

Warner Electric

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TB Wood's

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Wichita Clutch

Marland Clutch

Industrial Clutch

Bauer Gear Motor

Nuttall Gear

Warner Linear

Delroyd Worm Gear

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## Field Test Shows Bauer PMSM Delivers 40% Energy Savings



As seen in  
**Machine Design**  
March, 2013



As seen in  
**Power Transmission  
Engineering**  
February, 2013



 **Bauer**<sup>®</sup>  
Gear Motor

An Altra Industrial Motion Company

# Independent field test shows Bauer's Permanent Magnetic Synchronous Motors deliver 40% energy savings

Leading geared motor specialist Bauer Gear Motor has welcomed the results from a direct product comparison test to see how its latest IE4, super premium efficiency Permanent Magnetic Synchronous Motor performed against a standard Asynchronous Motor. The test was carried out on a Hüber disc thickener at a waste water treatment plant in Germany in partnership with inverter drive specialist Danfoss. Once installed the motor from Bauer was found to operate with 87.7% efficiency and delivered energy savings of almost 40%.

Bauer Gear Motor, part of the global Altra Industrial Motion Group, is one of the world's leading manufacturers of geared motor solutions. It has always been at the forefront of developing new technologies with a desire to improve energy efficiency and reduce costs for its customers. It is this commitment to efficiency that has led to the introduction of a new range of Permanent Magnetic Synchronous Motors (PMSM) which meet the requirements of the IE4 (Super Premium Efficiency) classification.

Jens Gabel, Vice President Global Sales and R&D for Bauer Gear Motor, comments, "In today's market, energy efficiency has to be one of the key determining factors when specifying geared motor solutions. Energy prices are only going to go one way, so it is important that a drive's lifelong running costs are considered; rather than simply the cost of procurement. We have developed the new motor in anticipation of the new IE4 classification and to offer our customers the very best in terms of efficiency."

Bauer's PMSM series is an environmentally-friendly range of motors, employing a highly efficient rotor design that integrates embedded permanent magnets made from rare-earth metals, in place of a squirrel-cage rotor found in most LV induction motors. This design offers a number of key benefits. It reduces heat loss from the rotor by 100%, total loss by approximately 25%, and increases total efficiency by 10% or more.

For the PMSM user, this improved performance translates into a lower total cost of ownership, a reduction in CO2 emissions, and ongoing savings that buffer against future increases in energy costs.

During the product's development it was clear that the new PMSM would offer customers impressive energy savings over conventional, inverter driven Asynchronous Motors (ASM). There has been a large amount of publicity recently about PM motors, but there is still reluctance in the market to buy them, as the purchase cost is higher than that of standard motors. In some light-duty applications, where the motor is rarely on, it is still more economical to specify a standard motor, but, if the duty cycle is high then a PM motor can quickly meet its ROI figure and then go on to deliver savings for a long time to come.



Water treatment plant located outside of Munich processes waste water from approximately 50,000 residents.



Bauer PMSM unit installed on disc thickener which is in continuous operation for seven hours a day, seven days a week.

Eager to prove the real life savings potential of using a PMSM, Bauer was a willing volunteer to take part in the direct product comparison test which was carried out at a live and operational waste water treatment plant in Landsberg am Lech, South West Germany. A disc thickener which is in continuous operation for seven hours per day, seven days a week, provided an excellent test opportunity.

“Our water treatment plant is located just outside of Munich, where waste water from approximately 50,000 residents is processed,” Werner Haan, Plant Manager said. “As part of a program to introduce energy saving measures at our facility, we tested both Asynchronous and Permanent Magnet Synchronous motors. The savings we saw with the PMSM units was far larger than we anticipated. As we continue working to reduce costs, we will begin to replace other existing ASM motors throughout our plant.”

Prior to the test the existing ASM motor was running on a standard inverter. An inverter drive regulates power consumption based on load and frequency, as required by the application, which inherently makes a motor run more efficiently so, prior to the PMSM being installed, a Danfoss inverter drive was retro-fitted to the original system in order to ensure an accurate comparison.

The frequency inverter was programmed to monitor the loads on each motor to ensure that they ran at optimum efficiency. To ensure that any differences in efficiency could be attributed to the motors, each drive used the same Bauer gearbox, which had a reduction ratio of 381:5 at 94% efficiency.

It was found that, with the frequency inverter installed, the ASM created 2.62Nm torque at 1350 rpm and operated with 61.5% efficiency using 0.26kW/H.

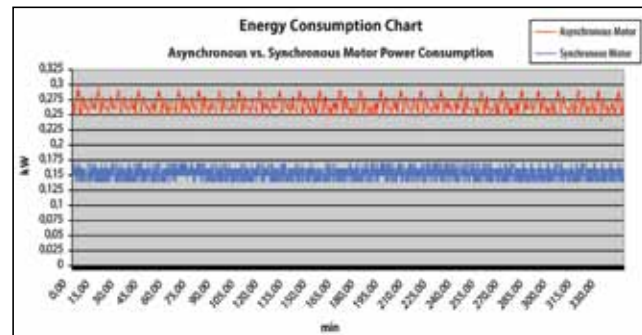
Having completed the measurements on the ASM, the PMSM was installed. The new motor from Bauer created 3.5Nm at 1500 rpm and operated with 87.7% efficiency using only 0.16kW/H. The PMSM yielded a 40% saving in energy use compared to the ASM with the same inverter drive installed.

Over a four year period it was estimated that, with an inverter used in both cases, an ASM would use 2657kW whereas Bauer’s PMSM would use 1635kW; a total saving of 1022kW.

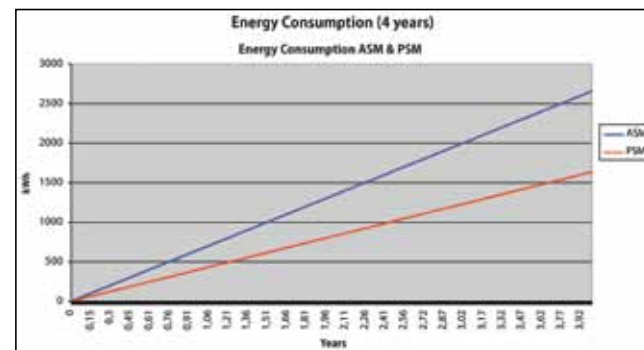
(continued)



Werner Haan, water treatment plant manager.



Graph illustrates the power used by the motor to drive the application over time. The energy usage of the asynchronous motor is shown in RED and the Permanent Magnet Motor in BLUE.



Graph illustrates how the energy usage of the PMSM will payback its purchase price due to the energy reduction over a 4 year period. The accumulated energy usage of the asynchronous motor is shown in RED and the Permanent Magnet Motor in BLUE over time.

“A lot of work has gone into developing our latest series of motors and we had hoped to be able to offer customers very real savings in terms of energy costs,” Mr. Gabel said. “We are very happy with the results of the test, as they show that super premium efficiency motors do deliver a real life measurable benefit and, in many higher demand applications, should certainly be considered by design engineers and maintenance engineers.”

Since the motors can deliver both efficiency and flexibly, the combination of these features with a compact size and high torque rating means that they can be used to cut inventory significantly for large plants. Offering a replacement for a wide variety of different asynchronous geared motors in the field can result in a further reduction in costs for inventory, logistic and maintenance.

The synchronous design of the PMSM motors means that not only are they superior at converting electrical energy into mechanical power, but also offer the added benefit of maintaining constant speed independent of the load. This means that motor speed does not vary, despite overload variations, or in cases of voltage drop, as long as the mains frequency is kept constant.

The PMSM motors are available in ventilated and non-ventilated configurations across the power range from 0.55kW to 15kW. They operate on 380V to 500V power supplies, and are rated for inverter duty, offering an extended speed range with constant torque.



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