



FAG



Optimised bearing seals for wind turbines

Packaged solutions for
rotor, blade and tower bearing arrangements

SCHAEFFLER

Optimised bearing seals for wind turbines



Figure 1: Seal variants for wind turbines

Schaeffler packaged solutions

Rotor, blade and tower bearing arrangements represent fundamental components of a wind turbine. Their reliable function is a precondition for the long term, efficient and defect-free operation of the installation. The varied and often extreme loads require a matched combination of bearing design, lubrication and bearing sealing. This leads to packaged solutions for each bearing position that are optimally matched to the specific application.

Worldwide, in wind and weather

Wind turbines are increasingly being applied in locations with a very wide variety of climatic conditions, both onshore and offshore.

The operating temperatures expected of a wind turbine range from -30°C in Arctic regions to $+60^{\circ}\text{C}$ in the sub-tropical climates. Depending on the location, the installation is exposed to differing levels of ozone, UV light, sand, dust and salt water. All wind turbines require durable and robust bearing solutions in order to ensure technical availability approaching 100%. This is achieved, for example, by the use of seals that ensure reliable protection of the system against weather conditions, *Figure 1*.

Optimised in great detail through systems know-how

At Schaeffler, the Business Unit Wind Energy combines unique rolling bearing know-how with comprehensive systems knowledge of wind turbines that has been built up over more than 30 years as a supplier and development partner.

Through the assistance of a network of high performance seal suppliers,

bearing seals are developed that represent the optimum blend in relation to functional performance, service life and cost-effectiveness.

The Applications Development function ensures that the specific details of the installation are taken into consideration. One example of this is calculation of the change in the seal gap of the rotor bearing arrangement in a 3MW installation, *Figure 2*.

The gap dimensions determined for the various load cases form the basis, in addition to numerous other parameters, for the optimum design of bearing seals.

Rotor bearings: rotary shaft seals

Rotary shaft seals are preferred for sealing the rotor bearing, *Figure 3*. The integrated, corrosion-resistant steel spring in the sealing element ensures effective sealing over a long operating period. Ambient media can be deterred even better by means of an additional dust lip.

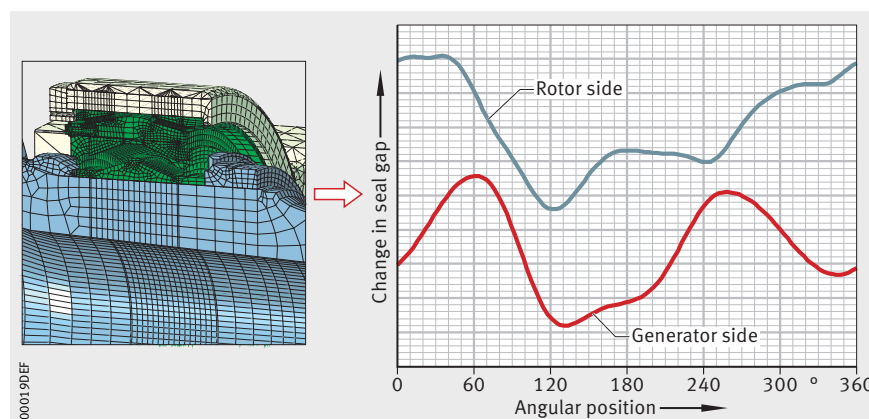


Figure 2: Calculation of the change in seal gap of a rotor bearing arrangement

Under the operating conditions present, the elastomer material HNBR used exhibits outstanding resistance to ozone, debris and ageing.

The flexible, fabric-reinforced, outer part of the rotary shaft seal allows simple mounting and dismounting. The sealing rings can be easily replaced by simple cutting and bonding into place using a special adhesive set during mounting on site.

Moulded, single-piece rotary shaft seals can currently be produced up to a shaft diameter of 3 000 mm.

Blade and tower bearings: profiled seals

In the case of blade and tower bearings, profiled seals of a double lip design are used, *Figure 3*.

The inner seal lip retains the lubricant within the bearing, the outer seal lip deters ingress of the ambient medium.

In comparison with the rotor bearing arrangement, the seals in blade and tower bearings undergo lower sliding speeds and are therefore subjected to only minimal thermal strain. In this case, the elastomer material NBR fulfils the requirements in relation to ozone, debris and ageing resistance over long operating periods of the wind turbine.

A method for vulcanising the end faces of profiled strands makes it possible to economically produce sealing rings of any diameter required.

Advantages of the optimised bearing seal

- Extended bearing life
- Reduced maintenance work
- Reduced grease leakage
- Simple replacement.

Effective quality assurance

In all phases of product development, Schaeffler focusses on very high quality. One example of this is in the requirements for material approval. Even during the development process, these ensure that all components such as greases and seal materials are compatible with each other, the required performance characteristics are reliably achieved and the guidelines relating to prohibited substances are observed.

All suppliers must fulfil stringent quality requirements. The seals are checked and approved by Schaeffler once again in accordance with stringent guidelines before they are fitted. In combination with the aforementioned system and development competences, these high quality standards lead to ideally matched bearing units comprising bearings, lubricant and sealing systems.

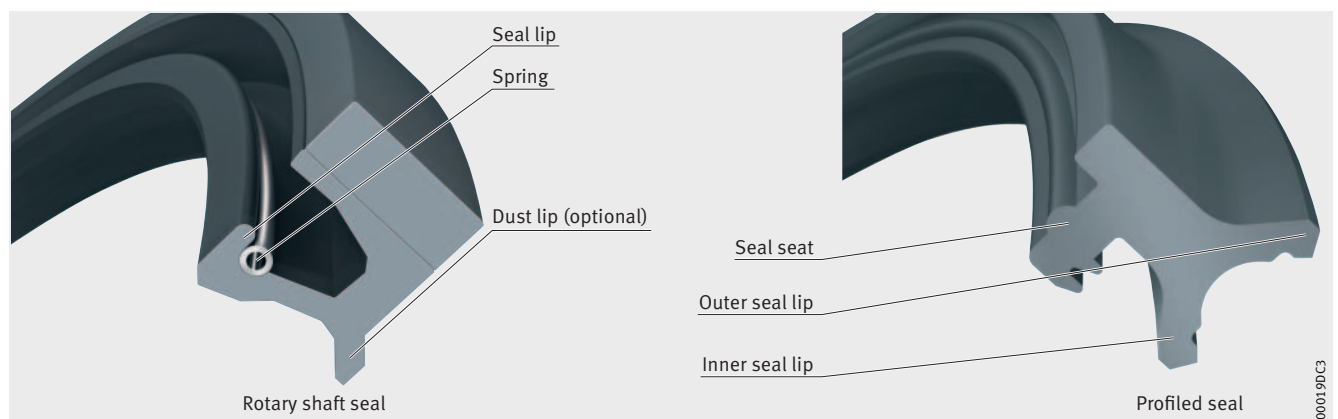


Figure 3: Functional elements of a rotary shaft seal and profiled seal

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