WIND TURBINE PITCH SERVO MOTOR

High performance, low maintenance actuation for Pitch Systems

Moog knows the challenges faced by wind turbine manufacturers and operators when it comes to pitch control. Consequently we are committed to offering the reliability, high performance and maintenance-free systems you need for maximum uptime in onshore or offshore turbines.

Moog is introducing a unique, cost effective AC synchronous electromagnetic servo motor, designed to meet the unique requirements of pitch systems. When combined with the Wind Turbine Servo Drive in the Moog Pitch System, it offers higher performance and additional safety. The new Pitch Servo Motor offers maximum reliability and very low maintenance cost due to its innovative design.

Built to meet the requirements of corrosion class C5-M (High) (according to DIN 12944 Standards) and with wind proof connector technology, this motor is suitable for Hot Climate Versions (HCV)/Cold Climate Versions (CCV) and offshore areas. From the hardware to the connectors to the plug, this motor is designed to work reliably under some of the most demanding environmental conditions including high vibration, extreme temperatures and high humidity.

ADVANTAGES

- Long Life and Very Low Maintenance– AC synchronous motor technology produces extremely long life and very low maintenance costs as it minimizes mechanical wear
- Protection in the event of grid loss– Compact motor offers high power density to reach required torques and speeds needed for safe feathering
- Extra Safety – Sensorless control means the Moog Pitch Servo Drive can control the motor in the event that position information is lost from the Servo Motor's resolver

APPLICATIONS

Actuation for Pitch Systems in Onshore and Offshore Wind Turbines

FEATURES AND BENEFITS

AC synchronous motor, natural cooled	Low maintenance, long-life product, IP65 (Assembled with Gear Box)
Maximized operation area	• Electromagnetic design and capabilities of the Moog Pitch Servo Motor guarantee a wide Torque versus Speed operation area. • Optimized behavior for emergency conditions at dynamically decreasing DC Link and / or battery backup.
High peak power density	Allow smaller motors (reduced cost), and higher dynamics as compared to DC motors (lower rotor inertias), while achieving feathering requirements even in the "Grid Loss" condition.
Sensorless control	• Additional safety feature where the Pitch Servo Drive can control the motor in the event of motor positional feedback loss. • Double pitch torque at 0 rpm.
Integrated permanent magnet brake	No wear of brake pad due to mechanically fixed friction pad. • Brake designed for motor lifetime (subject to failures in application) • Transmission of high holding torque at smallest installation space • Zero internal backlash
Connector technology	Data and power transmission with a proven connector for wind energy market.
PMC6 - IEC 112 or IEC 132 Flange PMC7 - IEC 200 Flange	Using standard motor mechanical interface dimensions simplifies redesign and retrofit from DC to AC pitch systems
Flexibility	The mechanical/electrical interfaces and performance characteristics can be tailored to meet customer-specific requirements.

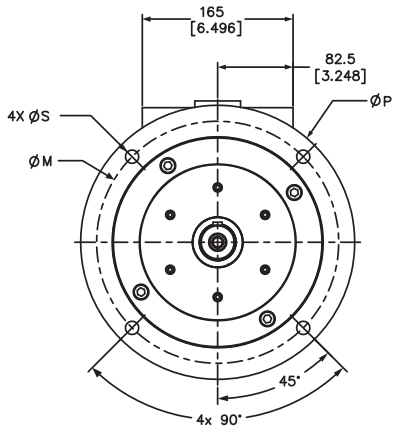
PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

Model		PMC6-045	PMC6-060	PMC7-060	Units
STALL CONDITION					
Continuous Stall Torque	M_0	40 [354]	55 [487]	135 [1195]	Nm [lb.in]
Continuous Stall Current	I_0	28	28	40	Arms
NOMINAL OPERATING CONDITION, S1					
Nominal Torque	M_N	32 [283]	42 [372]	75 [664]	Nm [lb.in]
Nominal Current	I_N	24	21	22	Arms
Nominal Speed	n_N	2000	1700	1500	rpm
Nominal Power	P_N	6.70 [9.0]	7.48 [10.0]	11.78 [15.8]	kW [hp]
PITCH OPERATING CONDITION, S9 (S1 equ.)					
Pitch Torque	M_{PTH}	40 [354]	55 [487]	135 [1195]	Nm [lb.in]
Pitch Current	I_{PTH}	28	28	40	Arms
Pitch Speed	n_{PTH}	500	500	500	rpm
Pitch Power	P_{PTH}	2.09 [2.81]	2.88 [3.86]	7.07 [9.48]	kW [hp]
PEAK OPERATING CONDITION, S2					
Peak Torque (0.5sec)	M_{max}	125 [1106]	170 [1505]	340 [3009]	Nm [lb.in]
Peak Current (0.5sec)	I_p	80	100	100	Arms
Peak Torque @80Arms S2/3sec	M_{maxP80}	125 [1106]	140 [1239]	275 [2434]	Nm [lb.in]
Peak Torque @100Arms S2/3sec	$M_{maxP100}$	NA*	170 [1505]	340 [3009]	Nm [lb.in]
Maximum speed *	n_{max}	4500	3000	1900	rpm
MOTOR PARAMETERS					
Torque constant	k_T	1.43 [12.6]	1.96 [17.4]	3.38 [29.9]	Nm/Arms [lb-in/Arms]
Voltage constant	k_e	81	107	205	Vrms/krpm
Thermal time constant	t_{Th}	4100	4200	5400	sec
Winding resistance at 25 °C (phase to phase)	R_{tt}	0.278	0.258	0.141	ohm
Winding inductance (Unsaturated)	Lq / Ld	5.3/2.01	6.5/3.2	9.1/3.5	mH / mH
Rotor inertia	J	154 [1363]	210 [1859]	873 [7725]	Kgcm2 [lb-in.sec2 x10-4]
Weight	m	45 [99.2]	54 [119.0]	125 [276]	Kg [lb]

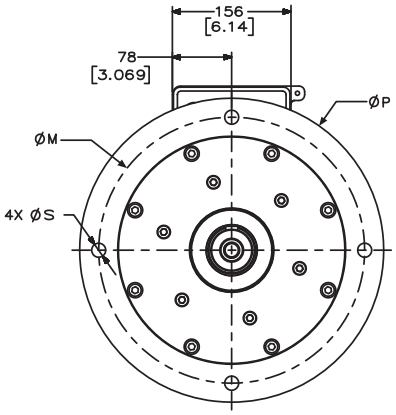
Notes:
1. Motor performances as measured with Moog's Pitchmaster Servodrive with Loss Optimised Control
2. Motor Pole Count: 8 (ie 4 pairs)
3. DC Link voltage 565V
4. Maximum Speed * of the motor is measured at 565VDC bus voltage without field weakening condition
5. Continious ratings values at 50°C ambient temperature.
6. NA* - PMC6-045 Motor maximum current limited to 80Arms

DIMENSIONAL DRAWINGS AND SIZES

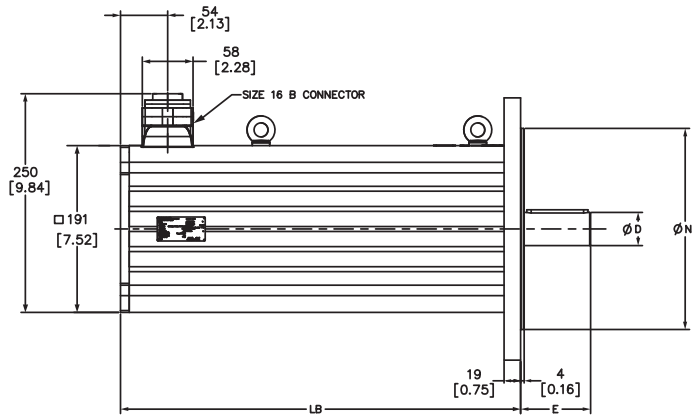
IEC 112 / 132



IEC 200



PMC6



PMC7

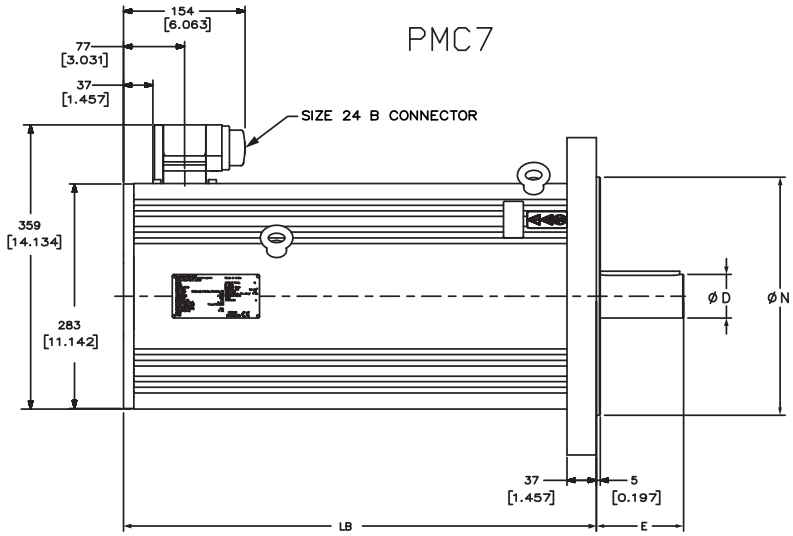


TABLE 1 - MOTOR LENGTHS

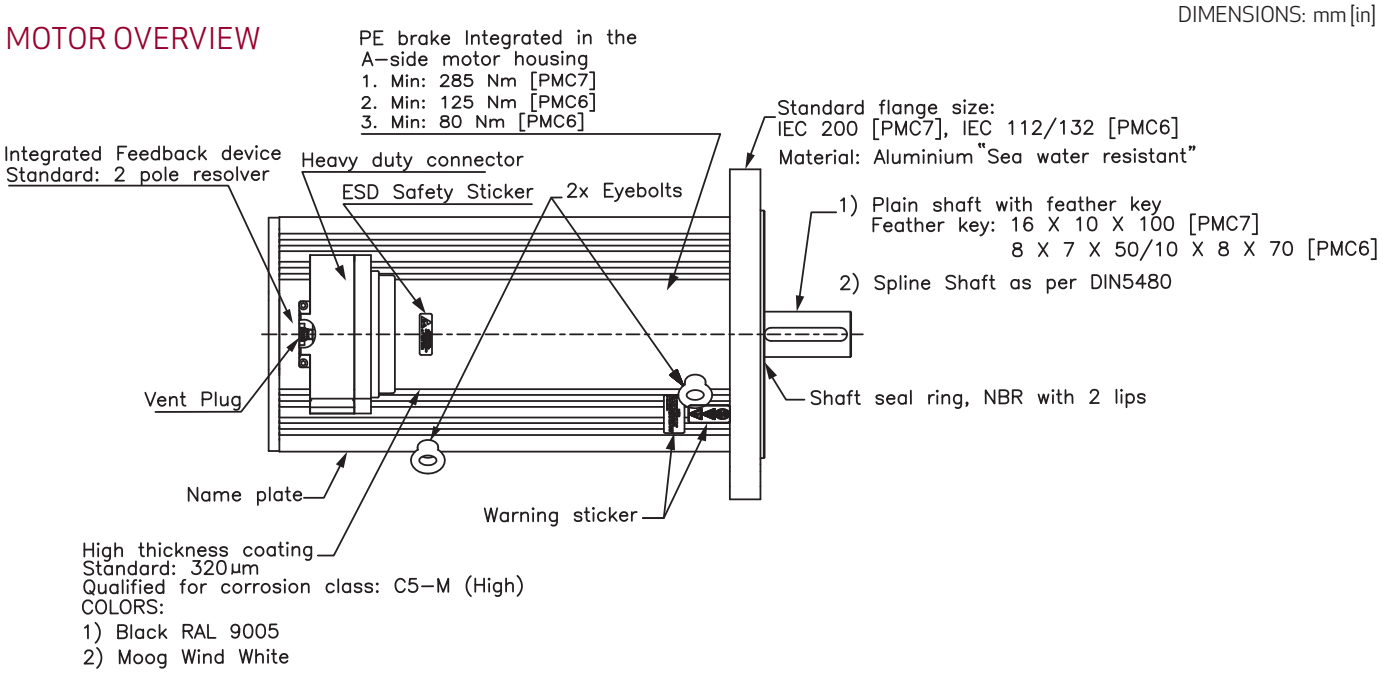
MODEL NO.	LB
PMC6-045	419 [16.50]
PMC6-060	458 [18.03]
PMC7-060	596 [23.47]

TABLE 2 - FLANGE AND SHAFT DIMENSIONS

MOTOR TYPE	FLANGE SIZE	E	D	N	S	M	P
PMC6	IEC 112	60 [2.36]	28 [1.10] j6	180 [7.09] j6	14.5 [0.57]	215 [8.47]	250 [9.84]
	IEC 132	80 [3.15]	38 [1.50] k6	230 [9.06] j6	14.5 [0.57]	265 [10.43]	300 [11.81]
PMC7	IEC 200	110 [4.33]	55 [2.17] m6	300 [11.81] j6	18.5 [0.73]	350 [13.78]	400 [15.75]

DIMENSIONS: mm [in]

MOTOR OVERVIEW



OPTIMIZED PERFORMANCE WITH THE PITCH SERVO DRIVE

The Moog Servo Drive was developed for the harsh conditions in the rotating hub to be resistant to vibration, shock and permanent shock. It is ideally matched to the Moog Pitch Servo Motor for optimized performance and enhanced safety. They work seamlessly together with the Backup System in the event of a grid loss condition, with the Servo Drive providing control for extra safety. Its flexible and compact design provides selectable installation positions and operates reliably under internal switchgear cabinet temperatures from -30 to 70 °C (-22 to 158 °F) in your onshore and offshore installations. Easy remote maintenance through Ethernet and service diagnostics of the Servo Drive combined with the use of AC synchronous motor technology produce an extremely long life option for pitch control.

Note: DC motors are also available for pitch systems requiring this safety concept.

MOOG GLOBAL SUPPORT™

Wherever you are in the world, you can rest assured that Moog's team of experienced, trained technicians are there for you with the service, training and parts you need to keep your wind turbines performing at peak condition. Moog Global Support™ is your direct link to optimal wind turbine reliability and performance.

MOOG GLOBAL SUPPORT™

Moog has offices around the world.

For more information or the office nearest you, contact us online.

www.moog.com/industrial

Wind Turbine Pitch Servo Motor
Origami/PDF August 2014 Rev.B

MOOG