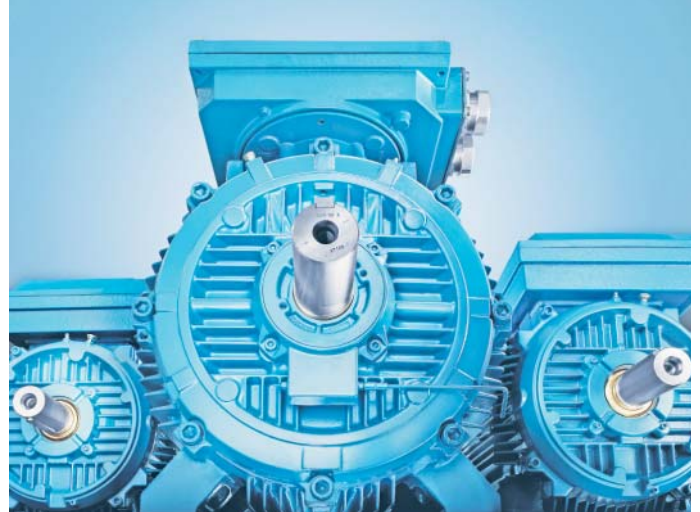


Technical note

IEC 60034-30-1 standard on efficiency classes for low voltage AC motors

Standard IEC/EN 60034-30-1 on efficiency classes of line operated AC motors was published by the International Electrotechnical Commission (IEC) on March 6, 2014. This IEC standard is concerned with the global harmonization of energy efficiency classes for electric motors. Compared with IEC/EN 60034-30: 2008, it significantly expands the range of products covered with the inclusion of 8-pole motors and introduces IE4 efficiency performance class for electric motors. All technical constructions of motors are covered as long as they are rated for direct on-line operation. Whereas the previous edition covered only three-phase products, the new standard also includes single-phase motors, as well as line-start permanent magnet motors.

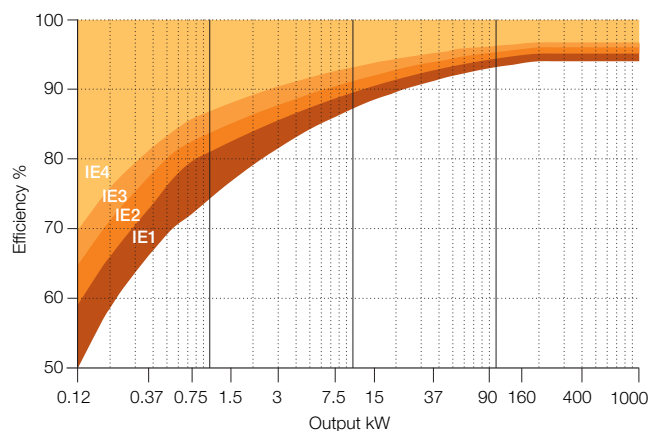


What are the efficiency classes defined by IEC/EN 60034-30-1: 2014?

The standard defines four IE (International Efficiency) efficiency classes for single speed electric motors that are rated according to IEC 60034-1 or IEC 60079-0 (explosive atmospheres) and designed for operation on sinusoidal voltage.

| | |
|--------------------------|-----|
| Super-Premium efficiency | IE4 |
| Premium efficiency | IE3 |
| High efficiency | IE2 |
| Standard efficiency | IE1 |

IE efficiency classes for 4 pole motors at 50 Hz



An IE5 level is envisaged for a future revision, with the goal of further reducing losses by some 20% relative to IE4.

What motors are covered by the standard?

The new standard covers a wider scope of products. The power range has been expanded to cover motors from 120 W to 1000 kW. All technical constructions of electric motors are covered as long as they are rated for direct on-line operation. The coverage of the new standard includes:

- Single speed electric motors (single and three phase), 50 and 60 Hz
- 2, 4, 6 or 8 poles
- Rated output P_N from 0.12 kW to 1000 kW
- Rated voltage U_N above 50 V up to 1 kV
- Motors, capable of continuous operation at their rated power with a temperature rise within the specified insulation temperature class
- Motors, marked with any ambient temperature within the range of -20 °C to +60 °C
- Motors, marked with an altitude up to 4000 m above sea level

The following motors are excluded from IEC/EN 60034-30-1

- Single-speed motors with 10 or more poles or multi-speed motors
- Motors completely integrated into a machine (for example, pump, fan or compressor) that cannot be tested separately from the machine.
- Brake motors, when the brake can not be dismantled or separately fed.

What is the classification based on?

The efficiency levels defined in IEC/EN 60034-30-1 are based on the low uncertainty test methods specified in IEC 60034-2-1, which has been updated to edition 2.0, 2014-06.

Table 1

Minimum 50 Hz efficiency values defined in IEC/EN 60034-30-1:2014 (based on test methods specified in IEC 60034-2-1:2014)

| Output kW | IE1 | | | | IE2 | | | | IE3 | | | | IE4 | | | |
|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 2 pole | 4 pole | 6 pole | 8 pole | 2 pole | 4 pole | 6 pole | 8 pole | 2 pole | 4 pole | 6 pole | 8 pole | 2 pole | 4 pole | 6 pole | 8 pole |
| 0.12 | 45.0 | 50.0 | 38.3 | 31.0 | 53.6 | 59.1 | 50.6 | 39.8 | 60.8 | 64.8 | 57.7 | 50.7 | 66.5 | 69.8 | 64.9 | 62.3 |
| 0.18 | 52.8 | 57.0 | 45.5 | 38.0 | 60.4 | 64.7 | 56.6 | 45.9 | 65.9 | 69.9 | 63.9 | 58.7 | 70.8 | 74.7 | 70.1 | 67.2 |
| 0.20 | 54.6 | 58.5 | 47.6 | 39.7 | 61.9 | 65.9 | 58.2 | 47.4 | 67.2 | 71.1 | 65.4 | 60.6 | 71.9 | 75.8 | 71.4 | 68.4 |
| 0.25 | 58.2 | 61.5 | 52.1 | 43.4 | 64.8 | 68.5 | 61.6 | 50.6 | 69.7 | 73.5 | 68.6 | 64.1 | 74.3 | 77.9 | 74.1 | 70.8 |
| 0.37 | 63.9 | 66.0 | 59.7 | 49.7 | 69.5 | 72.7 | 67.6 | 56.1 | 73.8 | 77.3 | 73.5 | 69.3 | 78.1 | 81.1 | 78.0 | 74.3 |
| 0.40 | 64.9 | 66.8 | 61.1 | 50.9 | 70.4 | 73.5 | 68.8 | 57.2 | 74.6 | 78.0 | 74.4 | 70.1 | 78.9 | 81.7 | 78.7 | 74.9 |
| 0.55 | 69.0 | 70.0 | 65.8 | 56.1 | 74.1 | 77.1 | 73.1 | 61.7 | 77.8 | 80.8 | 77.2 | 73.0 | 81.5 | 83.9 | 80.9 | 77.0 |
| 075 | 72.1 | 72.1 | 70.0 | 61.2 | 77.4 | 79.6 | 75.9 | 66.2 | 80.7 | 82.5 | 78.9 | 75.0 | 83.5 | 85.7 | 82.7 | 78.4 |
| 1.1 | 75.0 | 75.0 | 72.9 | 66.5 | 79.6 | 81.4 | 78.1 | 70.8 | 82.7 | 84.1 | 81.0 | 77.7 | 85.2 | 87.2 | 84.5 | 80.8 |
| 1.5 | 77.2 | 77.2 | 75.2 | 70.2 | 81.3 | 82.8 | 79.8 | 74.1 | 84.2 | 85.3 | 82.5 | 79.7 | 86.5 | 88.2 | 85.9 | 82.6 |
| 2.2 | 79.7 | 79.7 | 77.7 | 74.2 | 83.2 | 84.3 | 81.8 | 77.6 | 85.9 | 86.7 | 84.3 | 81.9 | 88.0 | 89.5 | 87.4 | 84.5 |
| 3 | 81.5 | 81.5 | 79.7 | 77.0 | 84.6 | 85.5 | 83.3 | 80.0 | 87.1 | 87.7 | 85.6 | 83.5 | 89.1 | 90.4 | 88.6 | 85.9 |
| 4 | 83.1 | 83.1 | 81.4 | 79.2 | 85.8 | 86.6 | 84.6 | 81.9 | 88.1 | 88.6 | 86.8 | 84.8 | 90.0 | 91.1 | 89.5 | 87.1 |
| 5.5 | 84.7 | 84.7 | 83.1 | 81.4 | 87.0 | 87.7 | 86.0 | 83.8 | 89.2 | 89.6 | 88.0 | 86.2 | 90.9 | 91.9 | 90.5 | 88.3 |
| 7.5 | 86.0 | 86.0 | 84.7 | 83.1 | 88.1 | 88.7 | 87.2 | 85.3 | 90.1 | 90.4 | 89.1 | 87.3 | 91.7 | 92.6 | 91.3 | 89.3 |
| 11 | 87.6 | 87.6 | 86.4 | 85.0 | 89.4 | 89.8 | 88.7 | 86.9 | 91.2 | 91.4 | 90.3 | 88.6 | 92.6 | 93.3 | 92.3 | 90.4 |
| 15 | 88.7 | 88.7 | 87.7 | 86.2 | 90.3 | 90.6 | 89.7 | 88.0 | 91.9 | 92.1 | 91.2 | 89.6 | 93.3 | 93.9 | 92.9 | 91.2 |
| 18.5 | 89.3 | 89.3 | 88.6 | 86.9 | 90.9 | 91.2 | 90.4 | 88.6 | 92.4 | 92.6 | 91.7 | 90.1 | 93.7 | 94.2 | 93.4 | 91.7 |
| 22 | 89.9 | 89.9 | 89.2 | 87.4 | 91.3 | 91.6 | 90.9 | 89.1 | 92.7 | 93.0 | 92.2 | 90.6 | 94.0 | 94.5 | 93.7 | 92.1 |
| 30 | 90.7 | 90.7 | 90.2 | 88.3 | 92.0 | 92.3 | 91.7 | 89.8 | 93.3 | 93.6 | 92.9 | 91.3 | 94.5 | 94.9 | 94.2 | 92.7 |
| 37 | 91.2 | 91.2 | 90.8 | 88.8 | 92.5 | 92.7 | 92.2 | 90.3 | 93.7 | 93.9 | 93.3 | 91.8 | 94.8 | 95.2 | 94.5 | 93.1 |
| 45 | 91.7 | 91.7 | 91.4 | 89.2 | 92.9 | 93.1 | 92.7 | 90.7 | 94.0 | 94.2 | 93.7 | 92.2 | 95.0 | 95.4 | 94.8 | 93.4 |
| 55 | 92.1 | 92.1 | 91.9 | 89.7 | 93.2 | 93.5 | 93.1 | 91.0 | 94.3 | 94.6 | 94.1 | 92.5 | 95.3 | 95.7 | 95.1 | 93.7 |
| 75 | 92.7 | 92.7 | 92.6 | 90.3 | 93.8 | 94.0 | 93.7 | 91.6 | 94.7 | 95.0 | 94.6 | 93.1 | 95.6 | 96.0 | 95.4 | 94.2 |
| 90 | 93.0 | 93.0 | 92.9 | 90.7 | 94.1 | 94.2 | 94.0 | 91.9 | 95.0 | 95.2 | 94.9 | 93.4 | 95.8 | 96.1 | 95.6 | 94.4 |
| 110 | 93.3 | 93.3 | 93.3 | 91.1 | 94.3 | 94.5 | 94.3 | 92.3 | 95.2 | 95.4 | 95.1 | 93.7 | 96.0 | 96.3 | 95.8 | 94.7 |
| 132 | 93.5 | 93.5 | 93.5 | 91.5 | 94.6 | 94.7 | 94.6 | 92.6 | 95.4 | 95.6 | 95.4 | 94.0 | 96.2 | 96.4 | 96.0 | 94.9 |
| 160 | 93.8 | 93.8 | 93.8 | 91.9 | 94.8 | 94.9 | 94.8 | 93.0 | 95.6 | 95.8 | 95.6 | 94.3 | 96.3 | 96.6 | 96.2 | 95.1 |
| 200 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.3 | 95.4 |
| 250 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.5 | 95.4 |
| 315 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.6 | 95.4 |
| 355 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.6 | 95.4 |
| 400 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.6 | 95.4 |
| 450 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.6 | 95.4 |
| 500-1000 | 94.0 | 94.0 | 94.0 | 92.5 | 95.0 | 95.1 | 95.0 | 93.5 | 95.8 | 96.0 | 95.8 | 94.6 | 96.5 | 96.7 | 96.6 | 95.4 |

TM025 EN 08-2014

The manufacturer's 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 2, 4, 6 and 8 pole motors between 0.12 and 1000 kW at 50 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 IEC/EN 60034-30-1 compatible with other efficiency standards?

Differences still exist between the various standards. The 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 IEC/EN 60034-30-1 and main national MEPS schemes world wide.

The IEC/EN 60034-30-1 defines only 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 EU Directive. Each country will be advised to adopt the minimum efficiency levels compatible with the EU Directive as a way to assure availability of the most efficient motors for users.

Table 2

| IEC/EN 60034-30-1 | EU MEPS | EISA US EEV Canada | Other, similar local regulations |
|------------------------------------|------------------------------|--|---|
| IE4 Super-Premium efficiency | | | |
| IE3 Premium efficiency | IE3 Premium efficiency | Identical to NEMA Premium efficiency | Japan 2015 Australia/New Zealand 2015 Korea 2015 China 2016 |
| IE2 High efficiency | IE2 High efficiency | Identical to NEMA Energy efficiency/ EPACT | Canada Mexico Australia New Zealand Brazil |
| IE1 Standard efficiency | | Below standard efficiency | Costa Rica Israel Taiwan |

How does ABB apply the standard?

- ABB has calculated motor efficiency values under the efficiency testing standard (IEC 60034-2-1: 2014) according to the indirect method, with additional losses determined from measuring.
- ABB has a full range of IE2 and IE3 available from stock, and a broad range of IE4 motors

For more information please contact:
www.abb.com/motors&generators

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