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 C5M (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

YOUR PARTNER IN PITCH CONTROL

MOOG

FEATURES AND BENEFITS

Features and benefits	
AC synchronous motor, IP65, natural cooled	Low maintenance, long-life product
Maximized Torque versus Speed operation area	• Electromagnetic design and capabilities of the Moog Pitch Servo Motor guarantee a maximized Torque versus Speed operation area • Optimized behavior for emergency conditions at dynamically decreasing and/ or very low DC link voltage
High peak power density	Allows for smaller motor (reduced cost), and higher dynamics (lower rotor inertias), while achieving feathering requirements even in the "Grid Loss" condition
Sensorless control	• Additional safety feature where the Motor Pitch Servo Motor 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 airgap • Brake designed for motor lifetime • Maximized peak torque capability with minimum installation space • Minimized internal backlash
Wind-proof connector technology	Heavy-duty connector for robust and quick installation inside the hub
IEC112 or IEC132 front flange	Using standard DC 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

CHARACTERISTICS

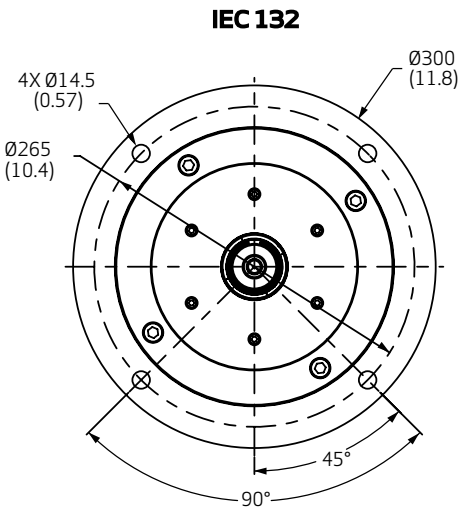
Model		PMC6-030	PMC6-045	PMC6-060	PMC6-075	Units
Continuous stall torque	M_0	28 (248)	40 (354)	55 (487)	65 (575)	Nm (lbf in)
Continuous stall current	I_0	17	21	28	30	A_{rms}
Nominal torque	M_N	23 (204)	32 (283)	42 (372)	50 (443)	Nm (lbf in)
Nominal current	I_N	15	17	21	26	A
Nominal speed	n_N	2,200	2,000	1,700	1,500	rpm
Nominal power	P_N	5.30 (7.11)	6.70 (8.99)	7.48 (10.0)	7.85 (10.5)	kW (hp)
Pitch torque	M_{PTH}	28 (248)	40 (354)	55 (487)	65 (575)	Nm (lbf in)
Pitch current	I_{PTH}	17	21	28	31	A_{rms}
Pitch speed	n_{PTH}	500	500	500	500	rpm
Pitch power	P_{PTH}	1.47 (1.97)	2.09 (2.81)	2.88 (3.86)	3.40 (4.56)	kW (hp)
Torque (0.5 s)*	M_{max}	105 (929)	145 (1283)	195 (1726)	250 (2213)	Nm (lbf in)
Peak current (0.5 s)	I_p	67	90	110	130	A_{rms}
Peak torque @ 80 Arms S2/3 s	M_{maxP80}	105* (929)	130 (1151)	160 (1416)	175 (1549)	Nm (lbf in)
Peak torque @ 100 Arms S2/3 s	$M_{maxP100}$	105* (929)	155 (1372)	195 (1726)	205 (1814)	Nm (lbf in)
Maximum speed	n_{max}	3600	3300	3000	2700	rpm
Torque constant	k_T	1.65 (14.6)	1.90 (16.9)	1.96 (17.4)	2.10 (18.6)	Nm/A_{rms} (lbf in/A_{rms})
Voltage constant	ke	89	98	107	119	V_{rms} / krpm
Thermal time constant	t_{Th}	3,900	4,100	4,200	4,400	s
Winding resistance at 25 °C (27 °F) (phase to phase)	R_{tt}	0.48	0.34	0.27	0.23	Ohm
Ohm winding inductance (unsaturated)	Lq / Ld	8.0 / 3.2	7.0 / 3.0	5.74 / 2.28	4.3 / 1.67	mH / mH
Rotor inertia	J	134 (1,182)	173 (1,529)	210 (1,860)	247 (2,190)	kg cm^2 (10^{-4} lbf in s^2)
Weight	m	35 (77.2)	45 (99.2)	54 (119)	66 (146)	kg (lb)
Overall motor length		390 (15.4)	427 (16.8)	467 (18.4)	506 (19.9)	mm (in)

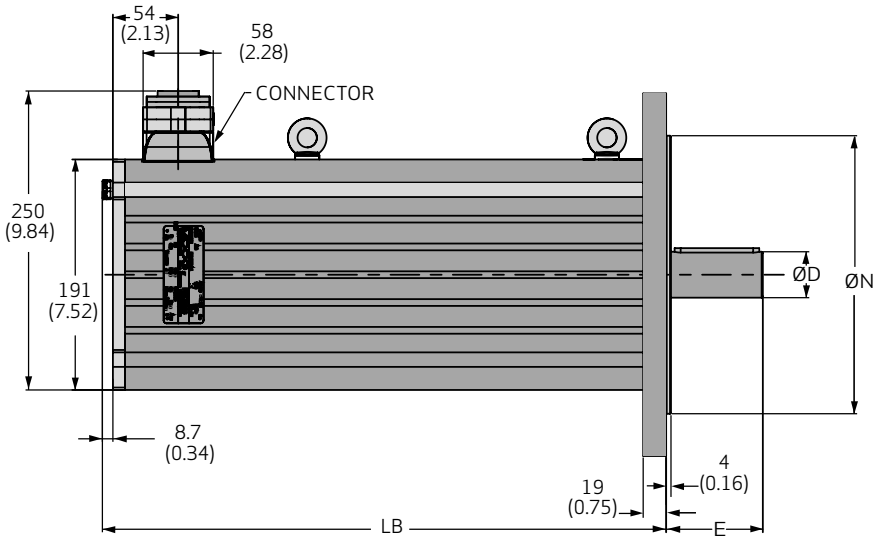
Notes:
1. Motor performances as measured with Moog's Pitch Servo Drive with Loss optimized control
2. Motor pole count: 8 (ie 4 pairs)
3. DC Link voltage 565 V
4. Continuous ratings values at 50 °C (122 °F) ambient temperature

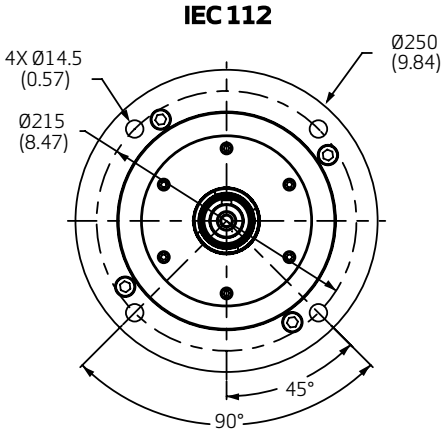
* Torque limited by peak current of 67 Arms for PMC6-030

** Maximum speed considering minimum voltage of 230 V DC with field weakening

DIMENSIONAL DRAWINGS AND SIZES

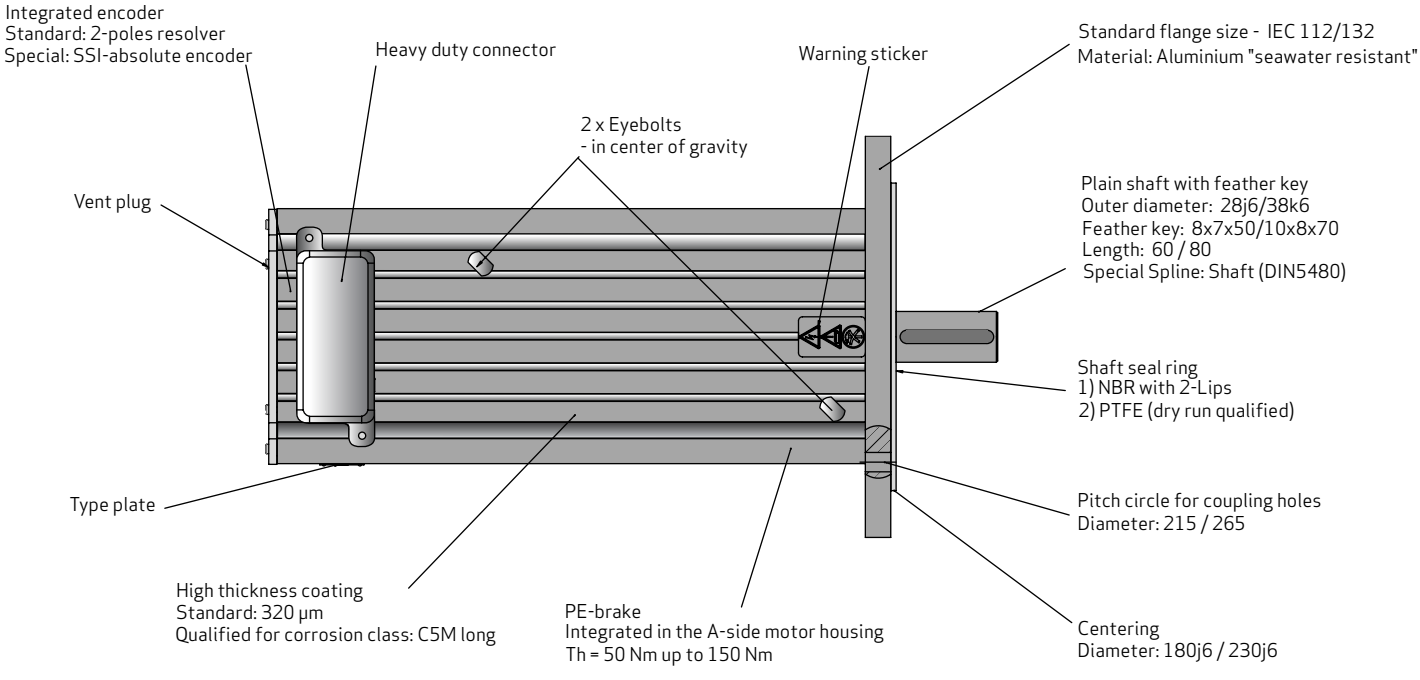






Model No.	Flange Size	LB	E	D	N
PMC6-030	IEC 112	390 (15.4)	60 (2.36)	28 (1.10) j6	180 (7.09) j6
PMC6-045	IEC 132	427 (16.8)	80 (3.15)	38 (1.50) k6	230 (9.06) j6
PMC6-060	IEC 132	467 (18.4)	80 (3.15)	38 (1.50) k6	230 (9.06) j6
PMC6-075	IEC 132	506 (19.9)	80 (3.15)	38 (1.50) k6	230 (9.06) j6

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/wind

Wind Turbine Pitch Servo Motor
TJW/Rev. 2, May 2011, Id. CDL31174-en

MOOG