

5.13 High efficiency motors

ABB motors offer maximum energy efficiency. Increased efficiency reduces the power required to operate a motor. Reduced power requirements allow the use of smaller generators and less fuel.

High motor efficiency

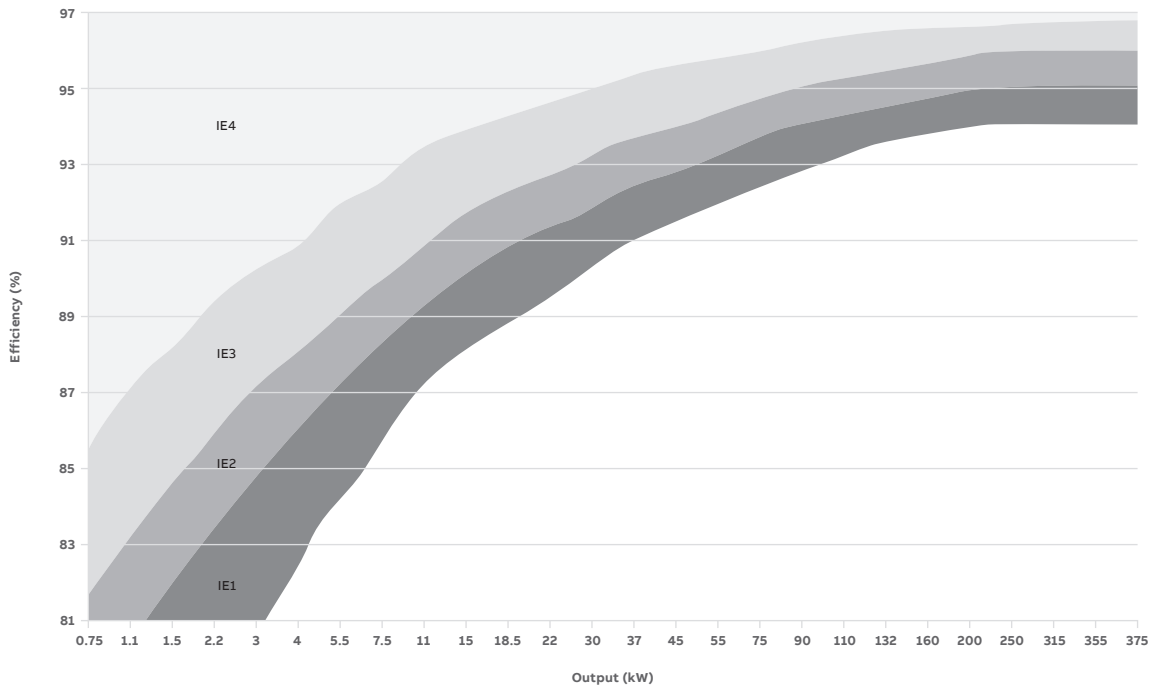
These advantages come together to reduce the customer's initial investment cost and ongoing operating expenses. Combined with variable speed drives, high efficiency motors provide optimum speed and torque control. This helps customers in the marine industry to further reduce their energy consumption, operating expenses and harmful emission levels.

Low voltage motors

ABB's low voltage motors portfolio covers an output range from 0.12 up to 1,000 kW. In recent years, development of Minimum Energy Performance Standards (MEPS) has represented a trend aimed at reducing energy consumption and levels of greenhouse gas emissions. The latest major MEPS came into force in the European Union and cover LV motors from 7.5 up to 375 kW, and up to

IEC 60034 and IEC 60034-31 define the efficiency classes for low voltage motors.

IE Classes - 4 pole





— Sea water cooling pumps with ABB high efficiency low voltage motors.

1,000 V, intended for 50 and 60 Hz operation. These motors are classified based on their energy efficiency performance, from the lowest level of IE1 up to IE4, and these levels are specified in the IEC standard IEC 60034 and IEC 60034-31.

Today's EU MEPS have defined IE2 (high efficiency) as the minimum level, while IE3 or IE2 operated with VFD will become mandatory in 2015. Similar types of MEPS currently account for 70% of the low voltage motors market.

End users benefit from these standards, since they ensure that energy efficiency comparisons between motors are possible. This is due to the manufacturers having to comply with the same standards when defining, measuring and publishing motor efficiencies.

In addition to lower energy consumption, ABB's highly efficient motors are more reliable, since they minimize losses. Losses in electric motors are dissipated by heat, vibration and noise. The mechanical and electrical design of highly efficient motors is optimized, which means lower temperature rises, cooler running, reduced temperatures in stator windings and bearings, and a lower noise level. Cooler running and a reduced stator winding temperature guarantee trouble-free running over the 30-year design lifetime, since every increase of 10 Kelvin in the stator winding reduces its lifetime by half.

On the other hand, reduced bearing temperatures mean longer re-creasing intervals and less maintenance, since every 15-Kelvin decrease in bearing temperatures doubles the re-creasing interval.

ABB motors are based on decades of experience in the manufacture of typical marine applications such as fans, pumps, cranes, winches, compressors and thrusters. All of these are vital when operating a vessel, and motors must meet the highest quality, availability and various standards. When selecting motors for quadratic torque applications such as fans and pumps, VFD should always be considered as the control method, to ensure optimally low cost of ownership.

High voltage induction motors

ABB's high voltage induction motors consist of two main product lines, cast iron and modular welded frame constructions. Cast iron motors cover an output range up to 2,250 kW and 11.5 kV. The output range of modular welded frame series reaches up to 23 MW and 13.8 kV.

ABB's HXR-series cast iron motors are custom designed to provide an ideal match with the customer's specific application. Innovative, TEFC (totally enclosed fan cooled) HXR motors are the right choice for applications requiring dependable, high efficiency motor power that cannot be provided by standard products.

ABB's high voltage HXR motors are used in a wide variety of processes across the marine industry. Typical applications include pumps, fans, blowers, compressors, conveyors and ship thrusters. Versions classified for hazardous areas are available for use within the marine, chemical, oil, gas and related sectors.

Basic specification

- Totally enclosed fan-cooled cast iron construction, horizontal or vertical
- 100 to 2,250 kW at 50 Hz
- 150 to 3,000 HP at 60 Hz
- Shaft heights: 355-560 mm 14.5-22.0 inches
- Voltages from 380 V to 11,500 V
- IP55/IP56, IC411/IC416
- TEFC/TEAO
- Standards IEC, NEMA, CSA...

Typical efficiency levels for 4-pole HXR motors		
Output	Efficiency %	
kW	100% Load	75% Load
500	96.7	96.7
630	97.0	97.0
710	97.1	97.1
800	97.2	97.2
900	97.3	97.3
1000	97.2	97.3
1250	97.4	97.5
1400	97.6	97.6
2000	97.9	97.9

- Motors for marine applications (LRS, DNV, BV, GL, ABS...)
- Motors for classified areas
- Motors for VSD

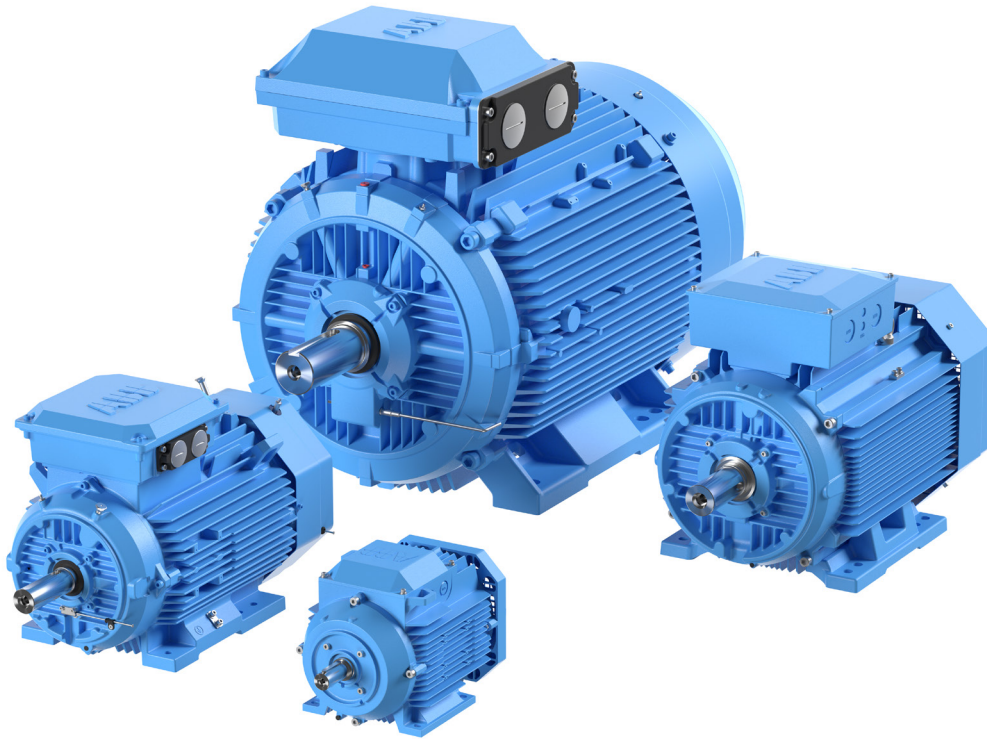
— Modular welded frame motor AMI 500 in a thruster application controlled with VFD.

ABB high voltage modular induction motors are designed to operate at the highest levels of efficiency, reliability and availability, in the toughest

and most demanding applications. These high-performance motors are available with all types of options, enclosures and cooling arrangements. They comply with all international standards, are optimized for variable speed control, pass through the most stringent of testing procedures at each stage of production and can be configured for the broadest range of applications, such as pumps, fans, compressors, conveyors, thrusters and propulsion.

ABB's testing program is far above the ordinary level. It is one of the many factors that differentiate an ABB motor from others on the market. Nothing is omitted from ABB testing procedures: they embrace noise levels, vibration, torque and temperature, as well as all individual components as they progress through the production process. When the motor is assembled, we conduct a full-scale operating test and measure all critical values. This can be done in our factories, at different loads and in combination with transformers, vari-





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ABB high efficiency
motors

able speed drives and other electrical equipment. The test report is handed over immediately after the conclusion of the tests. We also perform customized tests to measure special characteristics. All ABB tests are carried out in accordance with international standards and third-party certifications, such as those issued by LR (Lloyd's Register), BV (Bureau Veritas), DNV (Det Norske Veritas) and ABS (American Bureau of Shipping).

Benefits

- High availability of motors, throughout low temperature rise
- High quality, lower maintenance, longer lifetime
- Highest output from the smallest size; space and weight savings
- Fully compatible with various starting methods, DOL, Y/D, auto-trafo, soft starter, variable frequency drive
- Meeting the highest efficiency requirements, especially in all load points
- Wide range of motors already approved by the major classification societies
- Worldwide technical support
- Degrees of protection up to IP56 for open deck

Savings and payback time

ABB offers a broad range of motors already fulfilling the IE4 efficiency performance standard specified in IEC 60034 and IEC 60034-31. ABB's solutions consist of IE4 induction motors, the IE4 synchronous reluctance motor and drive package, and permanent magnet motors. For low voltage motors, the payback time is typically 2-3 years in the case of a replacement. When considering a new investment, the typical payback time for a higher IE efficiency performance class is less than one year.