

The latest developments

Incredible technology: Everything you need to know about compact AC motors & speed control

Global motor energy efficiency regulations (as of March, 2015)

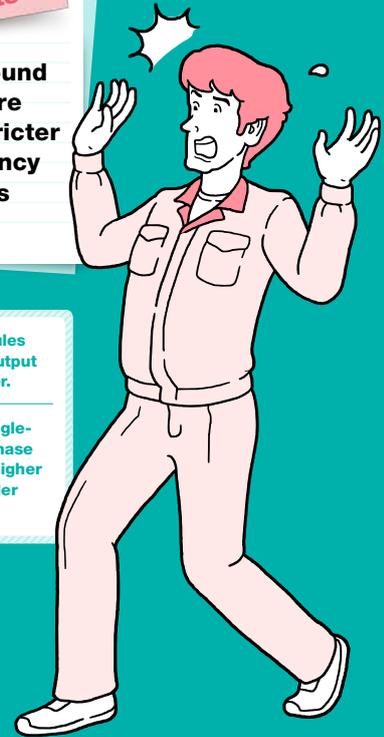
Country	Current efficiency class/output power	Future
 Europe (EU, 28 countries) [ErP Directive]	IE2 Class Three-phase from 0.75 kW–7.5 kW IE3 Class or IE2 Class + inverter operation Three-phase 7.5 kW–375 kW	IE3 Class or IE2 Class + inverter operation From 2017.01: Three-phase 0.75 kW and up
 China [Energy Conservation Law]	① Three-phase 0.75 kW–375 kW GB3 Class (IE2 Class) ② Single-phase, three-phase 10 W–2.2 kW GB3 Class	① GB2 Class (IE3 Class) subject to regulation From 2016.09: 7.5 kW and up From 2017.09: 0.75 kW and up ② TBA
 Japan [Energy Conservation Law–Top Runner Program]	IE3 Class Three-phase 0.75 kW–375 kW	TBA
 USA [Energy Independence and Security Act]	IE3 Class Three-phase 0.75 kW–375 kW	From 2016.01: Expansion of models subject to regulation
 Australia/New Zealand [E3 Program]	Level 1A or 1B (IE2 Class + α) Three-phase 0.75 kW–185 kW	TBA
 Brazil [Presidential Directive]	IE2 Class Three-phase 0.75 kW–375 kW	TBA
 Korea [Energy Efficiency Rating Labelling Program]	IE2 Class Three-phase 0.75 kW–375 kW	Subject to IE3 Class rules schedule •2015.10: 37 kW–200 kW •2016.10: 200 kW–375 kW •2018.10: 0.75 kW–37 kW

Latest developments

Countries around the world are introducing stricter motor efficiency regulations

Currently, these rules focus on 0.75 kW output power and higher.

Regulations for single-phase and three-phase motors 120 W and higher are currently under consideration.



Illustrated by Yoriyuki Suzuki

What are the latest developments in compact AC motors?

AC motors do not usually receive very much attention, but, actually, there have been some amazing advances in this area over the last few years. This article covers the latest developments, focusing mainly on compact motors under 90 W (90 mm square mounting dimensions).

◆ The era of energy-efficiency regulations for medium and large motors has arrived

Let's start with a look at the three-phase motor. Three-phase motors cover a wide output power range, from compact to large, and have many advantages over single-phase motors, including greater efficiency, higher starting torque and no need for a capacitor to operate. And when it comes to changing speed, the three-phase motor's current popularity can probably be explained by the fact that versatile speed control can be achieved by simply combining it with an inverter.

One key development related to the three-phase motor is the progress being made around the world in adopting regulations for motor-operating efficiency. It is said that motor applications account for about 30–40% of total global power consumption, so the trend is toward more stringent efficiency regulations – starting with power-consuming medium and large (0.75 kW and higher) motors. This includes Japan, which until recently did not have strict energy efficiency laws or regulations, though this is finally changing.

Japan's effort is distinguished by the Top Runner Program, which is based on a revision of the Energy Conservation Law. Following the efficiency rules adopted in Europe, the US, and elsewhere, since April 2015, the Top Runner Program has required that motors with 75 kW of output power or above and backup motors installed in equipment qualify for the country's top-class efficiency equivalent (namely, IEC* efficiency class IE3). Motor manufacturers and importers are subject to these rules and are fined for violations. In most cases, motor efficiency has been achieved through the use of expensive, low iron loss magnetic steel sheets and an iron core form, better

coil winding and so on. Overall, these motors are said to cost more than the motors that preceded them. It is true that these rules do not target those who purchase motors, but since the motors that manufacturers supply their customers will mostly be high-efficiency motors after April 2015, anyone using them should be prepared for the higher price tag.

*International Electrotechnical Commission

◆ Regulations are also being adopted for compact and single-phase motors

While the revision of the Energy Conservation Law covers medium and large three-phase motors with output greater than 0.75 kW, it does not include compact and single-phase motors. However, most production lines employ compact motors under 100 W – so, what is the policy for these smaller motors?

A closer look into the matter shows that movement towards adopting regulations for compact and single-phase motors has in fact begun. China's GB standards (GB 25958-2010), for example, already

Latest developments

Compact motors are also becoming more efficient

EVOLUTION



The latest single-phase motor



KII Series

6 W–90 W

The improved design of the unique KII Series includes high-torque and high-rigidity strength gears. The coating has also been changed from black to misty gray.

Conventional model comparison

Heat Generation

Vibration

Efficiency



Up to 20°C reduction

Up to 35% reduction

Up to 9% increase

The latest three-phase motor

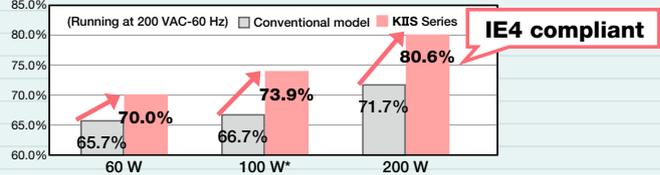


KIIS Series

- 90 mm-60 W ● 90 mm-100 W
- 110 mm-200 W

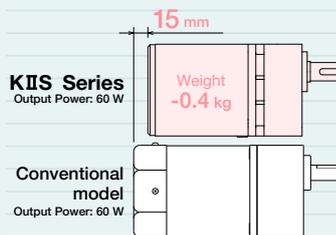
A new high-efficiency three-phase motor design available at a lower price than conventional three-phase motors.

Conventional model max. efficiency comparison



Standard values correspond to IEC 60034-30-1

*Conventional model of the same dimensions has 90 W output power

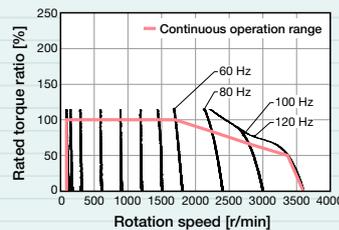


Fanless, compact

High-efficiency performance means no rear motor cooling fan is required.

No dust intake means quieter operation.

Properties when combined with a universal inverter



Even running with an inverter drives high performance

- Inverter parameter settings must match motor output power.

target single- and three-phase motors with over 10 W of output power. What's more, the international standard IEC 60034-30 has been revised to IEC 60034-30-1 to make it broader in scope. Besides lowering the minimum output power limit from 0.75 kW to 0.12 kW, these standards include both three-phase induction motors and single-phase induction motors. It is probable that laws and regulations based on these wide-ranging standards will be adopted. Moreover, action is being taken to develop efficiency standards that apply to speed control that combines inverters and other circuits. As such, it is important that we keep track of these developments in the future.

◆ Increased efficiency compact motors – the perfect combination for inverters

While compact motors under 120 W are not currently subject to regulations, smooth and efficient operation is obviously beneficial to users. When using multiple units and operating equipment for long periods of time, these energy efficient motors generate lower

running costs, and this efficiency makes for a more appealing product. In Japan, energy efficient compact motors are currently available due to the growing need to conserve energy.

Oriental Motor's three-phase motor KIIS Series achieves maximum efficiency of over 80%, and includes 200 W motors that surpass IE4 standards and more efficient 100 W motors that achieve improved output power while maintaining the same size as the conventional 90 W models. Low energy loss means lower electricity consumption and less heat generation. These motors achieve all of this with a fully enclosed structure and no cooling fan at the back, making them quieter than past compact motors. What's more, the motor's internal bearings have been completely redesigned so that they are capable of withstanding up to 120 Hz of rotation*, and the rotor rotation balance is rigorously checked throughout the manufacturing process. Since the winding has also been redesigned for maximum efficiency, operating the motor along with a universal inverter enables high rpm rotation regardless of V/f control or vector control. In short, these are

motors designed to deliver high performance. And, amazingly, their price is lower than older models despite their high-efficiency engineering.

In addition, we have reintroduced our long-running single-phase motor K Series as the KII Series. A new design that optimizes electromagnetic balance with each input voltage not only improves heat generation, vibration and efficiency, it also makes the gear drive quieter.

So, even though these motors are just as ordinary looking as before, the progress in terms of efficiency means that their popularity is sure to grow.

*Parallel shaft only