

Data Sheet

EM-PMI540-T4000

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 +40°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)	IM1001-B3 (Horizontal foot mounting) IM2001-B35 (Horizontal foot + flange mounting)
Standard Flange D-end (SAE J617)	SAE ½, transmission housing
Standard bearings	SKF 6216 C3
Male shaft, D-end	Cylindrical shaft, diameter 70 mm
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	950 kg (no options)
Moment of inertia	10.3 kgm ²
Rotating mass	380 kg
Maximum static torque on the shaft	6800 Nm
Maximum dynamic torque on the shaft	4600 Nm
Maximum deceleration (shaft braking)	1000 rad/s ²
Dimensions	
Length (frame)	1040 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 Glysantin G48 recommended
Cooling method (IEC 60034-6)	IC 9S7Y7 (Liquid cooled, external heat exchanger)
Minimum cooling liquid flow	40 l/min
Coolant circuit capacity	4.4 l
Maximum operating pressure	2 bar
Pressure loss	0.9 bar with 40l/min (+25°C coolant)
Cooling liquid temperature	+40°C (Derating required if max. temp exceeded)
Temperature rating	
Insulation class (IEC 60034-1)	H (180°C)
Temperature rise (IEC 60034-1)	110°C
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
HV cables	4 x 3 x 95 mm ² 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
HV connection boxes	4 x 3 phase box
LV connector	47-pin DEUTSCH HD34-24-47PE for resolver and temperature measurement.
LV connector type	DEUTSCH HD34-24-47PE
LV connector pin type	Gold plated
LV mating connector type	DEUTSCH HD36-24-47SE or DEUTSCH HD36-24-47SE-059
LV mating connector pin type	DEUTSCH 0462-201-1631 DEUTSCH 0462-005-2031

	Plug: DEUTSCH 0413-204-2005 (size 20)	Heater connector pin type	Hummel 7010 9 42 01 1
	Plug: DEUTSCH 0413-003-1605 (size 16)	Heater connector pin configuration	See Table below
LV connector pin configuration	See Table below	Bearing temp. measurement connector type	4-pin M12 A coded male
Anticondensing heater (optional)	50W 230VAC single phase heater resistor	Bearing temp. measurement mating type	4-pin M12 A coded female
Heater connector (optional)	Hummel art. no. 7651 0 51 01 D	Bearing temp. measurement connector pin configuration	See Table below
Heater mating connector	Hummel art. no. 7550 6 51 02 D		

Table 1 Pin configuration of LV-connector

PIN	Description
47	Temperature 1, PT100, Windings
46	Temperature 1, PT100, Windings GND
33	Temperature 2, PT100, Windings
32	Temperature 2, PT100, Windings GND
45	Temperature 3, PT100, Windings
31	Temperature 3, PT100, Windings GND
30	Temperature 4, PT100, Windings
29	Temperature 4, PT100, Windings GND
44	Temperature 5, PT100, Windings
43	Temperature 5, PT100, Windings GND
28	Temperature 6, PT100, Windings
16	Temperature 6, PT100, Windings GND
42	Temperature 7, PT100, Windings
27	Temperature 7, PT100, Windings GND
15	Temperature 8, PT100, Windings
14	Temperature 8, PT100, Windings GND
40	Temperature 9, PT100, Windings
26	Temperature 9, PT100, Windings GND
41	Temperature 10, PT100, Windings
13	Temperature 10, PT100, Windings GND
39	Temperature 11, PT100, Windings
38	Temperature 11, PT100, Windings GND
25	Temperature 12, PT100, Windings
12	Temperature 12, PT100, Windings GND

PIN	Description
35	Resolver, RES_COS_N
20	Resolver, RES_COS_P
36	Resolver, RES_SIN_N
21	Resolver, RES_SIN_P
22	Resolver, EXCN
10	Resolver, EXCP
34	Resolver, SHIELD
37	Reserve
24	Reserve
23	Reserve
11	Reserve
9	Reserve
8	Reserve
3	Reserve
2	Reserve
19	Reserve
18	Reserve
17	Reserve
7	Reserve
6	Reserve
5	Reserve
4	Reserve
1	Reserve

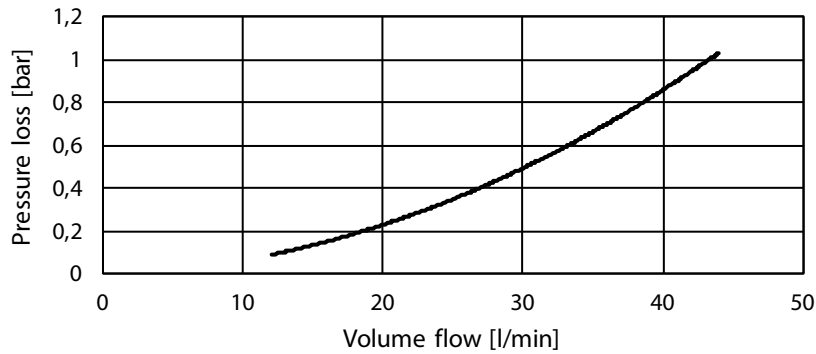
Table 2 Pin configuration of heater

PIN	Description
1	Phase, 230VAC
2	Neutral
3	Reserve
4	Reserve
5	Reserve

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 QUAD (**)
EM-PMI540-T4000-600	4522	284	387	5454	342	463	600	1200	NA	5930
EM-PMI540-T4000-1200	4229	531	716	4692	590	790	1200	2400	NA	5930
EM-PMI540-T4000-1600	4183	701	954	4639	777	1058	1600	3200	NA	5930
EM-PMI540-T4000-2400	3565	896	1232	4067	1022	1422	2400	4000	NA	4000

(* Peak torque achieved with a 350A inverter)

(** 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-T4000-600	340	336	388	0,99	408	397	464	0,97	800	107	0,816
EM-PMI540-T4000-1200	609	589	705	0.97	674	648	779	0.96	1400	187	0.416
EM-PMI540-T4000-1600	809	759	942	0.94	825	808	965	0.98	1800	240	0.29
EM-PMI540-T4000-2400	984	911	1185	0.92	1074	1024	1308	0.95	2500	333	0.193

(*** 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-T4000-1600	Standard 1600 rpm unit with standard options
EM-PMI540-T4000-1600+BIA+RES1	Standard unit otherwise but with isolated bearings and resolver

Table 4 Product code examples

Variant	code	Description	s = standard o = option	
			Standard	
High voltage connections	-QUAD	Four galvanically isolated 3 phase systems	s	4 connection boxes each containing one 3 phase system with one M32 cable gland per phase
Bearing insulation	*	Non-insulated bearings	s	Bearing types according to BHS
	+BIN	Insulated bearing in N-end	o	SKF 6216 insulated bearing in N-end
	+BIA	Insulated bearing in both ends	o	SKF 6216 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	6 x PT100 in windings
	+TEMP4	Redundant temperature surveillance	o	12 x PT100 in windings
Bearing temperature sensors	*	None	s	
	+BTMP1	PT100 in bearings	o	plug in connector
Anticondensation heaters	*	None	s	
	+HEAT2	Two anticondensation heaters	o	2 x 230VAC/50W

Table 5 Option list

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