Permanent Magnet Motors for REDA ESP pumps
Reduce electricity consumption and parasitic load while increasing the range of operations

Energy Consumption Reduction:
Lowers electricity consumption by a minimum of 10%

Emissions Reduction:
Reduces greenhouse gas emissions by up to 143 metric tons of CO₂e per well per year

Efficiency:
Up to 93% at 100% load

Motor ODs, in [mm]:
3.19 [81], 4.61 [117], and 5.62 [143]

High reliability:
Extended run life due to cooler motor running temperatures

Where they are used
Permanent magnet motors (PMMs) for electric submersible pumps (ESPs) are used with REDA ESP* pumps in multiple industries, including oil and gas, mining (for dewatering), and geothermal energy production (where the pump’s electricity consumption is considered a parasitic load).

Lower energy consumption and emissions
Assessing the power efficiency of ESPs is a practical first step to reducing energy consumption and the resulting emissions during operation. Pumps and motors are the components with the largest impact on energy consumed.

PMMs deliver higher efficiency, power factor, and power density as well as a wider range of operating speeds compared with conventional induction motors. REDA ESP pump PMM technology lowers electricity consumption by up to 10% because of its greater efficiency, saving energy and reducing Scope 1 or Scope 2 emissions (depending on the electricity source).

Greater operational flexibility
Schlumberger energy-efficient yet powerful PMMs are reliable, robust, and available in a wide range of sizes and horsepower options. Higher power per unit of length—power density—results in a motor that is shorter and lighter than legacy induction ESP motors without reducing the rating. It also enables a single-motor configuration in place of long tandem motor arrangements, which reduces risks associated with ESP installation in deviated wells, especially wells with high dogleg severity (DLS).

In rapidly changing environments, the PMM’s higher torque capabilities enable stable ESP operation during increased solids production or water cut. Stable torque across various load conditions is the key differentiator, enabling higher efficiency and power savings versus induction motor technology.

A detailed study of the potential economic and environmental benefits of using PMMs can be found in SPE-204485.

Permanent magnet motor for REDA ESP pumps.

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<th>Permanent Magnet Motor Specifications</th>
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<tr>
<td>Series</td>
<td>319</td>
<td>461</td>
<td>562</td>
<td>562-GT†</td>
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<tr>
<td>Max. power at 60 Hz, hp [kW]</td>
<td>150 [112]</td>
<td>320 [239]</td>
<td>794 [592]</td>
<td>850 [634]</td>
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</table>

All specifications are subject to change without notice.
† High-horsepower PMM designed and engineered for high-enthalpy geothermal applications.

Performance improvement is based on a 4.61-in [117-mm], 322-hp motor configuration compared with previous-generation induction motor technology. Calculations are based on a run life of 365 days with 100% uptime and take into consideration efficiency losses of the power cable, variable frequency or variable speed ESP drive, and transformer.

The conversion from electricity to CO₂ is based on the IEA Emission Factors 2019 reference of 485.30 g of CO₂/kW.h.
**Permanent magnet motors**

**Why PMMs are more efficient than induction motors**
PMMs are synchronous electric machines—the rotor rotates at the same speed as the magnetic field in the stator. This synchronous operation reduces losses in the core, resulting in less heating and an expanded operating envelope for the ESP.

For optimal operation, PMMs require a variable speed drive (VSD) with special control algorithms to time the switching of the output transistors and control the current in the motor windings. The incremental cost of upgrading to a VSD is quickly recovered.

**Streamlined installation and real-time monitoring**
Schlumberger PMMs are filled in a controlled environment with high-temperature synthetic oil to provide dielectric strength, bearing lubrication, and thermal conductivity. The ESP flange connection facilitates reliable motor and protector connections while ensuring a leak-tight seal. MaxLok* ESP quick-plug motor lead extension (MLE) simplifies making up the pothead to the motor with a plug-in connection that eliminates taping of pothead terminals at the wellsite.

The gauge-ready base is compatible with any Phoenix* artificial lift downhole monitoring system sensor for real-time monitoring of ESP and reservoir properties. A temperature sensor connected directly to the motor winding enables monitoring motor-winding temperature in real time through all stages of operation.

**PMM safety**
Schlumberger has implemented operational standard work instructions globally to enhance the safety of everyone involved in running, operating, and removing PMMs. Training for customer personnel is available on request at Schlumberger assembly, repair, and test (ART) centers.

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