

Data Sheet

EM-PMI540-T3000

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 torque: EM-PMI motor can produce instantly full torque to a non-rotating shaft
- 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 direction Only horizontal assembly, see user guide for details

Mounting (IEC 60034-7) IM1001-B3 (Horizontal foot mounting)
IM2001-B35 (Horizontal foot + flange mounting)

Standard Flange D-end (SAE J617) SAE ½ mating transmission housing

D-end shaft Male cylindrical shaft, diameter 70 mm h7

Standard Flange N-end SAE 1/2 flywheel housing partly available for supporting structures (see main dimension drawings)

Bearing type Standard: 6216/C3 (with LGHP2 grease)
+BIN option: D-end: 6216/C3 (with LGHP2 grease) N-end: 6216/C3VL0241 (with LGHP2 grease)
+BIA option: 6216/C3VL0241 (with LGHP2 grease)

Standard rotation direction Clockwise (both directions possible)

Protection class IP65
Following best design principles

Duty type (IEC 60034-1) S9

Standard color Dark grey RAL7024 wet painting

Mechanical

Total weight 680 kg (no options)

Moment of inertia 6.89 kgm²

Rotating mass 245 kg

Maximum static torque on the shaft 6800 Nm

Maximum dynamic torque on the shaft 4600 Nm

Maximum deceleration (shaft braking) 1400 rad/s²

Dimensions

Length (frame) 840 mm

Height (frame) 665 mm

Cooling

Cooling liquid Plain water with appropriate corrosive inhibitor (max. 50 % corrosive inhibitor)

Cooling liquid corrosive inhibitor type Ethylene glycol Glystantin G48 recommended

Cooling method (IEC 60034-6) IC 71 W

Minimum cooling liquid flow 40 l/min

Coolant circuit capacity 2.8 l

Maximum operating pressure 2 bar

Pressure loss 0.58 bar with 40l/min (+25°C coolant)

Cooling liquid temperature max +65°C / +40°C with +CL option (derating required if exceeded)

Temperature rating

Insulation class (IEC 60034-1) H (180°C)

Temperature rise (IEC 60034-1) 85°C / 110°C with +CL option

Maximum winding temperature 150°C

Nominal ambient temperature 65°C

Min. ambient temperature -40°C

Nominal altitude (IEC 60034-1) 1000 m

Connections

Coolant connection 2 x G3/4 bore

Cable direction Cable direction fixed

HV cables 2 x 3 x 95 mm² max.
4 x 3 x 95 mm² max.

HV cable glands Pflitsch blueglobe TRI bg 232ms tri

HV cable Recommended H+S Radox screened cable

HV cable lug size	70-8, 95-8	Anti-condensation heater (+HEAT2 option)	2 x 130 W 230 V _{AC} single phase heater resistors
HV connection boxes	2 x 3 phase box 4 x 3 phase box	Heater connector (+HEAT2 option)	Hummel art. no. 7651 0 51 01 D
LV connector	47 pin DEUTSCH HD34-24-47PE for resolver and temperature measurement.	Heater mating connector	Hummel art. no. 7550 6 51 02 D
LV connector type	DEUTSCH HD34-24-47PE	Heater connector pin type	Hummel art. no. 7010 9 42 01 1
LV connector pin type	Gold plated	Heater connector pin configuration	See Table below
LV mating connector type	DEUTSCH HD36-24-47SE or DEUTSCH HD36-24-47SE-059	Bearing temp. measurement connector type	4-pin M12 A coded male
LV mating connector pin type	DEUTSCH 0462-201-1631 DEUTSCH 0462-005-2031 Plug: DEUTSCH 0413-204-2005 (size 20) Plug: DEUTSCH 0413-003-1605 (size 16)	Bearing temp. measurement mating type	4-pin M12 A coded female
LV connector pin configuration	See Table below	Bearing temp. measurement connector pin configuration	See Table below

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
29	Temperature 4, PT100 (N), windings
44	Temperature 5, PT100 (P), windings
43	Temperature 5, PT100 (N), windings
28	Temperature 6, PT100 (P), windings
16	Temperature 6, PT100 (N), windings
42	Temperature 7, PT100 (P), windings (+TEMP4 option)
27	Temperature 7, PT100 (N), windings (+TEMP4 option)
15	Temperature 8, PT100, (P) windings (+TEMP4 option)
14	Temperature 8, PT100 (N), windings (+TEMP4 option)
40	Temperature 9, PT100 (P), windings (+TEMP4 option)
26	Temperature 9, PT100 (N), windings (+TEMP4 option)
41	Temperature 10, PT100 (P), windings (+TEMP4 option)
13	Temperature 10, PT100 (N), windings (+TEMP4 option)
39	Temperature 11, PT100 (P), windings (+TEMP4 option)
38	Temperature 11, PT100 (N), windings (+TEMP4 option)
25	Temperature 12, PT100 (P), windings (+TEMP4 option)
12	Temperature 12, PT100 (N), windings (+TEMP4 option)
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 1 Pin configuration of LV-connector

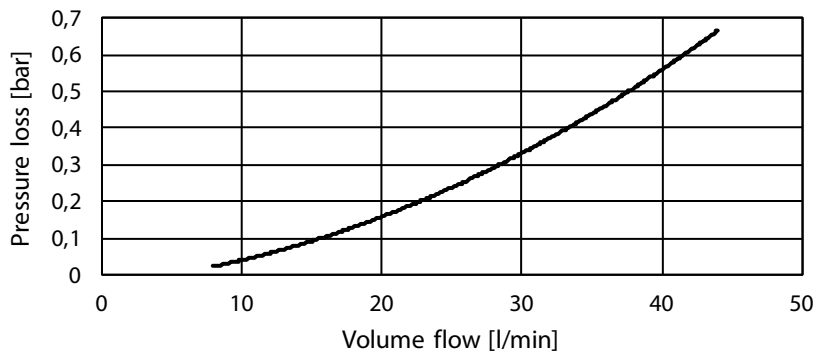
PIN	Description
1	Phase, 230 V _{AC}
2	Neutral
⊥	Ground/protective earth
4	Reserve
5	Reserve

Table 2 Pin configuration of heater

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

Table 3 Pin configuration of bearing temperature sensor connector (one sensor)

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 DUAL (*)	Peak torque QUAD (**)
EM-PMI540-T3000-1300	2900	395	486	3383	461	569	1300	2600	3914	5940
EM-PMI540-T3000-1500	2669	419	546	2991	470	609	1500	3200	3350	4560
EM-PMI540-T3000-2000	2297	481	601	2784	583	732	2000	4000	2700	4340
EM-PMI540-T3000-2400	1900	480	681	2460	619	877	2400	4000	-	4050

(* Peak torque achieved with two 350A inverters)

(** Peak torque achieved with four 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-T3000-1300	420	415	483	0.99	490	480	565	0.98	1400	186.7	0.389
EM-PMI540-T3000-1500	466	443	540	0.95	522	495	585	0.99	1600	213.3	0.324
EM-PMI540-T3000-2000	507	497	592	0.98	607	599	704	0.99	2100	280	0.25
EM-PMI540-T3000-2400	487	471	598	0.96	667	631	804	0.95	2600	347	0.208

(*** 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. Standard options are indicated by a star (*).

Product code	Description
EM-PMI540-T3000-1600-DUAL	Standard 1600 rpm unit with standard options
EM-PMI540-T3000-1600-DUAL+BIA+RES1	Standard unit with insulated bearings and resolver

Table 4 Product code examples

Variant	Code	Description	Additional information
High voltage connections	-DUAL	Two galvanically isolated 3 phase systems	Two connection boxes each containing one 3 phase system with one M32 cable gland per phase
	-QUAD	Four galvanically isolated 3 phase systems	Four connection boxes each containing one 3 phase system with one M32 cable gland per phase
Bearing insulation	*	Non-insulated bearings	Non-insulated bearings
	+BIN	Insulated bearing in N-end	Insulated bearing in N-end
	+BIA	Insulated bearing in both ends	Insulated bearing in both ends
Shaft grounding	*	None	
	+SG1	D-end shaft grounding	In-built grounding ring
Rotation sensor	*	None	No resolver
	+RES1	Resolver	In-built non contacting resolver, 8-pole pair
Winding temperature sensors	*	Temperature surveillance	6 x PT100 in windings
	+TEMP4	Redundant temperature surveillance	12 x PT100 in windings
Bearing temperature sensors	*	None	
	+BTMP1	PT100 in bearings	Plug-in connector
Anti-condensation heaters	*	None	
	+HEAT2	Two anti-condensation heaters	2 x 230 V _{AC} / 130 W
Marine classification	*	No marine classification	
	+CL1		ABS American Bureau of Shipping
	+CL2		BV Bureau Veritas
	+CL3		DNV GL DNV GL AS
	+CL4		LR Lloyd's Register
	+CL5		RINA

*Standard option

Table 5 Option list

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