

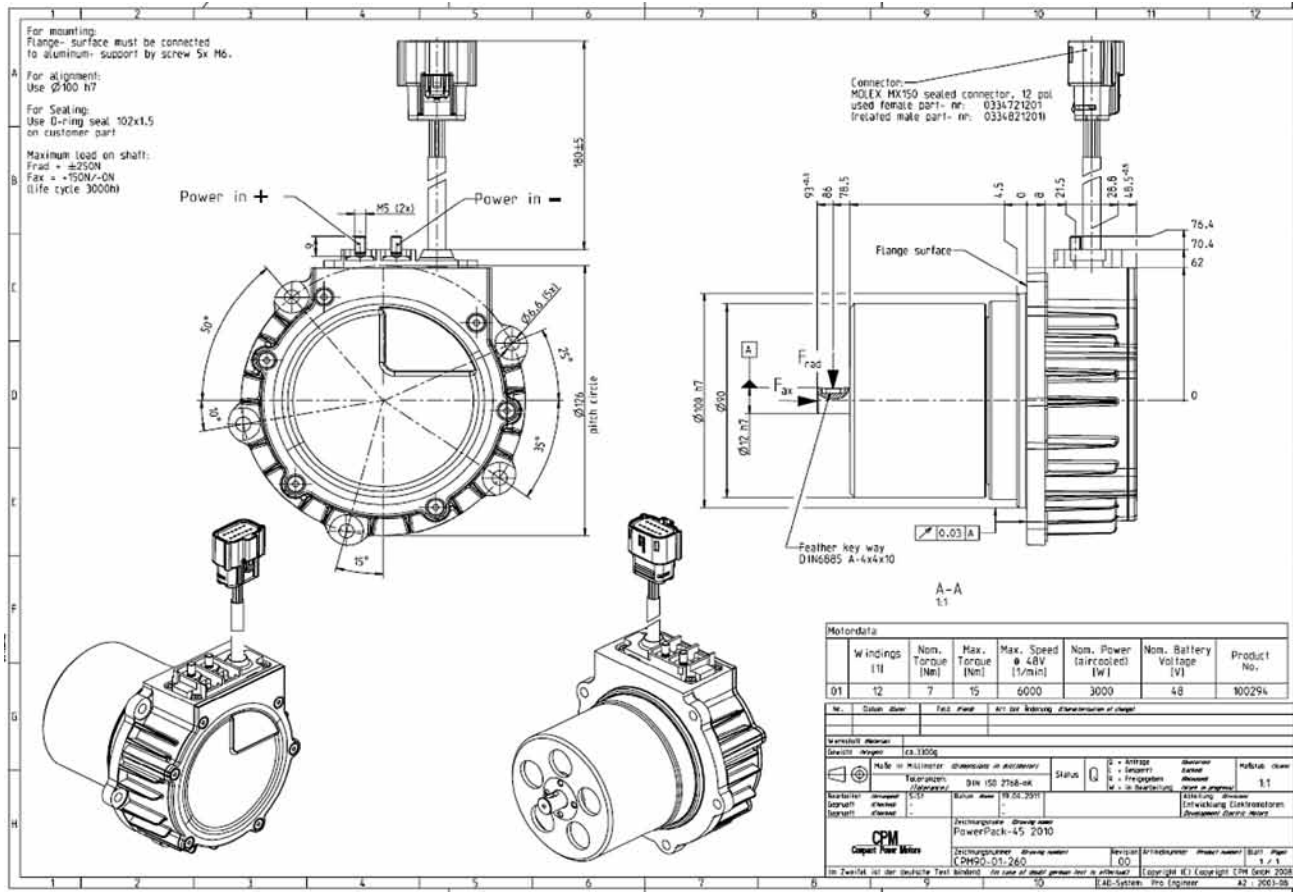
Power Pack CPM90-45-4000-L (72V)



4 kW (6 kW peak), nominal voltage 72 V, 8000 rpm, 15 Nm
Application: Light electric vehicles (80 km/h)

– air cooled –

Dimensions



Main data Power Pack

| | | | |
|----|---------------------------------|----------------------|--------------|
| 1 | Nominal power | W | 4000 |
| 2 | Peak power | W | 6000 |
| 3 | Weight | kg | 4 |
| 4 | Voltage | V | 72 |
| 5 | Idle speed w/o flux weakening | 1/min | 6000 |
| 6 | Top speed w/flux weakening | 1/min | 8000 |
| 7 | Peak torque | Nm | 15 |
| 8 | Resistance phase-phase (20°C) | mOhm | 23 |
| 9 | Winding inductance phase-phase | μ H | 70 |
| 10 | Torque constant | mNm/A | 75 |
| 11 | Speed constant | min ⁻¹ /V | 94 |
| 12 | Rotor moment of inertia | gcm ² | 13000 |
| 13 | Thermal resistance coil-housing | K/W | 0.35 – 0.23* |

* 0.35 at 0 rpm, 0.23 at 7000 rpm, requires aluminium housing to cover rotor, for details see "CPM 90 integration guide"

Main data integrated power electronics

| | | | |
|---|---|---|----------------|
| 1 | Power MOSFET type | / | BSC060N10NS3 G |
| | Max. voltage V_{DS} | V | 100 |
| 2 | Max. supply current (continuous) | A | 100 |
| | Max supply current (pulse 10 sec) | A | 150 |
| 3 | Max. phase current (continuous) | A | 180 |
| | Max. phase current (pulse 10 s) | A | 225 |
| 4 | Max continuous phase current for lifetime | | |
| | ■ 10000 h (45 °C / 85 °C) | A | 175 / 150 |
| | ■ 40000 h (45 °C / 85 °C) | A | 175 / 115 |

Specification

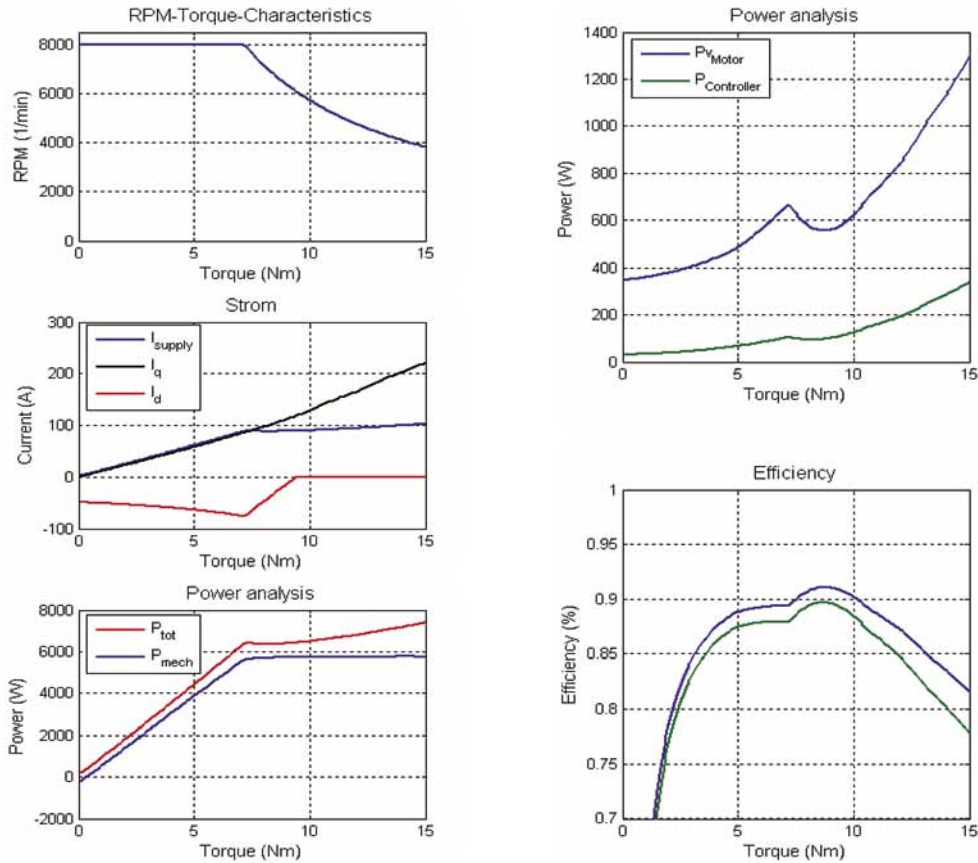
- Max. housing temperature: 85°C
- Ambient temperature: - 40 to 80°C
- Max. coil temperature: 180°C (temperature class H)
- Max. load:
 - axial: 100 N,
 - radial (10 mm from rotor): 500 N
- Max. torque load on shaft-rotor connection: 50 Nm
- Compliance with UL94V0 standard
- Norms: EN60664-1, EN61000-X-X EMV, ECE-R-100
- IP 55, IP 67 upon request

Controller/sensor

- Control:
 - Field oriented sinus commutation
 - Space vector modulation (13.5% higher performance as compared to sinus commutation)
 - Adaptive flux weakening control
 - Torque control with speed limitation
 - Power/battery current control
 - Recuperation and downhill protection
- Specific software and electronic hardware solutions for
 - E-mobility without recuperation
 - E-mobility with recuperation with system protection (recuperation at battery at full SOC, downhill)
 - APU control
- Comprehensive monitoring (i.e. motor temperature, pcb temperature, etc.) and emergency switch-off function
- Interfaces:
 - CAN
 - 3 digital and 2 analog I/O
- High resolution angular sensor (absolute position of rotor)
- CPM motion workbench software for parameterization, debugging and data logging
- **Optional:** Integrated module for soft-start and supply power disconnection

Power pack characteristics at max torque / max. power*

CPM90-12n72V, T_{coil} : 80°C, T_{rotor} : 60°C, U: 72 V, $R_{cu_{Ph-Ph,80°C}}$: 28.4 mOhm



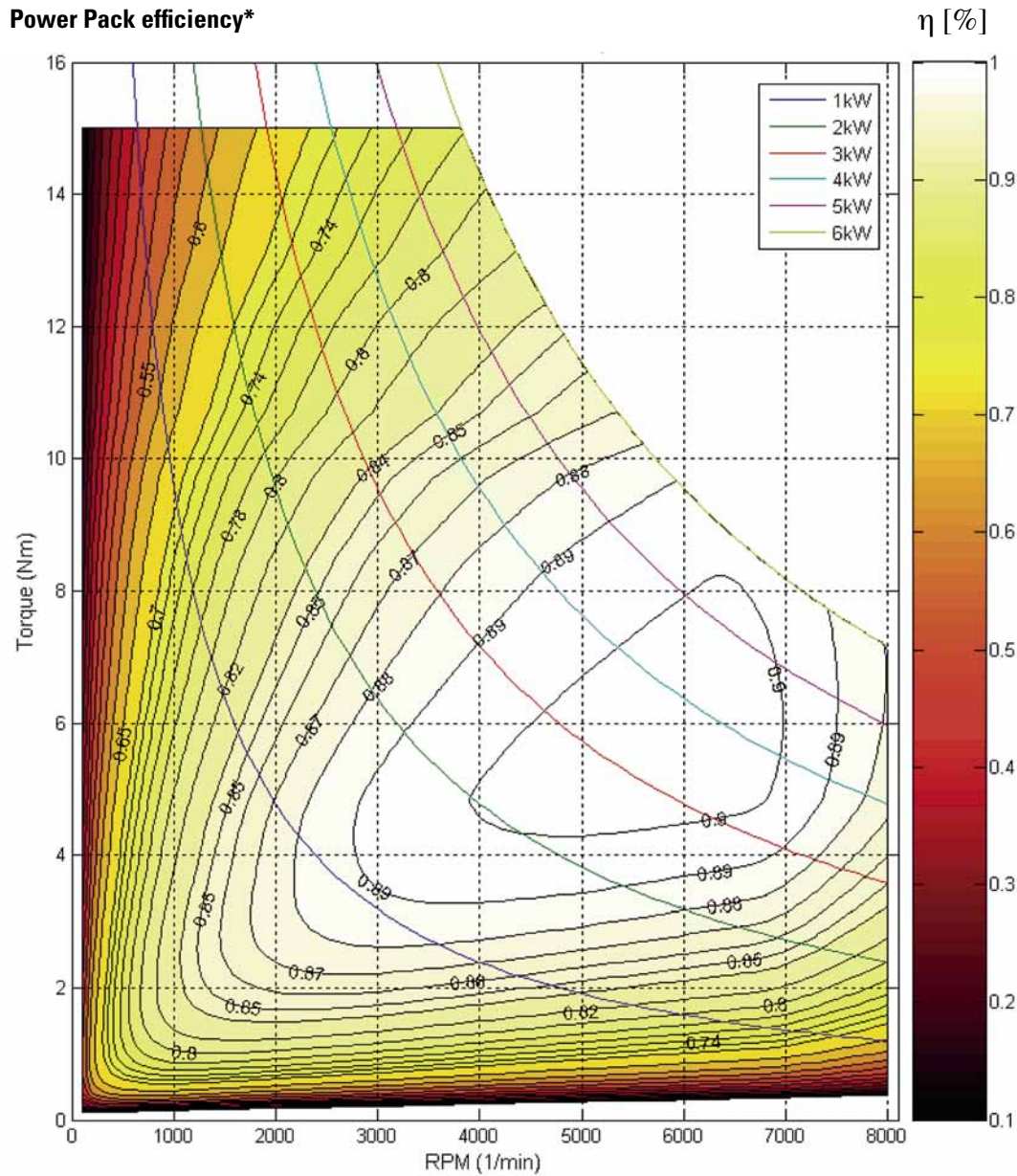
Legend:

| | | |
|------------------|---|--|
| I_{supply} | A | Current from energy source (battery, power supply) |
| I_q | A | Torque determining current |
| I_d | A | Flux weakening current |
| P_{tot} | W | Power input motor and electronics |
| P_{mech} | W | Mechanical power output motor |
| $P_{V_{Motor}}$ | W | Power loss motor |
| $P_{Controller}$ | W | Power loss electronics |
| η_{total} | % | Total efficiency (motor + electronics + wire) |
| η_{Motor} | % | Efficiency motor |

*Note:

The characteristics have been determined under warm conditions at a coil temperature of 80°C, a rotor temperature of 60°C, tested in conjunction with our proprietary CPM controller. Due to tolerances the performance data may deviate +/- 5% from the specified data due to production tolerances.

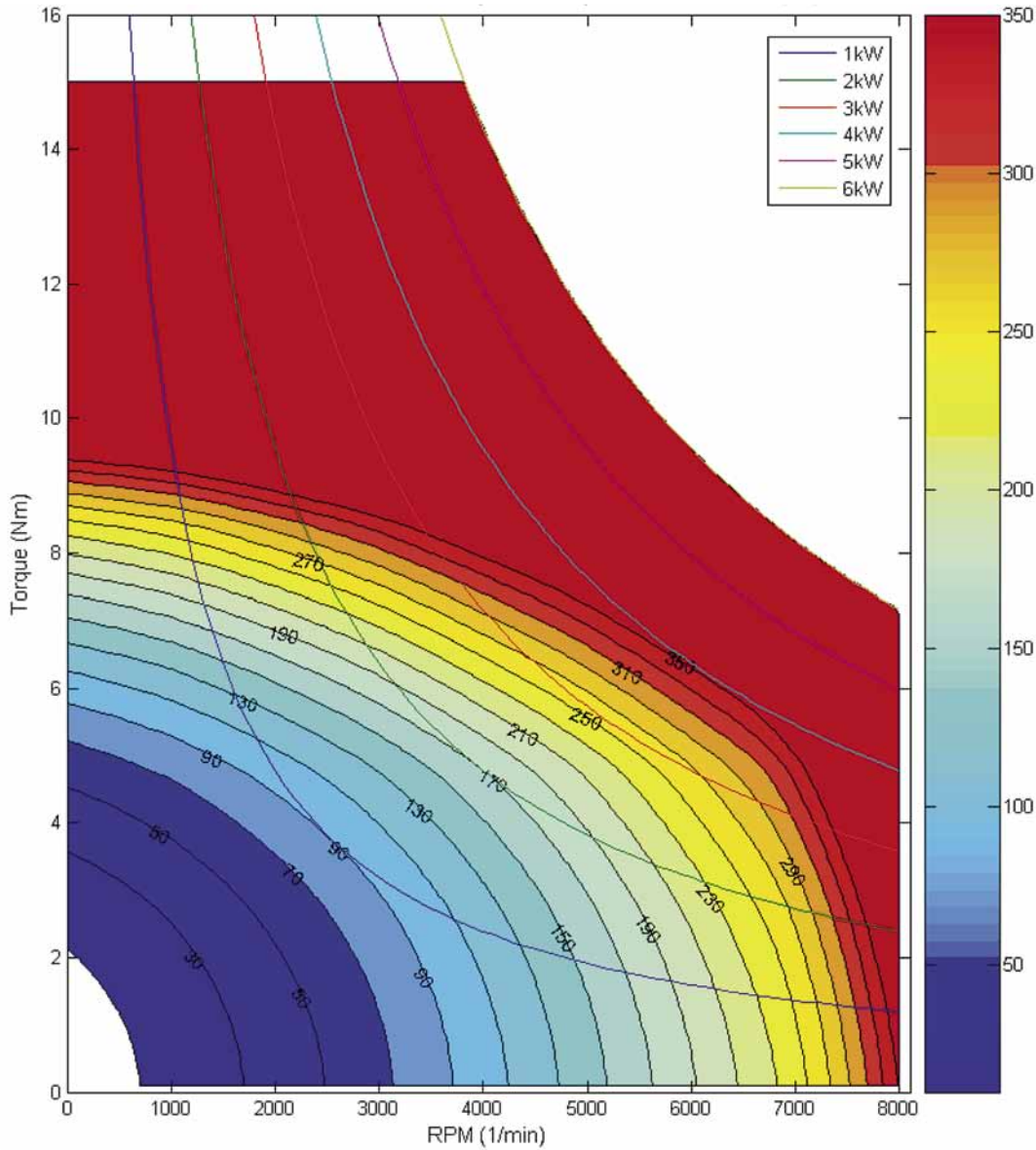
Power Pack efficiency map*



*Note:
 The efficiency map has been determined based on measurements under warm conditions at a coil temperature of 80°C and a rotor temperature of 60°C tested in conjunction with our proprietary CPM controller. The performance data may deviate from the specified data due to production tolerances.

Power Pack thermal limits*

Power losses at continuous power / operational limits (W)

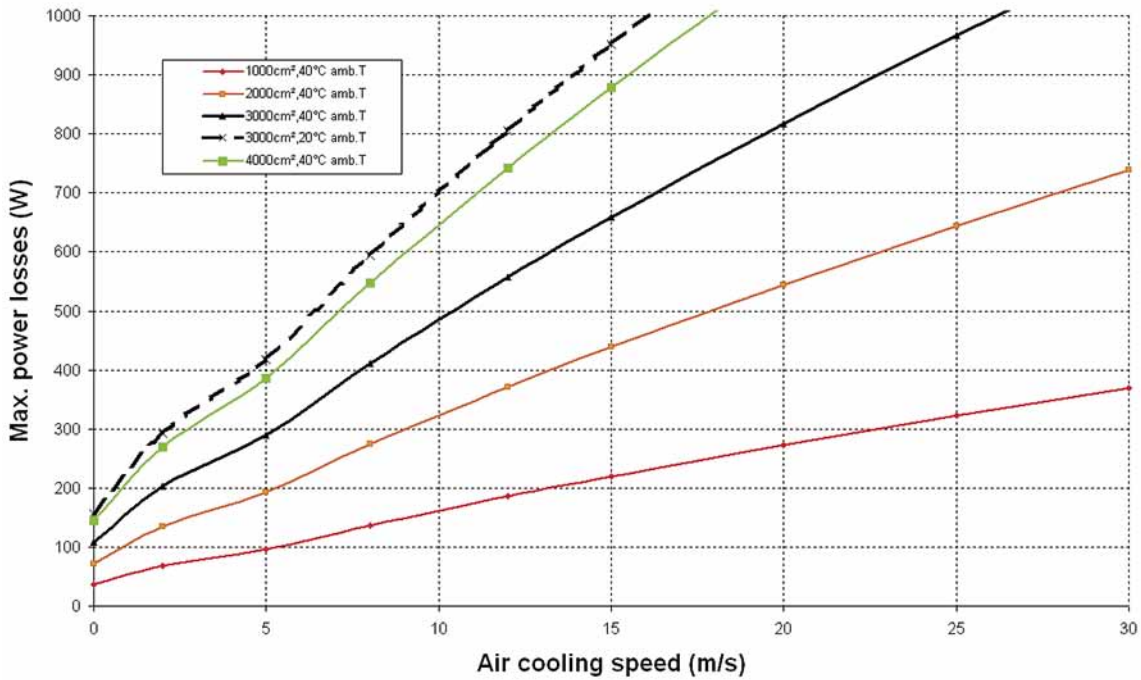


***Note:**

Taking into account the thermal resistance at 4800 rpm, specified on page 1, a maximum coil temperature of 160°C and a housing temperature of 75°C (max. temperature of integrated electronics for max. power). AT lower housing temperatures a higher continuous power can be reached, at higher housing temperatures the power pack is still operational, but with reduced power.

Thermal design suggestions*

Air cooling limits dependent of housing surface at 40°C ambient temperature



*Note:

Surface is specified as effective surface exposed to air flow

Suggested surface: 4000 cm² + use of baffle plates for efficient use of vehicle air flow