Magnetic gear – Torque converter

Sintex' magnetic gear is an innovative solution designed to transmit power in challenging applications. It is based on a unique design, which offers a robust and efficient gear.

How does it work?

We call it a magnetic gear. You could also call it torque converter. It is all just names for magnetic transmission - transfer of power using magnetic forces.

The working principle of Sintex magnetic gear is non contact power transmission - magnetic transmission of torque from an inner to an outer drive. This means that the magnetic solution and the application - in contrast to traditional mechanical solutions - is protected against overload, experience minimum wear and therefore has a very long service life.

The magnets are fully enclosed in stainless steel such that it is fully protected against all external factors and the gear can operate directly as a wet runner in liquids, if wanted.

Uniqueness of the magnetic gear

An encapsulated magnetic gear solution provides a range of advantages compared to mechanical solutions. Below pictures summarize the main advantages.

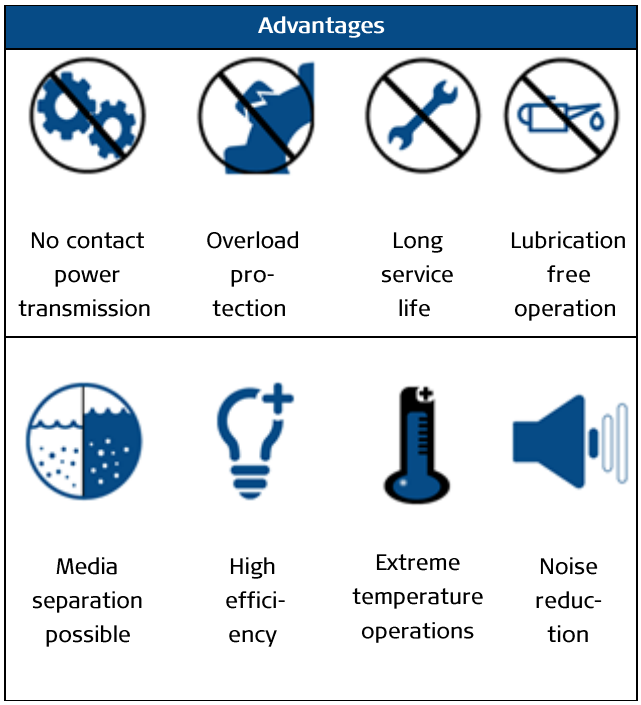

Figure 1: Advantages of Sintex magnetic gears

Overload protection indicates that the gear can be used as a torque limiter in order to avoid damages to the system. With mechanical systems the solutions are often over dimensioned to avoid damages - with magnetic solutions this is not necessary.

The contactless design have also been found to permit higher assembly tolerances and self-alignment of two separate rotating systems compared to mechanical solutions.

See an illustration of the magnetic gear with flux path below.

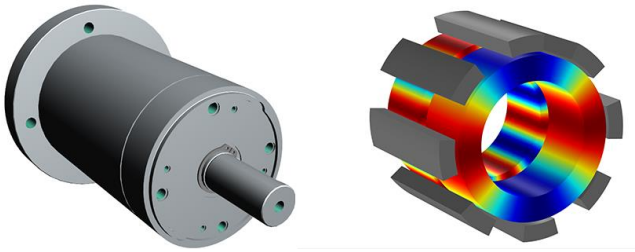

Figure 2: Sintex magnetic gear concept

The combination of all these advantages comprises a unique magnetic gear concept, which allows Sintex to offer a high-quality and strong performing magnetic gear at cost efficient prices.

Characteristics and finite element simulations

Examples of dimensions and characteristics of a magnetic gear can be seen in figure 3.

Parameter	Value	Comment
Gear ratio	Up to 1:6	Per stage
Temperature range	-40°C to 150°C	-150°C to 300°C in special applications
Length of full drive	110 mm	Smaller if integrated
Outer diameter	90 mm	
Type of magnet	IPN6-855, or sintered, NdFeB	Sintex a/s patented solution / Higher torque density

Figure 3: Generel properties of a Sintex magnetic gear

Rethinking Components of Tomorrow

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The poles in the magnetic gear are magnetized to form the effect of a hallbach array, thus naturally leading the flux from one pole to the other – effectively eliminating the need for a flux return path in the core back. Below is a finite element simulation showing the basic function of a magnetic gear.

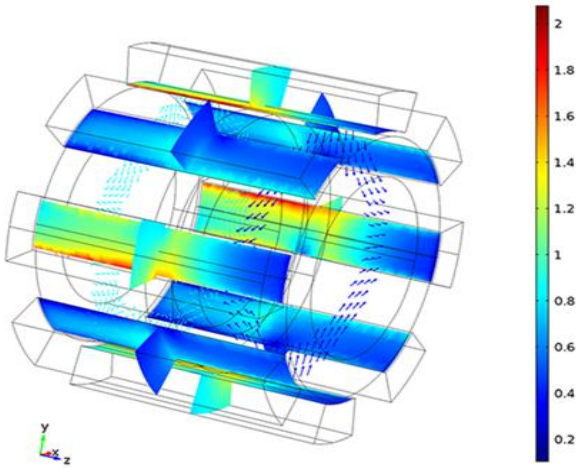

Figure 4: Finite element simulation of a magnetic gear

Applications

The magnetic gear is specially designed for medium torque and high speed applications in challenging environments e.g. with high hygienic requirements, but it also enables high torque transmission in e.g. glandless or wet runner applications. Examples of application areas are:

- Lubrication free operation in food processing
- Media separation in vacuum and water pumps
- Mixers in the pharmaceutical industry
- Safety and noise reduction in logistics industry

Suited for high volume production

The gear is developed in correlation to existing product platforms, hence the materials are known and based on innovative Sintex core process technologies.

This has allowed us to develop a concept, which consists of an innovative product as well as an efficient manufacturing process. The aim is to offer an accessible, agile and price competitive magnetic gear concept, applicable in a variety of application within e.g. the food, pharmaceutical, and pump industries.

Customized standardization

Customization and standardisation is normally 2 words contradicting each other. But with the Sintex magnetic gear solution, we can offer the best of both worlds.

The standardised version of the Sintex magnetic gear can be late customized in order to design the gear ratio needed for the specific application. Outer diameter and length is given, but number of poles and number of SMC-bridges are customised.

In the optimized design the outer diameter is 90 mm, and the length is 110 mm. This results in various output torque levels for a fixed gearing ratio as depicted in figure 5.

In this figure the more high-end sintered magnet type is included for gear dimensions consistent with the IP magnet drives.

Type of magnet	Outer diameter	Length of full drive	Gear ratio	Output Torque	Gear ratio, house*	Output Torque, house*
IP	90 mm	110 mm	1:3	3.8 Nm	1:4	5.0 Nm
Sintered	94 mm	110 mm	1:3	7.9 Nm	1:4	10.0 Nm
IP	130 mm	110 mm	1:3	10.4 Nm	1:4	13.7 Nm
Sintered	136 mm	110 mm	1:3	21.8 Nm	1:4	27.6 Nm

Figure 5: Torque levels for various magnetic gears

*It is noticeable that the gear offers two gearing options, because both the inner drives and the outer housing can be used to transmit torque.

Development project

The magnetic gear concept is still a development project at Sintex. Thus, the dimensions, gearing ratios, output torques etc. in figure 5, is depicted only to give an example of the magnetic gear performance for those optimized outer dimensions. E.g. the use of an alternative sintered magnet design allow us to make magnetic gears with >95 Nm torque transmission.

More information

Do not hesitate to contact us about potential applications, even if the performance presented in this data sheet is not a perfect match. You are more than welcome to visit Sintex and experience the magnetic gear in operation in our test facilities.

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