



New Efficiency Classes- IE Codes.

Saving energy has become worldwide increasingly important, so that the homogeneity of a universal system for efficiency classification of low voltage three-phase asynchronous motors was necessary.

In March 2009, CENELEC (European Committee for Electrotechnical Standardization) which consists of EU countries members with the addition of Iceland, Norway and Switzerland has therefore in this respect implemented the new International Standard **IEC 60034-30:2008** "Rotating electrical machines- Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE Code) " by issuing EN 60034-30:2008.

Standard IEC 60034-30

IT COVERS 50 Hz and 60 Hz single-speed three-phase cage-induction motors that

- › have a rated voltage UN up to 1000V
- › have a rated output PN between 0.75 kW and 375 kW
- › have either 2, 4 or 6 poles
- › are rated on the basis of either duty type S1 (continuous duty) or S3 (intermittent periodic duty) with a rated cyclic duration factor $\geq 80\%$
- › are capable of operating direct on-line
- › are rated for operating conditions in accordance with IEC 60034-1, Clause 6

Moreover, this standard also covers:

- Motors with flanges, feet and/or shafts with mechanical dimensions different from IEC 60072-1
- Geared motors and brake motors, although special flanges or special shafts may be used in such motors.

The following motors are **EXCLUDED**:

- › 8 poles motors
- › motors made solely for converter operation in accordance with IEC 60034-25
- › motors completely integrated into a machine that cannot be tested separately from the machine.

This standard establishes **the new international efficiency classes** for three-phase asynchronous motors in:

IE1 = STANDARD

IE2= HIGH

IE3 = PREMIUM

IE4 = SUPER PREMIUM (this class is currently under consideration)

Efficiency levels in accordance with IEC 60034-30 must be measured applying the method specified in IEC 60034-2-1: direct or indirect.

To determine the efficiency level Cima Spa applies the direct method.

IEC 60034-30 Standard fixes only the requirements regarding efficiency classes, establishing internationally shared measures. Therefore it does not have legislative power and it does not define which motors have to be supplied and their according efficiency level: this is sanctioned by the single legislations in force in the different countries.

US Department of Energy established that starting from 19/12/2010 NEMA (National Electric Manufacturers Association) Premium requirement becomes the minimum energy-efficiency performance standard for United States motors. In order to obtain this certification, manufacturers will have to have their products tested by accredited laboratories.

Instead, the situation is different in EU countries, since it is the manufacturer's responsibility to comply with the established standards. A third party certification is not compulsory; however, government agencies will carry out sporadic inspections. In case any device is not in compliance with the prescribed and declared efficiency levels, the manufacturer will be forced to withdraw it from the market at his expense.





EuP EUROPEAN DIRECTIVE

Through Directive 2005/32 EC, European Parliament established a framework for the setting of eco-design requirements to be fulfilled by energy-using products, specifying the efficiency levels machines sold on European market will have to reach.

IT COVERS motors defined by IEC 60034-30 and sanctions the obligation to put high efficiency motors on the market according to these dates:

- IE2 Class from June 16th 2011
- IE3 Class (or IE2 with variable speed drive) from January 1st 2015 for motors with a rated output of 7.5 kW up to 375 kW
- IE3 Class (or IE2 with variable speed drive) from January 1st 2017 for motors with a rated output of 0.75 kW up to 375 kW

IT DOES NOT COVER:

- Motors designed to operate wholly immersed in a liquid
- Motors with duty different from S1 or S3 $\geq 80\%$
- Motors completely integrated into another product
- Motors designed for applications in special conditions :
 - Altitude > 1000m
 - Ambient temperature > 40°C
 - Maximum operating temperature > 400°C
 - Ambient temperature < -15°C or < 0°C for air cooled motors
 - Cooling water temperature at product input < 5°C or > 25°C
 - Brake motors
 - Motors on board (street, rails, water)
 - Safety motors in compliance to Directive ATEX 94/9/EC

Summary table of IE Efficiency levels as prescribed in Standard IEC 60034-30

Efficiency level	Efficiency class IEC 60034-30	Uncertainty as per test standard IEC 60034-2-1	Countries that adopt performance standards' normatives	Date of entry into force of the standard
Premium	IE3	Low uncertainty	USA	2011
			Europe	2015/2017*
High	IE2	Low uncertainty	USA	In force
			Canada	In force
			Mexico	In force
			Australia	In force
			New Zealand	In force
			Brazil	In force
			China	2011
			Europe	2011*
			Switzerland	2012

*Timing for the entry into force of the efficiency level in the EU:

- **From June 16th 2011** all motors with rated output PN between 0.75 kW and 375 kW shall comply with IE2 efficiency class
- **From January 1st 2015** motors with rated power PN between 7.5 kW and 375 kW shall not have an efficiency level lower than what prescribed by IE2 class and shall be equipped with variable speed drive
- **From January 1st 2017** motors with rated power PN between 7.5 kW and 375 kW shall not have an efficiency level lower than what prescribed by IE3 or they shall comply with IE2 class requirements and equipped with variable speed drive





Summary table of Standard IEC 60034-30 and EuP Directive 2005/32/EC application fields		
Motor type	Standard IEC 60034-30	EuP 2005/32/EC
Standard motors 2, 4, 6 poles from 0.75 kW up to 375 kW S1 IP1x up to IP6x	YES	YES
Standard motors with devices (gearbox, encoder...)	YES (Measures without devices)	YES (Measures without devices)
High temperature smoke extraction motors $\leq 400^{\circ}\text{C}$	YES	YES
Motors for gearboxes	YES	YES
ATEX, brake motors 2, 4, 6 poles, from 0.75 kW up to 375 kW S1 IP4X, 5X, 6X	YES (measures without devices)	NO
Motors on board for refrigeration	YES	NO
Motors with short time duty S2 or intermittent duty S3, S4...	NO	NO
Special motors for speed variators (multi-speed,...)	NO	NO
Motors completely integrated into another product that cannot be tested separately	NO	NO

The standard prescribes that motor efficiency class (IE1 or IE2 or IE3), rated output and efficiency value with full load efficiency at 100%, 75% of load and 50% of load are always mentioned on the plate data.

Here below is an example for a plate that CIMA SpA applies on its motors: the legend describes the parameters and values mentioned on the plate.

MOTOR PLATE

LEGEND

CIMA MOTORIELETTRICI SpA CREAZZO VICENZA (ITALY)
TEL. 0444/341220 FAX 0444/341223 www.cimamotori.com
ASYNCHRONOUS MOTOR 3 - PHASE

IE2

Type CODE

kW Poles Duty IP

Ins. CL.

CE

	Volt Δ	A	rpm	Cos. ϕ	Hz
Δ	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Y	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Δ	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Y	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

η 100% η 75% η 50%

N° YEAR ISO 9001

MADE IN ITALY IEC 60034-1 CERTIFICATE N°029/01/5

- TYPE** motor construction class
- CODE** motor code
- kW** motor output power
- POLES** Poles' number
- DUTY** Operating duty
- IP** Protection degree
- Ins. CL.** Insulation class
- Volt Δ** rated voltage delta connection
- Volt Y** rated voltage star connection
- A** rated current
- Rpm** number of rounds
- Cos Φ** power factor
- Hz** rated frequency
- η 100%** full load efficiency
- η 75%** 3/4 load efficiency
- η 50%** 1/2 load efficiency
- N°** motor serial number
- YEAR** year of construction of the motor





Table of efficiency values at 50 Hz

Pn in kW	Efficiency Level HIGH IE2			Efficiency Level PREMIUM IE3		
	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	77,4	79,6	75,9	80,7	82,5	78,9
1,1	79,6	81,4	78,1	82,7	84,1	81,0
1,5	81,3	82,8	79,8	84,2	85,3	82,5
2,2	83,2	84,3	81,8	85,9	86,7	84,3
3	84,6	85,5	83,3	87,1	87,7	85,6
4	85,8	86,6	84,6	88,1	88,6	86,8
5,5	87,0	87,7	86,0	89,2	89,6	88,0
7,5	88,1	88,7	87,2	90,1	90,4	89,1
11	89,4	89,8	88,7	91,2	91,4	90,3
15	90,3	90,6	89,7	91,9	92,1	91,2
18,5	90,9	91,2	90,4	92,4	92,6	91,7
22	91,3	91,6	90,9	92,7	93,0	92,2
30	92,0	92,3	91,7	93,3	93,6	92,9
37	92,5	92,7	92,2	93,7	93,9	93,3
45	92,9	93,1	92,7	94,0	94,2	93,7

Table of efficiency at 60 Hz

Pn in kW	Efficiency Level HIGH IE2			Efficiency Level PREMIUM IE3		
	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	75,5	82,5	80,0	77,0	85,5	82,5
1,1	82,5	84,0	85,5	84,0	86,5	87,5
1,5	84,0	84,0	86,5	85,5	86,5	88,5
2,2	85,5	87,5	87,5	86,5	89,5	89,5
3,7	87,5	87,5	87,5	88,5	89,5	89,5
5,5	88,5	89,5	89,5	89,5	91,7	91,0
7,5	89,5	89,5	89,5	90,2	91,7	91,0
11	90,2	91,0	90,2	91,0	92,4	91,7
15	90,2	91,0	90,2	91,0	93,0	91,7
18,5	91,0	92,4	91,7	91,7	93,6	93,0
22	91,0	92,4	91,7	91,7	93,6	93,0
30	91,7	93,0	93,0	92,4	94,1	94,1
37	92,4	93,0	93,0	93,0	94,5	94,1
45	93,0	93,6	93,6	93,6	95,0	94,5

