

Low-Voltage MOTORS

IEC Squirrel-Cage Motors
Frame sizes 56 to 315
Power range 0.06 kW to 200 kW

SIEMENS

IEC Squirrel-Cage Motors

Standard motors up to frame size 315 L

Orientation

Overview



Standard motors from Siemens are characterised by their flexibility, ruggedness and energy efficiency. In general, all motors are suitable for converter-fed operation with line voltages of up to 500 V +10%. The motors are designed to fulfill the requirements of the European and International markets with an output range from 0.06 to 200 kW.

Standard motors for use worldwide.

IEC motors for the European and International market

The standard motors comply both electrically and mechanically with the applicable IEC/EN standards. For exporting to China, CCC certified motors (China Compulsory Certification) can be supplied.

IEC motors for the North American market

Motors are also available to the NEMA specification (National Electrical Manufacturers Association), with UL approval (Underwriters Laboratories Inc.) and CSA certification (Canadian Standard Association) for exporting to NAFTA states (USA, Canada and Mexico). The mechanical design of all motors is compliant only to IEC/EN, not to NEMA dimensions.

NEMA motors for the North American market

Low-voltage motors are manufactured to the NEMA standard for compliance with the local specifications of the NAFTA markets (USA, Canada and Mexico). This includes motors designed in accordance with the US act, EPACT (specified minimum efficiency levels), as well as motors with NEMA premium efficiency levels. The NEMA motor series provide the highest operating reliability for maximum service life.

Further information regarding NEMA motors is available on the Internet:

<http://www.sea.siemens.com/motors>

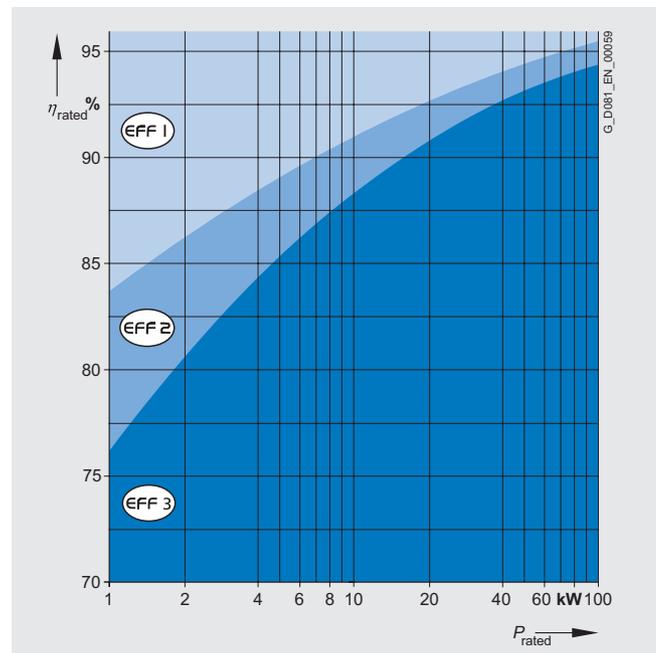
Classified energy-saving motors for an efficient energy balance

Depending on requirements, energy-saving motors are available for an efficient energy balance – for EU requirements in accordance with CEMEP (European Committee of Manufacturers of Electrical Machines and Power Electronics) and for the North American market in accordance with EPACT (US Energy Policy Act).

Efficiency requirements according to CEMEP

CEMEP classifies efficiency levels for 2-pole and 4-pole motors with outputs of 1.1 to 90 kW. Three efficiency classes are defined:

- **EFF1** (High Efficiency motors – referred to below as “Motors with high efficiency”)
- **EFF2** (Improved Efficiency motors – referred to below as “Motors with improved efficiency”)
- **EFF3** (Conventional Efficiency motors)



At a glance: EU/CEMEP for Europe

- Status
Voluntary compliance with efficiency classification
- Covers
2-pole, 4-pole 50 Hz squirrel-cage motors from 1.1 to 90 kW (at 400 V and 50 Hz)
- Required marking
Efficiency class on the motor rating plate
 η_N , $\eta_{3/4}$ load and efficiency class in the documentation

Overview (continued)

Efficiency requirements according to EPACT

In 1997, an act was passed in the US to define minimum efficiencies for low-voltage three-phase motors (EPACT).

An act is in force in Canada that is largely identical, although it is based on different verification methods. The efficiency is verified for these motors for the USA using IEEE 112, Test Method B and for Canada using CSA-C390. Apart from a few exceptions, all three-phase low-voltage motors imported into the USA or Canada must comply with the legal efficiency requirements. The law demands minimum efficiency levels for motors with a voltage of 230 and 460 V at 60 Hz, in the output range of 1 to 200 HP (0.75 to 160 kW) with 2, 4 and 6 poles. Explosion-proof motors must also be included.

The EPACT efficiency requirements exclude, for example:

- Motors whose frame size output classification does not correspond with the standard series according to NEMA MG1-12.
- Flange-mounting motors
- Brake motors
- Converter-fed motors
- Motors with design letter C and higher

EPACT lays down that the nominal efficiency at full load and a "CC" number (Compliance Certification) must be included on the rating plate. The "CC" number is issued by the US Department of Energy (DOE). The following information is stamped on the rating plate of EPACT motors which must be marked by law:

- Nominal efficiency
- Design letter
- Code letter
- CONT
- CC No. CC 032A (Siemens) and NEMA MG1-12.

At a glance: EPACT/CSA for North America

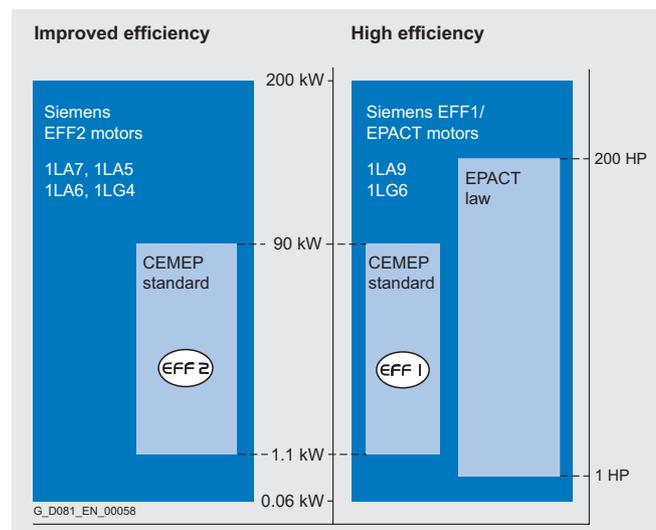
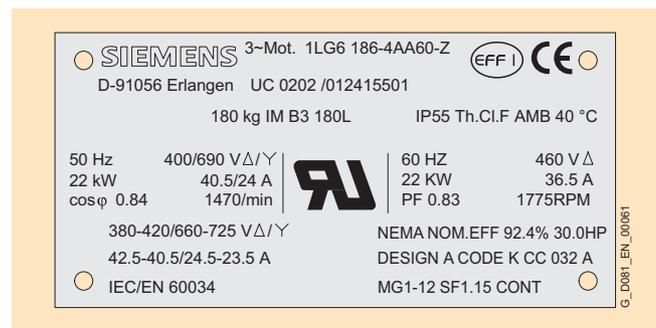
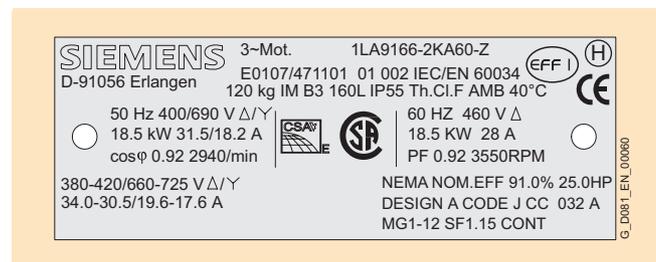
- Status
Minimum efficiencies required by law
- Covers
2-, 4- and 6-pole 60 Hz squirrel-cage motors from 1 to 200 HP (0.75 to 150 kW) for 230 V and/or 460 V 60 Hz
- Required marking
Efficiency η_N on the motor rating plate

Energy-saving motors from Siemens according to CEMEP or EPACT

The product range of standard motors exclusively comprises motors in the EU efficiency classes EFF1 "High Efficiency" or EFF2 "Improved Efficiency". The active parts of the motor have been optimized so that the requirements of the CEMEP efficiency classes EFF1 and EFF2 are fulfilled. The procedure for determining the efficiency is based on the summation of losses in accordance with IEC 60034-2. With these energy-saving motors a significant reduction in energy costs can be achieved as compared to conventional motors according to EFF3.

EPACT motors from Siemens are available CC certified, marked with the number CC032A on the rating plate and optionally also according to UL with the recognition mark. Siemens offers motors with the CSA Energy Efficiency Verification Mark specially for the Canadian market.

At a glance: Energy-saving motors from Siemens according to CEMEP EFF1/EFF2, EPACT and CSA



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Overview (continued)

Standard motors with increased output and compact construction

Standard motors with increased output and compact construction can be used to advantage in confined spaces. For a slightly longer overall length, the output is at least as high as that of the next largest shaft height. These compact motors are also optimised for efficiency and therefore reduce the operating costs.

Standard motors with reduced output without external fan

Self-cooled motors with surface cooling without external fan are suitable for the following operating conditions:

- Types of duty with adequate cooling times (e.g. temporary duty for positioning drives)
- Environmental conditions that demand compact installation space (e.g. in motors with a stopping function)
- Conditions under which an external fan has an adverse effect (e.g. simple cleaning in the food industry, textile industry)

Standard motors that can be supplied from stock with an extremely short delivery time

The most commonly used basic versions of standard motor series 1LA7, 1LA5 and 1LG4 can be supplied from stock – some of these are already marked with “CCC” (China Compulsory Certification) for export to China. Apart from these, a so-called “Sector version” is available for some of the motors available from stock. These include a located bearing at the drive end (DE), PTC thermistor and screwed on feet for the IM B35 type of construction.

The normal delivery time for motors from stock is 1 to 2 days from the time of clarification of the order at the factory until delivery from the factory. To determine the time of arrival at the customer site, the appropriate shipping time must be added.

Advantages

Standard motors from Siemens offer the user numerous advantages:

- The motors are approved and certified for worldwide use and meet high quality standards (confirmed, for example, by CSA ¹⁾, UL ²⁾, EXAM ³⁾, PTB ⁴⁾, CQC ⁵⁾)
- The ruggedness and lack of complexity of the components guarantee an extremely long service life
- Complete product spectrum for energy-saving motors according to EU/CEMEP and EPACT
- Extremely easy selection of energy-saving motors due to the efficiency classification (EFF1/EFF2)
- Energy-saving motors in motor series 1LA9 and 1LG6 meet both the EFF1 and EPACT efficiency levels.
- Reduction in operating costs thanks to a high degree of efficiency with EFF1

- Higher motor service life thanks to lower winding temperature in EFF1 and EPACT motors with rated load and supply
- Reduced environmental impact due to CO₂ reduction
- High overload reserves under continuous duty (SF 1.15 for motor series 1LA9/1LG6)
- Suitable for universal applications worldwide
- Standard motors with increased output and extremely compact construction
- Short delivery times for motors from stock
- The module mounting concept supports rapid modification by the customer
- A fast and comprehensive service is provided by factories and modification partners distributed throughout the world

Field of application

The numerous available options enable standard motors from Siemens to be used in every area of industry and every sector. They are suitable both for special environmental conditions such as those that predominate in the chemical or petrochemical industry as well as for most climatic requirements such as those of offshore applications. Their large range of line voltages enables them to be used all over the world.

The wide field of implementation includes the following applications:

- Pumps
- Fans
- Compressors
- Conveyor systems such as cranes, belts and lifting gear
- High-bay warehouses
- Packaging machines
- Automation and Drives

¹⁾ Canadian Standard Association

²⁾ Underwriters Laboratories Inc.

³⁾ EXAM BBG Prüf und Zertifizier GmbH (previously BVS = Bergbau Versuchsstrecke)

⁴⁾ Physikalisch-Technische Bundesanstalt

⁵⁾ China Quality Certification

Integration

MICROMASTER 411/ COMBIMASTER 411 distributed drive solutions

The MICROMASTER 411/COMBIMASTER 411 series is included in Catalogue DA 51.3 which contains the complete product spectrum with ordering data, technical details and explanations.

Application

MICROMASTER 411 and COMBIMASTER 411 are the ideal solution for distributed drive applications that require a high degree of protection. The devices are designed for a wide drive range – for simple individual applications for pumps and fans through to multiple drives for conveyor systems in networked control systems. The ECOFAST versions of the MICROMASTER 411/COMBIMASTER 411 frequency converter series contain plug-in cables for the power supply, communications interface and motor connections. They support fast and problem-free replacement in time-critical applications and are completely compatible with the ECOFAST technology systems. They are based on the universal MICROMASTER 420 converter series and are characterised by customer-oriented performance and ease of use.

Structure

The modular structure allows MICROMASTER 411/COMBIMASTER 411 products and their accessories to be individually selected, e.g. electromechanical brake control module or PROFIBUS module.

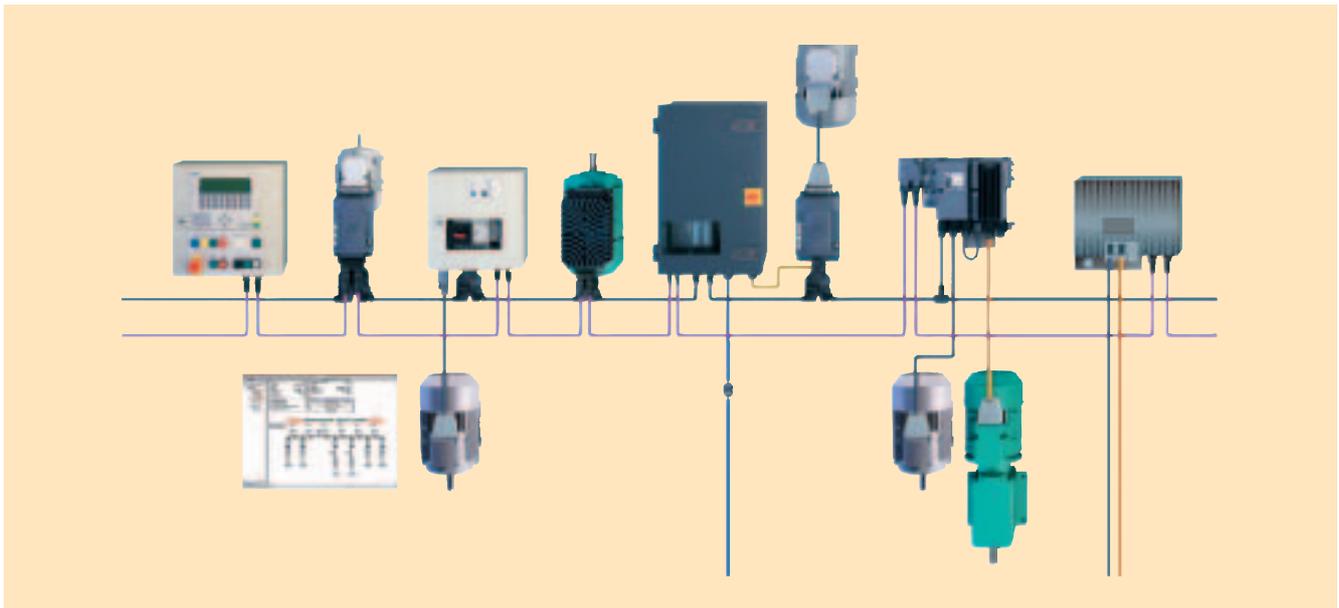
Main features:

- Output range: 0.37 to 3.0 kW, 400 V, 3AC
- IP66 degree of protection (MICROMASTER 411), self-cooling
- Electrical isolation between the electronics and the connection terminals
- Parameter sets for fast startup and cost savings
- Modular structure with numerous accessories
- Operation without operator panel possible (using jumpers and/or control potentiometer)
- Integrated control potentiometer accessible from outside.

Accessories (overview):

- Basic Operator Panel (BOP) for parameterising the converter
- Plain text Advanced Operator Panel (AOP) for MICROMASTER 411 and COMBIMASTER 411 with multiple-language display
- PROFIBUS module
- AS-Interface module
- DeviceNet module
- REM module (dynamic brake and control module for electro-mechanical brake)
- EM module (electromechanical brake control module)
- PC connection kit
- Mounting kits for installing the operator panels
- PC startup programs

ECOFAST system



ECOFAST is a system which permits extensive decentralisation and a modular structure for installation elements on the component level.

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Standard motors up to frame size 315 L

Orientation

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Integration (continued)

Advantages

The main advantages of the ECOFAST motor connector over a terminal strip are as follows:

- Fast assembly of I/O devices (e.g. motor starters) from the ECOFAST system
- Reduction of assembly and repair times at the end user
- No wiring errors due to connector technology
- Replacement of motor without intervention in the electronics

Main features of the ECOFAST motor connector (with separate MICROMASTER 411 frequency converter)

The motor connector is mounted in the factory and replaces the connection box with terminal board. The connector is mounted towards the non-drive end (NDE). It comprises an angled motor connection casing that can be rotated by $4 \times 90^\circ$. A 10-pole (+ earth) male insert is used in the housing. In the plug-in connector, the winding connections are connected and optionally the power supply for the brake and the signal leads for the temperature sensors.

The ECOFAST motor connector is compatible with the products of the ECOFAST field device system. Further information can be found in Catalogue IK PI.

The mounting dimensions of this casing match those of standard industrial connectors, so it is possible to use a complete series of different standard inserts (such as Han E, ES, ESS from Harting). The motor circuit (star or delta connection) is selected in the mating connector for motor connection. The relevant jumpers are inserted by the customer in the mating connector. As a casing for the mating connector, all standard sleeve casings with lengthwise locking, frame size 10B (e.g. from Harting) can be used.

Only one sensor (temperature sensor or PTC thermistor) can be connected.

Maximum permissible line voltage on motor connector: ≤ 500 V

Availability of the ECOFAST motor connector

The ECOFAST motor connector can be supplied for the following motor versions with the exception of the explosion-proof motors:

- Frame sizes 56 M to 132 M
- Output range 0.06 to 5.5 kW (7.5 kW on request)
- Direct on-line starting: Voltage code 1 for 230 V Δ /400 VY, 50 Hz
- Star-delta starting: Voltage code **9** with order code **L1U** 400 V Δ , 50 Hz

Further information

Further information is available in the catalogues IK PI and DA 51.3 "MICROMASTER 411/COMBIMASTER 411 distributed drive solutions" as well as on the Internet at:

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

Technical specifications

The following table lists the most important technical specifications. For further information and details, see the "Introduction" section of the catalogue.

Technical specifications at a glance

Type of motor	IEC squirrel-cage motor
Connection types	Star connection/delta connection You can establish the connection type used from the Order No. supplements in the selection and ordering data for the required motor.
Number of poles	2, 4, 6, 8, pole-changing for constant load torque (pole-changing for fans, see the section "Fan motors")
Rated speed (synchronous speed)	750 ... 3000 rpm
Rated output	0.06 ... 200 kW
Rated torque	0.25 ... 1700 Nm
Insulation of the stator winding to EN 60034-1 (IEC 60034-1)	Temperature class F, used acc. to temperature class B DURIGNIT IR 2000 insulation system
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP55 as standard
Cooling according to EN 60034-6 (IEC 60034-6)	Self-cooled (motor series 1LA, 1LG) Frame sizes 63 to 315 (IC 411), Frame size 56 (IC 410) Self-cooled (motor series 1LP) Frame sizes 63 to 315 (IC 410)
Maximum ambient temperature and site altitude	-20 °C ... +40 °C as standard, site altitude 1000 mm above sea level. See "Ambient temperature and site altitude" in the section "Introduction".
Standard voltages according to EN 60038 (IEC 60038)	50 Hz: 230 V, 400 V, 500 V, 690 V The voltage used can be found in the selection and ordering data for the required motor.
Type of construction according to EN 60034-7 (IEC 60034-7):	Without flange: IM B3, IM B6, IM B7, IM B8, IM V5 without protective cover, IM V6, IM V5 with protective cover With flange: IM B5, IM V1 without protective cover, IM V1 with protective cover, IM V3, IM B35 With standard flange: IM B14, IM V19, IM V18 without protective cover, IM V18 with protective cover, IM B34 With special flange: IM B14, IM V19, IM V18 without protective cover, IM V18 with protective cover, IM B34
Paint finish Suitability of paint finish for climate group according to IEC 60721, Part 2-1	Standard: Color RAL 7030 stone gray Climate group "worldwide" with special finish Climate group "moderate" with standard finish See "Paint finish" in the "Introduction" section.
Vibration severity level according to EN 60034-14 (IEC 60034-14)	Level N (normal) See "Balance and vibration severity" in the "Introduction" section.
Shaft extension according to DIN 748 (IEC 60072)	Balance type: Half-key balancing See "Balance and vibration severity" in the "Introduction" section.
Sound pressure level to DIN EN ISO 1680 (tolerance +3dB)	The sound pressure level is listed in the selection and ordering data for the required motor.
Weights	The weight is listed in the selection and ordering data for the required motor.
Mechanical limit speeds	The limit speed for the required motor can be found on Page 5/6.
Packaging weights and dimensions	See "Packing weights and packing dimensions" in the "Introduction" section.
Rating plates	Fixed to the motor See "Rating plate" in the "Introduction" section.
Connection and connection boxes	See "Connection, circuit and connection boxes" in the "Introduction" section.
Bearing design	See "Bearings" in the "Introduction" section.
Cantilever forces	See "Maximum cantilever forces" in the "Introduction" section.
Options	See the selection and ordering data for "Special versions"

General note

All the data listed in the catalogue is applicable for a 50 Hz line supply. With converter-fed operation, the reduction factors for constant torque and drives for fans, pumps and compressors must be observed. Noise values for motors operating with a converter at frequencies other than 50 Hz are available on request.

Mechanical limit speeds

When the motor is operated at its rated frequency, it is important to note that the maximum speeds are limited by the limits for the roller bearings, critical rotor speed and rigidity of the rotating parts.

Ventilation/noise generation (converter-fed operation)

The fan noise can increase at speeds that are higher than the rated speed of self-ventilated motors. To increase motor utilisation at low speeds it is recommended that forced-air cooled motors are used.

Mechanical stress and grease lifetime (converter-fed operation)

High speeds that exceed the rated speed 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. More detailed information on request.