PLEUGER
INDUSTRIES

PLEUGER® PMM

High Efficiency Submersible Motor with Permanent-Magnet-Technology for Electrical Submersible Pumps (ESP)

Edition 11.18

Trusted Supplier of Choice for Water Resources

Since 1929 Pleuger Industries GmbH is in the forefront of virtually every significant advancement in pumping technology to meet water-handling challenges. Today, Pleuger offers a wide range of submersible pumps with water-filled motors and systems (Pleuger design) for water applications along with a comprehensive technical service and support.

Hamburg – Germany
Headquarter and Design Center for Submersible Pumps and Motors

Orleans – France
Assembling and Service Center

Significant Increase of Motor Efficiency and Power Output

The Pleuger PMM permanent magnet motor has been developed for the highest possible energy efficiency.

The permanent magnet technology provides up to 14 percentage points better efficiency compared to asynchronous technology (AC), resulting in a lower elevated temperature rise of the motor windings, increasing power output more than 100%.

The PMM motor is available from 4 kW (5.4 hp) to 200 kW (268.2 hp) with efficiencies up to 95%.

Construction of the PMM motor is based on the reliable Pleuger three-phase AC submersible squirrel cage induction motor.

PMM motors are rewindable, synchronous electric motors. Control via variable frequency drive (VFD) ensures most efficient operation.

Pleuger offers the complete system of pump, motor and VFD.

Markets

- Water Resources
- Mining Industry
- Agriculture / Irrigation
- Steel and Aluminum Plants
- Power
- General Industry

Applications

- Groundwater Development
- Water Supply and Distribution
- Dewatering / Irrigation
- Cooling Water
- Water Level-Management
- Pressure Increase (Booster)

Hamburg – Alster Lake Fountain
Operated by Pleuger PMM

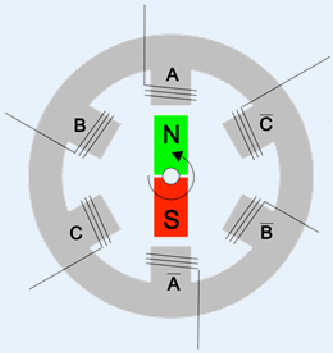
Engineered to Maximize Efficiency

PMM Features and Benefits

- Electrical submersible motor, including permanent magnet technology, provides up to 14 percent points better efficiency than induction (asynchronous, AC) motors.
- Increased power output of more than 100% compared to an AC, motors allow smaller unit sizes with reduced installation costs.
- Wide efficiency curves drastically reduce number of motor sizes and simplify storage.
- Pleuger synchronous motors are based on the reliable Pleuger asynchronous motor design.
- No special VFD required; standard VFDs from various manufacturers can be used.
- Low motor temperature increases lifetime and MTBF.
- No sinus filter or du/dt filter required, reduce investment and energy cost.

Permanent Magnet Motor

Synchronous Motor

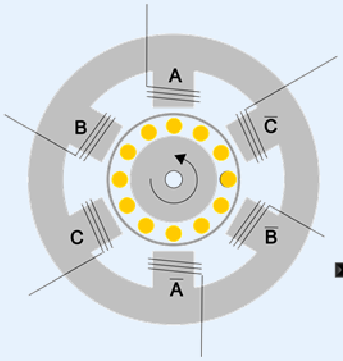


Magnetization of PMM Rotor via Permanent Magnets

➡ **No Copper Losses**

Induction Motor

Asynchronous Motor (Squirrel Cage Motor)

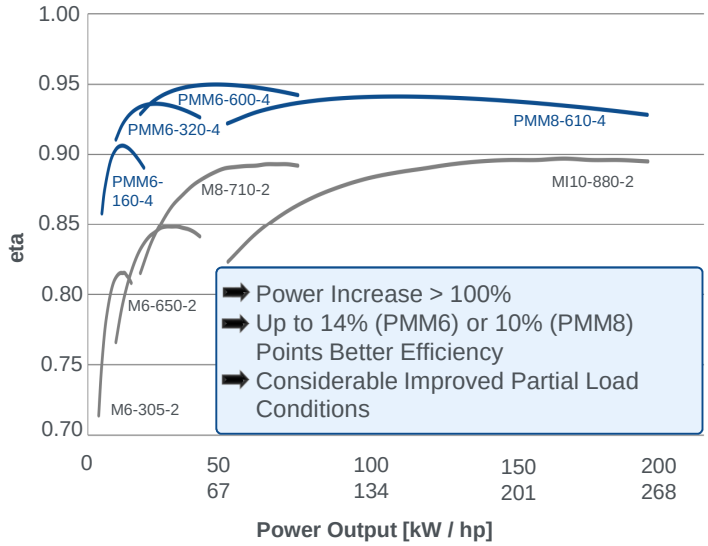


Magnetization of Squirrel Cage Rotor through Stator

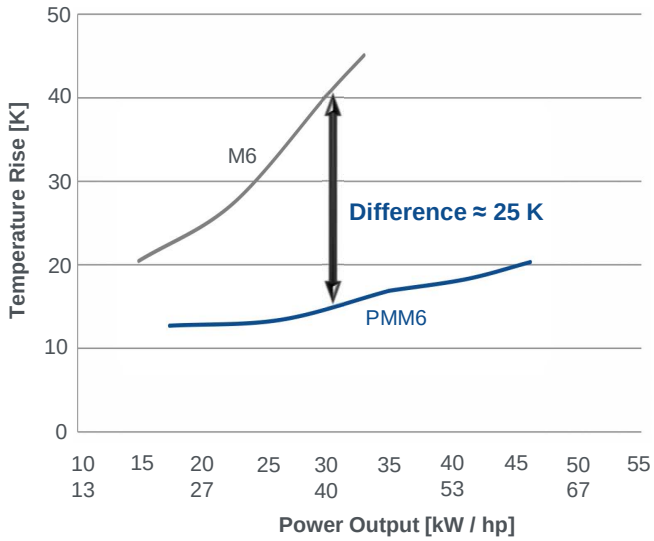
➡ **Copper Losses in Rotor**

Synchronous Motor (PMM) versus Asynchronous Motor (M-Series)

Efficiency



Winding Temperature



Designed to Minimize Life Cycle Costs

Flat- or Round Cable
Space-saving cable design for installation with limited space. Certified for drinking water application.

NEMA Flange Connection
Offers easy connection to standard hydraulics.

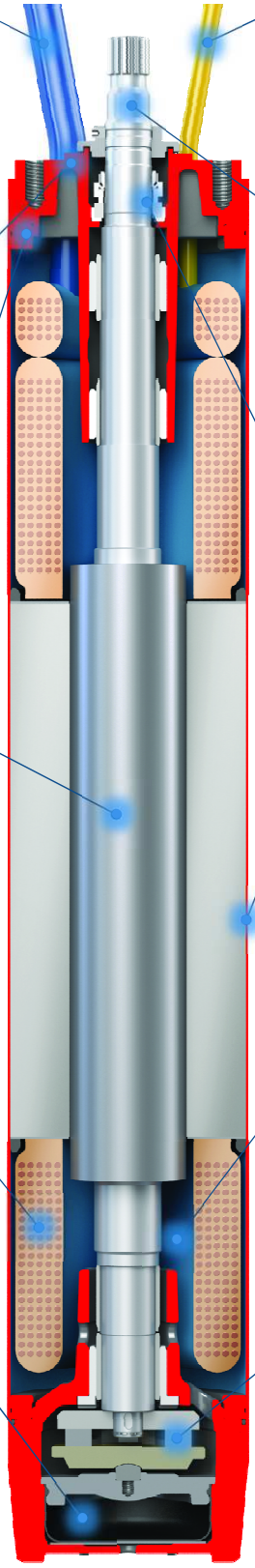
Motor Housing
Robustly designed cast housing ensures reliable strength, stiffness, corrosion resistance and durability.

Permanent-Magnet-Rotor
Up to 14 percent points higher motor efficiency compared to asynchronous motors due to no copper losses.

Hermetic encapsulated rotor ensures protection of magnets against corrosion and mechanical damage.

Rewindable Winding
Provides maintenance and cost saving; PVC or PE2 insulation.

Breather Diaphragm
Guarantees pressure compensation of liquid inside and outside the motor to extend mechanical seal and O-ring service life.



Signal Cable (optional)
Used with temperature sensor PT100 for monitoring motor temperature.

Motor Shaft End
Standard duplex stainless steel construction provides best combination of corrosion resistance, mechanical strength and stiffness. Special materials available on request.

Mechanical Seal
High-grade SIC/SIC/Viton ® as standard ensures wear resistance and maintenance-free operation.

Stator Tube
Standard 316 stainless steel construction offers excellent corrosion resistance over the service life. Special materials available on request.

Motor Filling
Prefilled and tested with water/glycol mixture or potable water on request.

Thrust Bearing
Heavy-duty, maintenance-free design to ensure long lifetime.

Technical Data

Motor Type	Power Output * kW (HP)	Current * A	Efficiency * %	Cos Phi *	Length, L mm (inch)	Diameter, D mm (inch)	Weight kg (lb)	Maximum Permissible Thrust kN (lbf)	
								F_{A1}	F_{A2}
PMM6-160-4	4.0 (5.4)	8.2	87.0%	0.995	696 (27.40)	144 (5.669)	46 (101)	27.5 (6182)	6 (1349)
	5.5 (7.4)	11.0	89.0%	0.990					
	9.2 (12.3)	17.9	91.0%	0.975					
	11.0 (14.3)	21.5	91.5%	0.965					
	13.0 (17.4)	25.5	91.0%	0.955					
	15.0 (20.1)	29.0	91.0%	0.940					
PMM6-320-4	15.0 (20.1)	28.5	92.5%	0.990	856 (33.70)	144 (5.669)	64 (141)	27.5 (6182)	6 (1349)
	18.5 (24.8)	35.0	93.0%	0.985					
	22.0 (29.5)	41.5	93.5%	0.975					
	26.0 (34.9)	48.5	93.5%	0.970					
	30.0 (40.2)	57.0	93.0%	0.960					
	33.0 (44.3)	63.0	93.0%	0.950					
	37.0 (49.6)	71.0	92.5%	0.935					
	40.0 (53.6)	77.0	92.5%	0.925					
PMM6-600-4	40.0 (53.6)	79.0	94.5%	0.980	1136 (44.72)	144 (5.669)	101 (223)	27.5 (6182)	6 (1349)
	46.0 (61.7)	92.0	94.5%	0.970					
	50.0 (67.1)	100.0	94.5%	0.965					
	55.0 (73.8)	110.0	94.5%	0.960					
	60.0 (80.5)	121.0	94.5%	0.950					
	68.0 (91.2)	137.0	94.5%	0.935					
	75.0 (100.6)	153.0	94.0%	0.920					
PMM8-610-4	75.0 (100.6)	140.0	93.5%	0.985	1438 (56.61)	186 (7.323)	179 (395)	80.0 (17985)	12.5 (2810)
	83.0 (111.3)	153.0	94.0%	0.985					
	90.0 (120.7)	166.0	94.0%	0.985					
	110.0 (147.5)	205.0	94.0%	0.975					
	140.0 (187.7)	260.0	94.0%	0.960					
	170.0 (228.0)	320.0	93.0%	0.940					
	190.0 (254.9)	360.0	93.0%	0.920					
	200.0 (268.2)	380.0	92.5%	0.915					

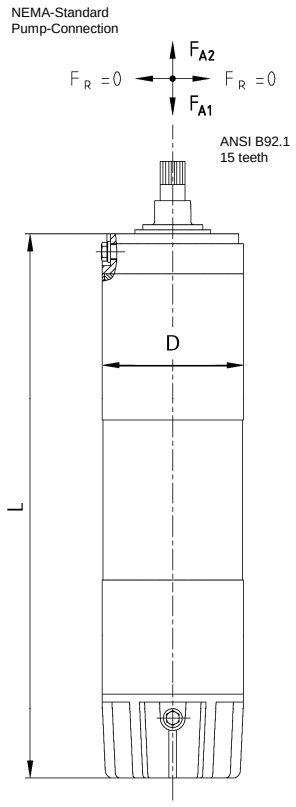
* at 120Hz and 3600 rpm

Motor Specification

- Driven by VFD
- VFD Input Voltage: 400 – 500 V
- Operating Frequency: 70–120 Hz
- Operating Speed: 2100–3600 1/min; max. 3800 1/min
- Motor Flange: NEMA
- Protection: IP68
- Installation: Horizontal/Vertical
- Motor Lead: PMM6 = 3 m (9.8 ft); PMM8 = 7 m (23 ft)
- Operating Ambient Temp: -15°C to 50°C (5°F to 122°F)
- Cooling Velocity: 0.2 m/s @ 20°C (0.66 ft/s @ 68°F) or 0.5m/s @ 30°C (11.6 ft/s @ 86°F)
- Starts per Hour: PMM6 = 20; PMM8 = 10
- Drinking Water Approval for Power Cable

Construction Materials

- Casted Housing Materials: Cast Iron, Bronze, 316 Stainless Steel, Super Duplex Stainless Steel
- Shaft End: Duplex Stainless Steel (Standard), Super Duplex Stainless Steel
- Rubbers: NBR
- Mechanical Seal: SIC/SIC/Viton
- Stator Tube: 316 Stainless Steel, SMO
- Radial Bearing: Carbon
- Thrust Bearing: Synthetic/ stainless steel
- Fasteners: 316 Stainless Steel, Super Duplex Stainless Steel
- Diaphragm: NBR



VFD and Filter

- VFD on request or any on the market suitable to operate synchronous motor
- Filter du/dt or Sinus Filter: Not required; on request for special requirements

Motor Options

- PT100 (directly built-in or retrofitable)
- Higher or lower temperature

Life Cycle Cost Solutions

Typically, 90% of the total life cycle cost (LCC) of a pumping system is accumulated after the equipment is purchased and installed.

Pleuger has developed a comprehensive suite of solutions aimed at providing customers with unprecedented value and cost savings throughout the life span of the pumping system.

These solutions account for every facet of life cycle cost, including:

Capital Expenses

- Initial purchase
- Installation
- De-installation
- Disposal

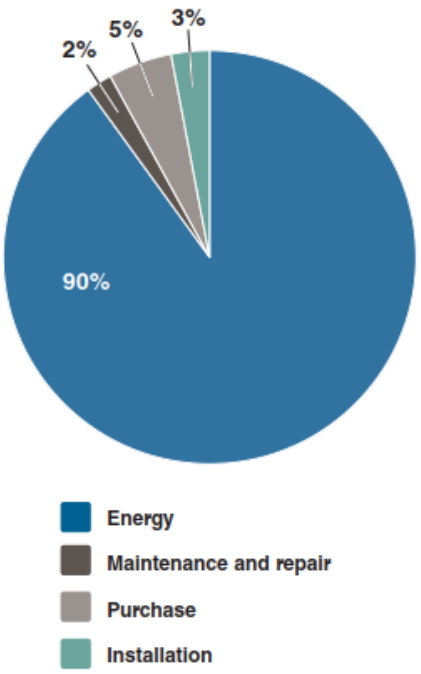
Operating Expenses

- Energy consumption
- Maintenance
- Production losses
- Environmental
- Inventory
- Operating
- Removal

Innovative Life Cycle Cost Solutions

- New pump selection
- Turnkey engineering and field service
- Energy management
- Pump availability
- Proactive maintenance
- Inventory management

Typical Life Cycle Costs for Submersible Pumps[1]



[1] While exact values may differ, these percentages are consistent with those published by leading pump manufacturers and end users, as well as industry associations and government agencies worldwide.

Contact

Your PLEUGER Industries Contact:

GERMANY

Pleuger Industries GmbH
Friedrich-Ebert-Damm 105
D-22047 Hamburg
Germany

Phone.: +49 (0) 40 69 689 0
Fax: +49 (0) 40 69 689 242

Email: hamburg@pleugerindustries.com

Your PLEUGER Industries Contact:

FRANCE

Pleuger Industries France
21, Rue de la Mouchetière
Parc d'activités d'Ingré
F – 45140 Saint-Jean de la Ruelle

Tel.: +33 (0) 2 38 70 84 00
Fax: +33 (0) 2 38 43 00 92

Email: orleans@pleugerindustries.com

For more details and local contact information visit our website:

www.pleugerindustries.com