc. to EN 60529	IP65
Maximum admissible axial force	40 N
Maximum admissible radial cantilever force	80 N
Connection system	12-pin connector M23 with 1 m cable
Certificates	PLD/SIL2 – SIL 3/PLe
Weight	0.45 kg
Shock resistance acc. to EN 60068-2-27	500 m/s <sup>2</sup> , 11 ms
Vibration resistance acc. to EN 60068-2-6	200 m/s <sup>2</sup> , 10 ... 150 Hz

Manufacturer:  
Fritz Kübler GmbH  
Schubertstrasse 47  
78054 Villingen-Schwenningen, Germany  
Phone +49 (7720) 3903-0  
Fax +49 (7720) 21564

[www.kuebler.com/drehgeber](http://www.kuebler.com/drehgeber)  
Email: [info@kuebler.com](mailto:info@kuebler.com)

## Overview

**HOGS 100 S rotary pulse encoder**

The HOGS 100 S rotary pulse encoder from Baumer in the version SinCos can be used in compliance with safety integrity level SIL2 when mounted complete on motors with order code **G25** for frame sizes 180 to 450.

Technical specifications for HOGS 100 S

	HOGS 100 S
Supply voltage	5 V DC $\pm$ 10 %
Current input under load	$\leq$ 150 mA
Sine cycles per revolution	1024
Operating speed	$\leq$ 10000 rpm
Signal frequency	$\leq$ 250 kHz
Temperature range	-20 ... +85 °C
Degree of protection	IP66
Maximum adm. axial force	250 N
Maximum adm. radial cantilever force	400 N
Connection system	Terminal box
Anti-corrosion protection	Complies with corrosivity category C4 acc. to ISO 12944-2
Explosion protection (gas)	II 3G Ex nA IIC T4 Gc
Explosion protection (dust)	II 3D Ex tc IIIC T135°C Dc
Functional safety	PL d / SIL2
Weight	1.8 kg

Manufacturer:  
Baumer Hübner GmbH  
Max-Döhrn-Str. 2+4  
10589 Berlin, Germany  
Phone +49 (30) 69003-0  
Fax +49 (30) 69003-104

[www.baumer.com](http://www.baumer.com)  
Email: [sales@baumerhuebner.com](mailto:sales@baumerhuebner.com)

**FSI 862 rotary pulse encoder**

This FSI 862 rotary pulse encoder is extremely rugged and is therefore suitable for difficult operating conditions. This rotary pulse encoder in a HC HTL (High Current HTL) version can be used in compliance with safety integrity level SIL2 when mounted complete on motors with order code **G27** for frame sizes 180 to 450.

Technical specifications for FSI 862

	FSI 862
Supply voltage	9 ... 30 V DC
Current input	60 mA at 24 V DC (max. 80 mA)
Output current	$\pm$ 40 mA
Pulses per revolution	1024 or 2048
Outputs	HCHTL
Pulse offset between the two outputs	90° el $\pm$ 25° el
Pitch error	$\pm$ 50 el
Cable length	max. 350 m at 100 kHz
Maximum speed	6000 rpm
Temperature range	-40 ... +85 °C
Degree of protection	IP66 (IP67)
Maximum adm. radial cantilever force	100 N
Maximum adm. axial force	300 N
Connection system	Cable gland M20
Weight	approx. 1.3 kg
Shock resistance acc. to	$\leq$ 400 g, 3.5 ms EN 60068-2-27
Vibration resistance acc. to	$\leq$ 20 g, 55 ... 2000 Hz EN 60068-2-6

Manufacturer:  
Leine und Linde AG  
Olivehällsvägen 8  
SE-64542 Strängnäs  
Phone +46 152 265 00  
Fax +46 152 265 05

[www.leinelinde.com](http://www.leinelinde.com)  
Email: [info@leinelinde.de](mailto:info@leinelinde.de)



## Introduction

### Mounting technology

## Special technology

1

### Overview

#### XSI 850 rotary pulse encoder



The XSI 850 with HC HTL (High Current HTL) rotary pulse encoder can be used in compliance when mounted complete on motors with order code **G93** for frame sizes 180 to 450.

More information:

- programming of 4 logical signals
- available settings
  - Overspeed
  - Underspeed
  - Programmable level: Standstill to 6000 rpm
  - Direction

#### Technical specifications for XSI 850

	XSI 850
Supply voltage	9 ... 30 V DC
Current input	60 mA at 24 V DC (max. 80 mA)
Output current	± 40 mA
Pulses per revolution	1024
Outputs	HCHTL
Pulse offset between the two outputs	90° el ± 25° el
Pitch error	± 50 el
Cable length	max. 350 m at 100 kHz
Maximum speed	6000 rpm
Temperature range	-20 ... +85 °C
Degree of protection	IP67
Maximum adm. radial cantilever force	1200 N
Maximum adm. axial force	500 N
Connection system	Cable gland M20
Weight	approx. 1.3 kg
Shock resistance acc. to	≤ 400 g, 3,5 ms
Vibration resistance acc. to	≤ 20 g, 55 ... 2000 Hz

Manufacturer:

Leine und Linde AG  
 Olivehällsvägen 8  
 SE-64542 Strängnäs  
 Phone +46 152 265 00  
 Fax +46 152 265 05

[www.leinelinde.com](http://www.leinelinde.com)  
 Email: [info@leinelinde.de](mailto:info@leinelinde.de)

#### XHI 861 rotary pulse encoder



The XHI 861 with HC HTL (High Current HTL) rotary pulse encoder can be used in compliance when mounted complete on motors with order code **G94** for frame sizes 180 to 450.

More information:

- programming of 4 logical signals
- available settings
  - Overspeed
  - Underspeed
  - Programmable level: Standstill to 6000 rpm
  - Direction

#### Technical specifications for XHI 861

	XHI 861
Supply voltage	9 ... 30 V DC
Current input	60 mA at 24 V DC (max. 180 mA)
Output current	± 40 mA
Pulses per revolution	1024
Outputs	HCHTL
Pulse offset between the two outputs	90° el ± 25° el
Pitch error	± 50 el
Cable length	max. 350 m at 100 kHz
Maximum speed	6000 rpm
Temperature range	-20 ... +85 °C
Degree of protection	IP67
Maximum adm. radial cantilever force	1200 N
Maximum adm. axial force	500 N
Connection system	Cable gland M20
Weight	approx. 1.3 kg
Shock resistance acc. to	≤ 200 g, 6 ms
Vibration resistance acc. to	≤ 20 g, 55 ... 2000 Hz

Manufacturer:

Leine und Linde AG  
 Olivehällsvägen 8  
 SE-64542 Strängnäs  
 Phone +46 152 265 00  
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 Email: [info@leinelinde.de](mailto:info@leinelinde.de)

## Overview

**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 Innomatics SD – 1LE15/1LE16, 1LE55/1LE56, VSD10, VSD4000 motors.

- Counterclockwise motion blocked: Order code **F40**
- Clockwise motion blocked: Order code **F41**

Motor series	Frame size	No. of poles	Backstop Type	Rated torque, theoretical	Start speed	Maximum speed	Order code <b>F40</b>	Order code <b>F41</b>
				Nm	rpm	rpm	$\Delta l$ mm	$\Delta l$ mm
1LE15/1LE16 1FP15	132	2, 4, 6, 8	FXM 66-25 NX	950	700	5000	114	114
	160	2, 4, 6, 8	FXM 76-25 NX	1200	670	5000	130	130
	180	2, 4, 6, 8	FXM 76-25 NX	1200	670	5000	126	126
	200	2, 4, 6, 8	FXM 86-25 NX	1600	630	5000	137	137
	225	2, 4, 6, 8	FXM 86-25 NX	1600	630	5000	183	183
	250	2, 4, 6, 8	FXM 86-25 NX	1600	630	5000	106	106
	280	2, 4, 6, 8	FXM 100-40 MX	3700	400	4500	112	112
	315	2, 4, 6, 8	FXM 120-50 MX	7700	320	4000	115	115
1LE55/1LE56	315	2	FXM 120-50 MX	7700	320	4000	115	115
		4, 6, 8	FXM 140-50 MX	10100	320	3000	115	115
	355	2	FXM 120-50 MX	7700	320	4000	155	155
	4	FXM 140-50 MX	10100	320	3000	155	155	
		6, 8	FXM 170-63 MX	20500	250	2700	155	155

**Protective cover diameter**

Frame size	Protective cover for separately driven fan	Protective cover	Protective cover for encoder		Protective cover for encoder adapter	Protective cover
		<b>H00</b>	<b>G11/G12</b>	<b>G04 ... G06</b>	<b>G41/G42</b>	<b>F75</b>
	mm	mm	mm	mm	mm	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	165	340	340	340
200	338	340	165	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	–
355	On request	On request	On request	On request	On request	On request
400	On request	On request	On request	On request	On request	On request
450	On request	On request	On request	On request	On request	On request

# Introduction

## Mounting technology

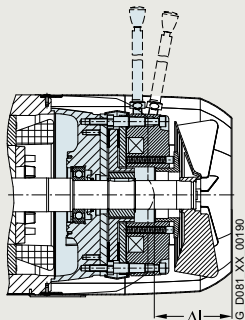
### Dimensions and weights of the mountings

1

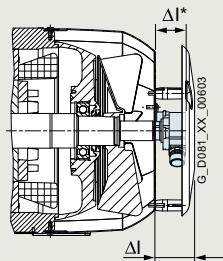
#### Overview

##### 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 codes **G04/G05/G06/G11/G12** [**G11, G12** protective cover as standard]

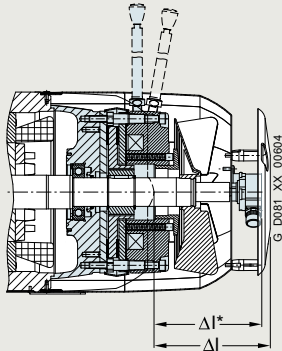


Assignment												
Frame size	Fig. 1		Fig. 2									
	Brake		Rotary pulse encoder including protective cover (G43)				HOG 10 D 1024 I		Sendix 5020			
	Order codes <b>F01/F04</b>		Order code <b>G04</b>		Order code <b>G05</b>		Order code <b>G06</b>		Order codes <b>G11/G12</b>			
	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.		
	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg		
<b>1LE1</b>												
80	60	3.5	-	-	-	-	-	-	68.5	0.8		
90	77.5	5.3	-	-	-	-	-	-	68.5	0.8		
100	81	5.9/9.1	83	1.9	83	1.5	126	2.2	56	1.0		
112	88	7.8/11.8	83	1.9	83	1.5	126	2.2	56	0.9		
132	114	11.9/17.6	87	2.4	87	2	130	2.7	60	1.4		
160	130	30.7/40.5	87	2.7	87	2.3	130	3	60	1.6		
180	126	28/37.8	136.5	2.3	136.5	1.9	136.5	2.6	87	2.2		
200	137	38/53.8	136.5	2.5	136.5	2.1	136.5	2.8	87	2.4		
225	135/199	63/49	135	2	135	1.6	135	2.3	87	1		
250	225/185	83/54	135	2	135	1.6	135	2.3	87	1		
280	297/192	118/92	135	2	135	1.6	135	2.3	87	1		
315	308/188	256/167	135	2	135	1.6	135	2.3	87	1		
<b>1LE5</b>												
280	297/192	118/92	135	2	135	1.6	135	2.3	87	1		
315	309	355	135	2	135	1.6	135	2.3	87	1		
355	324	425	135	2	135	1.6	135	2.3	87	1		
400	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request		
450	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request		

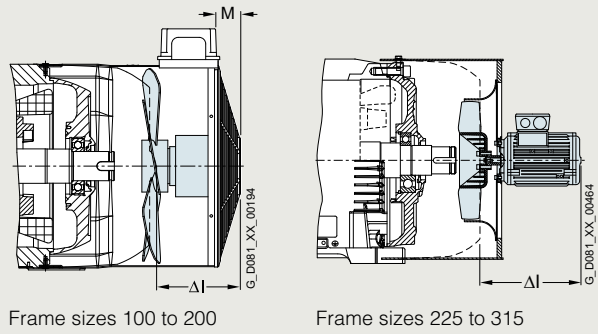
Assignment											
Frame size	Fig. 2		Rotary pulse encoder without protective cover				HOG 10 D 1024 I		Sendix 5020		
	Order code <b>G04</b>		Order code <b>G05</b>		Order code <b>G06</b>		Order codes <b>G11/G12</b>				
	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.	Δl*	Weight, approx.			
	mm	kg	mm	kg	mm	kg	mm	kg			
<b>1LE1</b>											
225	75	1.3	72	0.9	116	1.6	65	0.4			
250	75	1.3	72	0.9	116	1.6	65	0.4			
280	75	1.3	72	0.9	116	1.6	65	0.4			
315	75	1.3	72	0.9	116	1.6	65	0.4			
<b>1LE5</b>											
280	75	1.3	72	0.9	116	1.6	65	0.4			
355	On request	On request	On request	On request	On request	On request	On request	On request			
400	On request	On request	On request	On request	On request	On request	On request	On request			
450	On request	On request	On request	On request	On request	On request	On request	On request			

Overview

**Fig. 3** Brake and rotary pulse encoder (on cover), order codes **F01/F04 + G04/G05/G06/G11/G12** [optionally with manual release, order code **F50**; **G11, G12** protective cover as standard]



**Fig. 4** Separately driven fan, order code **F70**



Assignment

**Fig. 3**

Frame size Brake and rotary pulse encoder (on cover)  
**LL 861 900 220** **HOG 9 D 1024 I**  
Order codes **F01** Order codes **F04**  
**+ G04** **+ G05**

Δl\*

Weight, approx.  
kg

Δl\*

Weight, approx.  
kg

**HOG 10 D 1024 I**  
Order codes **F01**  
**+ G06**

Δl\*

Weight, approx.  
kg

**Sendix 5020**  
Order codes **F01**  
**+ G11/G12**

Δl

Weight, approx.  
kg

**Fig. 4**

Separately driven fan  
Order code **F70**

Δl

M

Weight, approx.  
kg

1LE1	Δl*	Weight, approx. kg	Δl*	Weight, approx. kg	Δl*	Weight, approx. kg	Δl	Weight, approx. kg	Δl	M	Weight, approx. kg
71	–	–	–	–	–	–	–	–	75	20	1.9
80	–	–	–	–	–	–	128.5	4.3	88	20	1.9
90	–	–	–	–	–	–	146	6.1	104	30	2.5
100	164	7.8/11	164	7.4/10.6	207	8.1/11.3	137	6.9/10.1	86.5	30	2.6
112	171	9.7/13.7	171	9.3/13.3	214	10/14	144	8.7/12.7	81.5	30	2.9
132	201	14.3/20	201	13.9/19.6	244	14.6/20.3	174	13.3/19	116	40	3.9
160	217	33.4/43.2	217	33/42.8	260	33.7/43.5	190	32.3/42.1	135.5	40	5.6
180	216	30.3/40.1	216	29.9/39.7	252	30.6/40.4	216	30.2/40	257	40	8.3
200	228	40.5/56.3	228	40.1/55.9	264	40.8/56.6	228	40.4/56.2	262	40	9.3
225	210	64.3	207	64.2	251	63.9	186	63.4	259	–	27
250	300	84.3	297	84.2	341	83.9	276	83.4	264	–	30
280	372	119.3	369	119.2	413	118.9	348	118.4	260	–	33
315	383	256.3	380	256.2	424	255.9	359	256.4	312 <sup>1)</sup>	–	44,8 <sup>1)</sup>
315	–	–	–	–	–	–	–	–	274 <sup>2)</sup>	–	41 <sup>2)</sup>
1LE5											
280	372	119.3	369	119.2	413	118.9	348	118.4	269	–	33
315 2-pole	444	357	444	356.6	444	357.3	396	356	307	–	44.6
4-, 6- and 8-pole	–	–	–	–	–	–	–	–	272	–	41.3
355	459	427	459	426.6	459	427.3	411	426	320	–	34.5
400	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request
450	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request

Assignment

**Fig. 3**

Frame size Brake and rotary pulse encoder (on cover)  
**LL 861 900 220** **HOG 9 D 1024 I**  
Order codes **F04** Order codes **F04**  
**+ G04** **+ G05**

Δl

Weight, approx.  
kg

Δl

Weight, approx.  
kg

**HOG 10 D 1024 I**  
Order codes **F04**  
**+ G06**

Δl

Weight, approx.  
kg

**Sendix 5020**  
Order codes **F04**  
**+ G11/G12**

Δl

Weight, approx.  
kg

1LE1	Δl	Weight, approx. kg	Δl	Weight, approx. kg	Δl	Weight, approx. kg	Δl	Weight, approx. kg
225	274	50.3	271	49.9	315	50.6	285.5	49.4
250	260	55.3	257	54.9	301	55.6	271.5	54.4
280	267	93.3	264	92.9	308	93.6	278.5	92.4
315	263	168.3	260	167.9	304	168.6	274.5	167.4

<sup>1)</sup> Valid for 4-pole, 6-pole, and 8-pole motors

<sup>2)</sup> Valid for 2-pole motors

# Introduction

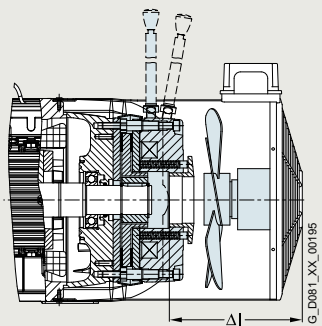
## Mounting technology

### Dimensions and weights of the mountings

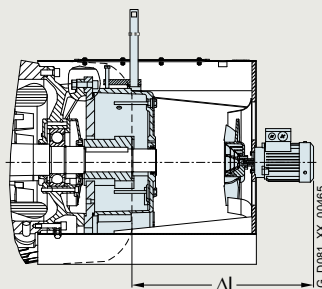
1

#### Overview

**Fig. 5** Brake and separately driven fan, order codes **F01/F04 + F70** [optionally with manual release, order code **F50**]

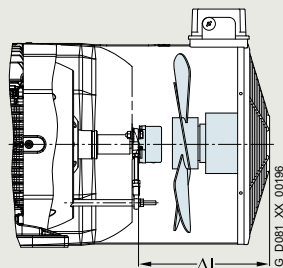


Frame sizes 100 to 200

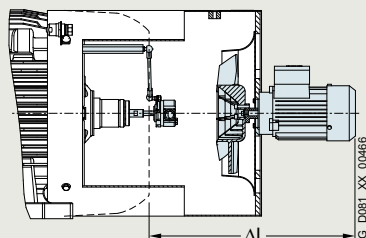


Frame sizes 225 to 355

**Fig. 6** Rotary pulse encoder (under cover) and separately driven fan, order codes **F70 + G04/G05/G06/G11/G12**



Frame sizes 100 to 200



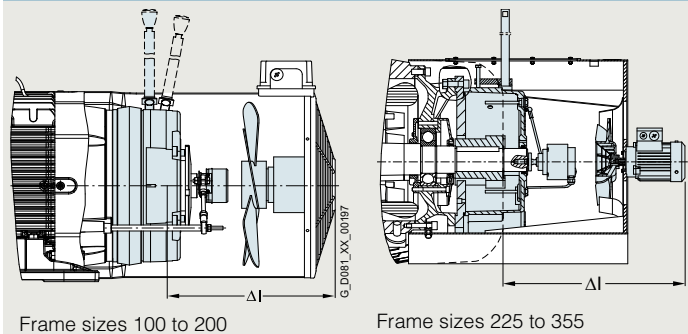
Frame sizes 225 to 355

**Assignment**

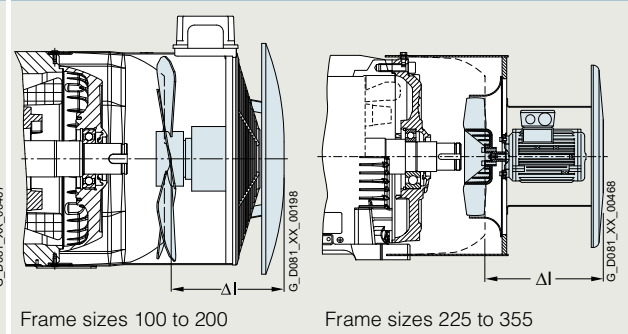
Frame size	Fig. 5 Brake and separately driven fan				Fig. 6 Separately driven fan and rotary pulse encoder (under cover)							
	Order codes <b>F01 + F70</b>		Order codes <b>F04 + F70</b>		Order codes <b>F70 + G04</b>		Order codes <b>F70 + G05</b>		Order codes <b>F70 + G06</b>		Order codes <b>F70 + G11/G12</b>	
$\Delta l$	Weight, approx.	$\Delta l$	Weight, approx.	$\Delta l$	Weight, approx.	$\Delta l$	Weight, approx.	$\Delta l$	Weight, approx.	$\Delta l$	Weight, approx.	
mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	mm	kg	
<b>1LE1</b>												
71	–	–	–	–	–	–	–	–	–	165	2.7	
80	161.5	5.4	–	–	–	–	–	–	–	161.5	3	
90	174	7.7	–	–	–	–	–	–	–	174	3.6	
100	161.5	6.9	161.5	10.1	161.5	4.8	161.5	4.4	246.5	5.3	161.5	3.9
112	156.5	8.7	156.5	12.7	156.5	5.1	156.5	4.7	241.5	5.6	156.5	4.1
132	186	13.3	186	19	186	6.8	186	6.4	291	7.4	186	5.8
160	205.5	32.3	205.5	42.1	205.5	9.8	205.5	9.4	320.5	10.5	205.5	8.7
180	257	30.2	257	40	257	10.6	257	10.2	400	10.9	257	10.5
200	262	40.4	262	56.2	262	11.8	262	11.4	397	12.1	262	11.7
225	601	92	448	65	448	31	448	31	448	31	448	30
250	618	115	418	81	463	33	463	33	463	33	463	32
280	577	154	577	125	467	36	467	36	467	36	467	35
315 2-pole	617	305	–	–	509	51	509	50	509	51	509	50
315 4-, 6- and 8-pole	579	301	579	208	471	47	471	47	471	47	471	46
<b>1LE5</b>												
280	466	144	416	116	476	37	476	37	476	37	476	37
315 2-pole	633	415.7	–	–	497	46.6	497	46.2	497	46.9	497	45.6
315 4-, 6- and 8-pole	593	413.7	–	–	462	42.3	462	41.9	462	42.6	462	41.3
355	628	471.7	–	–	381	29.5	381	29.1	381	29.8	381	28.5
400	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request
450	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request

**Overview**

**Fig. 7** Brake, rotary pulse encoder (under cover) and separately driven fan, order codes **F01/F04 + F70 + 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 Brake, separately driven fan, and rotary pulse encoder (under cover)						Sendix 5020		Fig. 8 Protective cover for separately driven fan		
	Order codes <b>F01 + F70 + G04</b>		Order codes <b>F01 + F70 + G05</b>		Order codes <b>F01 + F70 + G06</b>		Order codes <b>F01 + F70 + G11/G12</b>	Order code <b>F70+H00</b>	Diameter of the separately-driven-fan cover		
	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
<b>1LE1</b>											
80	–	–	–	–	–	–	186.5	6.7	124.5	0.2	157
90	–	–	–	–	–	–	199	9	141.5	0.2	177
100	196.5	10.9	196.5	10.5	246.5	11.5	196.5	10	124	1.4	210
112	191.5	13.1	191.5	12.7	241.5	13.6	191.5	12.1	122	1.8	249
132	241	19	241	18.6	291	19.6	241	18	149	2.4	300
160	270.5	40.9	270.5	40.5	320.5	41.6	270.5	39.8	177	3	338
180	257	38.6	257	38.2	400	40.6	257	38.5	288	1.7	338
200	262	49.9	262	49.1	397	51.5	262	49.7	293	1.7	338
225	601	93.3	601	93.2	601	93.9	601	92.4	305	2.5	427
250	618	116.3	618	116.2	618	116.9	618	115.4	311	2.5	485
280	577	155.3	577	155.2	577	155.9	577	154.4	307	2.5	535
315 2-pole	617	306.3	617	306.2	617	306.9	617	306.9	–	–	–
315 4-, 6- and 8-pole	579	302.3	579	302.2	579	302.9	579	301.4	321 <sup>1)</sup>	2.5 <sup>1)</sup>	600 <sup>1)</sup>
<b>1LE5</b>											
280	586	156	586	155.6	586	156	586	156	311	2.5	525
315 2-pole	665	422	665	421.9	665	422.6	665	421.1	402	46.1	618
315 4-, 6- and 8-pole	630	421	630	420.9	630	421.6	630	420.1	317	43.5	618
355	700	478	700	477.9	700	478.6	700	477.1	330	36	695
400	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request
450	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request	On request

Frame size	Assignment Fig. 7 Brake, separately driven fan, and rotary pulse encoder (under cover)						Sendix 5020	
	Order codes <b>F04 + F70 + G04</b>		Order codes <b>F04 + F70 + G05</b>		Order codes <b>F04 + F70 + G06</b>		Order codes <b>F04+ F70 + G11/G12</b>	Weight, approx.
	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.	Δl	Weight, approx.
	mm	kg	mm	kg	mm	kg	mm	kg
<b>1LE1</b>								
225	601	72.3	601	71.9	601	72.6	601	71.4
250	618	85.3	618	84.9	618	85.6	618	84.4
280	577	126.3	577	125.9	577	126.6	577	125.4
315	579	209.3	579	208.9	579	209.6	579	208.4
<b>1LE5</b>								
280	536	123	536	123	536	123	536	123
315 2-pole	665	424.7	665	424.3	665	425	665	423.7
315 4-, 6- and 8-pole	630	421.7	630	421.6	630	422	630	420.7
355	700	480.7	700	480.3	700	481	700	479.7

<sup>1)</sup> Valid for FS 315 (2, 4, 6, and 8-pole)

# Introduction

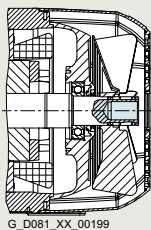
## Mounting technology

### Dimensions and weights of the mountings

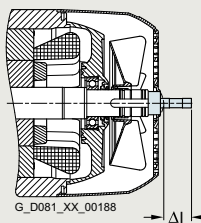
1

#### Overview

**Fig. 9** Prepared for mountings, center hole only (for BFK458 brake, order code **F01** and/or encoder order code **G04/G05/G06/G11/G12**), order code **G40** (up to frame size 160, standard with frame size 180 and above)



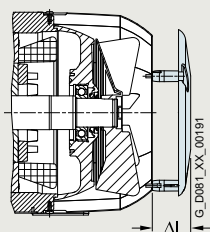
**Fig. 10** Prepared for mountings with shaft D12/D16, order code **G41/G42**



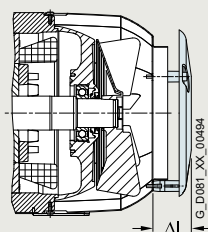
Frame size	Assignment <b>Fig. 9</b>		Assignment <b>Fig. 10</b>		Assignment <b>Fig. 10</b>	
	Order code <b>G40</b>	Order code <b>G41</b>	Order code <b>G41</b>	Order code <b>G42</b>	Order code <b>G42</b>	Order code <b>G42</b>
	Δl mm	Weight, approx. kg	Δl mm	Weight, approx. kg	Δl mm	Weight, approx. kg
<b>1LE1</b>						
71	–	–	–	–	–	–
80	–	–	22	0.1	52	0.1
90	–	–	22	0.1	52	0.1
100	–	–	18.3	0.15	54.3	0.2
112	–	–	14.5	0.15	54.3	0.2
132	–	0.1	18.8	0.3	58.8	0.4
160	–	0.2	18.6	0.4	55.6	0.7
180	–	–	18	0.27	57	0.33
200	–	–	17	0.27	56	0.27
225	–	–	23	0.27	58	0.33
250	–	–	23	0.27	58	0.33
280	–	–	23	0.27	58	0.33
315	–	–	23	0.27	58	0.33
<b>1LE5</b>						
280	–	–	23	0.27	58	0.33
315	–	–	23	0.27	58	0.33
355	–	–	23	0.27	58	0.33
400	On request	On request	On request	On request	On request	On request
450	On request	On request	On request	On request	On request	On request

**Overview**

**Fig. 11** Standard protective cover for types of construction, order code **H00**



**Fig. 12** Protective cover for textile industry, order code **F75**



<b>Assignment</b>						
Frame size	<b>Fig. 11</b>			<b>Fig. 12</b>		
	Protective cover Order code <b>H00</b>	$\Delta l$ mm	Weight, approx. kg	Protective cover Order code <b>F75</b>	$\Delta l$ mm	Weight, approx. kg
71	29	0.15	–	–	–	–
80	128	0.3	17	0.3	17	0.3
90	144	0.4	15	0.4	15	0.4
100	137	0.5	64	0.7	64	0.7
112	122	0.7	64	0.9	64	0.9
132	156	1.3	71	1.3	71	1.3
160	182.5	1.7	71	1.9	71	1.9
180	285	1.7	90	3.2	90	3.2
200	297	1.7	90	3.4	90	3.4
225	100	2.2	On request	On request	On request	On request
250	100	2.4	On request	On request	On request	On request
280	110	3.4	On request	On request	On request	On request
315	110	4	On request	On request	On request	On request
<b>1LE5</b>						
280	110	3.4	On request	On request	On request	On request
315	110	8	–	–	–	–
355	140	8.5	–	–	–	–
400	On request	On request	–	–	–	–
450	On request	On request	–	–	–	–

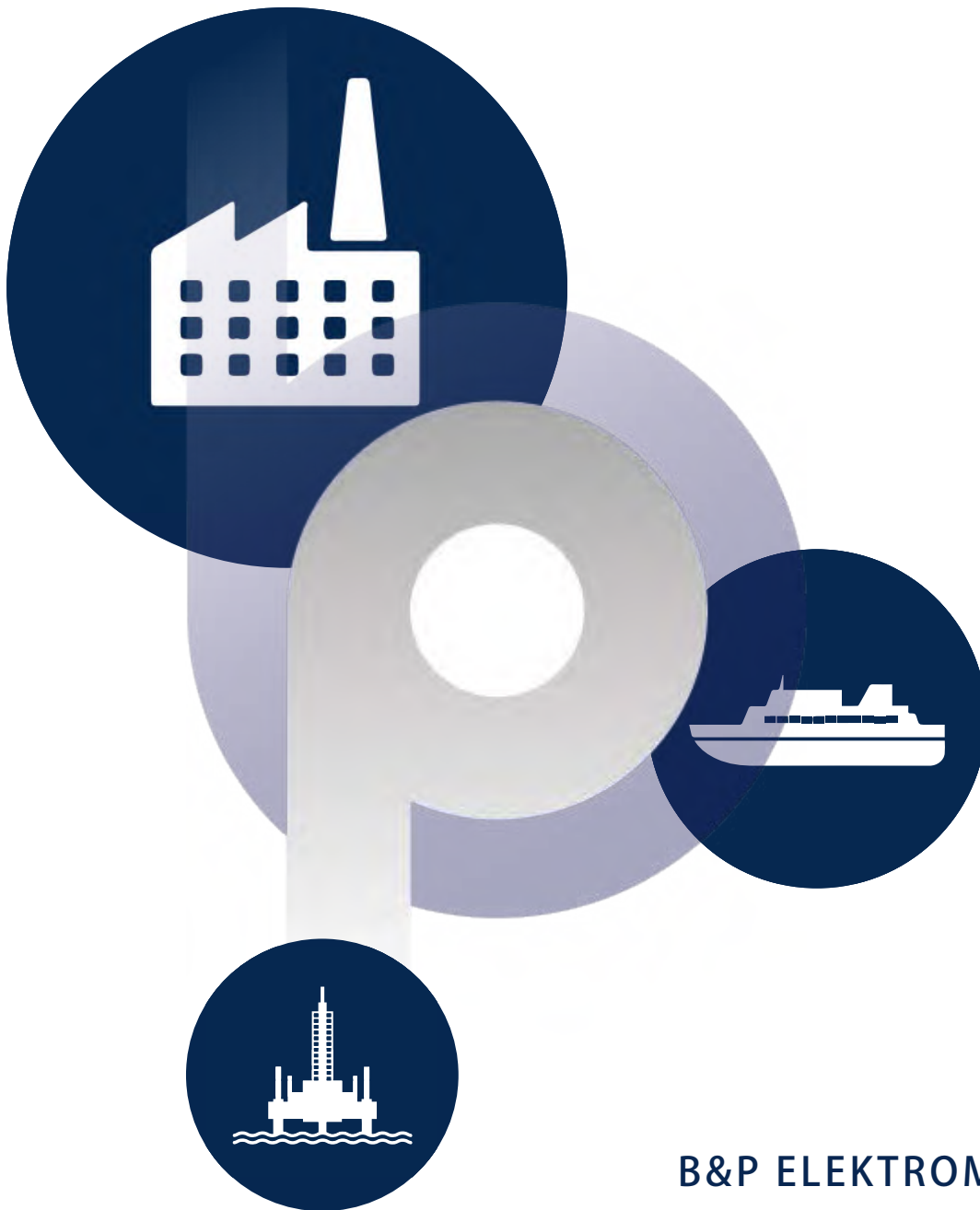


## Introduction

Mounting technology

Notes

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