

Data Sheet

EM-PMI375-T200

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		Diameter (frame)	450 mm
Nominal voltage (line to line)	500 V _{AC}	Cooling	
Voltage stress	IEC 60034-25, Curve A: Without filters for motors up to 500 V _{AC}	Cooling liquid	Plain water with appropriate corrosive inhibitor (max. 50 % corrosive inhibitor)
Nominal efficiency	96 %	Cooling liquid corrosive inhibitor type	Ethylene glycol Glysantin G48 recommended
Pole pair number	6	Cooling method (IEC 60034-6)	IC 9S7Y7 (Liquid cooled, external heat exchanger)
Power supply	Inverter fed.	Minimum cooling liquid flow	20 l/min
Nominal inverter switching frequency	8 kHz	Coolant circuit capacity	0.8 l
Basic information		Maximum operating pressure	2 bar
Machine type	Synchronous reluctance assisted permanent magnet	Pressure loss	0.4 bar with 20l/min (+25°C coolant)
Mounting (IEC 60034-7)	IM 3001 (Flange)	Cooling liquid temperature max	+65°C (Derating required if exceeded)
Standard Flange D-end (SAE J617)	SAE 3, transmission housing	Temperature rating	
Standard bearings	SKF 6211 2RS1 C3 WT	Insulation class (IEC 60034-1)	H (180°C)
Standard axle spline D-end	DIN5480 W50x2x24x8f	Temperature rise (IEC 60034-1)	85°C (F) / 110°C (H)
Standard Flange N-end (SAE J617)	SAE 4, flywheel housing	Maximum winding temperature	175°C
Standard rotation direction	Clockwise (both directions possible)	Nominal ambient temperature	65°C
Protection class	IP65 IP67 available as option +IP67 Tests: 0.3 bar under pressure held for 120 seconds. Pressure not allowed to drop under 0.25 bar	Min. ambient temperature	-40°C
Duty type (IEC 60034-1)	S9	Nominal altitude (IEC 60034-1)	1000 m
Standard color	Dark grey RAL7024 powder coating	Vibration & Shock tolerance	
Mechanical		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
Total weight	98 kg (no options)	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.
Moment of inertia	0.21 kgm ²		
Rotating mass	26.5 kg		
Maximum static torque on the shaft	3400 Nm		
Maximum dynamic torque on the shaft	2500 Nm		
Maximum deceleration (shaft braking)	6000 rad/s ²		
Dimensions			
Length (frame)	278 mm		

	Test done with EM-PMI375-T800		Plug: DEUTSCH 0413-204-2005 (size 20) Plug: DEUTSCH 0413-003-1605 (size 16)
Connections			
Coolant connection	2 x G3/4 bore	LV connector pin configuration	See Table below
HV cables	3 x 70 mm ² max.	Anticondensing heater (optional)	50W 230VAC single phase heater resistor
HV cable glands	Pflitsch blueglobe TRI bg 225ms tri	Heater connector (optional)	Hummel art. no. 7651 0 51 01 D
HV cable	Recommended H+S Radox screened cable	Heater mating connector	Hummel art. no. 7550 6 51 02 D
HV cable lug size	35-8, 50-8, 70-8	Heater connector pin type	Hummel 7010 9 42 01 1
HV connection boxes	1 x 3 phase box (SINGLE winding model) 2 x 3 phase box (DUAL winding model)	Heater connector pin configuration	See Table below
LV connector	47 pin DEUTSCH HD34-24-47PE for resolver and temperature measurement.	Bearing temp. measurement connector type	4-pin M12 A coded male
LV connector type	DEUTSCH HD34-24-47PE	Bearing temp. measurement mating type	4-pin M12 A coded female
LV connector pin type	Gold plated	Bearing temp. measurement connector pin configuration	See Table below
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		

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

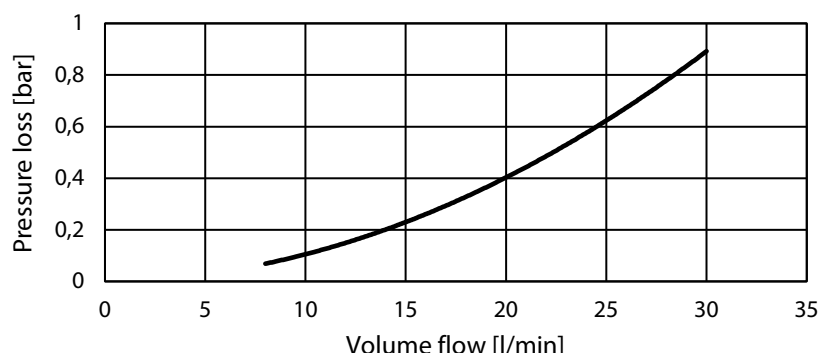
Table 2 Pin configuration of heater

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

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 (temperature class F, maximum winding temperature 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 (*)
EM-PMI375-T200-600	190	12	16	210	13	18	600	1200	500
EM-PMI375-T200-1000	197	21	28	213	22	31	1000	2000	500
EM-PMI375-T200-1400	186	27	34	209	31	39	1400	2800	500
EM-PMI375-T200-1900	184	37	51	203	40	60	1900	3800	500
EM-PMI375-T200-2600	170	46	61	205	56	73	2600	4000	500
EM-PMI375-T200-3200	161	54	72	189	63	85	3200	4000	500

(* Peak torque achieved with 1 (350A) inverter

GENERATORS (temperature class F, maximum winding temperature 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-T200-600	15	15	16	0.97	17	16	18	0.96	700	70	0.833
EM-PMI375-T200-1000	25	24	27	0.97	27	26	30	0.96	1200	120	0.5
EM-PMI375-T200-1400	31	31	33	0.98	36	35	38	0.97	1600	160	0.365
EM-PMI375-T200-1900	44	39	50	0.90	53	45	60	0.85	2200	220	0.269
EM-PMI375-T200-2600	52	49	60	0.94	63	59	72	0.93	2700	270	0.182
EM-PMI375-T200-3200	59	55	71	0.92	74	67	84	0.9	3300	330	0.148

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

MOTORS (temperature class H, maximum winding temperature 175 °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 (*)
EM-PMI375-T200-600	209	13	18	228	14	19	600	1200	500
EM-PMI375-T200-1000	213	22	31	243	25	35	1000	2000	500
EM-PMI375-T200-1400	209	31	39	231	34	43	1400	2800	500
EM-PMI375-T200-1900	208	41	62	214	43	63	1900	3800	500
EM-PMI375-T200-2600	191	52	68	212	58	76	2600	4000	500
EM-PMI375-T200-3200	189	63	86	212	71	96	3200	4000	500

(* Peak torque achieved with 1 (350A) inverter

GENERATORS (temperature class H, maximum winding temperature 175°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-T200-600	17	16	18	0.96	19	18	19	0.95	700	70	0.833
EM-PMI375-T200-1000	27	26	31	0.96	32	30	34	0.94	1200	120	0.5
EM-PMI375-T200-1400	36	35	38	0.97	36	35	42	0.97	1600	160	0.365
EM-PMI375-T200-1900	54	46	61	0.85	53	45	62	0.85	2200	220	0.269
EM-PMI375-T200-2600	59	55	67	0.94	66	61	76	0.93	2700	270	0.182
EM-PMI375-T200-3200	74	67	84	0.90	83	74	95	0.90	3300	330	0.148

(*** 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-PMI375-T200-2600	Standard 2600 rpm unit with standard options
EM-PMI375-T200-2600+BIN+RES1	Standard unit otherwise but with insulated bearing in N-end and resolver

Table 3 Product code examples

Variant	code	Description	s = standard o = option	
			Standard	
N-end attachment	+NE1	Flange	s	SAE 4 FH
	+NE2	Male shaft + Flange	o	DIN5480 W50x2x24x8f + SAE 4 FH
Bearing insulation	*	Non-insulated bearings	s	Bearing types according to greased for life bearing
	+BIN	Insulated bearing in N-end	o	SKF 6211 insulated bearing in N-end
	+BIA	Insulated bearing in both ends	o	SKF 6211 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, Not available with +BHS option
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

Table 4 Option list

Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.