

PERMANENT MAGNET MOTOR

Borets high efficiency Permanent Magnet Motor (PMM) lowers operating cost and enhances reliability for a successful producing environment

APPLICATIONS

- All wells that require cost efficient operation
- Gas slugging environments common with unconventional and deliquification
- Deviated and horizontal wells

FEATURES & BENEFITS

- High energy efficiency up to 93 % and higher power factor through load range compared to a conventional induction ESP motor:
 - Provides power cost savings up to 20 %
- 40 % shorter motor length & lighter motor weight comparing to the conventional induction ESP motor:
 - Enable ease of installation and improves the ability to run through higher deviations
- The ability to ride through conditions that would cause a conventional induction motor to trip:
 - Provides improved production potential and mitigates problems associated with frequent starts and stops
- Single section motors capable of delivering 400 HP (456 series) & 760 HP (512 series):
 - Reduce installation time and save money by eliminating tandem motors for certain applications. Also shorter length improves ability to run in highly deviated sections
- No slip design reduces heat with no energy wasted on slip:
 - Improves reliability by reducing heat and insulation degradation especially in severe environments such as intermittent flow in unconventional wells
- PMM designs range from 250 up to 6,000 rpm:
 - The PMM wide operating range provides energy efficient system solutions by coupling it to a conventional ESP pump, a Wide Range, Wear Resistant (WR2) Pump or a Progressive Cavity Pump (PCP)
- Locked rotor bearing design for improved run life

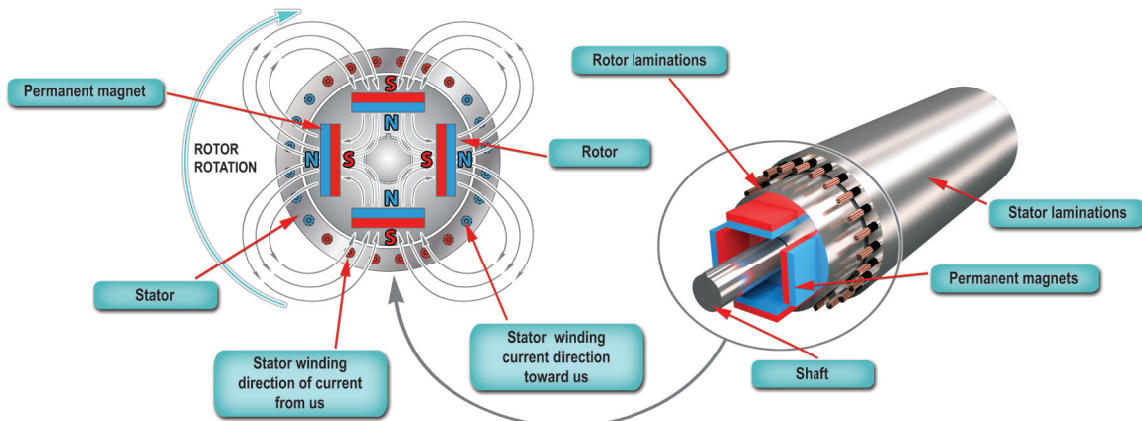
Borets breaks from convention by merging the unique properties of Permanent Magnet Motor (PMM) technology with the traditional design of today's submersible pump systems. The result is an efficient and highly flexible system capable of operating in applications that were once deemed cost-prohibitive or impossible for the technology of yesterday.

Borets Permanent Magnet Motors improve system reliability & efficiency through a series of technical revolutionary advancements over conventional induction motors (IM) thus maximizing a well's potential while reducing operating costs.

PMM OPERATING PRINCIPLE

Unlike a conventional induction motor, the PMM design incorporates a rotor with permanent magnets that are made of sintered hard-magnetic materials. The magnets produce the rotor flux that requires less power for field generation.

As a result the PMM has a higher power density and is shorter than a conventional induction motor of the same horsepower rating. The increased efficiency and the synchronous operation also translate into reduced electrical losses, lower operating current and less heat generation. With less heat generated the motor cooling requirements are reduced and it is possible to operate the system with PMM at lower flow rates than with conventional induction motors. Adaptive surface control allows the system to respond to changing well conditions and extend system run life by optimizing or eliminating cycling in low flow conditions, thus ensuring the maximum production rate. As a result, less heat and faster and more accurate control of the motor allows for an expanded operating range.



PMM-ESP & PMM-PCP APPLICATIONS

Borets offers three PMM rotor design options:

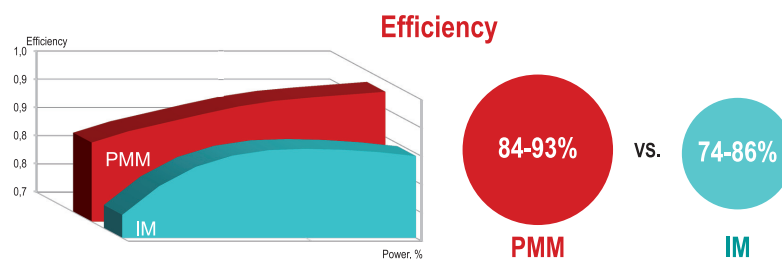
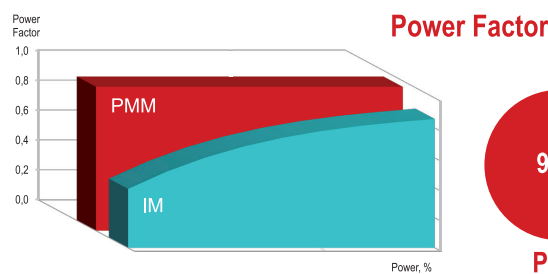
1. **Standard rotor** with adjustable speed range from 500 to 3,900 rpm for conventional ESPs.
2. **High-speed rotor** with adjustable speed range from 3,000 to 6,000 rpm for WR2 ESPs.
3. **Low-speed rotor** with adjustable speed range from 250 to 2,000 rpm for PCP.

PUMP	RPM	MOTOR SERIES	HP										
			25	50	100	150	200	400	600	800	1000		
PCP	250-2,000	456	7	48									
ESP	500-3,900	406		24				228					
		456		40				400					
		512			80				760				
		562				100			980				
WR2	3,000-6,000	456			94			241					

40 %
shorter motor length



PMM vs IM Performance Curve*



* ESP B 456 PL200 Permanent Magnet Motor vs ESP B 456 IL200 Induction Motor at 50 Hz

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