EU Ecodesign Regulation for motors and drives
For a more sustainable future
There is rapidly growing demand worldwide for more efficient products to cut energy consumption, reduce emissions and help to build a more sustainable future. The EU’s Ecodesign legislation is an effective way to improve the environmental performance of products by setting minimum energy efficiency requirements.

Ecodesign Regulation (EU) 2019/1781 sets minimum efficiency levels for both direct-on-line (DOL) rated low voltage motors and variable speed drives. It repeals and replaces Regulation 640/2009, setting new and more demanding requirements. The regulation will be implemented in two steps, on July 1, 2021 and July 1, 2023.
Efficiency classes for motors and drives

The Ecodesign Regulation sets mandatory minimum efficiency levels for electric motors and drives introduced into the EU markets. It uses efficiency classes created by the International Electrotechnical Commission (IEC), a global standard-setting organization.

Motor efficiency classes

IEC/EN 60034-30-1 establishes four efficiency classes for electric motors. It applies to single-speed motors that are rated according to IEC 60034-1 or IEC 60079-0 (explosive atmospheres) and designed for direct-on-line (DOL) operation. The limit efficiency values are based on frequency, number of poles and motor power, and the efficiency classes are (low to high) IE1 to IE4.

Drive efficiency classes

IEC 61800-9-2 defines efficiency classes for AC drives, which are also referred to as ‘complete drive modules’ (CDM). The efficiency classes range (low to high) from IE0 to IE2. These classes apply to AC drives rated 100 to 1000 V and 0.12 to 1000 kW.

Motors and drives combined

IEC 61800-9-2 defines efficiency classes for AC drives and motors in combination, which are also called ‘Power Drive Systems’ or PDS. These IES classes range (low to high) from IES0 to IES2. The classes are valid for motors and AC drives rated 100 to 1000 V, and 0.12 to 1000 kW. Note that the Ecodesign Regulation does not set minimum efficiency requirements for PDS.

By selecting motors and drives from the comprehensive ABB range, you not only ensure full compliance with the Ecodesign requirements but also cut energy consumption, reduce costs and optimize your cost of ownership. And all ABB motors and drives are supported by our global service network.
ABB has long promoted the benefits of efficient motors, and welcomes the new Ecodesign Regulation, which now includes variable speed drives for the first time.

### Ecodesign Regulation timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>The EU adopted the framework Directive 2009/125/EC. Requirements for motors were introduced by Commission Regulation EC 640/2009, which entered into force from 2011 to 2017.</td>
</tr>
<tr>
<td>2011</td>
<td>16 June 2011 Stage 1: Motors must be IE2 compliant.</td>
</tr>
<tr>
<td>2015</td>
<td>1 January 2015 Stage 2: Motors with a rated output of 7.5 to 375 kW must be EITHER IE3 compliant (driven direct-on-line) OR IE2 compliant if fitted with a variable speed drive.</td>
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<tr>
<td>2017</td>
<td>1 January 2017 Stage 3: Motors with a rated output of 0.75 to 375 kW must be EITHER IE3 compliant (driven direct-on-line) OR IE2 compliant if fitted with a variable speed drive.</td>
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<tr>
<td>2021</td>
<td>July 1, 2021 Ecodesign Regulation Step 1: Motors with a rated output of 0.75 to 1000 kW must be IE3 compliant. The option of IE2 with a VSD is no longer available. Motors rated from 0.12 to below 0.75 kW must be IE2 compliant. The scope is expanded from the previous regulations (see next page). Drives rated from 0.12 to 1000 kW must be IE2 compliant.</td>
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<tr>
<td>2023</td>
<td>July 1, 2023 Ecodesign Regulation Step 2: Motors rated from 75 kW to 200 kW must be IE4 compliant. Motors with protection type Ex eB and 1-phase motors must be IE2 compliant. Drives: No changes from Step 1.</td>
</tr>
</tbody>
</table>

Here is a summary of the steps:

<table>
<thead>
<tr>
<th>Step</th>
<th>Dates</th>
<th>Voltage [V]</th>
<th>Pn [kW]</th>
<th>Poles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 for motors from July 1, 2021</td>
<td>0.12 0.75 75 200 375 1,000</td>
<td>IE2</td>
<td>2 4 6 8</td>
<td></td>
</tr>
<tr>
<td>Step 1 for drives from July 1, 2021</td>
<td>0.12 0.75 75 200 375 1,000</td>
<td>IE2</td>
<td>2 4 6 8</td>
<td></td>
</tr>
<tr>
<td>Step 2 for motors from July 1, 2023</td>
<td>0.12 0.75 75 200 375 1,000</td>
<td>IE2 IE4 IE3</td>
<td>2 4 6 8</td>
<td></td>
</tr>
</tbody>
</table>
Scope from July 1, 2021 for motors

The Ecodesign Regulation covers three-phase single-speed motors rated up to 1000 V, 50 Hz, 60 Hz, 50/60 Hz for direct-on-line operation with continuous duty defined as S1, S3 ≥ 80% and S6 ≥ 80%.

IE3 efficiency class mandatory for motors:
- Rated output from 0.75 to 1000 kW
- 2, 4, 6 and 8 poles
- Protection types Ex ec, Ex d, Ex de, Ex t
- Brake motors with external brake
- TEAO (Totally Enclosed Air Over)
- Ambient temperatures between -30°C and +60°C

It is important to note that the option of IE2 with a VSD is no longer available.

IE2 efficiency class mandatory for motors:
- Rated output from 0.12 kW and below 0.75 kW
- Otherwise the scope is as shown for IE3

The links below provide further information, including cases where motors are used with variable speed drives.

For more information on how the regulation affects motors, click here.

For more information about ABB’s IEC LV motors offering, click here.
Scope from July 1, 2021 for AC drives

The Ecodesign Regulation covers three-phase drives with a diode rectifier rated from 0.12 to 1000 kW.

IE2 efficiency class mandatory for AC drives:
- 3-phase drives in power range 0.12 – 1000 kW (diode rectifier)

Exclusions:
- Cabinets containing a module that has already been conformity assessed
- Regenerative drives
- Low harmonic drives (THD <10%)
- Single phase drives
- AC drives with multiple AC outputs
- Medium voltage drives, DC drives and traction drives

For more information about ABB’s drives offering, click here.
What does the Ecodesign Regulation mean for standard induction motors rated for direct-on-line (DOL) operation?

When motors rated for sinusoidal supply (DOL) are used with a DOL supply, they must meet the minimum efficiency level requirements specified in the regulation.

Standard induction motors can additionally have a rating plate showing their performance characteristics in variable speed drive (VSD) controlled applications. This additional information on VSD duty has no relation to the energy efficiency requirements or IE classification. This is because the regulation applies only to motors rated for DOL use.

Note that IE2 DOL rated motors can no longer be sold with the CE mark, even if they are used with a VSD.

How does the Ecodesign Regulation affect motors specified for operation exclusively with a variable speed drive?

Motors specified for operation exclusively with a variable speed drive are outside the scope of the regulation. Hence the regulation does not cover motors such as synchronous reluctance, permanent magnet and DC motors.

Application and industry specific induction motors for VSD duty, that cannot be DOL connected, such as roller table, highspeed and servo motors, belong to this category. These types of motor can also be labelled ‘VSD only’ or ‘Inverter duty’ motors. These motors may also have an IE class according to EN IEC TS 60034-30-2.

Are direct-on-line (DOL) duties and VSD duty affected?

The scope of the regulation covers induction motors rated for continuous duty, i.e. duty class S1, S3≥80% and S6≥80% as defined in the regulation.

Restamping a standard induction motor for S9 duty does not put it outside the scope of the regulation. If a motor is rated for DOL operation then it is covered by the regulation.

However, induction motors that are not rated for 50 Hz or 60 Hz, but are rated for duty cycle S9, e.g. ‘VSD duty only’, may have some non-standard and specific features meeting the conditions to be specifically designed for VSD duty.

What does IE2 mean for drives?

The regulation covers 3-phase standard drives with a diode rectifier in the range 0.12 kW ≤ Pn < 1000 kW. After July 1, 2021, the power losses of these drives shall not exceed the maximum power losses corresponding to the IE2 efficiency level.

Drive manufacturers must declare power losses in terms of percentage of rated apparent output power at eight different operating points, as well as standby losses. The International Efficiency (IE) level is given at the nominal point.

Which drives are excluded from the regulation?

The following types of low voltage AC drives are excluded from the regulation: regenerative drives, low harmonic drives (THD < 10%), multidrives (multiple AC-output drives) and 1-phase drives.

A drive cabinet containing a drive module that has already been assessed does not need to be reassessed.

Several other types of drive are excluded, including medium voltage drives, DC drives, integrated drives and traction drives.
FAQ

1. **Does the Ecodesign Regulation affect motor and drive systems?**
   The Ecodesign Regulation does not include minimum efficiency requirements for Power Drive Systems (PDS). IEC 61800-9-2 specifies efficiency classes for motor-drive systems (IES), which it refers to as PDS.

2. **How does the regulation affect the CE mark?**
   Motors and drives covered by the regulation must also meet the efficiency requirements in order to be CE marked.
   - After July 1, 2021 DOL rated motors covered by the regulation must be IE3 compliant as a minimum in order to be CE marked.
   - After July 1, 2021 drives covered by the regulation must be IE2 compliant as a minimum in order to be CE marked.
   If a motor or drive covered by the regulation does not fulfill the efficiency requirements, it shall not be labelled with the CE mark and consequently it shall not be placed on the European market. Such a motor or drive (without the CE mark) can be delivered outside Europe, provided that it meets local requirements in the target market.

3. **Will ATEX certificates be revised?**
   There is no need to revise ATEX certificates due to the new regulation.

4. **How can I check the data provided by my variable speed drive supplier?**
   The regulation specifies for market surveillance that three methods are available to manufacturers to determine losses:
   - Direct method
   - Calorimetric method
   - Single loss determination method
   The only practical way to check the manufacturer’s data is to use the direct input/output method. This requires sophisticated equipment and suitable conditions to perform testing.

5. **What tolerances are allowed for the efficiency classes?**
   The efficiency level (IE class) of a design or product type must be guaranteed by the manufacturer.
   The efficiency value shall be obtained as a band or average of the population of tested or verified samples. Normal variations in production processes, materials and test results shall be considered during the design process by the manufacturer.
   The use of tolerances is only allowed by market surveillance to assess the test results and determine whether or not the product is compliant.

6. **Does the regulation apply to motors that have two or more stated speeds for one frequency?**
   Yes, in the case of single speed motors operating at 50 Hz or 60 Hz DOL that have two or more rated voltages and speeds.
   No, in the case of multi-speed or pole-changing motors with two or more speeds per frequency, regardless of design.

7. **Are marine motors affected by the regulation?**
   Yes, motors must comply with the regulation if their power rating and pole number are within the scope.
   Only motors designed specifically for the traction of electric vehicles are outside the scope.

8. **Are servo drives affected by the regulation?**
   Drives designed for use with both induction and servo motors must meet the minimum requirement of IE2 compliance.
   Drives not rated to operate with induction motors are outside the scope of the regulation and do not require Ecodesign marking. However, they are subject to other CE marking requirements.
Ecodesign Regulation (EU) 2019/1781 is the next logical step in the EU’s efforts to reduce greenhouse gas emissions by ensuring that electrical equipment meets minimum efficiency requirements. It builds on the results achieved by the first framework Directive, which was adopted in 2009. The new regulation increases the requirements and expands the scope, not only bringing in more types of motor but also covering drives.

ABB is ready to help motor and drive users with a range of high efficiency products that are fully compliant with the new requirements.