

IE2 motor efficiency compliance

Date: April 29th, 2011

Object: Electric motor efficiency compliance within ITT RCW EMEA

Background

The European Commission has developed the Energy Efficiency Plan which is a framework of policies and measures to save energy. This is a step by step process that involves several kinds of equipment, structures and materials.

Since 2007 the Commission began to establish a scheme for mandatory minimum efficiency levels for 14 products groups known as *European Minimum Energy Performance Standards* (EU MEPS) or *Eco-design*. This now involves electric motors to be sold and used into the European Union market.

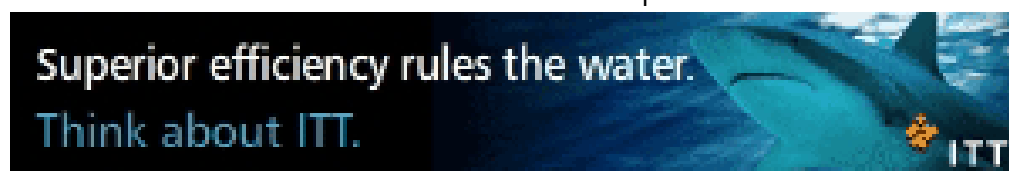
European Commission Regulation (EC) no. 640/2009

The European Commission Regulation (EC) no. 640/2009 was set up in July 2009 as part of the EU's legislation frame for Eco-design (EuP 2005/32/EC and ErP 2009/125/EC) which aims to reduce the energy consumption and other negative environmental impacts of energy-using products.

The EU Regulation efficiency classes are the same as in the standard EN 60034-30:2009, and its equivalent international standard IEC 60034-30:2008, but applied only for 50Hz motors.

Early on, Lowara srl adopted the voluntary European CEMEP agreement defining motor classification (EFF1, EFF2 and EFF3). This classification will be substituted by the classification from the EU MEPS (IE1, IE2, IE3) from 16th of June 2011. The two standards are not identical (different ways to test motors and slightly different application field) but as a general rule they can be compared as follows.

Efficiency levels			
IEC 60034-30 50 & 60 Hz		EU Regulation 50 Hz	CEMEP 50 Hz
Super-Premium	IE 4 (to be defined)		
Premium	IE 3	IE 3	
High	IE 2	IE 2	~ EFF 1 (high)
Standard	IE 1		~ EFF 2 (improved)
			~ EFF 3 (low)



In this document we refer only to EU Regulation's requirements as there are differences between EU Regulation and IEC 60034-30:2008 about which types of motors that fall under the scope.

The EU Regulation has been applied to motors

- squirrel cage induction
- three-phase
- single speed
- 2 to 6 poles
- 50 or 50/60 Hz
- rated voltage up to 1 000 V
- rated output power between 0,75 kW and 375 kW
- continuous duty operation (S1 as classified by EN & IEC 60034-1)
- designed to operate within standard environmental conditions established by EN & IEC 60034-1 (air temperature between -15 and +40°C, altitude ≤ 1 000 meters above sea-level)
- placed on the market as alone unit or part of other products.

Some exceptions to be found and some examples are also shown in the FAQ section.

Timing when EU Regulation comes into force

The EU Regulation will be mandatory within the European Economic Area, EEA, from 16th of June 2011 and come in force following a sequence of deadlines.

Mandatory eco-design requirements		
Timetable (from)	Rated output in kW	Efficiency not less than
16 th of June 2011	0,75 kW ÷ 375 kW	IE2
01 st of January 2015	< 7,5 kW	IE2
	7,5 kW ÷ 375 kW	IE3 IE2 plus variable speed drive
01 st of January 2017	0,75 kW ÷ 375 kW	IE3
		IE2 plus variable speed drive

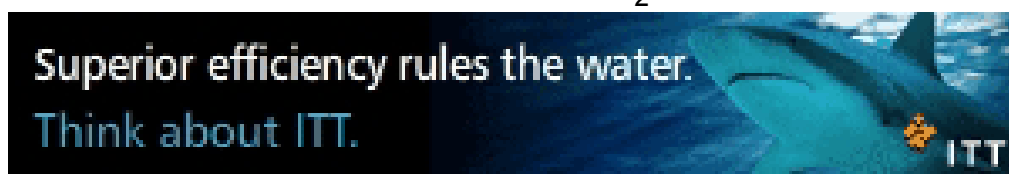
Also countries outside EEA might choose to follow the regulation and for example Switzerland is expected to apply similar legislation from 01st of July 2011.

ITT RCW EMEA's position

ITT RCW EMEA will introduce the new classification and make all the products covered by the EU Regulation available with efficiencies within IE2 efficiency levels within the required timeframe. However products already in the distribution chain can legally be sold by the distribution chain and put into service by the end user even after this date.

In practise this means that you may receive products using non-IE2 motors even for a period after June 15th while stock is depleted.

But these products can legally be sold since they are manufactured before the required date and already placed on the market by the natural or legal manufacturer (EU Regulation and ErP Directive).



Ways to improve motor efficiency

The efficiency of an induction motor depends on how well losses are kept low in the motor. The main types of losses are electrical, mechanical and magnetic losses. Mechanical losses are mainly due to the bearings, sealing systems and the cooling fan in the motor. Electrical losses are due to resistance in the windings. Magnetic losses are due to hysteresis and eddy current losses.

Since there are a number of different types of losses the ways of reaching higher efficiencies will vary with the type of motor you start with. In general actions like adding more copper to the motor, using higher grade materials in the stator and rotor or equipping the motor with low friction bearings are common ways to reach a more efficient motor.

Our products and actions

The motors in our current range are in a different position to reach the new efficiency levels and the changes are different for each motor family. In general the products that used to be EFF1 will relatively easily reach the IE2 levels and only small internal modifications are needed to reach the IE2 efficiency level. For this range there will be some part numbers that are replaced with new part numbers while the main part will remain the same.

The motors that today are EFF2 classed will need bigger modifications and generally the frame size of the motors will be increased. This means a physically larger pump and as a general rule there will be new part numbers issued for these pumps.

Dates of introduction

ITT RCW EMEA will introduce pumps equipped with IE2 motors according to the following schedule.

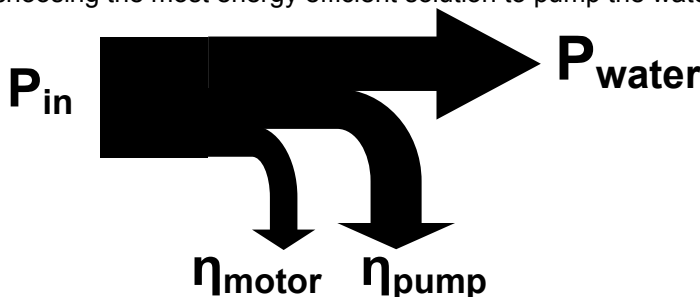
Dates of introduction		
Product family	First order	First delivery
LSN – LSB – LS – MP – MPA P (vertical) – PVa	02 nd of May 2011	06 th of June 2011
FC & FCT – FH – SH – SHO SV – SVI – TDB – TDV	15 th of May 2011	06 th of June 2011
BG – CA – CEA – CO P (peripheral) – SP – HM	15 th of May 2011	13 th of June 2011

ITT RCW EMEAs view on motor efficiency in a pump system

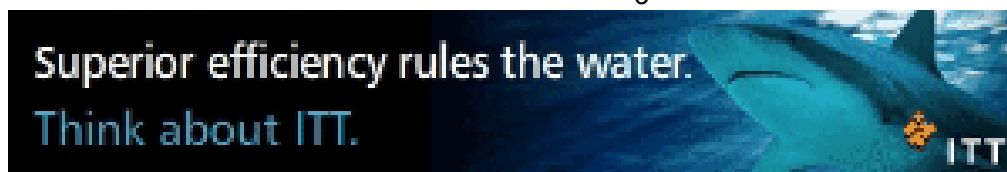
The motor is only one component in a pump system. The energy bill or the CO₂ emission comes from the total efficiency of a pump system and what sets the base line for the energy consumption is the design of the pump system itself (the choice of pipe diameter, components, pipe layout etc). The energy required is determined by the formula

$$P_{water} = Q \times H \times g \times \rho$$

The less head needed for a certain flow, the less energy is needed. When the system is set, it's about choosing the most energy efficient solution to pump the water in the system.



The figure shows the different losses in the pump system and the relation between them.



The first factor is to choose a pump as close to its *best efficiency point* as possible. Here it can easily differ 5-10% in efficiency in available alternatives. At this point the motor is also operating at a high efficiency compared to the very left part of the pump curve.

The second factor is to determine if the pump system has big enough variations in the flow to justify a speed controller like Hydrovar®. This can make really big savings (up to 75%) in some systems. This is also acknowledged by the EU commission as an IE2 motor with VSD (Variable Speed Drive) is also allowed to sell also after 2015.

The third factor is the motor efficiency. Here we talk about differences of ~1-3% in efficiency. It's not unimportant, but the big potential lies in the other factors. In systems with long running hours, it could make sense to use a high efficiency motor as the payback time becomes more reasonable.

If you have questions related to which energy efficient solutions that gives you the best possible payback please contact your local ITT representative. We can help you to choosing an energy efficient pump solutions since we understand the environment that our products are designed for and operate in.

Frequently asked questions

Q1 Are the pumps I receive today already equipped with IE2 motors?

A1 PLM motors have already an efficiency that complies with IE2 level and from 20th of April 2011 the data plates will bear IE2 mark. SMP motors will be redesigned to meet IE2 efficiency levels and introduced as stated in the dates of introduction. Motors made by other manufacturers (e.g. WEG & ABB) could bear the IE2 mark before 16th of June 2011.

Q2 When will I start to receive pumps equipped with IE2 motors?

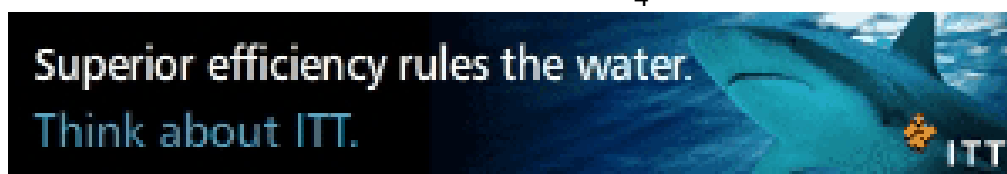
A2 This depends on the product family and how much stock that is present in the distribution channel. But you may already start to receive some pumps with IE2 marked motors from 20th of April.

Q3 When is it not possible to have IE2 or IE3 marked motor?

A3 With reference to the EU Regulation, when motors are configured/designed to operate as at least one of the following;

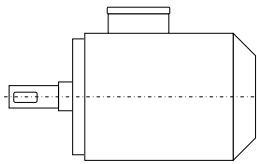
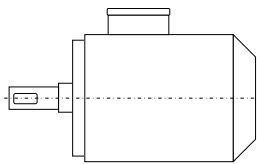
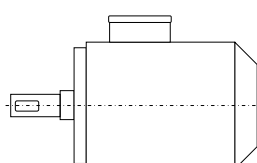
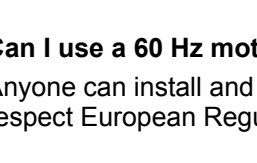
- wholly immersed in a liquid;
- at altitudes exceeding 1 000 metres above sea-level (above standard limits of IEC 60034-1);
- at ambient air temperatures exceed 40 °C (above standard limits of IEC 60034-1);
- at ambient air temperatures are less than -15 °C (air-cooled) or 0 °C (water-cooled) (both of them below standard limits of IEC 60034-1);
- in ATEX version;
- only for 60 Hz;
- in 8-pole;
- with rated output less than 0,75 kW or more than 375 kW;
- with rated voltage more than 1 000 V;
- specifically for converter operation (IEC 60034-25);
- and more situations.

As mentioned before differences there are between EU Regulation and IEC 60034-30:2008 about types of motors fall into the scope of themselves. So you could find a motor having one or more features fallen in above list which bears IE mark. In that case the motor has been declared IE referring to IEC 60034-30:2008 and not EU Regulation.



Q4 Can I use a 50/60 Hz motor within EEA?

A4 In case of double-frequency motors they have to be compliant with European Regulation only for 50 Hz rated voltage(s). Below is an example for information purposes only.

	IE 2 230/400 V 50 Hz η/L 4/4 86% - 3/4 85% - 1/4 84%	✓ European Regulation (EC) no. 640/2009 ✓ IEC 60034-30
230/400 V 50 Hz		
	IE 2 230/400 V 50 Hz η/L 4/4 86% - 3/4 85% - 1/4 84%	✓ European Regulation (EC) no. 640/2009 ✓ IEC 60034-30
	IE 2 230/400 V 60 Hz η/L 4/4 88%	✗ European Regulation (EC) no. 640/2009 ✓ IEC 60034-30
230/400 V 50/60 Hz		
	IE 2 230/400 V 60 Hz η/L 4/4 88%	✗ European Regulation (EC) no. 640/2009 ✓ IEC 60034-30
230/400 V 60 Hz		

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Q5 Can I use a 60 Hz motor within EEA for special application?

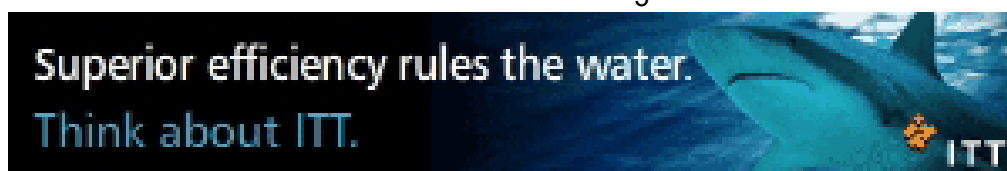
A5 Anyone can install and use a 60-cycle motor (e.g. for special industrial application) without having to respect European Regulation.

Q6 Are motors with data plates having double-frequency no longer available?

A6 From a technical point of view a SMP or PLM motor can be operated at 50 or 60-cycle. But current double-frequency data plates are not longer available as standard but only on specific request. We inform you the ranges of voltages on the data plates will be different from the previous offering. Two examples are found below for information purposes only.

	Voltages range		
	Standard 50 Hz	Alternative 60 Hz	On request 50/60Hz
Motor #1	220-230-240/380-400-415	255-265-277/440-460-480	230/400 (50Hz) 265/460 (60Hz)
Motor #2	380-400-415/660-690	440-460-480/-	400/690 (50Hz) 460 (60Hz)

Also note that the new standard voltage above 4kW in 60Hz is 220/380V and not 380/660V as previously. The 380/660V is available as a configuration.



Q7 Are only 230 or 400 V motors under the scope of EU Regulation?

A7 No, any motors having rated voltage(s) up to 1 000 volts at 50 Hz.

Q8 Can I still order and receive non-IE2 motors as spare parts within EEA?

A8 There are no any exceptions for motors as spare parts with the final destination within EEA. We understand that this might cause problems in various applications but at this time we cannot sell non-IE2 motors after 15th of June 2011.

Q9 Can I still order and receive pumps equipped with non-IE2 motors as spare parts for my machinery used within EEA?

A9 No, there are no exceptions present today (see Q8).

Q10 Are motors complying to EU Regulation or IEC 60034-30:2008 interchangeable with old motors in case of replacement of same rated output power?

A10 No this needs to be checked case by case. In the recent past the interchangeability was one of the priorities and some national norms established mechanical dimensions (IEC 60072, EN 50347). Now the priority is the energy-saving and manufacturers are free to choose any way to achieve this, which in many cases mean different motor sizes.

Q11 Are motors installed in closed-coupled pumps subject to EU Regulation?

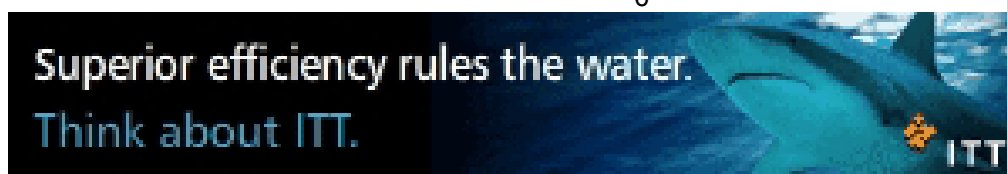
A11 In the EU legislation there are some exceptions from the mandatory efficiency levels and one of them says "motors completely integrated into a product (for example gear, pump, fan or compressor) of which the energy performance cannot be tested independently from the product". It has come to our attention that this statement has sometimes been used to keep pumps using standard motors with special shaft extension out of the regulation. ITT RCW EMEA share the same opinion as the Italian Pump Manufacturers Association (Assopompe), that these motors do fall under the scope of the EU Regulation. Consequently all ITT RCW EMEA pumps, even if using a motor with extended shaft, will have IE2 efficient motors in the range defined within the directive.

Q12 Can I, as European customer, still order and receive non-IE2 motors or pumps equipped with non-IE2 motors to be sold and installed outside EEA?

A12 Yes. For customers in EEA, ITT RCW EMEA needs a signed letter for each order that confirms that the products will be used for export purposes. If you have this need, ask your local ITT representative for the template. Remember that not all products are still available with non-IE2 motors.

Q13 Can I, as European customer, order and receive IE2 motors or pumps equipped with IE2 motors to be sold and installed outside EEA?

A13 Yes, but it is up to the customer's care to verify the local legislation since some countries have been applying or will apply in medium-term local legislations a bit different compared to EU Regulation and IEC 60034-30:2008.



For the purposes of this document, the following information shall apply.

Abbreviations & Definitions

ATEX

Potentially explosive atmospheres (Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres, Directive 1999/92/EC of the European Parliament and the Council of 16 December 1999 on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres and subsequent acts amending directives)

CEMEP

Comité Européen de Constructeurs de Machines Electriques et d'Electronique de Puissance.
(European manufacturers of electrical machines and power electronics equipment and systems).

CSA

Canadian Standards Association.

EISA

The Energy Independence and Security Act of 2007 (EISA).

EEA

European Economic Area agreement extends the free-trade market outside the European Union involving Iceland, Liechtenstein and Norway (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, The United Kingdom + Iceland, Liechtenstein, Norway).

EN

European Norm.

EN 50347

General purpose three-phase induction motors having standard dimensions and outputs - Frame numbers 56 to 315 and flange numbers 65 to 740

EPCA

The Energy Policy and Conservation Act) of 1975

EPAct

The Energy Policy Act of 1992, renewed in 2005.

UR

Recognized Component Mark managed by UL (Underwriters' Laboratory)

EU

European Union.

EU Regulation

In this document means European Commission Regulation (EC) no. 640/2009.

EuP 2005/32/EC

Energy-using Products (Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council).

ErP 2009/125/EC

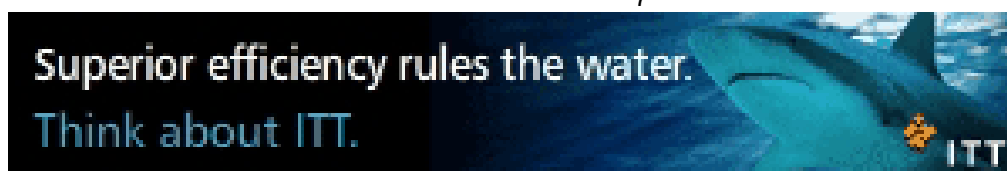
Energy-related Products (Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products).

IEC

International Electrotechnical Commission.

IEC 60034-1

Rotating electrical machines - Part 1: Rating and performance



IEC 60034-25

Rotating electrical machines - Part 25: Guidance for the design and performance of a.c. motors specifically designed for converter supply

IEC 60034-30

Rotating electrical machines - Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)

IEC 60072-1

Dimensions and Output Series for Rotating Electrical Machines - Part 1: Frame Numbers 56 to 400 and Flange Numbers 55 to 1080

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MEPS

Minimum Energy Performance Standards.

Placing on the market

In accordance with ErP 2009/125/EC, the making a product available for the first time on the Community market with a view to its distribution or use within the Community, whether for reward or free of charge and irrespective of the selling technique.

Putting into service

In accordance with ErP 2009/125/EC, the first use of a product for its intended purpose by an end-user in the Community.

Manufacturer

In accordance with ErP 2009/125/EC, the natural or legal person who manufactures products covered by this Directive and is responsible for their conformity with this Directive in view of their being placed on the market and/or put into service under the manufacturer's own name or trademark or for the manufacturer's own use. In the absence of a manufacturer as defined in the first sentence of this point or of an importer as defined in point 8, any natural or legal person who places on the market and/or puts into service products covered by this Directive shall be considered a manufacturer.

Best regards

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