SIEMENS

Motors

Low-Voltage Motors

SIMOTICS SD – 1LE5

355 - 1000 kW

Catalog
Add-on
D 81.1 AO

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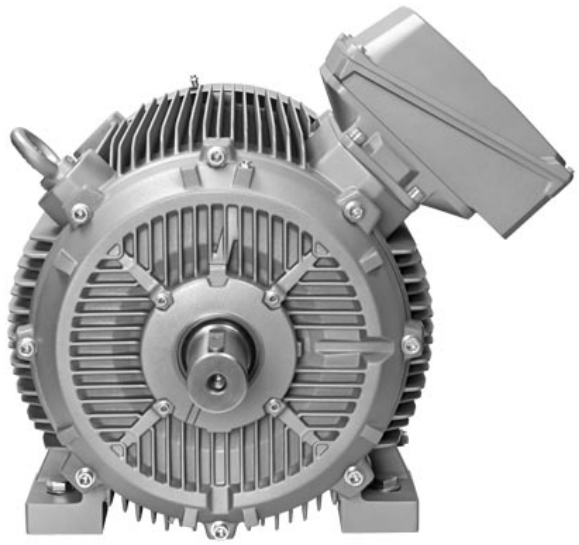
Low-Voltage Motors SIMOTICS SD – 1LE5



Catalog D 81.1 AO · 04/2018

For reasons of readability, the chapter Introduction generally refers to motors and does not mention the MLFB fuselage.
In this catalogue Add-on D81.1 AO the term motors refers to
SIMOTICS SD next generation, Series 1LE5 frame sizes 400 and 450.

Overview

Steps for drive selection

Step 1	Orientation and general technical information		
Technical requirements for the motor	Rated frequency and rated voltage	50/60 Hz 3 AC, 380 ... 690 V	
	Duty type	Standard duty (continuous duty S1 according to EN 60034-1)	
	Degree of protection	IP..	
	Rated speed	n = ... rpm	
	Rated power	P = ... kW	
	Rated torque	$M = P \cdot 9550/n$ = ... Nm	
	Type of construction	IM..	
Step 2	**Preselection in accordance with the application**		
Determination of the installation conditions and definition of the application, if necessary	Ambient temperature	≤ 40 °C	> 40 °C
	Installation altitude	≤ 1000 m	> 1000 m
	Factors for derating	None	Determine the factor for derating (for reduction factor, see "Coolant temperature and installation altitude" on Page 1/11)
Cross-reference to other motors	Motors for special requirements in explosion protection and applications or motors according to the NEMA standard.		
Step 3	**Preliminary selection of the motor**		
Determination of the range of possible motors	Select the frame size and therefore the possible motors on the basis of the following parameters: cooling method, degree of protection, rated power, rated speed and rated torque range. 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		
Table header – Meaning																					
P_{rated}, 50 Hz	P_{rated}, 60 Hz	P_{rated}, 60 Hz	Frame size	n_{rated}, 50 Hz	T_{rated}, 50 Hz	IE class	CC No. CC032A	η_{rated}, 50 Hz, 4/4	η_{rated}, 50 Hz, 3/4	η_{rated}, 50 Hz, 2/4	$\cos\varphi_{rated}$, 50 Hz, 4/4	I_{rated}, 50 Hz, 400 V	T_{LR}/T_{rated}	I_{LR}/I_{rated}	T_B/T_{rated}	L_{pfA}, 50 Hz	L_{WA}, 50 Hz	Article No.	m IM B3	J
kW	**kW**	**hp**	FS	rpm	Nm			%	%	%		A				dB (A)	dB (A)		kg	kgm^2
Rated power at 50 Hz	Rated power at 60 Hz	Rated power at 60 Hz	Frame size	Rated speed at 50 Hz	Rated torque at 50 Hz	Efficiency class according to IEC 60034-30-1	CC No. CC032A	Efficiency at 50 Hz, 4/4-load	Efficiency at 50 Hz, 3/4-load	Efficiency at 50 Hz, 2/4-load	Power factor at 50 Hz, 4/4-load	Rated current at 400 V, 50 Hz	Locked-rotor torque at direct switch-on as a multiple of the rated torque	Locked-rotor current at 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 IM B3 type of construction, approx.	Moment of inertia

Legend:

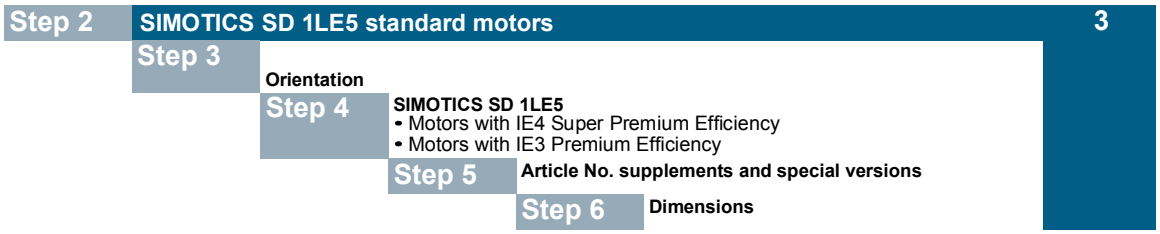
Primary key
Standard values for all motors
Specially for NEMA Energy Efficient MG1 motors, Table 12-11 or NEMA Premium Efficient MG1 motors, Table 12-12

Note on pole-changing motors:
The operating values are specified here for the rated power for the two different pole numbers.

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

Overview (continued)

Steps for drive selection in the catalog



1LE5 standard motors – next generation

Motor version	Efficiency class	Rated power at	Frame size – Motor type 400 450	Page
SIMOTICS SD Add cast-iron housing				
IEC	IE4 Super Premium Efficiency	355 … 1000 kW	1LE5534	2/9
	IE3 Premium Efficiency	355 … 1000 kW	1LE5533	2/11
SIMOTICS SD Pro cast-iron housing				
IEC	IE3 Premium Efficiency	335 … 980 kW	1LE5583	2/13

Overview (continued)

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

	Additional identification code **–Z** with order code						
Standard version	**S00**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**
Paint finish, suitability of paint finish for climate group in accordance with IEC 60721-2-1							
Standard paint finish C2	Unpainted, but unfinished cast-iron surfaces are primed	Unpainted, motor primed	Special paint finish C3	Special paint finish system "sea air resistant" C4	Special paint finish system "offshore" C5	Interior paint finish, all bare internal components primed with rust inhibitor [1]	Polyurethane-based top coat, standard version
Use							
Moderate (extended) for indoor and outdoor installation under a roof not directly exposed to weather conditions.	The motors can be supplied unpainted on request.	The motors can be supplied with just a primer coat on request.	Worldwide (global) for outdoor installation in direct sunlight and/or exposed to weather conditions.	Recommended for indoor or outdoor installation directly exposed to weather conditions, industrial climate with moderate SO_2 exposure, VIK requirements, coastal ocean climate, but not offshore ocean climate, e.g. for crane drives and for the paper industry.	Recommended for outdoor installation directly exposed to weather conditions, industrial climate with moderate SO_2 exposure and offshore ocean climate, e.g. for crane drives.	The motors can be supplied with internal paint finish on request. Recommended when there is a risk of heavy condensate formation.	Direct sunlight (ultraviolet light) can change the color of the paint. When color stability is a requirement, a polyurethane-based paint system is recommended for the top coat (RAL 7030). Other colors are available on request.
Test requirements according to EN ISO 12944-5 Corrosivity Category							
C2	–	–	C3	C4	C5	–	–
Total film thickness – nominal film thickness in µm [2] [3]							
Motors in cast-iron version							
Water-b. 2K polyurethane	Resin primer	Water-b. 2K polyurethane primer	Water-b. 2K polyurethane	Water-b. 2K polyurethane	Water-b. 2K polyurethane	2K epoxy resin/ 2K polyurethane primer	Water-b. 2K polyurethane
120	60	120	180	240	320	60	Film thickness similar to S03/S04
Resistance							
			For corrosive atmospheres up to 1 % acid and alkali concentration or permanent dampness in sheltered rooms.	Chemical exposure up to 5 % acid and alkali concentration.	Chemical exposure up to 5 % acid and alkali concentration.		Sunlight
Temperature range							
Up to 120 °C for brief periods Up to 100 °C continuously	–	–	Briefly up to 140 °C Continuously up to 120 °C	–40 … 140 °C	–40 … 140 °C		
Rel. air humidity at (temperature)							
60 % (40 °C)	–	–	100 % (40 °C)	75 % (50 °C)	75 % (60 °C)		

Table continues on the next page.

Colors and paint finish

Overview (continued)

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

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

Increased corrosion protection for exterior components (H90)

The corrosion protection of the motor can be expanded with the H90 option for exterior components. In conjunction with options for special paints (S00-S06) or other materials such as bolts made of stainless steel (H07), the corrosion protection can be adapted to special ambient conditions.
When the H90 option is ordered, the motor is as follows:

- Surfaces not visible from outside are painted with the film thickness ordered (S01-S04)
- Bearing sealing with increased corrosion resistance
- Air inlet grille made of stainless steel
- For optional externally mounted components: cable installation in protective tubes with increased corrosion resistance

Depending on the level of salinity at the installation location, the following options may have to be ordered:

1. Location with high salinity or areas with almost continuous condensation (corrosivity category C5-M / C5-I)
   - H90 Increased corrosion protection for exterior components
   - R53 Undrilled removable entry plate
   - H07 Rust-resistant screws (externally)
   - S04 Special paint for use offshore
   - S05 Internal coating

2. Location with moderate salinity (corrosivity category C4)
   - H90 Increased corrosion protection for exterior components
   - H07 Rust-resistant screws (externally)
   - S03 Special paint finish sea air resistant
   - S05 Internal coating

3. Location with low salinity (corrosivity category C3):
   - H90 Increased corrosion protection for exterior components
   - H07 Rust-resistant screws (externally)
   - S02 Special paint finish C3
   - S05 Internal coating

1) Machined laminated rotor core, shaft, inner diameter of cast-iron housing, interior surfaces of cast-iron bearing plates.
2) Total film thickness:
- The specified film thickness represents average values for the external motor surfaces
- Unpainted or one layer of paint (60 µm) less beneath the fan cover
- The film thickness may differ at inaccessible locations (pockets/recesses or bases of ribs)

The film thickness specified for aluminum/cast-iron versions refers not only to motors, but also to components such as the bearing plate and housing. Motors in a mixed aluminum/cast-iron version are also available.

3) n.a.
4) n.a.
5) n.a.
6) n.a.
7) Primers, water-based 2K epoxy resin paints and polyurethane-based paints can be painted over with paints of the same kind if the motors are in the original packaging and are still covered by the warranty. A suitability test should be conducted before any recoating work is undertaken if the customer intends to use a coating of a different kind to overpaint the motor. Alternatively, a test in accordance with EN ISO 16927 "Determination of the overcoatability and recoatability of a coating" can be requested and ordered.

Overview (continued)

Finish in other standard RAL colors – Order code Y53 (plain-text specification of the RAL number required)

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

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

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

Paint finish in special RAL colors – Order code Y56 (plain-text specification of the RAL number required)

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

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

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

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

Overview (continued)

EN 60034-1 specifies that, for all motors, the approximate total weight be indicated on the rating plate.

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 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 400 V∆/690 VY (voltage code "34").
Order code **B07.**

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

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

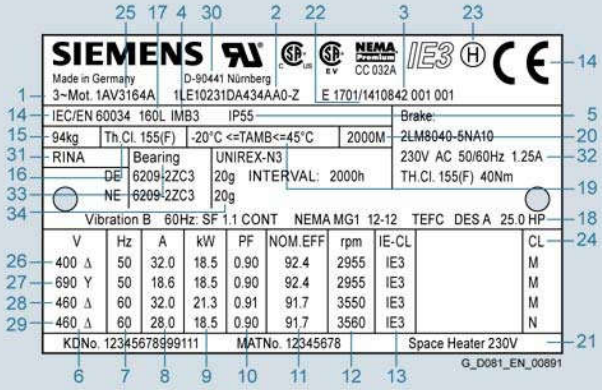
In the standard version, the rating plate is available in international format or in German/English.
The language for the rating plate can be ordered by specifying in plain text. An overview of the languages that can be ordered is provided in the table below.

Overview of languages on the rating plate

Motor type	Frame size	Rating plate in	
		German (de)	English (en)
1LE5	400 ... 450	◘	○

◘ Standard version
○ Without additional charge

Other languages on request



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

Overview (continued)

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

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

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 corner-grounded TN systems because of the higher voltage load.

Operation on non-grounded IT systems is also possible. However, when a ground fault occurs, 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 **R21, R23,** and **R24**), please inquire in the case of converter operation.

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

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

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

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

The following applies for the voltage rise time: T_a > 0.3 µs

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

Insulation systems for converter operation > 480 V/500 V

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

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

For IE3 standard motors as of frame size 225, the PREMIUM insulation system is available on request.

Bearing insulation/shaft grounding brushes for converter operation

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

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

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

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

In rare cases, depending on the application and system, it may be necessary to take further measures on the converter or motor. On the motor side, bearing insulation is available on the non-drive end (NDE) (order code **L51**) and shaft grounding brushes (order code **L52**).

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

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

Thermal utilization of the motor

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

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