

## SDG Construction of Electric Hub Motors for Direct Driven Vehicles

Electric motors for direct drive of vehicles have to be compact and lightweight, but at the same time able to produce high enough torque. The Sineton company has developed a proprietary construction of electric motors that maximizes torque and at the same time minimizes size and weight of electric motors and generators. It's named SDG (Symmetrical Dual Gap) construction.

SDG construction is based on a symmetrical dual gap topology, where a rotor is placed between two stators with concentrated multiphase windings. Main advantages of electric motors with SDG construction are:

- higher specific torque & torque density
- enhanced motor performance due to better heat management
- lower noise and vibration due to balanced forces on a rotor
- low cogging
- high efficiency over a wide range of torque and speed

Those advantages are best exploited in electronically commutated electric motors and generators employing permanent magnets. Electric motors based on the SDG construction achieve at least 30% higher peak torque compared to motors of the same size and weight based on constructions with a single magnetic gap.

Electric motors based on the SDG construction are suitable for direct drive of automobiles, bicycles, motorcycles, buses, forklifts, wheelchairs and other vehicles, including also marine vehicles and aircrafts. They can also be employed as torque motors and direct driven generators. Figure 1 shows a mounted hub motor with a wheel mounting flange.



Figure 1. SDG electric hub motor

Fig. 2 shows a comparison of ohmic losses and torque constant for some electric motors based on different constructions. Electromagnetic circuits of all motors are of the same size, utilizing the same amount of copper and permanent magnets.

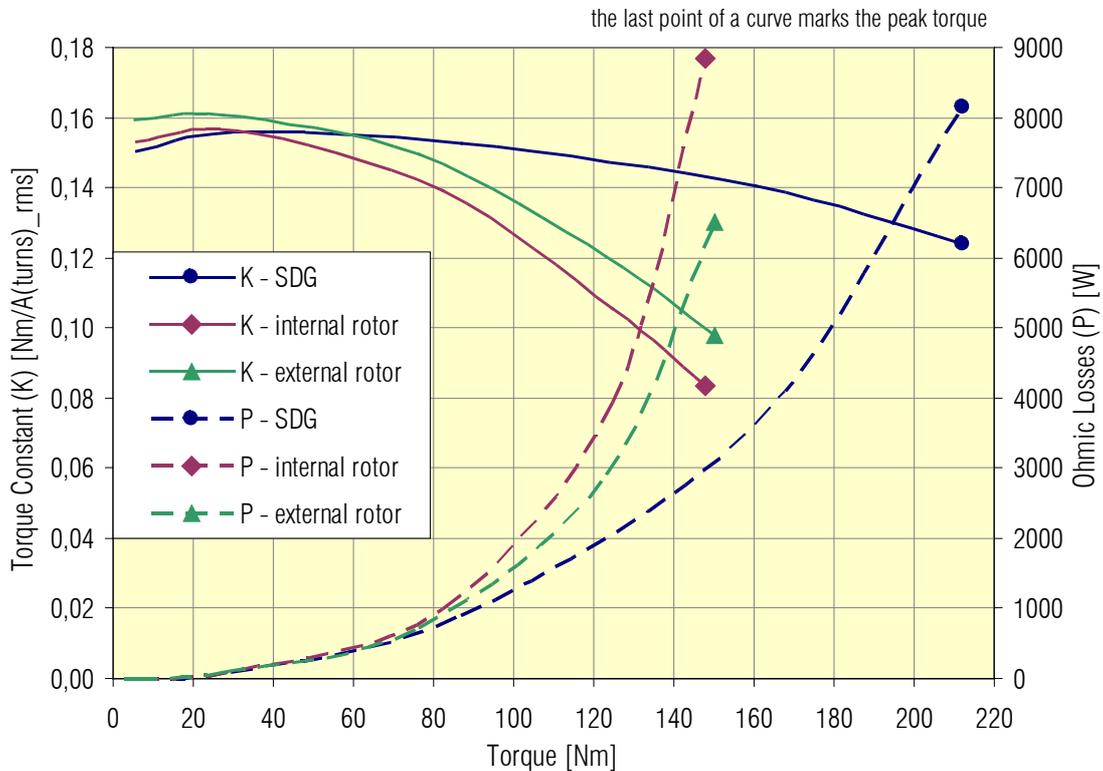


Figure 2. Windings ohmic losses  $P$  and torque constant  $K$  of electric motors based on different constructions