

Data Sheet

EM-PMI540-T2000

Electric machine, permanent magnet internal

FEATURES

- Synchronous Reluctance assisted Permanent Magnet (SRPM) technology
- Extremely compact and robust structure
- Highest efficiency throughout the operation range on the market (~96 %)
- Liquid cooled with plain water or water/glycol mixture
- Low coolant flow required
- Allowed coolant temperature up to +65°C
- IP65 enclosure class to maximize reliability
- Multiple mounting possibilities



GENERATOR SPECIFIC FEATURES

- Standard SAE flange mounting to match the diesel engine connection
- Wide selection of speed ratings allowing the generator to be selected to customer specific applications with various voltage requirements
- Can be also used as starter motor for the ICE

MOTOR SPECIFIC FEATURES

- Extended speed and torque capabilities compared to standard PM motors from Danfoss reluctance assisted permanent magnet motor technology
- Motor structure is designed to be able to produce high starting torques: EM-PMI motor can produce instantly full torque to a non-moving axle
- Optimized speed range to meet the most common gear ratios used in heavy mobile machinery

GENERAL

The machine is developed especially for demanding applications. The design of these machines makes them smaller, lighter and more efficient than conventional products on the market.

TYPICAL APPLICATIONS

- Generator for diesel-electric/ serial hybrid applications
- Traction/propulsion motor
- Generator/Motor for parallel hybrid applications

SPECIFICATIONS

General electrical properties

Nominal voltage (line to line)	500 V _{AC}
Voltage stress	IEC 60034-25, Curve A: Without filters for motors up to 500 V _{AC}
Nominal efficiency	96 %
Pole pair number	8
Power supply	Inverter fed.
Nominal inverter switching frequency	8 kHz

Basic information

Machine type	Synchronous reluctance assisted permanent magnet
Mounting (IEC 60034-7)	IM 3001 (Flange)
Standard Flange D-end (SAE J617)	SAE ½, transmission housing
Standard axle spline D-end	DIN5480 W55x2x30x26x8a
Standard bearings	SKF 6214 C3
Standard rotation direction	Clockwise (both directions possible)
Protection class	IP65 Tests: 0.3 bar under pressure held for 120 seconds. Pressure not allowed to drop under 0.1 bar

Duty type (IEC 60034-1) S9

Standard color Dark grey RAL7024 powder coating

Mechanical

Total weight	490 kg (no options)
Moment of inertia	4.73 kgm ²
Rotating mass	189 kg
Maximum static torque on the shaft	6800 Nm
Maximum dynamic torque on the shaft	4000 Nm
Maximum deceleration (shaft braking)	850 rad/s ²

Dimensions

Length (frame)	598 mm
Diameter (frame)	648 mm

Cooling

Cooling liquid	Plain water with appropriate corrosive inhibitor (max. 50 % corrosive inhibitor)
Cooling liquid corrosive inhibitor type	Ethylene glycol Glysantin G48 recommended
Cooling method (IEC 60034-6)	IC 9S7Y7 (Liquid cooled, external heat exchanger)
Minimum cooling liquid flow	20 l/min
Coolant circuit capacity	3.9 l
Maximum operating pressure	2 bar

Pressure loss	0.4 bar with 20l/min (+25°C coolant)
Cooling liquid temperature	+65°C (Derating required if max. temp exceeded)

Temperature rating

Insulation class (IEC 60034-1)	H (180°C)
Temperature rise (IEC 60034-1)	85°C
Maximum winding temperature	150°C
Nominal ambient temperature	65°C
Min. ambient temperature	-40°C
Nominal altitude (IEC 60034-1)	1000 m

Vibration & Shock tolerance

Mechanical vibration	5.9 G _{RMS} ISO 16750-3 Test VII – Commercial vehicle, sprung masses – Table 12 Notes: test duration 8h axis (two axes tested; radial and axial) total spectral acceleration 5,91 grms Test done with EM-PMI540-T1500
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Mechanical shock	50 G ISO 16750-3 4.2.2 Test for devices on rigid points on the body and on the frame Notes: –acceleration: 500 m/s ² ; –duration: 6 ms; –number of shocks: 10 per test direction. Test done with EM-PMI540-T1500
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Connections

Coolant connection	2 x G3/4 bore	Plug: DEUTSCH 0413-003-1605 (size 16)
HV cables	2 x 3 x 95 mm ² max.	LV connector pin configuration
HV cable glands	Pflitsch blueglobe TRI bg 232ms tri	Anticondensing heater (optional)
HV cable	Recommended H+S Radox screened cable	50W 230VAC single phase heater resistor
HV cable lug size	35-8, 50-8, 70-8	Heater connection (optional)
HV connection boxes	2 x 3 phase box	Pflitsch blueglobe mstri212 (M12) and terminal strip inside connection box
LV connector	47 pin DEUTSCH HD34-24-47PE for resolver and temperature measurement.	Heater terminal strip pin configuration
LV connector type	DEUTSCH HD34-24-47PE	Bearing temp. measurement connector type
LV connector pin type	Gold plated	4-pin M12 A coded male
LV mating connector type	DEUTSCH HD36-24-47SE or DEUTSCH HD36-24-47SE-059	Bearing temp. measurement mating type
LV mating connector pin type	DEUTSCH 0462-201-1631 DEUTSCH 0462-005-2031 Plug: DEUTSCH 0413-204-2005 (size 20)	4-pin M12 A coded female
		Bearing temp. measurement connector pin configuration
		See Table below

Table 1 Pin configuration of LV-connector

PIN	Description
47	Temperature 1, PT100 (P), windings
46	Temperature 1, PT100 (N), windings
33	Temperature 2, PT100 (P), windings
32	Temperature 2, PT100 (N), windings
45	Temperature 3, PT100 (P), windings
31	Temperature 3, PT100 (N), windings
30	Temperature 4, PT100 (P), windings option TEMP4
29	Temperature 4, PT100 (N), windings option TEMP4
44	Temperature 5, PT100 (P), windings option TEMP4
43	Temperature 5, PT100 (N), windings option TEMP4
28	Temperature 6, PT100 (P), windings option TEMP4
16	Temperature 6, PT100 (N), windings option TEMP4
35	Resolver, RES_COS_N, in-built non-contacting
20	Resolver, RES_COS_P, in-built non-contacting
36	Resolver, RES_SIN_N, in-built non-contacting
21	Resolver, RES_SIN_P, in-built non-contacting
22	Resolver, EXCN, in-built non-contacting
10	Resolver, EXCP, in-built non-contacting
34	Resolver, SHIELD/GROUND, in-built non-contacting

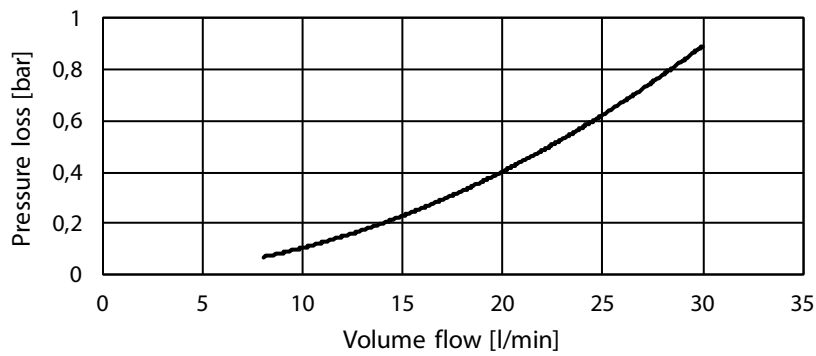
Table 2 Pin configuration of Heater (pin configuration does not matter)

PIN	Description
1	Phase, 230VAC / Neutral
2	Phase, 230VAC / Neutral

Table 3 Pin configuration of bearing temperature sensor connector

PIN	Description
1	PT-100
2	PT-100
3	PT-100_GND
4	PT-100_GND

PRESSURE LOSS VS COOLANT FLOW



Picture 1 Pressure loss vs coolant flow

MOTORS

Type	Coolant temperature +65°C			Coolant temperature +40°C			Coolant temperature +40 / +65°C			
	Cont. Torque [Nm]	Cont. Power [kW]	Nom. Current [A]	Cont. Torque [Nm]	Cont. Power [kW]	Nom. Current [A]	Nom. speed [rpm]	Max. speed [rpm]	Peak torque Single (*)	Peak torque DUAL (**)
EM-PMI540-T2000-700	2462	180	242	2716	199	267	700	1400	3400	3700
EM-PMI540-T2000-1300	2303	313	413	2386	325	431	1300	2600	1850	3700
EM-PMI540-T2000-1700	2009	358	485	2276	405	543	1700	3400	1400	2800
EM-PMI540-T2000-2100	1919	422	569	2153	473	633	2100	4000	1150	2300

(* Peak torque achieved with a 350A inverter

(** Peak torque achieved with two 350A inverters

GENERATORS

Type	Coolant temperature +65°C				Coolant temperature +40°C				Coolant temperature +40 / +65°C		
	Apparent power [kVA]	Cont. power [kW]	Nom. Current [A]	Power factor	Apparent power [kVA]	Cont. Power [kW]	Nom. Current [A]	Power factor	Nom. speed [rpm]	Nom. Freq. [Hz]	Volt/ speed ratio [V/rpm] (***)
EM-PMI540-T2000-700	211	201	241	0.95	233	221	266	0.95	800	107	0.714
EM-PMI540-T2000-1300	355	331	410	0.93	372	347	428	0.93	1400	186	0.363
EM-PMI540-T2000-1700	436	413	506	0.95	466	440	538	0.94	1900	253	0.272
EM-PMI540-T2000-2100	482	454	562	0.94	573	536	666	0.94	2300	307	0.227

(*** Back EMF for cold (20°C) generator

PRODUCT CODE AND OPTIONS

Use product code including all needed options for ordering. Standard options are not given with the code as they are selected by default if a non-standard option is not selected.

Product code	Description
EM-PMI540-T2000-1700-DUAL	Standard 1700 rpm unit with standard options
EM-PMI540-T2000-1700-DUAL+BIN+RES1	Standard unit with insulated bearing in N-end and resolver

Table 3 Product code examples

Variant	code	Description	Legend	
			s = standard	o = option
High voltage connections	-DUAL	Two galvanically isolated 3 phase syst	s	2 connection boxes each containing one 3 phase system with one M32 cable gland per phase
Connection extension	*	None	s	2 connection boxes each containing one 3 phase system with one M32 cable gland per phase
	+CE1	Double phase connections	o	2 connection boxes each containing one 3 phase system with two M32 cable glands per phase
N-end attachment	*	None	s	
	+NE4	Male shaft, no flange	o	DIN5480 W55x2x30x26x8a
Bearing insulation	*	Non-insulated bearings	s	Bearing types according to BHS
	+BIN	Insulated bearing in N-end	o	SKF 6214 insulated bearing in N-end
	+BIA	Insulated bearing in both ends	o	SKF 6214 insulated bearing in both ends
Shaft grounding	*	None	s	
	+SG1	D-end shaft grounding	o	In-built grounding ring
Rotation sensor	*	None	s	No resolver
	+RES1	Resolver	o	In-built non contacting resolver, 8-pole pair
Winding temperature sensors	*	Temperature surveillance	s	3 x PT100 (two wire) in windings
	+TEMP4	Redundant temperature surveillance	o	6 x PT100 (two wire) in windings
Bearing temperature sensors	*	None	s	
	+BTMP1	PT100 in bearings	o	plug in connector
Anticondensation heaters	*	None	s	
	+HEAT1	One anticondensation heater	o	230VAC/50W

Table 4 Option list

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