

Data Sheet

EM-PMI375-T1100

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, IP67 available as option
- 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. It is 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	6
Power supply	Inverter fed.
Minimum 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 3, transmission housing
Standard axle spline D-end	DIN5480 W55x2x30x26x8a
Standard Flange N-end (SAE J617)	SAE 4, flywheel housing
Standard rotation direction	Clockwise (both directions possible)
Protection class	IP65 IP67 available as option +IP67 Tests: 0.3 bar under pressure held for 120 seconds. Pressure not allowed to drop under 0.1 bar (IP65) Pressure not allowed to drop under 0.25 bar (IP67)
Duty type (IEC 60034-1)	S9

Mechanical

Total weight	295 kg (no options)
Moment of inertia	0.99 kgm ²
Rotating mass	111 kg
Maximum static torque on the shaft	6800 Nm
Maximum dynamic torque on the shaft	4000 Nm
Maximum deceleration (shaft braking)	1000 rad/s ²

Dimensions

Length (frame)	548 mm
Diameter (frame)	450 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 9S7Y7 (Liquid cooled, external heat exchanger)
Minimum cooling liquid flow	20 l/min
Maximum operating pressure	2 bar
Pressure loss	0.4 bar with 20l/min (+25°C coolant)
Cooling liquid temperature max	+65°C (Derating required if exceeded)
Temperature rating	
Insulation class (IEC 60034-1)	H (180°C)
Temperature rise (IEC 60034-1)	85°C (F) / 115°C (H)
Maximum winding temperature	180°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-PMI375-T800
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-PMI375-T800	LV connector pin type	Gold plated
Connections		LV mating connector type	DEUTSCH HD36-24-47SE or DEUTSCH HD36-24-47SE-059
Coolant connection	2 x G3/4 bore	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)
HV cables	3 x 70 mm ² max. (SINGLE winding model) 2 x 3 x 70 mm ² max. (DUAL winding model)	LV connector pin configuration	See Table below.
HV cable glands	Pflitsch blueglobe TRI bg 225ms tri	Anticondensing heater (optional)	50W 230VAC single phase heater resistor
HV cable	Recommended H+S Radox screened cable	Heater connector (optional)	Hummel art. no. 7651 0 51 01 D
HV cable lug size	35-8, 50-8, 70-8	Heater mating connector	Hummel art. no. 7550 6 51 02 D
HV connection boxes	1 x 3 phase box (SINGLE winding model) 2 x 3 phase box (DUAL winding model)	Heater connector pin type	Hummel 7010 9 42 01 1
LV connector	47 pin DEUTSCH HD34-24-47PE for resolver and temperature measurement.	Heater connector pin configuration	See Table below
LV connector type	DEUTSCH HD34-24-47PE		

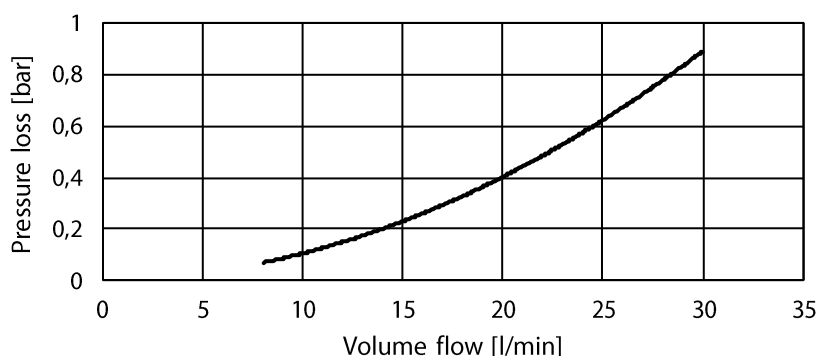
Table 1 Pin configuration of LV-connector

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

PRESSURE LOSS VS COOLANT FLOW



Picture 1 Pressure loss vs coolant flow

MOTORS (temperature class F, 150 °C)

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-PMI375-T1100-1200	1306	162	207	1399	176	221	1200	2400	2100	3270
EM-PMI375-T1100-1800	1077	203	271	1225	231	310	1800	3600	1380	2500
EM-PMI375-T1100-2100	995	219	288	1178	259	343	2100	4000	1100	2170
EM-PMI375-T1100-2400	952	239	323	1060	266	358	2400	4000	1040	2000
EM-PMI375-T1100-2900	896	274	367	998	303	409	2900	4000	800	1500

(* Peak torque achieved with a 350A inverter)

(** Peak torque achieved with two 350A inverters)

GENERATORS (temperature class F, 150 °C)

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-PMI375-T1100-1200	179	175	205	0.98	193	188	219	0.97	1300	130	0.41
EM-PMI375-T1100-1800	232	214	267	0.92	266	243	305	0.92	1900	190	0.278
EM-PMI375-T1100-2100	245	230	283	0.94	293	271	338	0.93	2200	220	0.238
EM-PMI375-T1100-2400	270	248	314	0.92	302	277	351	0.92	2500	250	0.208
EM-PMI375-T1100-2900	308	281	358	0.91	344	312	401	0.91	3000	300	0.172

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

MOTORS (temperature class H, 180°C)

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-PMI375-T1100-1200	1410	177	242	1515	190	263	1200	2400	2100	3270
EM-PMI375-T1100-1800	1187	224	298	1338	252	338	1800	3600	1380	2500
EM-PMI375-T1100-2100	1070	235	310	1300	286	380	2100	4000	1100	2170
EM-PMI375-T1100-2400	1036	260	350	1155	290	386	2400	4000	1040	2000
EM-PMI375-T1100-2900	976	296	398	1098	333	456	2900	4000	800	1500

(* Peak torque achieved with a 350A inverter

(** Peak torque achieved with two 350A inverters

GENERATORS (temperature class H, 180°C)

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-PMI375-T1100-1200	211	199	239	0.94	229	213	260	0.93	1400	140	0.41
EM-PMI375-T1100-1800	252	239	292	0.95	287	269	332	0.94	2000	200	0.278
EM-PMI375-T1100-2100	264	246	305	0.93	325	306	373	0.94	2200	220	0.238
EM-PMI375-T1100-2400	293	269	343	0.92	328	300	379	0.92	2500	250	0.208
EM-PMI375-T1100-2900	332	307	385	0.93	384	349	443	0.91	3100	310	0.172

(*** 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 examples

Product code	Description
EM-PMI375-T1100-1800	Standard 1800 rpm unit with standard options
EM-PMI375-T1100-1800+BIN+RES1	Standard unit with insulated bearing in N-end and resolver

Table 3 Product code examples

		s = standard o = option		
Variant	code	Description	Standard	
High voltage connections	*	One 3 phase system	s	One connection box containing one 3 phase system with one M25 cable gland per phase
	-DUAL	Two galvanically isolated 3 phase systems	o	2 connection boxes each containing one 3 phase system with one M25 cable gland per phase
N-end attachment	+NE1	Flange	s	SAE 4 FH
	+NE2	Male shaft + Flange	o	DIN5480 W55x2x30x26x8a + SAE 4 FH
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
Protection class	*	Standard protection class	s	IP65 protection class
	+IP67	IP67 protection class	o	IP67 protection class
Cable direction	*	Cable direction fixed	s	Cable direction towards D-end
	+CNE	Cable direction towards N-end	o	
Rotation sensor	*	None	s	No resolver
	+RES1	Resolver	o	In-built non contacting resolver, 6-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,DUAL option not possible

Table 4 Option list

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