

# New European efficiency regulations

(EU) 2019/1781

For low voltage electric motors  
and variable speed drives



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The values shown are subject to change without prior notice.  
The information contained is reference values.



## Legislation

The European Union (EU) Commission estimates that there are 85 million large electrical motors in operation throughout the community consuming around 65 - 70% of all energy used in industry.

Since 2009, the commission have been working towards reducing the energy consumption through legislation governing the eco-design requirements for all energy related products.

July 2021 will see the implementation of the next phase of the directive which broadens the scope of the regulations to cover a wider range of electric motors. It is estimated that the prescribed changes have the potential to deliver an estimated 10TWh of energy savings in 2030 reducing greenhouse gas emissions significantly.

## What's New

For the first time, the regulations will include 60 Hz motors, brake motors with external brakes and motors designed for use within hazardous environments.

Also new with the (EU) 2019/1781 legislation is the inclusion of variable speed drives (VSD), those with a rated voltage above 100V and up to and including 1000 V A.C. are included within the scope.



*W22 Brake Motor*





## Electric Motors

Valid until 30th June 2021

Applies to induction motors (single speed, 3-phase 50 Hz or 50/60 Hz, squirrel cage induction motor for continuous duty). Major exemptions Ex-motors and submersible motors.

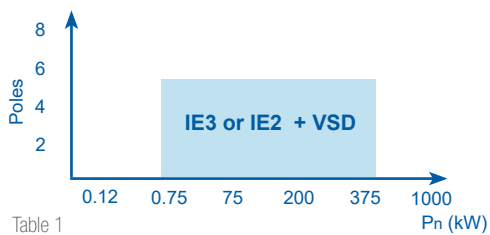


Table 1

Starting from 1st July 2021 (Step 1)

This will include 60 Hz motors, brake motors with external brake, motors Ex tb, Ex ec, Ex db, Ex dc and Ex db eb rated for duty class: S3 ≥ 80%, S6 ≥ 80% and also TEAO motors. Motors for use with VSD must meet the same rules for DOL motors. Major exceptions: High voltage motors, Mining Motors and Increased safety motors (Ex eb)

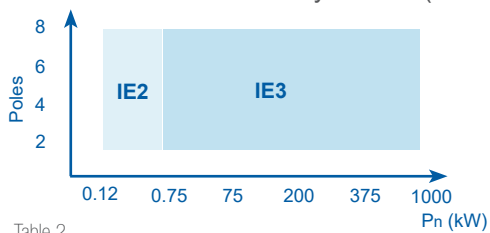


Table 2

Starting from 1st July 2023 (Step 2)

IE4 for 3-phase will become mandatory for 2 - 6 pole single speed motors between 75 - 200 kW. The coverage is also extended to Ex eb motors and single-phase motors which are required to have a minimum IE2 efficiency rating

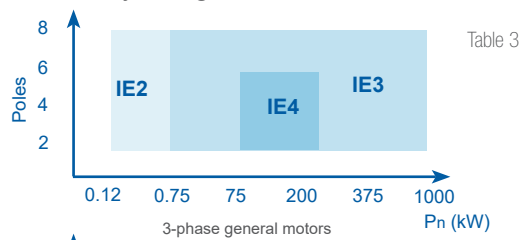


Table 3

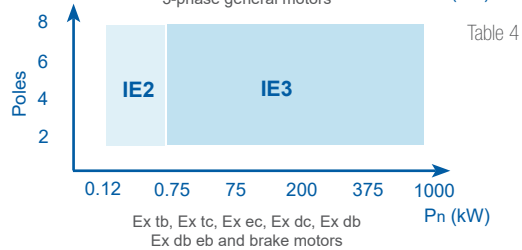


Table 4

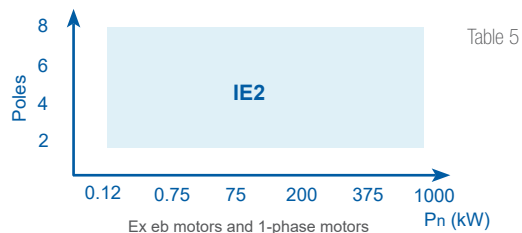
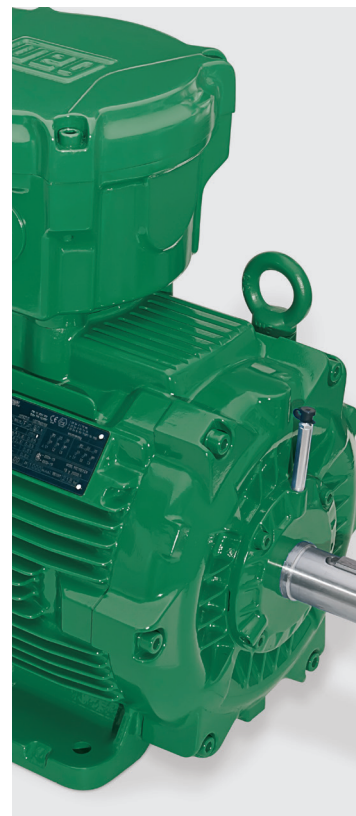


Table 5



## New Regulation (EU) 2019/1781 - Step 1 for Motors

From 1 July 2021 (only three-phase motors)		
Characteristics	Motors Included in the Regulation	Motors Excluded From the Regulation
1. Type of motor	Squirrel cage induction motor Open and closed motors.	Wound rotors, DC, permanent magnet. Motors specifically designed to operate wholly immersed in water.
2. Speed	Single speed motors, for fixed speed or VSD application.	Motors with multiple windings or with a switchable winding providing a different number of poles and speeds.
3. Mounting	Motors completely integrated into a product of which the energy performance <u>can be tested</u> independently from the product.	Motors completely integrated into a product of which the energy performance <u>cannot be tested</u> independently from the product.
4. Frequency	50 Hz, 60 Hz and 50/60 Hz	Others
5. Number of Poles	2,4,6 and 8 poles	10 poles or higher
6. Rated Voltage	50 up to 1,000 v	Above 1,000 V
7. Rated Output	3 phase motors 0.75 - 1,000 kW must meet IE3 3 phase motors 0.12 kW - 0.75 kW (not incl.) must meet IE2	3 phase motors below 0.12 kW and above 1,000 kW
8. Duty Cycle	Continuous duty operation (S1), S3 >= 80%, or S6 >= 80%	Intermittent duty operations such as S2, S4, S5 etc.
9. Altitude	Up to 4000 m.a.s.l	Above 4000 m.a.s.l
10. Ambient Air Temperature	All motors: -30° C to 60° C Water cooled motors 0° C to 32° C	All motors: below -30° C or above 60° C Water cooled motors below 0° C or above 32° C
11. Cooling Method	Air: TEFC, TEAO, TEBC Water: Coolant temperature at the inlet is between 0° C and 32° C	Air: TENV - Totally Enclosed Non-Ventilated Water: Coolant temperature at the inlet is less than 0° C or higher than 32° C
12. Maximum Operating Temperature	Up to 400° C	Above 400° C
13. Brake	Brake motors with external brake	Motors with an integrated brake where the brake is an integral part of the inner motor construction and can neither be removed nor supplied by a separate power source during the testing of the motor efficiency.
14. Area Classification	Explosion-protected motors 'Ex ec', 'Ex tb', 'Ex tc', 'Ex db', 'Ex dc' or 'Ex db eb'	Explosion protected-motors for mining as defined in Annex 1, Point 1 of Directive 2014/34/EU Increased safety motors of the Ex eb type
15. Variable Speed Drive Motors	When able to be equipped with a VSD must meet the same rules for motors without VSD.	Motors with integrated variable speed drive (compact drives) of which energy performance cannot be tested independently from the variable speed drive
16. Others	Not applicable	
	<ul style="list-style-type: none"> <li>. Motors specifically qualified for the safety of nuclear installations, as defined in article 3 of Directive 2009/71/EURATOM</li> <li>. Motors in cordless or battery operated equipment</li> <li>. Motors in hand-held equipment whose weight is supported by hand during operation</li> <li>. Motors in hand-guided mobile equipment moved while in operation</li> <li>. Motors with mechanical commutators</li> <li>. Motors specifically designed for electric vehicles</li> </ul>	

# New Regulation (EU) 2019/1781 - Step 2 for Motors

From 1 July 2023 (three-phase motors and single phase motors)		
Characteristics	Motors Included in the Regulation	Motors Excluded From the Regulation
1. Type of motor	Squirrel cage induction motor Open and closed motors.	Wound rotors, DC, permanent magnet. Motors specifically designed to operate wholly immersed in water.
2. Speed	Single speed motors, for fixed speed or VSD application.	Motors with multiple windings or with a switchable winding providing a different number of poles and speeds.
3. Mounting	Motors completely integrated into a product of which the energy performance <u>can be</u> tested independently from the product.	Motors completely integrated into a product of which the energy performance <u>cannot be</u> tested independently from the product.
4. Frequency	50 Hz, 60 Hz and 50/60 Hz	Others
5. Number of Poles	2,4,6 and 8 poles	10 poles or higher
6. Rated Voltage	50 up to 1,000 v	Above 1,000 V
7. Rated Output	3 phase motors 0.12 up to 0.75 kW (not included) must meet IE2 3 phase motors 0.75 kW -1,000 kW must meet IE3 3 phase motors: 2, 4 and 6 pole, 75 kW up to 200 kW must meet IE4 Single-phase: 0.12kW and above must meet IE2	3 phase motors below 0.12 kW and above 1,000 kW
8. Duty Cycle	Continuous duty operation (S1), S3 >= 80%, or S6 >= 80%	Intermittent duty operations such as S2, S4, S5 etc.
9. Altitude	Up to 4000 m.a.s.l	Above 4000 m.a.s.l
10. Ambient Air Temperature	All motors: -30° C to 60° C Water cooled motors 0° C to 32° C	All motors: below -30° C or above 60° C Water cooled motors below 0° C or above 32° C
11. Cooling Method	Air: TEFC, TEAO, TEBC Water: Coolant temperature at the inlet is between 0° C and 32° C	Air: TENV - Totally Enclosed Non-Ventilated Water: Coolant temperature at the inlet is less than 0° C or higher than 32° C
12. Maximum Operating Temperature	Up to 400° C	Above 400° C
13. Brake	Brake motors with external brake 0.12kW up to 0.75 kW (not incl.) must meet IE2 0.75 kW up to 1,000 Kw must meet IE3	Motors with an integrated brake where the brake is an integral part of the inner motor construction and can neither be removed nor supplied by a separate power source during the testing of the motor efficiency.
14. Area Classification	Explosion-protected motors 'Ex ec', 'Ex tb', 'Ex tc', 'Ex db', 'Ex dc' or 'Ex db eb' 0.12kW up to 0.75 kW (not incl.) must meet IE2 0.75 kW up to 1,000 Kw must meet IE3 Ex eb Equal or above 0.12 kW and equal or below 1,000 kW must meet IE2	Explosion protected-motors for mining as defined in Annex 1, Point 1 of Directive 2014/34/EU
15. Variable Speed Drive Motors	When able to be equipped with a VSD must meet the same rules for motors without VSD.	Motors with integrated variable speed drive (compact drives) of which energy performance cannot be tested independently from the variable speed drive
16. Others	Not applicable	
	<ul style="list-style-type: none"> <li>. Motors specifically qualified for the safety of nuclear installations, as defined in article 3 of Directive 2009/71/EURATOM</li> <li>. Motors in cordless or battery operated equipment</li> <li>. Motors in hand-held equipment whose weight is supported by hand during operation</li> <li>. Motors in hand-guided mobile equipment moved while in operation</li> <li>. Motors with mechanical commutators</li> <li>. Motors specifically designed for electric vehicles</li> </ul>	



From July 1st 2021, variable speed drives will fall within the remit of the EU regulation. Initially, the regulation will cover 3-phase standard VSD from  $0.12 \text{ kW} \leq P_n \leq 1000 \text{ kW}$  VSDs that have a rated voltage above 100V and up to and including 1000V are included in the scope. Power losses of VSD rated for operating with motors in this power range shall not exceed the maximum power losses corresponding to the IE2 efficiency level.

**Major exemptions:**

- 1) VSDs integrated into a product of which the energy performance cannot be tested independently from the product.
- 2) Regenerative drives.
- 3) Multiple AC-output drives.

**Limit Dates for Meeting the New Regulations for Motors and VSDs**

The dates in the regulation are valid for

- New motors/VSDs placed on the market for the first time.
- Replacement motors, as substitutes for identical motors integrated in products placed on the market until 1st July 2022 and specifically marketed for this purpose, do not have to meet the requirements of the new regulation and may be supplied according to (EC) 640/2009 until 1st July 2029.

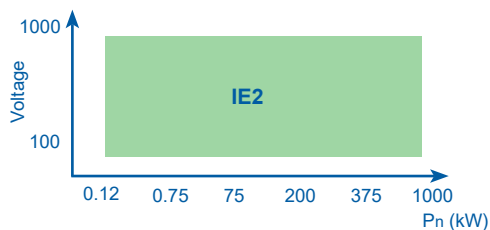


Table 6





## New Regulation (EU) 2019/1781 for VSD

Applicable from 1 July 2021 (only for application with three-phase motors)	
Characteristics	VSD Included in the Regulation
1. Variable Speed Drives	<p>Have a rated voltage above 100 V and up to and including 1,000 V A.C.</p> <p>The power losses of VSDs rated for operating with motors with a rated output power <math>\geq 0.12</math> kW and <math>\leq 1,000</math> kW shall not exceed the maximum power losses corresponding to the IE2 efficiency level. Energy efficiency for VSDs, expressed in International efficiency classes (IE), is determined based on the power losses as follow: The maximum power losses of the IE2 class are 25% lower than the reference value referred to in Table 6 (of the regulations).</p>







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