ELECTRODRIVE

Electrodrive is a three phase electronically commutated synchronous hub motor and generator of proprietary design. It employs high energy rare earth permanent magnets to maximize torque and efficiency and minimize mass enabling high torque and power density per mass, suitable for direct drive.

Direct drive

With direct drive power is transferred to driven wheels in electrical form without employing conventional powertrain. This results in several advantages including:

- drive control over individual wheels
- increased regenerative breaking efficiency
- generic ABS breaking action
- lower noise and vibration
- lower maintenance
- vehicles with increased maneuverability

Due to comparative advantages of direct drive vehicles with enhanced driving capabilities, reduced energy consumption and emissions can be built.

Target applications

Hybrid electric and electric vehicles of all kind are the primary target applications.
Other applications include forklifts, torque motors, machinery, positioners, manipulators and wind power plant generators.

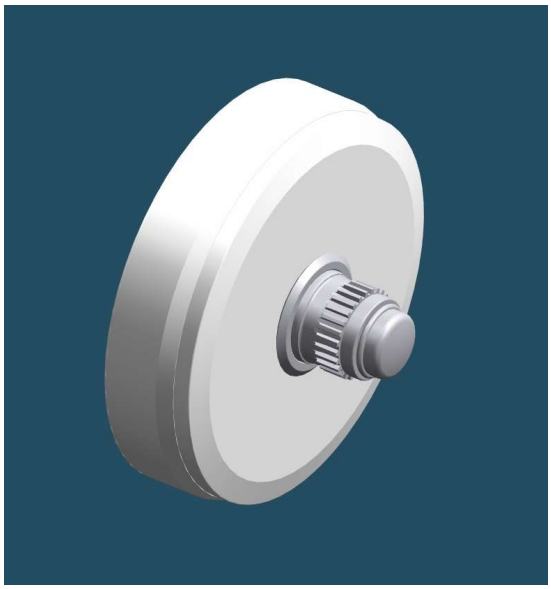
Type of vehicles it is suitable for

Automobiles, motorcycles, buses, small urban vehicles and transport vehicles can employ electrodrives for propulsion and regenerative braking. Marine vehicles and aircrafts can use them for main or auxiliary propulsion.

General electrodrive properties

All electrodrive motors are designed for high torque and power to mass ratios. They offer high torque over a wide range of revolution speeds. Peak torque several times higher than rated torque can be achieved for limited periods of time, provided the temperature of a motor is kept within safe operating limits. Full torque is available at stall.

Most electrodrive motors are designed as a wheel hub utilizing a compact and durable casing that can support full mass of a vehicle with bearings capable of withstanding high radial and axial loads. Casing usually includes integrated channels for a cooling medium to enable high power densities requiring high heat transfer rates. Mass is kept relatively low to minimize increase of unsprung masses, especially in light vehicles.



Proprietary magnetic design of electrodrive motors using magnetically highly permeable pole cores ensures very low cogging torque. Cogging torque can be reduced to negligible levels in models that don't employ permeable pole cores although at the expense of torque per power efficiency.

Revolution speeds are limited to moderate values due to high rotor pole count. Maximum speed is usually two to four times higher than rated speed.

Efficiency of electrodrive exceeds 90% when operated relatively close to rated operating parameters. It is decreased at higher torques or low speeds. Elevated temperatures have detrimental effect on efficiency mainly due to higher winding resistance and decreased performance of permanent magnets.

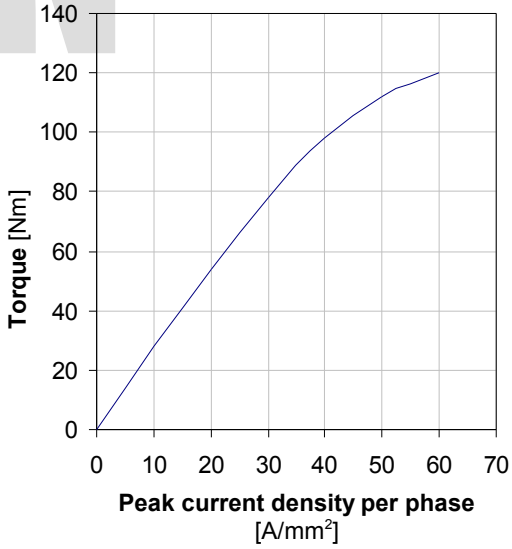
Preliminary 2005-02

ELECTRODRIVE

P03 28M180D Specifications

Electrodrive P03 28M180D is particularly suitable for direct drive applications in small urban vehicles, scooters and motorcycles.

Motor construction	Radial
Number of phases	3
Commutation	Electronic
Type of EMF	Sinusoidal
Rated torque [1, 3]	28 Nm
Peak torque [2, 3]	120 Nm
Cogging torque	< 0,2 Nm
Torque ripple (sinusoidal EMF)	< 2 %
Rated speed	750 min^{-1}
Maximum speed	2600 min^{-1}
Rated power	2,2 kW
Diameter	180 mm
Length [4]	50 mm
Mass	4,4 kg
Moment of inertia	0,005 kgm^2
Efficiency [5]	> 92 %
Copper loss constant [5, 6]	0,16 $W(Nm)^{-2}$
Core loss constant [5, 7]	0,18 Ws^2
Motor constant K [5]	2,3 $Nm/W^{1/2}$
Dynamic heat capacity	0,8 kJ/K



The above diagram shows P03 28M180D torque – current density characteristics at stall at operating temperature of 60°C.

1 Peak current density per phase j_P = 10 A/mm^2

2 Peak current density per phase j_P = 60 A/mm^2

3 RMS current density per phase equals 0,707 of peak current density for sinusoidal EMF.

4 Casing not including shaft

5 Motor only at rated operating parameters: Torque = 28 Nm, Speed = 750 min^{-1}, Temperature = 60°C

6 Copper loss in Watts is approximated by a product of copper loss constant and squared value of torque in Nm.

7 Core loss in Watts is approximated by a product of core loss constant and squared value of speed in Hz.

Preliminary 2005-02

P03 70M252D-F Specifications

Electrodrive P03 70M252D-F is suitable for direct drive applications in automobiles and motorcycles. It is provided with channels and integrated in/outlets for a cooling fluid.

Motor construction	Radial
Number of phases	3
Commutation	Electronic
Type of EMF	Sinusoidal
Rated torque [1, 3]	70 Nm
Peak torque [2, 3]	300 Nm
Cogging torque	< 0,2 Nm
Torque ripple (sinusoidal EMF)	< 2 %
Rated speed	600 min^{-1}
Maximum speed	2000 min^{-1}
Rated power	4,4 kW
Diameter	252 mm
Length [4]	62 mm
Mass	8,2 kg
Moment of inertia	0,012 kgm^2
Efficiency [5]	> 92 %
Copper loss constant [5, 6]	0,04 $W(Nm)^{-2}$
Core loss constant [5, 7]	0,8 Ws^2
Motor constant K [5]	4,1 $Nm/W^{1/2}$
Temperature constant [8]	0,001 $K(Nm)^{-2}$
Dynamic heat capacity	1,6 kJ/K

1 Peak current density per phase j_P = 10 A/mm²

2 Peak current density per phase j_P = 60 A/mm²

3 RMS current density per phase equals 0,707 of peak current density for sinusoidal EMF.

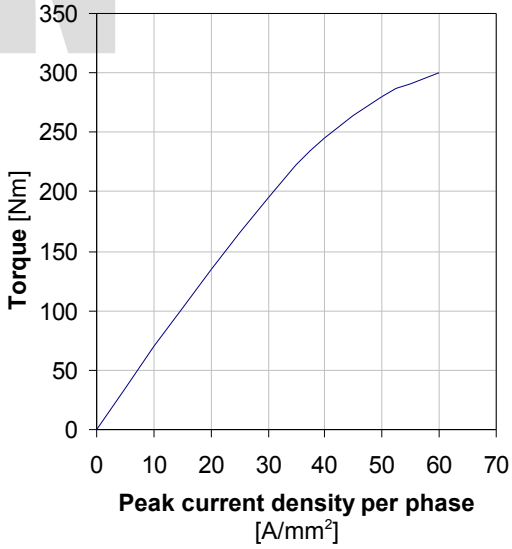
4 Casing not including shaft

5 Motor only at rated operating parameters: Torque = 70 Nm, Speed = 600 min^{-1}, Temperature = 60°C

6 Copper loss in Watts is approximated by a product of copper loss constant and squared value of torque in Nm.

7 Core loss in Watts is approximated by a product of core loss constant and squared value of speed in Hz.

8 Employing liquid cooling



The above diagram shows P03 70M252D-F torque – current density characteristics at stall at operating temperature of 60°C.

P03 70M242D is a version of P03 70M252D-F having the same electromechanical properties but without provisions for fluid cooling. It has a diameter of 242 mm and weights 7,7 kg.

SINETON Plečnikova 9, SI 2000 Maribor, Slovenia info@sineton.com

ELECTRODRIVE

P03 320M360D-F Specifications

Electrodrive P03 320M360D-F is suitable for direct drive applications in buses and small transport vehicles. It is provided with channels and integrated in/outlets for a cooling fluid.

Motor construction	Radial
Number of phases	3
Commutation	Electronic
Type of EMF	Sinusoidal
Rated torque [1, 3]	320 Nm
Peak torque [2, 3]	1300 Nm
Cogging torque	< 0,5 Nm
Torque ripple (sinusoidal EMF)	< 2 %
Rated speed	400 min^{-1}
Maximum speed	1300 min^{-1}
Rated power	13,4 kW
Diameter	360 mm
Length [4]	110 mm
Mass	25 kg
Moment of inertia	0,06 kgm^2
Efficiency [5]	> 92 %
Copper loss constant [5, 6]	0,007 $W(Nm)^{-2}$
Core loss constant [5, 7]	5,4 Ws^2
Motor constant K [5]	10,2 $Nm/W^{1/2}$
Temperature constant [8]	0,001 $K(Nm)^{-2}$
Dynamic heat capacity	4,5 kJ/K

1 Peak current density per phase j_P = 10 A/mm²

2 Peak current density per phase j_P = 60 A/mm²

3 RMS current density per phase equals 0,707 of peak current density for sinusoidal EMF.

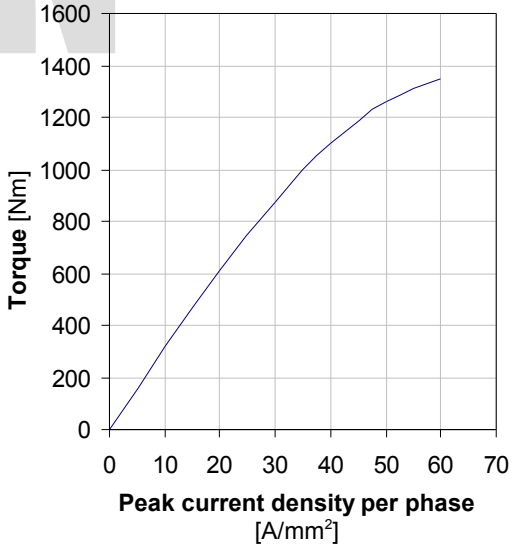
4 Casing not including shaft

5 Motor only at rated operating parameters: Torque = 320 Nm, Speed = 400 min^{-1}, Temperature = 60°C

6 Copper loss in Watts is approximated by a product of copper loss constant and squared value of torque in Nm.

7 Core loss in Watts is approximated by a product of core loss constant and squared value of speed in Hz.

8 Employing liquid cooling



The above diagram shows P03 320M360D-F torque – current density characteristics at stall at operating temperature of 60°C.

Custom designs are available.

SINETON ELECTRODRIVE

About Sineton

Sineton d.o.o. was established in May 2004 after four years of research in the field of applied electromagnetics. We are specialized in research, development, construction and prototyping of electric motors for direct drive applications and power supply converters.
We are located in Maribor, the second biggest town in Slovenia, near Austrian border.

Company data

Sineton d.o.o.
Plečnikova 9,
SI 2000 Maribor, Slovenia

Identification Nr.: 1934031
VAT Id.: SI53521471

Please feel free to contact us at:

- [386] 4 1291361
- [386] 2 4613504
- info@sineton.com
- http://www.sineton.com

Notes:

Preliminary 2005-02