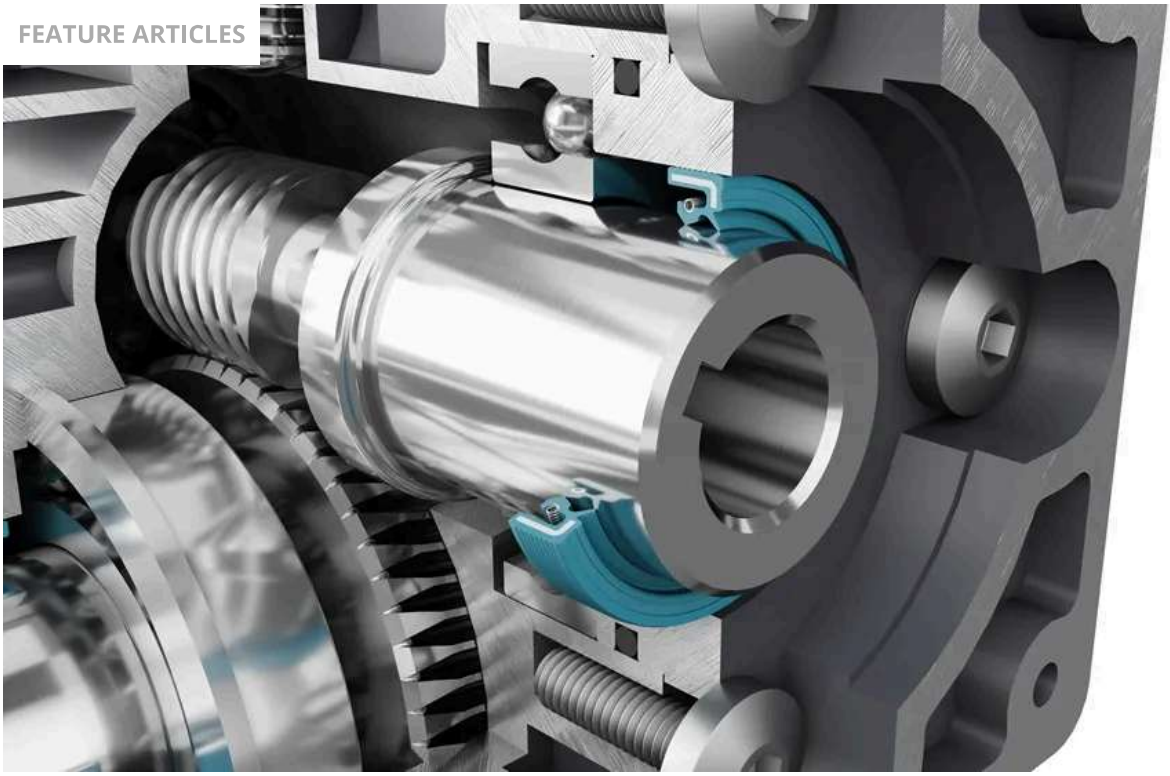
FEATURE ARTICLES



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Trelleborg Presents Sealing Solutions for Speed Reducers

The spectrum of machinery and equipment used in industrial automation includes everything from electric motors to robotics and each has its own unique attributes and sealing requirements. David Kaley, Trelleborg global segment manager for industrial automation, shares his expertise on speed reducers covering what they are, how they work and key considerations for correct sealing in this article.

Back to Basics: Speed Reducers

A speed reducer is a mechanical system of gears in an arrangement where input speed can be lowered to a slower output speed but maintain the same or more output torque. The operation of a speed reducer involves a set of rotating gears that are connected to a shaft with a high incoming speed, which is sent to a set of rotating gears where the speed or torque is changed.

Optimization

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The terms speed reducer and gearbox are often used interchangeably but there are some distinctions. Gearbox is a broad term that refers to any device using gears to transmit power from one part of a machine to another. Gearboxes can change the speed, torque and direction of the power source. They can either increase or decrease speed, depending on their design.

A speed reducer is a specific type of gearbox designed to reduce the speed of the input power while increasing torque. They are used to slow down the output speed of a motor or engine to a desired level. While all speed reducers are gearboxes, not all gearboxes are speed reducers. Speed reducers specifically focus on reducing speed and increasing torque while gearboxes can have a variety of functions.

Speed reducers are used when the drive gear attached to the motor shaft is smaller and has fewer teeth than the driven gear, or the second gear attached to the load shaft.

They are essential in applications where the high rotational speed of a motor is converted to slower speeds for other components.

Key Considerations

The main factors for speed reducer original equipment manufacturers are as follows:

- **Gear protection**: Gear protection is crucial for ensuring the longevity and efficient operation of the machinery. Considerations like lubrication, sealing, material selection and load management can contribute to gear protection.
- **Rotor lubrication**: A primary part of rotor lubrication revolves around the lubrication of the bearings supporting the rotor. It's vital to ensure adequate lubrication to mitigate friction, minimize wear and promote seamless functionality.
- **Particle ingression**: In speed reducers, the intrusion of liquids, dust, dirt and other particulate matter is referred to as particle ingression. This can substantially affect the reducer's efficiency and lifespan.
- **Shaft vibration**: Shaft vibration in speed reducers refers to the oscillatory motion of the shaft, which can lead to various operational issues if not properly managed.
- **Friction/heat generation**: The generation of heat, a by-product of friction, can pose potential challenges to the reducer's performance and durability.
- **System life**: The system life of a speed reducer refers to the duration it can operate effectively before requiring significant maintenance or replacement. Several factors influence the system life of a speed reducer including operating conditions, load and speed, and component quality.

Critical Sealing Requirements

Shaft seals on both the input and output shafts keep lubrication inside the gearbox while keeping debris and solid particles out. For equipment used in demanding applications, harsh environments or requiring ingress protection certifications, additional protective elements can be used.

Depending on temperature and rotation requirements, radial oil seals made of acrylonitrile butadiene rubber (NBR) or fluorocarbon rubber (FKM) are recommended as shaft seals, while V-Rings can be used as secondary seals to prevent the ingress of dirt and/or water. Static seals such as O-Rings, gaskets, bonded seals and molded parts can be found as sealing elements for lids, flange joints, threads and

covers. For high-end gearboxes and speed reducers a cassette seal can also be used as a long-lasting single sealing element with heavy duty dust lips that grant longer service life and lower maintenance.

In some instances, speed reducers can benefit from Trelleborg's Varilip PDR radial oil seal. Constructed from one or multiple Turcon PTFE-based sealing elements they are mechanically retained in a precision machined metal body. The metal body gives a robust static seal against the housing, preventing thermal cycling, while the Turcon sealing element provides positive dynamic sealing on the shaft, leading to excellent performance at high rotary speeds. Characterized by low friction and stick-slip-free running, the seal reduces temperature generation, permits higher peripheral speeds and lowers power consumption. This results in a long-service life, with maximized meantime between planned maintenance and greater productivity.