

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 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. 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 | | Maximum dynamic torque on the shaft | 2200 Nm |
| Nominal voltage (line to line) | 500 V _{AC} | Maximum deceleration (shaft braking) | 6000 rad/s ² |
| Voltage stress | IEC 60034-25, Curve A: Without filters for motors up to 500 V _{AC} | Dimensions | |
| Nominal efficiency | 96 % | Length (frame) | 377 mm |
| Pole pair number | 6 | Diameter (frame) | 408 mm |
| Power supply | Inverter fed. | Cooling | |
| Nominal inverter switching frequency | 8 kHz | Cooling liquid | Plain water with appropriate corrosive inhibitor (max. 50 % corrosive inhibitor) |
| Basic information | | Cooling liquid corrosive inhibitor type | Ethylene glycol Glysantin G48 recommended |
| Machine type | Synchronous reluctance assisted permanent magnet | Cooling method (IEC 60034-6) | IC 71 W |
| Mounting direction | Can be used in any direction, see user guide for details. Greased for life bearings required | Minimum cooling liquid flow | 10 l/min |
| Mounting (IEC 60034-7) | IM 3001 (Flange) | Coolant circuit capacity | 0.65 l |
| Standard Flange D-end (SAE J617) | SAE 4 mating transmission housing | Maximum operating pressure | 2 bar |
| Standard axle spline D-end | DIN5480 W50x2x24x8f, shaft length 75mm | Pressure loss | 0.1 bar with 10l/min (+25°C coolant) |
| Bearing type | Standard: 6211-2RS1/C3WT +BHS option: 6211/C3 (with LGHP2 grease) +BIN option: D-end: 6211-2RS1/C3WT, N-end: 6211-2RS1/HC5C3WT +BIA option: 6211-2RS1/HC5C3WT +BHS+BIN options: D-end: 6211/C3 (with LGHP2 grease), N-end: 6211/HC5C3WT (with LGHP2 grease) +BHS+BIA options: 6211/HC5C3 (with LGHP2 grease) | Cooling liquid temperature max | +65°C / +40°C with +CL option (derating required if exceeded) |
| Standard rotation direction | Clockwise (both directions possible) | Temperature rating | |
| Protection class | IP65 Following best design principles | Insulation class (IEC 60034-1) | F (155°C) |
| Duty type (IEC 60034-1) | S9 | Temperature rise (IEC 60034-1) | 85°C |
| Standard color | Dark grey RAL7024 powder coating | Maximum winding temperature | 150°C |
| Mechanical | | Nominal ambient temperature | +65°C / +45°C with +CL option |
| Total weight | 125 kg (no options) | Min. ambient temperature | -40°C |
| Moment of inertia | 0.21 kgm ² | Nominal altitude (IEC 60034-1) | 1000 m |
| Rotating mass | 40 kg | Connections | |
| Maximum static torque on the shaft | 3300 Nm | Coolant connection | 2 x G3/4 bore |
| | | Cable direction | Standard cable direction towards D-end |
| | | 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 connector 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 |
| LV connections (+LVB1 option) | Connection box with 2x M25 cable glands (reserve 2x plugged M16 threads available) and terminal block for LV connections. See Table below |
| Anti-condensation heater (+HEAT1 option) | 65 W 230 V _{AC} single phase heater resistor (requires +LVB1 option) |

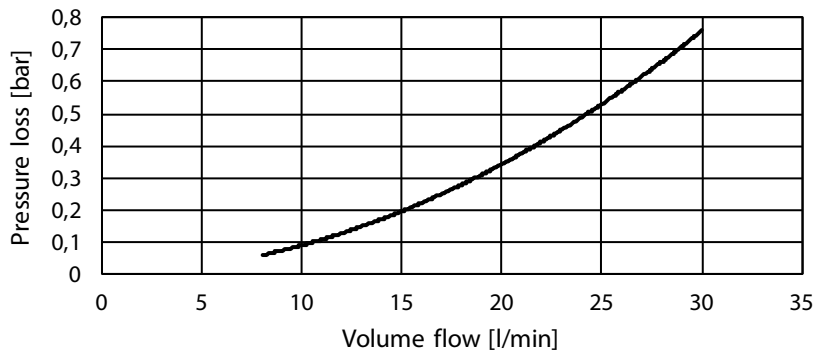
| PIN | Description |
|-----|----------------------------------|
| 1 | Resolver, RES_COSN |
| 2 | Resolver, RES_SINN |
| 3 | Resolver, EXCN |
| 4 | Temperature, PT100, windings |
| 5 | Temperature, PT100, windings |
| 6 | Temperature, PT100, windings |
| 7 | Resolver, RES_COSP |
| 8 | Resolver, RES_SINP |
| 9 | Resolver, EXCP |
| 10 | Temperature, PT100, windings GND |
| 11 | Temperature, PT100, windings GND |
| 12 | Temperature, PT100, windings GND |

Table 1 Pin configuration of LV-connector

| PIN | Description |
|-----|--|
| 1 | Temperature 1, PT100 (P), windings |
| 2 | Temperature 1, PT100 (N), windings |
| 3 | Temperature 2, PT100 (P), windings |
| 4 | Temperature 2, PT100 (N), windings |
| 5 | Temperature 3, PT100 (P), windings |
| 6 | Temperature 3, PT100 (N), windings |
| 7 | Temperature 4, PT100 (P), windings (+TEMP4 option) |
| 8 | Temperature 4, PT100 (N), windings (+TEMP4 option) |
| 9 | Temperature 5, PT100 (P), windings (+TEMP4 option) |
| 10 | Temperature 5, PT100 (N), windings (+TEMP4 option) |
| 11 | Temperature 6, PT100 (P), windings (+TEMP4 option) |
| 12 | Temperature 6, PT100 (N), windings (+TEMP4 option) |
| 16 | Heater, phase, 230 V _{AC} |
| 17 | Heater, neutral |
| ⊥ | Heater, ground / protective earth, M4 screw inside connection box |
| ⊥ | General shielding, ground / protective earth, M4 screw inside connection box |
| 18 | Resolver, RES_COS_N, in-built non-contacting |
| 19 | Resolver, RES_COS_P, in-built non-contacting |
| 20 | Resolver, RES_SIN_N, in-built non-contacting |
| 21 | Resolver, RES_SIN_P, in-built non-contacting |
| 22 | Resolver, EXCN, in-built non-contacting |
| 23 | Resolver, EXCP, in-built non-contacting |
| 24 | Temperature, PT100 (P), bearings N-end (+BTMP1 option) |
| 25 | Temperature, PT100 (N), bearings N-end (+BTMP1 option) |

Table 2 Pin configuration of LV connections (+LVB1 option)

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

| 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 3 Product code examples

| Variant | Code | Description | Additional information |
|--|--------|---|--|
| Low voltage connections | * | Low voltage connections done with connector | TYCO TE 1-1564520-1 connector for LV connections |
| | +LVB1 | Low voltage connections done with connection box and terminal strip | Connection box with 2x M25 cable glands (reserve 2x plugged M16 threads available) and terminal block for LV connections |
| N-end attachment | * | None | |
| | +NE1 | Flange | SAE 4 mating transmission housing |
| | +NE2 | Male shaft + Flange | DIN5480 W50x2x24x8f + SAE 4 mating transmission housing |
| Bearing lubrication and mounting direction | * | Greased for life | Deep groove ball bearing, contact seal on both sides, any mounting direction (see user guide for details) |
| | +BHS | Grease lubricated | Deep groove ball bearing, open design, horizontal mounting direction (see user guide for details) |
| 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 |
| Rotation sensor | * | None | No resolver |
| | +RES1 | Resolver | In-built non contacting resolver, 6-pole pair |
| Winding temperature sensors | * | Temperature surveillance | 3 x PT100 (two wire) in windings |
| | +TEMP4 | Redundant temperature surveillance | 6 x PT100 (two wire) in windings (requires +LVB1 option) |
| Anti-condensation heaters | * | None | |
| | +HEAT1 | One anti-condensation heater | 230 V _{AC} / 65 W (requires +LVB1 option) |
| 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 4 Option list

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