ENGINEERING TOMORROW

Data Sheet

EM-PMI300-T310

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. 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.
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 4, transmission housing
Standard axle spline D-end	DIN5480 W50x2x24x8f, shaft length 75mm
Standard bearings	SKF 6211 2RS1 C3 WT
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 powder coating

Mechanical

Total weight	125 kg (no options)
Moment of inertia	0.21 kgm^2
Rotating mass	40 kg
Maximum static torque on the shaft	3300 Nm
Maximum dynamic torque on the shaft	2200 Nm
Maximum deceleration (shaft braking)	6000 rad/s^2

Dimensions

Length (frame)	377 mm
Diameter (frame)	408 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	10 l/min
Coolant circuit capacity	0.65 l
Maximum operating pressure	2 bar
Pressure loss	0.1 bar with 10l/min (+25°C coolant)
Cooling liquid temperature max	+65°C (Derating required if exceeded)

Temperature rating

Insulation class (IEC 60034-1)	F (155°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

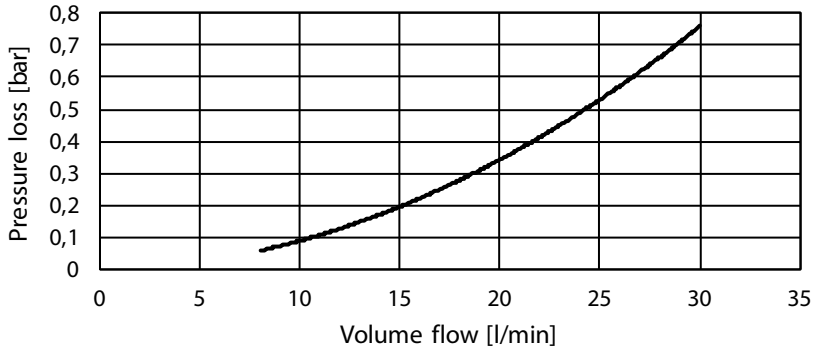
Connections

Coolant connection	2 x G3/4 bore
HV cables	3 x 50 mm^2 max.
HV cable glands	Pflitsch blueglobe TRI bg 225ms tri
HV cable	Recommended H+S Radox screened cable
HV cable lug size	35-8, 50-8
HV connection boxes	1 x 3 phase box
LV connector	12 pin TE HDSCS
LV connecter type	TE 1-1564520-1
LV connector pin type	Gold plated
LV mating connector type	TE 1-1703639-1
LV mating connector pin type	TE 1241380-2 (Gold plated)
LV connector pin configuration	See Table below.

Table 1 Pin configuration of LV-connector

PIN	Description
1	Resolver, RES_COSN
2	Resolver, RES_SINN
3	Resolver, EXCN
4	Temperature, PT100, Windings
5	Temperature, PT100, Windings
6	Temperature, PT100, Windings
7	Resolver, RES_COSP
8	Resolver, RES_SINP
9	Resolver, EXCP
10	Temperature, PT100, Windings GND
11	Temperature, PT100, Windings GND
12	Temperature, PT100, Windings 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 (*
EM-PMI300-T310-1100	353	41	54	399	46	64	1100	2200	700
EM-PMI300- T310-1300	353	48	63	398	54	73	1300	2600	700
EM-PMI300- T310-1600	351	59	78	389	65	90	1600	3200	700
EM-PMI300- T310-2200	345	79	105	390	90	121	2200	4000	700
EM-PMI300- T310-2800	312	91	123	369	108	148	2800	4000	700
EM-PMI300- T310-3200	279	94	125	314	105	138	3200	4000	700

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

GENERATORS

Type	Coolant temperature +65°C			Coolant temperature +40°C			Coolant temperature +40 / +65°C			
	Apparent power [kVA]	Cont. power [kW]	Nom. Current [A]	Apparent power [kVA]	Cont. Power [kW]	Nom. Current [A]	Nom. speed [rpm]	Nom. Freq. [Hz]	Power factor	Volt/ speed ratio [V/rpm]
EM-PMI300-T310-1100	44	44	52	49	49	58	1200	113	0.91	0.498
EM-PMI300- T310-1300	53	53	62	61	61	71	1400	134	0.91	0.415
EM-PMI300- T310-1600	65	65	75	72	72	85	1700	165	0.90	0.332
EM-PMI300- T310-2200	86	86	100	100	100	116	2300	227	0.91	0.249
EM-PMI300- T310-2800	103	102	120	120	119	139	2900	288	0.89	0.194
EM-PMI300- T310-3200	124	124	145	145	145	168	3200	330	0.89	0.166

*(*** 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-PMI300-T310-1600	Standard 1600 rpm unit with standard options
EM-PMI300-T310-1600+BHS+RES1	Standard unit with grease lubricated bearings and resolver

Table 2 Product code examples

s = standard
o = option

Variant	code	Description	Standard	
D-end attachement	*	Flange Mating transmission housing	s	SAE 4 Mating transmission housing
Mounting direction	*	Can be used in any direction	s	Requires greased for life bearings
	+MH	Only horizontal assembly	o	With all bearing options
N-end attachement	*	None	s	
	+NE1	Flange	o	SAE 4 TH
	+NE2	Male shaft + Flange	o	DIN5480 W50x2x24x8f + SAE 4 TH
	+NE4	Male shaft, no flange	o	DIN5480 W50x2x24x8f
Bearing lubrication	*	Greased for life	s	Bearings: SKF 6211 2RS1 C3 WT (available BIN)
	+BHS	Grease lubricated	o	Bearings: SKF 6211 C3, Grease: SKF LGHP2. Requires MH.
Bearing insulation	*	Non-insulated bearings	s	Bearing types according to greased for life bearing or BHS
	+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
Rotation sensor	*	None	s	No resolver
	+RES1	Resolver	o	In-built non contacting resolver, 6-pole pair

Table 3 Option list