Technical note
IEC 60034-30 standard on efficiency classes for low voltage AC motors

The International Electrotechnical Commission has introduced a new standards relating to energy efficient motors.
IEC 60034-30 defines new efficiency classes for motors and harmonizes the currently different requirements for induction motor efficiency levels around the world. It will hopefully put an end to the difficulties encountered by manufacturers producing motors for the global market. Motor users will benefit through the availability of more transparent and easier to understand information.

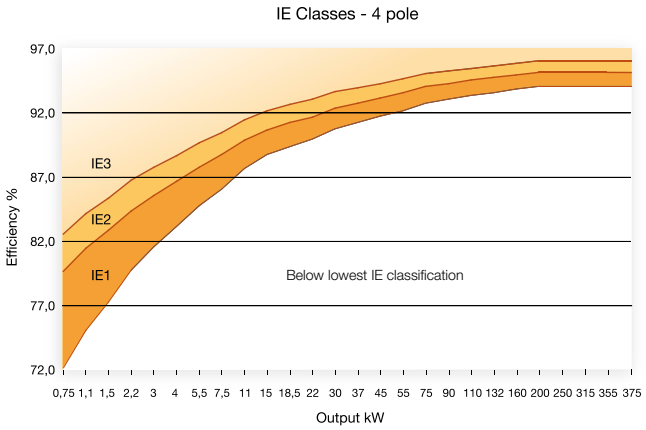
What are the new efficiency classes defined by IEC 60034-30: 2008?

The new standard defines three IE (International Efficiency) efficiency classes for single-speed, three phase, cage induction motors.

Premium efficiency	IE3	Premium
High efficiency	IE2	Comparable to EFF1
Standard efficiency	IE1	Comparable to EFF2

The standard also introduces IE4 (Super Premium Efficiency), a future level above IE3. IE4 products are not yet commercially available.

IE efficiency classes for 4-pole motors at 50 Hz



What motors are covered by the standard?

The scope of the new standard is wider than that of the agreement previously in force in Europe. IEC 60034-30 covers almost all motors (for example standard, hazardous area, marine, brake motors):

- Single-speed, three-phase, 50 and 60 Hz
- 2, 4 or 6-pole
- Rated output from 0.75 to 375 kW
- Rated voltage U_N up to 1000 V
- Duty type S1 (continuous duty) or S3 (intermittent periodic duty) with a rated cyclic duration factor of 80% or higher
- Capable of operating direct online 50 and 60 Hz

The following motors are excluded from IEC60034-30

- Motors made solely for converter operation
- Motors completely integrated into a machine (for example, pump, fan or compressor) that cannot be tested separately from the machine.

What is the new classification based on?

The efficiency levels defined in IEC 60034-30 are based on test methods specified in IEC 60034-2-1: 2007 with low uncertainty for IE2 and IE3. The methods with IEC 60034-2-1 determine efficiency values more accurately than the methods previously used.

Table 1 Table with efficiency classes: IE 60034-30 (2008)

kW	HP	IE-1 - Standard efficiency						IE2 - High efficiency						IE3 - Premium efficiency					
		2 pole		4 pole		6 pole		2 pole		4 pole		6 pole		2 pole		4 pole		6 pole	
		50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
0.75	1	72.1	77.0	72.1	78.0	70.0	73.0	77.4	75.5	79.6	82.5	75.9	80.0	80.7	77.0	82.5	85.5	78.9	82.5
1.1	1.5	75.0	78.5	75.0	79.0	72.9	75.0	79.6	82.5	81.4	84.0	78.1	85.5	82.7	84.0	84.1	86.5	81.0	87.5
1.5	2	77.2	81.0	77.2	81.5	75.2	77.0	81.3	84.0	82.8	84.0	79.8	86.5	84.2	85.5	85.3	86.5	82.5	88.5
2.2	3	79.7	81.5	79.7	83.0	77.7	78.5	83.2	85.5	84.3	87.5	81.8	87.5	85.9	86.5	86.7	89.5	84.3	89.5
3		81.5	–	81.5	–	79.7	–	84.6	–	85.5	–	83.3	–	87.1	–	87.7	–	85.6	–
3.7	5	–	84.5	–	85.0	–	83.5	–	87.5	–	87.5	–	87.5	–	88.5	–	89.5	–	89.5
4		83.1	–	83.1	–	81.4		85.8	–	86.6	–	84.6	–	88.1	–	88.6	–	86.8	–
5.5	7.5	84.7	86.0	84.7	87.0	83.1	85.0	87.0	88.5	87.7	89.5	86.0	89.5	89.2	89.5	89.6	91.7	88.0	91.0
7.5	10	86.0	87.5	86.0	87.5	84.7	86.0	88.1	89.5	88.7	89.5	87.2	89.5	90.1	90.2	90.4	91.7	89.1	91.0
11	15	87.6	87.5	87.6	88.5	86.4	89.0	89.4	90.2	89.8	91.0	88.7	90.2	91.2	91.0	91.4	92.4	90.3	91.7
15	20	88.7	88.5	88.7	89.5	87.7	89.5	90.3	90.2	90.6	91.0	89.7	90.2	91.9	91.0	92.1	93.0	91.2	91.7
18.5	25	89.3	89.5	89.3	90.5	88.6	90.2	90.9	91.0	91.2	92.4	90.4	91.7	92.4	91.7	92.6	93.6	91.7	93.0
22	30	89.9	89.5	89.9	91.0	89.2	91.0	91.3	91.0	91.6	92.4	90.9	91.7	92.7	91.7	93.0	93.6	92.2	93.0
30	40	90.7	90.2	90.7	91.7	90.2	91.7	92.0	91.7	92.3	93.0	91.7	93.0	93.3	92.4	93.6	94.1	92.9	94.1
37	50	91.2	91.5	91.2	92.4	90.8	91.7	92.5	92.4	92.7	93.0	92.2	93.0	93.7	93.0	93.9	94.5	93.3	94.1
45	60	91.7	91.7	91.7	93.0	91.4	91.7	92.9	93.0	93.1	93.6	92.7	93.6	94.0	93.6	94.2	95.0	93.7	94.5
55	75	92.1	92.4	92.1	93.0	91.9	92.1	93.2	93.0	93.5	94.1	93.1	93.6	94.3	93.6	94.6	95.4	94.1	94.5
75	100	92.7	93.0	92.7	93.2	92.6	93.0	93.8	93.6	94.0	94.5	93.7	94.1	94.7	94.1	95.0	95.4	94.6	95.0
90	125	93.0	93.0	93.0	93.2	92.9	93.0	94.1	94.5	94.2	94.5	94.0	94.1	95.0	95.0	95.2	95.4	94.9	95.0
110	150	93.3	93.0	93.3	93.5	93.3	94.1	94.3	94.5	94.5	95.0	94.3	95.0	95.2	95.0	95.4	95.8	95.1	95.8
132		93.5		93.5	–	93.5	–	94.6	–	94.7	–	94.6	–	95.4		95.6	–	95.4	–
150	200	–	94.1	–	94.5	–	94.1	–	95.0	–	95.0	–	95.0	–	95.4	–	96.2		95.8
160		93.8		93.8	–	93.8	–	94.8	–	94.9	–	94.8	–	95.6	–	95.8	–	95.6	–
185	250	–	94.1	–	94.5	–	94.1	–	95.4	–	95.4	–	95.0	–	95.8	–	96.2	–	95.8
200		94.0	–	94.0	–	94.0	–	95.0	–	95.1	–	95.0	–	95.8	–	96.0	–	95.8	–
220	300	94.0	94.1	94.0	94.5	94.0	94.1	95.0	95.4	95.1	95.4	95.0	95.0	95.8	95.8	96.0	96.2	95.8	95.8
250	350	94.0	94.1	94.0	94.5	94.0	94.1	95.0	95.4	95.1	95.4	95.0	95.0	95.8	95.8	96.0	96.2	95.8	95.8
300	400	94.0	94.1	94.0	94.5	94.0	94.1	95.0	95.4	95.1	95.4	95.0	95.0	95.8	95.8	96.0	96.2	95.8	95.8
330	450	94.0	94.1	94.0	94.5	94.0	94.1	95.0	95.4	95.1	95.4	95.0	95.0	95.8	95.8	96.0	96.2	95.8	95.8
375	500	94.0	94.1	94.0	94.5	94.0	94.1	95.0	95.4	95.1	95.4	95.0	95.0	95.8	95.8	96.0	96.2	95.8	95.8

The resulting efficiency values differ from those obtained under the previous IEC testing standard, IEC 60034-2: 1996, which generally gave higher overall efficiency values as the estimated additional losses were too low.

Manufacturers documentation must show how the efficiency values are determined. Efficiency values can only be compared if they are based on the same testing method.

What are the threshold levels of the motor efficiency classes?

Table 1 above shows the threshold levels of the motor efficiency classes for two-, four- and six-pole motors between 0.75 and 375 kW (50 and 60 Hz).

How is the IE class marked?

The lowest efficiency value and the associated IE-code of the motor are shown on the rating plate.

How is IEC60034-30 compatible with other efficiency standards?

Differences still exist between the various standards. The new IEC standard harmonizes the currently different requirements for induction motor efficiency levels around the world, however, making the comparison easier. Work to harmonize standards continues.

Table 2 below shows a rough comparison between IEC60034-30 and other efficiency schemes.

The IEC60034-30 only defines the requirements for the efficiency classes and aims to create a basis for International consistency. It does not specify which motors must be supplied with which efficiency level. This is left to the respective regional legislation and European Directive. Each country will be advised to adopt the minimum efficiency levels compatible with EU Directive as a way to assure availability of the most efficient motors for users.

Table 2

IEC60034-30 EuP Directive 2005/32/EC	Europe (50Hz) CEMEP voluntary agreement	US (60Hz) EPAct	Others Similar local regulations for example in countries like;
IE1 Standard efficiency	Comparable to EFF2	Below standard efficiency	AS in Australia NBR in Brazil GB/T in China IS in India JIS in Japan MEPS in Korea
IE2 High efficiency	Comparable to EFF1	Identical to NEMA Energy efficiency / EPACT	
IE3 Premium efficiency	Extrapolated IE2 with 10 to 15% lower losses	Identical to NEMA Premium efficiency	

How does ABB apply the new standard?

- ABB has calculated the efficiency values under the efficiency testing standard (IEC60034-2-1: 2007) according to the indirect method, with additional losses determined from measuring.
- ABB supplies a full range of motors in class IE2. Also Premium efficiency motors in class IE3 are available.

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