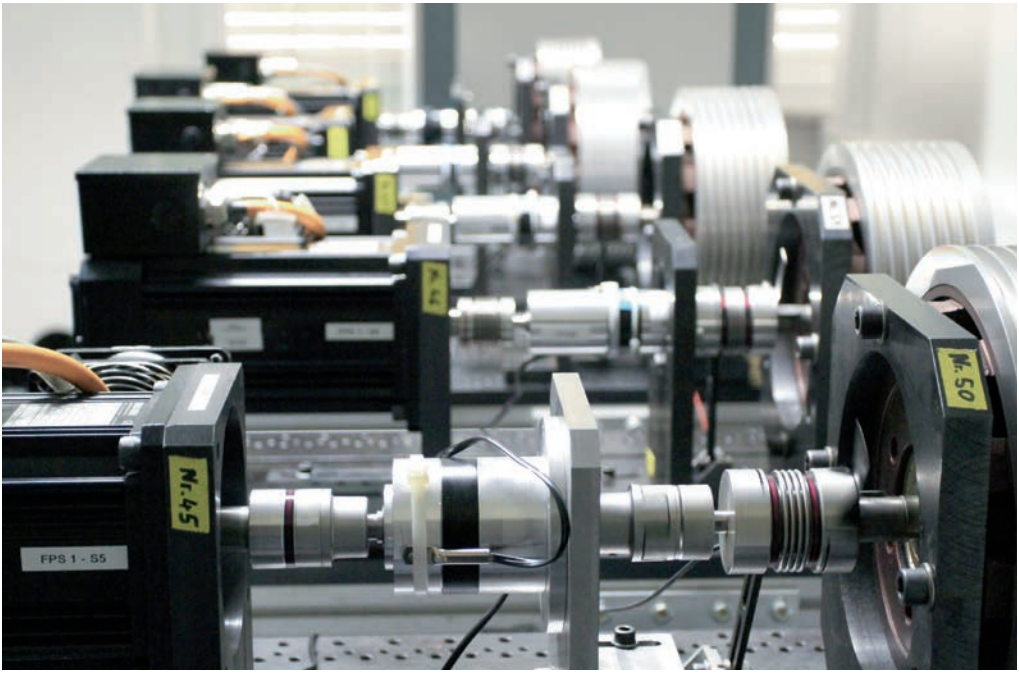


Extensive service life and load tests are conducted using specific test facilities before market launch.

Extension for IMS Gear's modular system for planetary gears

Oil Dorado of planetary gears

IMS Gear's modular system for planetary gears with its IMS.baseline, IMS.techline and IMS.SDline fills the gap between standard solutions and individual customer-specific requirements in most cases. More than 10,000 options for variations are available for precise customizing on the basis of standardized components. It's an El Dorado for users! Now IMS Gear is taking the next step towards a significant application range extension for cost-effective planetary gears: "We will additionally offer oil lubrication for planetary gears from the modular system in close collaboration with customers", Heinz Gert Hagedorn, Vice President Sales & Engineering Planetary Gears, announces. You could say the El Dorado is becoming an Oil Dorado.

Planetary gears offer a compact design, high power density and therefore enable high torque transmission at low space requirements. That makes them the preferred gear design for constructing energy-efficient drive solutions. With its modular design concept for planetary gears, IMS Gear combines the benefits of standardization - fast availability of matured technology and an attractive price-performance ratio all the way to volume production - with outstanding scope for individual customization. Until now, the solutions from IMS Gear's modular system for planetary gears have been supplied with lifetime grease lubrication only. "Now new fields of application for planetary gears are coming up, in which we have to be prepared for conditions such as higher ambience temperatures", Mr. Hagedorn says in view of the near future, "and oil is the perfect lubricant for such applications." One of the driving forces behind this development is, among others, the automotive industry that is increasingly using actuators to achieve better energy efficiency or to enable autonomous driving. These actuators often come in close proximity to the combustion engine or the electric motor.

Not "oil instead of grease" but "oil instead of customized gears"

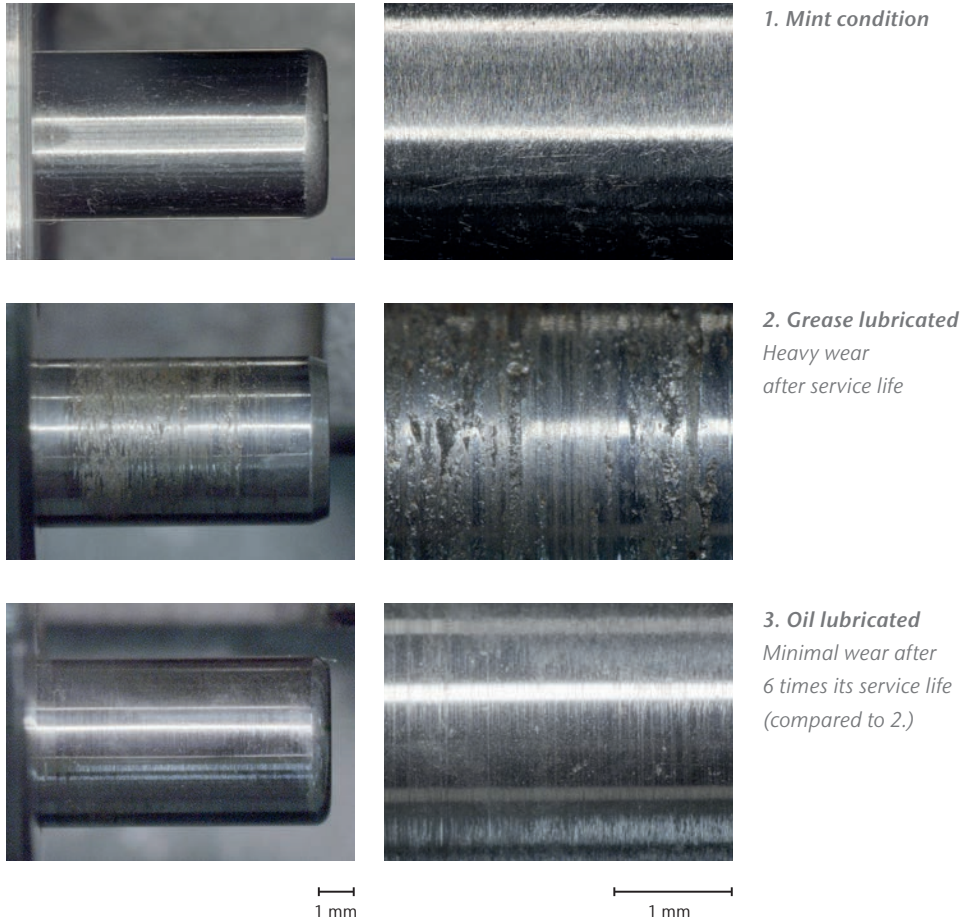
Mr. Hagedorn explained that the previous planetary gears from IMS Gear with lifetime grease lubrication will continue to be sufficient for the requirements of many future applications. "Oil-lubricated planetary gears will quickly gain popularity as an economically attractive alternative that can rapidly be implemented in the customer application." The alternative apart from a modular system solution used to be the development of a customized gear resulting in higher costs, increased time requirement and the underlying design risk of any new development. "IMS Gear now offers their customers an option of using a planetary gear from the modular design system with oil lubrication." Oil instead of customized gear - "That is why our strategy is of great benefit to the customer."

"Oil lubrication makes sense whenever applications with a significantly higher service life of up to several thousand hours are required at ambient temperatures of up to 140° C", Hagedorn explains possible framework conditions. The required improved sealing of the gear does constitute a technical challenge, however, it can be implemented using proven materials and processes. The location in the overall motor/gear system at which the sealing will be installed can be determined in coordination with the customer. In case only parts of the overall system should be running in oil, partial solutions up to the delivery of assembly kits are possible. The principle of the modular system remains fully applicable in this scenario as well. Due to the higher sealing effort, oil-lubricated planetary gears must be costlier than previous solutions - however, they are still much more cost-efficient than the distributed overall project costs of customized gears.

Oil vs. grease: a matter of distribution

In order to put an accurate number on the advantages of oil-lubricated planetary gears from a modular system, the IMS Gear test lab in Eisenbach, Germany has been conducting extensive tests regarding the basic goal of lubrication, which is the distribution of the lubricant to the locations where friction occurs. Mr. Hagedorn describes the task:

Axle wear pattern with different lubricants
(Tested under the same load conditions)



1. Mint condition

2. Grease lubricated
Heavy wear after service life

3. Oil lubricated
Minimal wear after 6 times its service life (compared to 2.)

"Wear that reduces the service life occurs at the axles of the planetary carriers rather than at the gear wheel." An efficient lubrication must function in the first gear step at high speed and low torque just as well as in the third stage at low speed and high torque. According to what is commonly known so far, the lubrication performance of grease is not generally inferior to the performance of oil. "However, oil distributes itself better in a planetary gear and hence increases the lubrication performance." A large part of the reason for the outperforming grease lubrication of oil-lubricated planetary gears is therefore: It's all a matter of distribution.

In any case, oil offers superior heat dissipation and hence decreases the temperature at the axle. Furthermore, as grease is slowly used up over time and loses its lubricating

More than 40 years of innovation in all aspects of planetary gears - latest development: low cost gear with oil lubrication.

characteristics due to accumulation of abrasion particles, using magnetic bolts in oil lubrication even enables gathering metallic abrasion particles. “Grease lubrication will continue to exist, however, the requirement triangle of performance, service life and costs is clearly shifting towards oil”, Mr. Hagedorn stresses. Whenever increased performance and a longer service life are required, oil-lubricated planetary gears will be the economically better choice.

Tests with the standard gears from IMS Gear’s modular system for planetary gears have shown that the service life of oil-lubricated variants can be extended by several times the service life of grease-lubricated gears. The temperature curve of the gears in operation has proven to be a reliable indicator for wear. Additional tests (particularly those in vertical mounting position) will likely result in further valuable findings.

Conclusion

The gradual extension of the modular system with the option for oil lubrication in close collaboration with the customers according to their respective applications extends the application range of standardized components with their cost advantages and the safety of proven technology into an area that previously required customized gears. As a result, IMS Gear offers its customers the chance to reach series maturity faster and without the risks of a separate development, even if the application is particularly demanding in terms of service life, ambient temperature or other parameters.