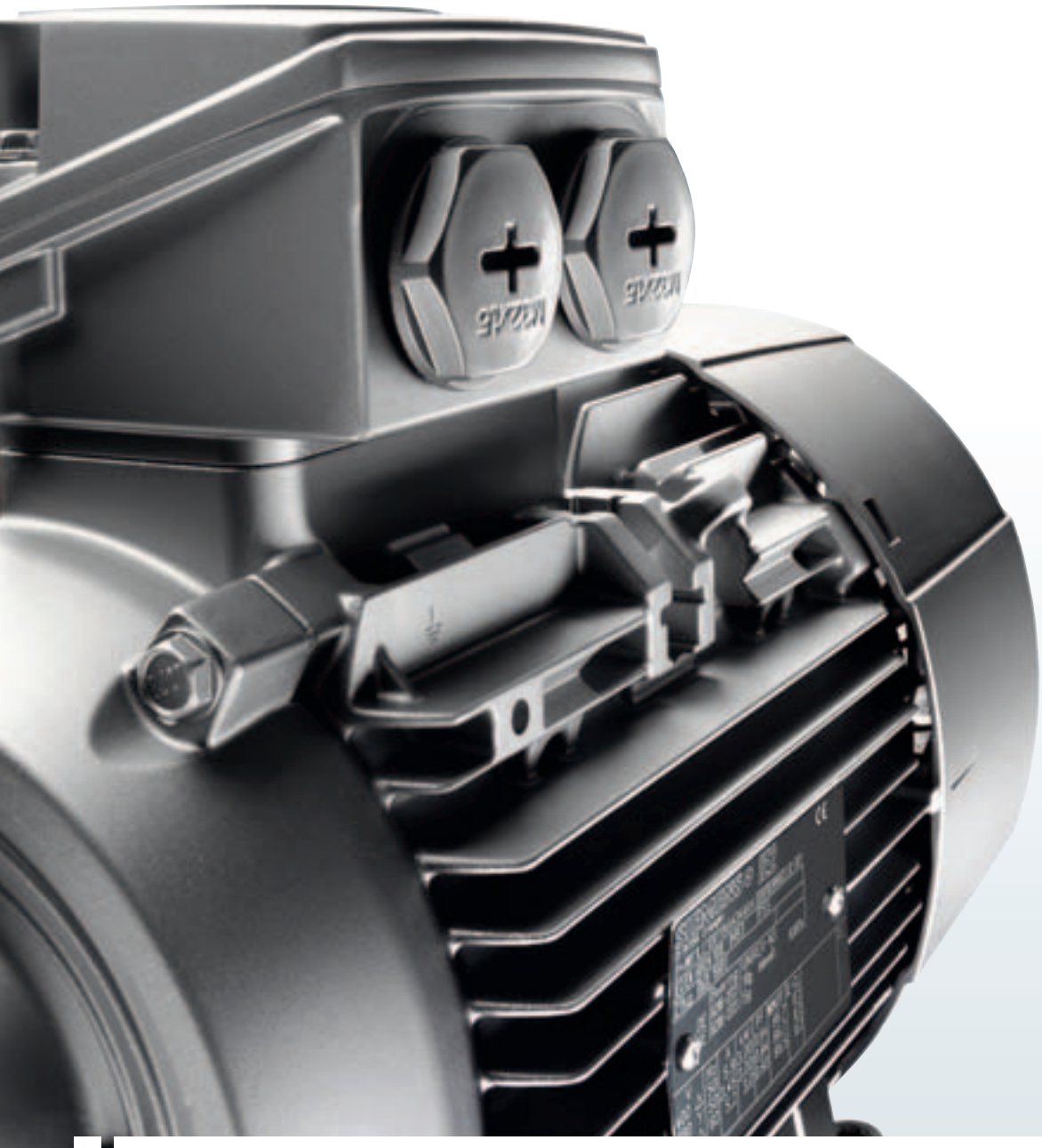
How do you take the first step towards an energy efficient future?



Low-voltage induction motors according to the new efficiency standard and new efficiency classes

Answers for industry.

SIEMENS

EU Regulation 640/2009 and IEC 60034-30
New definitions, new efficiency classes

Background

Comprehensive legislation has been passed in the European Union with the objective to reduce the energy consumption and therefore CO_2 emissions. Energy usage and the efficiency of induction motors in the industrial environment is discussed in the EU Regulation 640/2009. This regulation does apply for all countries of the European Union.

The standard IEC 60034-30:2008 defines efficiency classes for 50 and 60 Hz and stipulates, worldwide, which motors are involved and which exceptions apply. The EU Regulation is essentially based on this standard.

New nomenclature

New efficiency classes have been defined in IEC 60034-30 for induction motors (IE = International Efficiency):

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

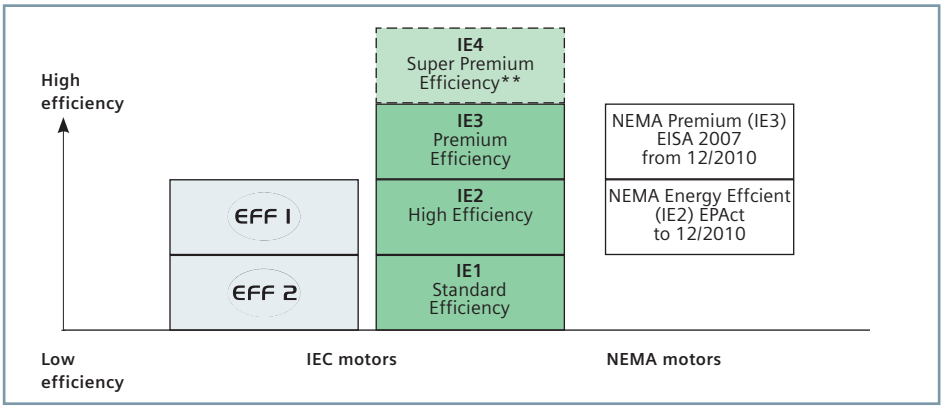
New measuring techniques to determine the efficiency

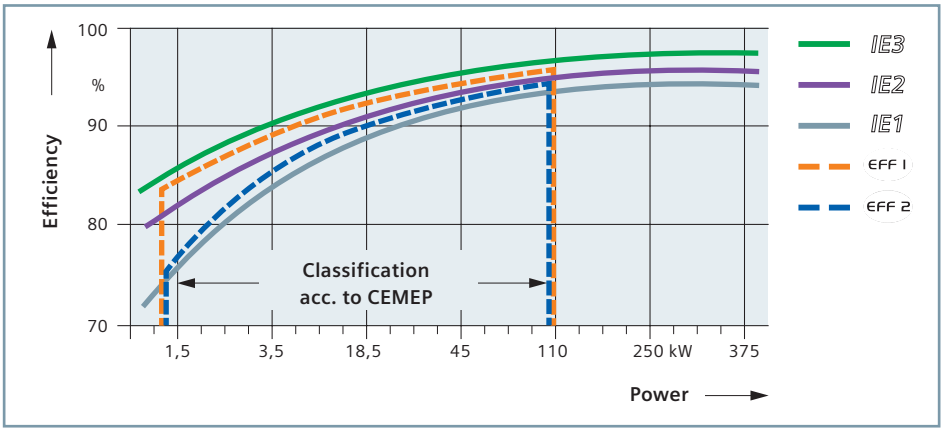
In addition to the new nomenclature, the measuring technique has also changed: With the new measuring technique IEC 60034-2-1:2007, the stray load losses are no longer assumed to be a lump sum value of 0.5%; instead, they are determined by making measurements.

This means that the nominal efficiencies decrease from EFF1 to IE2 or EFF2 to IE1 respectively, although nothing changes at the motor - neither technically nor physically.

Previously: P_{LL} = 0,5% as lump sum value
Now: P_{LL} = individual measurement
P_{LL} = load-dependent stray-load losses

The efficiencies specified in IEC 60034-30 should be determined corresponding to IEC 60034-2-1:2007. This part has been valid since November 2007 and from November 2010 onwards replaces the previous IEC 60034-2 part of the standard. What is new: the actual additional losses are now measured and are no longer added as lump sum.





As an example the efficiencies for three IE2 motors according to the new as well as the old measuring techniques are listed in the following table.

	Previous EFF measuring technique (incl. lump sum losses) EN/IEC 60034-2:1996 50 Hz	New technique to determine losses acc. to IEC 60034-2-1:2007 50 Hz	New technique to determine losses acc. to IEC 60034-2-1:2007 60 Hz
5.5 kW 4-pole	89.2 %	88.2 %	89.5 %
45 kW 4-pole	93.9 %	93.1 %	93.6 %
110 kW 4-pole	95.9 % (not defined acc. to CEMEP)	94.5 %	95.0 %

** still being coordinated

Motors involved




	CEMEP Voluntary EU Agreement	EU Regulation No 640/2009 passed 07/2009 based upon standard IEC 60034-30
Description	Voluntary agreement between the EU Commission and the European Manufacturers Association CEMEP.	The EU Regulation does apply to all EU countries. IEC 60034-2-1: 2007 is the basis for determining the losses and therefore the efficiency.
Number of poles	2, 4	2, 4, 6
Power range	1.1 – 90 kW	0.75 – 375 kW
Level	EFF3 - Standard EFF2 - Improved efficiency EFF1 - High efficiency	IE1 - Standard Efficiency IE2 - High Efficiency IE3 - Premium Efficiency
Voltage	400 V, 50 Hz	< 1000 V, 50/60 Hz
Degree of protection	IP5X	all
Motors with brake	no	no
Geared motors	no	yes
Ex motors	no	EU Regulation – NO Siemens stamps zone 2/21/22
Validity	Voluntary agreement; is withdrawn with the implementation of domestic legislation.	Standard IEC 60034-30, valid since October 2008; EU Regulation is becoming effective on 16.06.2011. This means that manufacturers may no longer market IE1 motors in the European Economic Area.

Exceptions in the EU Regulation

- Motors that have been designed so that they can be operated completely submerged in a liquid;
- Motors that are completely integrated into a product (e.g. a gear unit, a pump, a fan or a compressor) where the motor efficiency cannot be determined independently from this product;
- Motors that have been specifically designed for operation under the following conditions:

  at altitudes greater than 1000 meters above sea level;

  at ambient temperatures above 40 °C;

  at max. operating temperatures above 400 °C;

  at ambient temperatures below –15 °C (any motor)

  at cooling liquid temperatures at the product intake of below 5 °C or above 25 °C;

  in hazardous zones in the sense of Directive 94/9/EC of the European Parliament and Council;
- Brake motors

The following motors are not involved

- 8-pole motors
- Pole-changing motors
- Synchronous motors
- Motors for intermittent duty S2 ... S9
- Motors that have been specifically developed for converter operation

The changes become effective on these dates

From 16.06.2011
The legally specified minimum efficiency IE2 for induction motors in S1 duty must be maintained according to the EU regulation

From 1.1.2015:
The legally specified minimum efficiency IE3 must be maintained for power ratings **from 7.5 kW** to 375 kW or as alternative, an IE2 motor plus frequency inverter

From 1.1.2017:
The legally specified minimum efficiency IE3 must be maintained for power ratings **from 0.75 kW** up to 375 kW or as alternative, an IE2 motor plus converter

NEMA motors

The current energy legislation EPAct (Energy Policy Act) will be replaced effective 12.2010 by EISA (Energy Independence Security Act).

Currently, EPAct defines the minimum efficiency (IE2) for power ratings from 1 to 200 HP, 2/4/6-pole, voltages of 230 V and 460 V. A series of exceptions apply.

From 12.2010, EISA extends the legal minimum efficiency requirements and the following motors must fulfill the NEMA Premium Level (IE3):

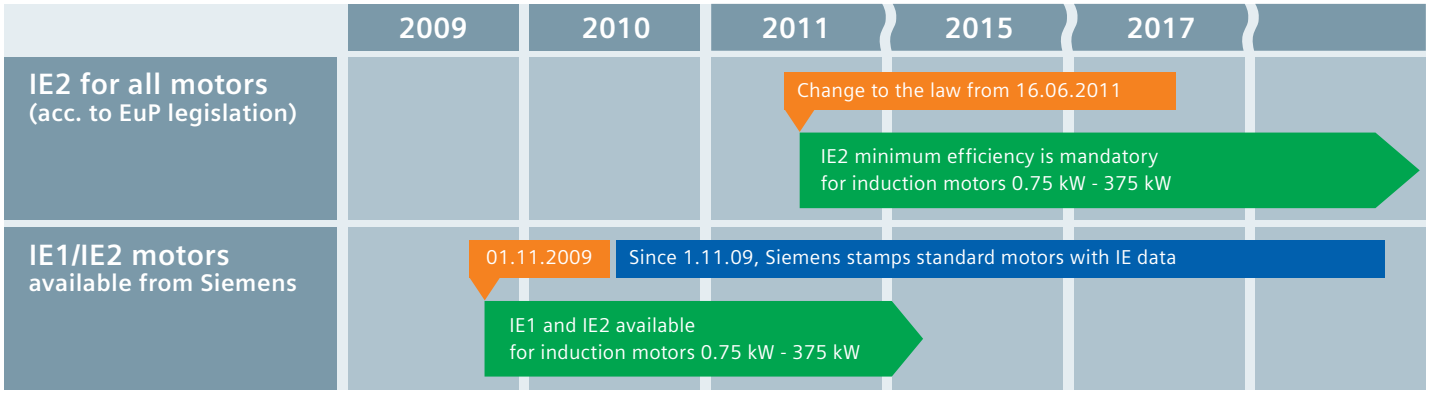
- 1-200 HP
- 2/4/6 pole
- 230 V, 460 V

Further, for instance, the following motors must comply with the NEMA Energy Efficient Level (IE2):

- 201-500 HP
- 2/4/6 and **8 pole**
- All voltages < 600 V with the exception of 230 V and 460 V
- Footless motors (IM B5)
- NEMA Design C (increased starting torque)

For details, refer to NEMA MG1, Table 12-11.

What changes?



The nominal voltage changes

With the introduction of IE specifications on the rating plate, the rated voltage (e.g. 400 VΔ / 690 VY) is stamped together with the associated efficiency. Voltage range data is eliminated (e.g. 380 - 420 VΔ). The reason for this is that the transition period for extended line supply voltage tolerances already expired worldwide back in 2007.

The rating plate changes

The technical data on the rating plate change as follows:

- **Efficiency:** The efficiencies stipulated by the standard are now specified.
- **Current:** The rated current changes as a result of the lower efficiency value.
- **Nominal voltage:** The voltage range is no longer specified, previously 380 - 420 V, new 400 V.

Changes relating to orders since 1.11.2009

Since 01.11.2009 (order entry), Siemens AG stamps all standard catalog motors, which are subject to the law, with the efficiency classification / nomenclature IE1 or IE2.

Regarding the standard, the motors will be changed over from today's EFF nomenclature to the IE nomenclature specified by law in the future (e.g. EFF2 → IE1).

Please take into account that under certain circumstances, this can result in changes in your documentation.

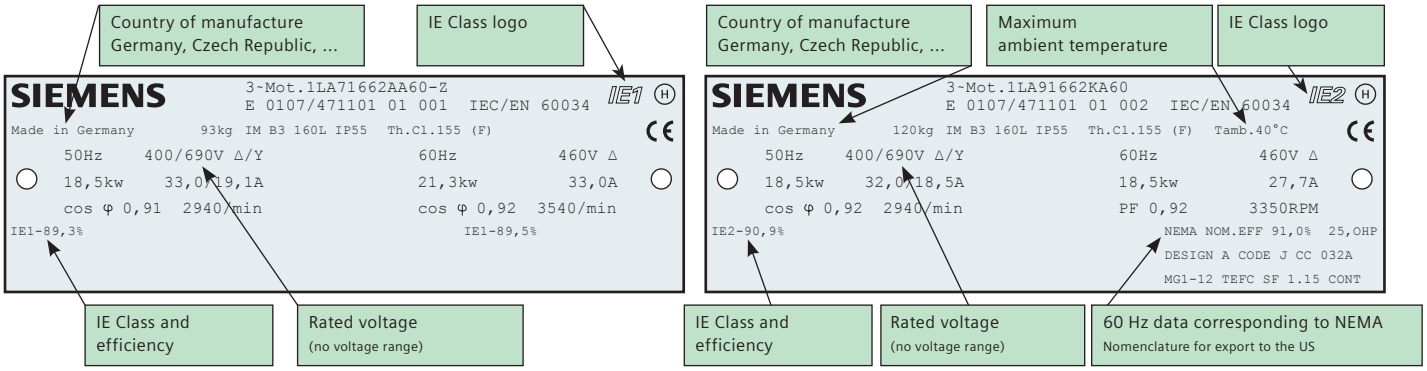
Changes on deliveries after the 16.6.2011

Siemens will not deliver IE1 motors after 16.6.2011, because from 16.6.2011 only motors with efficiency IE2 or IE3 may be marketed in the European Economic Area (EEA). Motors that are exempt from the EU regulation will be delivered on demand in IE1. Outside the EEA the national terms of delivery are valid, this means that IE1 motors may still be delivered.

Order your motors just as before using the identical Order No. as for EFF motors:

- We offer a broad spectrum of IE1 motors ex stock.
- Additionally we have already many IE2 motors ex stock available. The IE2 stock will be expanded with various motor types.

New rating plates



We can offer you an energy efficient future

By making the decision to use energy efficient drives, you can lower your energy costs and have a positive effect on the enviroment.

Analyzing the drive technology in your plant can lead to significant cost-saving potential that you may not be aware of. We can help you discover this by offering suitable tools, for example, SinaSave to calculate the payback time of drives, and also with our products – creating a secure investment in an efficient future!

Future standard – already today.

Siemens has already implemented the change over from the EFF labelling to the IE nomenclature which is to be legally specified in the future.

From **16.06.2011,** IE1 standard motors (previously EFF2) may no longer be marketed in the European Economic Area. From this date onwards, it is a legal requirement that all standard motors, which are sold into the market, must comply with the IE2 classification as a minimum.
Unless you already have a policy of purchasing EFF1 motors, this means that you must make the change to the higher class of motor from **EFF2 (IE1) to IE2** at the latest by 16.06.2011. For projects with longer run times, the changeover to IE2 must already have been completed by this date. Please note, the motor types, weights, dimensions etc will change.

Take the first step:
Effective immediately, you can help to protect the environment by using IE2 motors and in the process save energy and cost.

With Siemens, you are optimally equipped for the future. We can help you to ensure that your company makes the changeover on time.

Simply talk to your Siemens contact partner in your region.

Plan today with the higher class IE2 motor.

In addition to the catalog motors, we offer motors in IE1 and IE2 ex stock. This means that IE2 motors are available with short delivery times.

IE3 motors are available by catalog or on request at any time.

Customer-specific motors must be checked to determine whether or not they must be changed over to IE2.

All this means that you are already equipped for the future today: Use IE2 motors and reduce your costs.

Comparison of IE1 and IE2 motor types?

Motor IE1 (previously EFF2)	Frame size	Changeover to IE2 (previously EFF1)
1LA7	80 - 90	1LA9
1LA7/1LE1002	100 - 160	1LE1001
1LA5	180 - 200	1LA9
1LA5	225	1LG6
1LG4	180 - 315	1LG6
1LA8	315 - 355	1LA8 (the motors already fulfill IE2 today)
Ex motors: zones 2, 21 + 22, type of protection n or dust explosion protection	80 - 315	Minimum efficiency IE2 according to EU Regulation is not specified. However, Siemens will mark all frame sizes corresponding to the IE standard.
Ex motors zone 1, types of explosion protection d and e	80 - 315	Minimum efficiencies acc. to EU Regulation are not specified. Loher labels all frame sizes corresponding to the standard with IE.

A concept with future.

The second level of the EU regulation becomes effective in 2015 to replace inefficient process controls e.g. throttle valves by energy-saving solutions. Applications with frequency converter may still be operated with IE2 motors. Only motors which are operated directly at the mains supply must be designed in IE3. Therefore check now whether you use the future concept with an IE2 motor plus frequency converter already today.

Additional information

International Efficiency information
www.siemens.com/international-efficiency

Energy-efficient drives
www.siemens.com/energysaving

Payback calculator
www.siemens.com/sinasave

Configurator for drives
www.siemens.com/dt-configurator

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