

Application note

ABB low voltage permanent magnet motors for slurry pumps Highest efficiency for low speed and high torque applications

Developed from synchronous motors, ABB's low voltage permanent magnet motors combine the high speed accuracy of synchronous technology with the robust design of induction motors. They have the capability to deliver very high torque from small motor sizes at low speed, eliminating the need for gearboxes. Additionally, use of synchronous motor technology ensures high efficiency.



ABB low voltage permanent magnet motors are designed for control by ABB frequency converters only, and they cannot be operated direct on line.

What are the benefits of using ABB low voltage permanent magnet motors for slurry pumps?

Plants in the mining industry have increased their production capacity over the years, with the result that slurry pumps have significantly increased in size and power to match the demands of the process.

The slurry pump shaft is typically rotated at a nominal speed in the range 250 to 600 rpm and the application requires high torque at low speed. The conventional solution involves a standard high speed induction motor and gearbox, or belts and pulleys at lower power ratings.

At high power the overall efficiency of the pump drive system becomes more relevant, and energy efficient solutions are much more attractive due to lower running costs.

The ABB low voltage permanent magnet motor drive solution provides a high torque and low speed drive system coupled directly to the pump. Eliminating the gearbox - or belts and pulleys - also eliminates the losses caused by mechanical transmission equipment and significantly reduces the maintenance needs of the system.

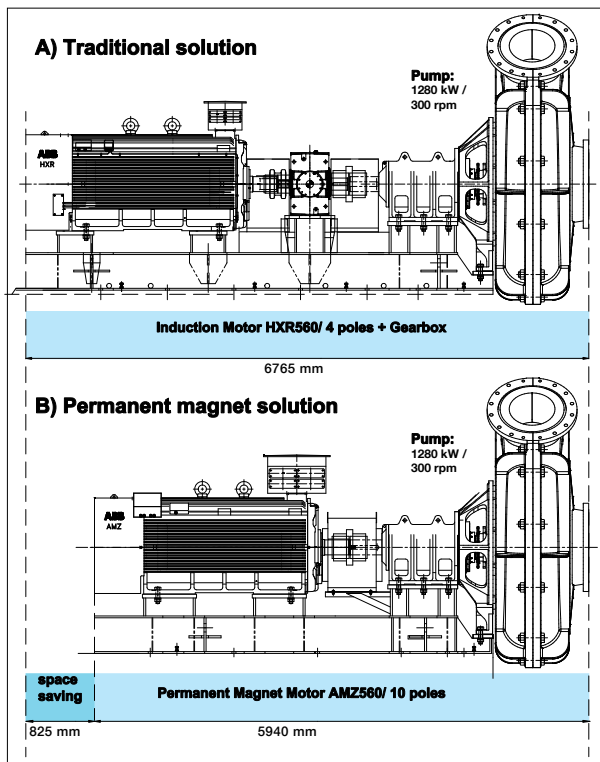
The combination of fewer components and more straightforward configuration not only saves energy but also reduces plant engineering hours, pump skid and foundation size, maintenance costs, and spare part inventories. At the same time installation becomes easier and system reliability is increased.

As the permanent magnet motors are synchronous motors driven by frequency converters, they can be very accurately controlled without the need for feedback devices like pulse encoders. The speed accuracy is as high as that of induction motors in variable speed drive applications with feedback devices.

Summary of benefits:

- High system efficiency due to high motor efficiency and gearbox not needed
- Reduced engineering time
- Smaller pump skid and foundation
- Lower maintenance cost
- Reduced spare parts inventories
- Easier system installation
- Higher "system reliability"

Typical application layout



The layout above compares the space required for A) traditional induction motor with gearbox and B) newest ABB Low voltage permanent magnet motor drive train solution. The space saving is an advantage of the permanent magnet solution. In this example, the permanent magnet motor is powering a 1280 kW / 300 rpm slurry pump directly without gearbox.

Highest efficiency

ABB low voltage permanent magnet motors deliver the highest efficiency in the market and – because the motor powers the slurry pump directly - the drivetrain system also provides the highest possible efficiency. The payback time for the drivetrain system is typically from 12 to 24 months, and in some cases even less.

The table above on the right hand side is a case study of a real slurry pump application. The overall efficiency of the traditional solution with a high speed induction motor and gearbox is 91.5% while that of the drive system with an ABB low voltage permanent magnet motor is 95.9%. This results in annual energy savings of USD 56 000. The efficiency of the ABB low voltage permanent magnet motor is 98.6%.

Application Data:		OPEX Analysis	
Maximum Continuous Torque: 41 kNm			
Maximum Continuous Power: 1280 kW			
Base Speed: 300 rpm			
Altitude: 3200 masl			
Pump type: Slurry Pump			
Equipment:		Traditional Solution	LV PM Motor Solution
AC Drive (including transformer)		97.3%	97.3%
Motor		97.0%	98.6%
High Speed coupling (Grid type)		100 %	NA
Gearbox (estimated)		97.0%	NA
Low Speed coupling (Grid type)		100 %	100 %
Pump		Acc. to pump	Acc. to pump
Overall System Efficiency		91.5%	95.9%
Shaft Power [kW]		1280	1280
Losses [kW]		119	55
Reduction in Losses [kW]		0	64
Energy Cost [USD/kWh]		0.1	0.1
Running Hours per year [h]		8760	8760
Energy Saving per year [USD 1000]		0	56

Technical information

ABB low voltage permanent magnet motors are synchronous motors. The stator incorporates a conventional three-phase winding, as in a squirrel cage motor, while the rotor uses powerful permanent magnets. The magnets in the rotor create a constant flux in the air gap, thereby eliminating the need for the rotor winding and brushes normally used for excitation in a synchronous motor.

Externally, the motors are similar to totally enclosed fan cooled (TEFC) induction motors. They use the same cast iron frame, bearings, seals, main terminal box and accessories as conventional induction motors.

Main features

Power: 17 to 2 500 kW
 Torque: 1 000 to 44 000 Nm
 Voltage: 400 to 690 V
 Standard: IEC
 Frame size: 280 to 560 mm
 Protection: IP55, IP56
 Cooling form: IC411, IC416
 Starting method: ABB frequency converter

Speed and output:

1 020 kW at 220 rpm
 1 390 kW at 300 rpm
 1 970 kW at 430 rpm
 2 490 kW at 600 rpm

For more information please contact:

www.abb.com/motors&generators

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