



Delivering the latest **efficiency standards** for power drive systems

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The latest developments in gear motor design and the benefits to the end user.

Recent regulations relating to electric motor efficiency requires a motor between 7,5 kW and 375 kW to use either an IE3 rated motor or an IE2 motor installed with a variable frequency drive (VFD). However, this is the minimum standard and some manufacturers continue to develop motor technology and designs to help end users maximise the potential energy savings. While the minimum energy efficiency ratings are tightened for the majority of electric motors, there are some exceptions - namely brake motors and those operating in potentially explosive atmospheres - that will retain their exempt status. However, the company represented by the author, is leading the field with the development of the S series of Permanent Magnet Synchronous Motor (PMSM) which offers variable-speed

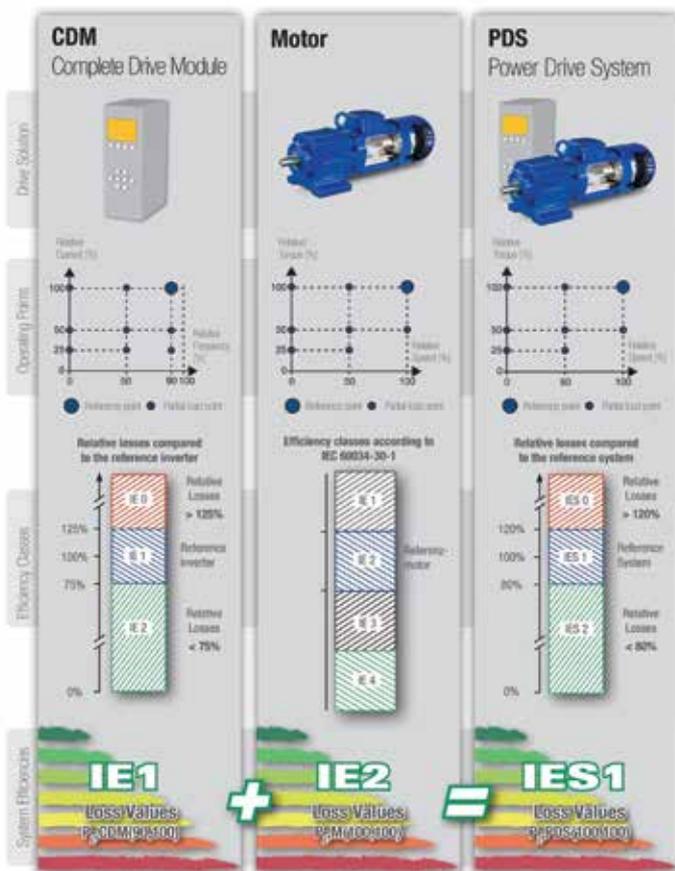
motors in efficiency class IE4 for use in explosion hazardous areas. Clearly explosion protection takes precedence over energy savings, but this has put some industries, such as Oil and Gas and Mining, at a disadvantage when trying to improve the overall efficiency of their operations. While safety has to be prioritised in such environments, historically this exemption has meant that operators are missing out on potential energy savings of as much as 40%.

Currently most Ex e (Increased Safety) rated variable speed, three-phase induction motors on the market are generally available in standard efficiency class IE1. While the efficiency of these can be improved with the addition of frequency inverters, they still fall well short in comparison to the improved design of IE3 motors.

Fortunately the company represented by the author has a long history of working within such sectors and has developed the S Series of Ex rated IE4 motors. The S Series brings the latest technology to applications that require motors to be specified and designed to meet ATEX classifications and deliver the energy savings that are available in other industrial areas.

The S series is part of Bauer's PMSM motor range which has been proven to provide the best possible energy efficiency. The range of motors is available from 0,55 kW to 15 kW and is classified for Zones 1 and 21. Not only is the PMSM design superior at converting electrical energy into mechanical power, it also offers the added benefit of maintaining constant speed independent of the load. This means that motor speed does not vary - despite overload variations or cases of voltage drop - as long as the mains frequency is kept constant.

The PMSM series is an environmentally friendly range of motors, employing a highly efficient design of rotor that integrates embedded permanent magnets made from rare-earth material, instead of the squirrel-cage rotor found in induction motors. This design offers a number of key benefits. It reduces heat losses from the rotor by 100%, total losses by approximately 25%, and increases total efficiency by 10% or more. For the PMSM user, this improved performance translates into lower total cost of ownership, a reduction in CO₂ emissions, and ongoing savings that buffer against future increases in energy costs. PMSM synchronous motors offer considerably improved efficiency when compared to induction motors, even under partial load conditions; and extremely high efficiency under rated operating conditions. They also have considerably higher power density, which, for geared motors, yields higher system efficiency with minimal installation volume – and also reduced weight. Importantly, PMSM drives can produce higher torque values for the same installation





There are series that deliver all the efficiency benefits of PMSM technology within an ATEX-certified package classified for Zone 1 and Zone 21 environments.

volume as conventional induction motors, a factor that allows cost saving, through the ability to specify a smaller motor size in some applications. The PMSM motor series is available in ventilated and non-ventilated configurations across the power range from 0,55 kW to 15 kW. They operate on 380 V to 500 V power supplies, and are rated for inverter duty, offering an extended speed range with constant torque.

Conclusion

IE4 is something many manufacturers are talking about yet few are actually delivering. There is a cost premium to these motors, but the

ATEX – Atmosphere Explosive
Ex e – Increased Safety
IE – International Efficiency
PMSM – Permanent Magnet Synchronous Motors
VFD – Variable Frequency Drive

Abbreviations/Acronyms

*IE4 is being discussed by many manufacturers
yet few are actually delivering.*

market uptake should be driven by the economics over the life of the motor. For a small to medium sized electric motor that is running close to capacity for the majority of the time, used in a continuous manufacturing process for example, then the additional investment in terms of purchase cost is quickly outweighed by the energy savings that can be achieved.



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