Synthetic
High Performance Gear Oils

worm gear units

Castrol Industrie GmbH
Performance Lubrication

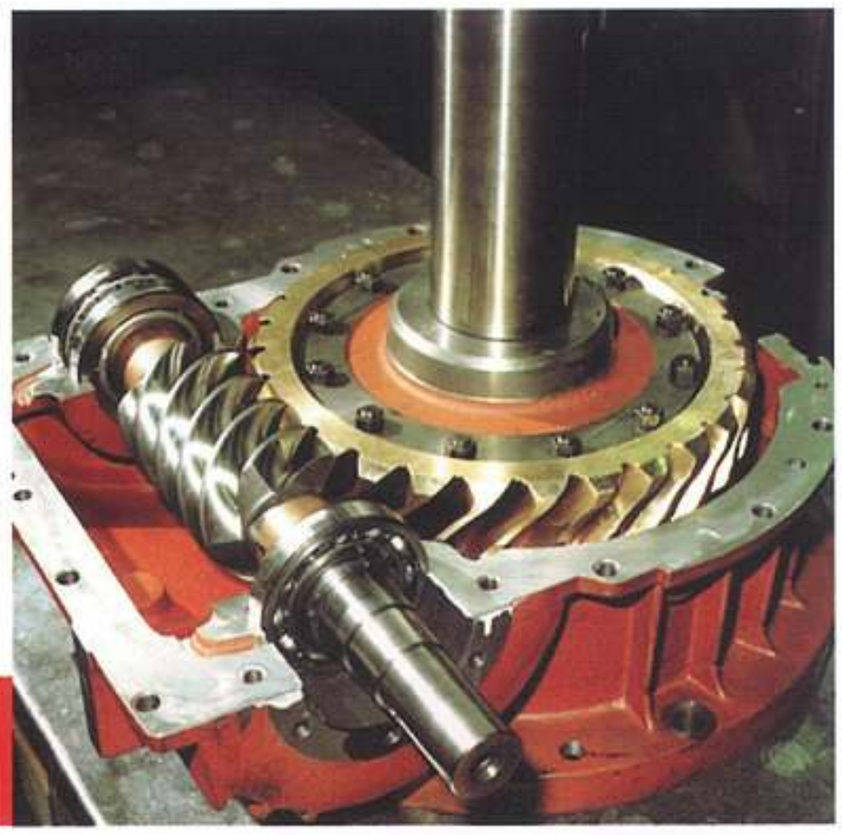
By using high performance gear oils based on polyglycols a considerably increased performance of worm gear units can be achieved.

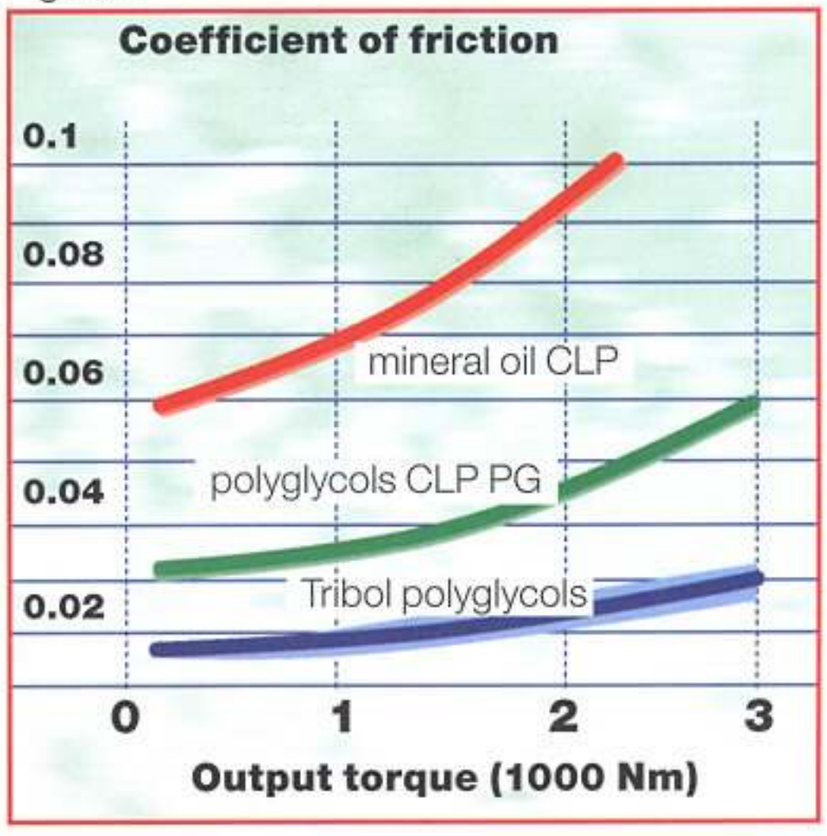
Optimol **Tribol®**
Molub-Alloy®

Worm gears are applied wherever high transmission ratios must be achieved within small spaces. Compared to spur or bevel gear units they further feature an excellent low-noise operation as well as a good resilience to vibrations. Moreover they do not only ensure a very good power transmission but are also less susceptible to short-time shock loads.

When it comes to the selection of material combinations the worm gear units also differ from the spur or bevel gear units. To keep the coefficient of friction as low as possible in the kinematics of worm gears, which is characterised by a high share of sliding friction, bronze is used as worm wheel material in combination with a steel screw. However, depending on the operating conditions, the choice of a softer material for the worm wheel may cause a certain degree of wear which cannot entirely be countered by a lubricant with a higher viscosity.

Figure 1





Until about ten years ago worm gear units were mainly lubricated with mineral oils.

However, for some years now, the trend has been going towards the application of synthetic gear oils based on polyalkylene glycols. Only with the use of the latter has it been possible to take the constructional conditions of the worm gears into account. The polyalkylene glycols reduce the coefficient of friction thus reducing temperature and wear. (Figure 1)

As the power limit of worm gear units is considerably limited by the maximum thermal performance, a decrease in temperature due to the application of synthetic gear oils largely contributes to an increased gear performance.

Synthetic gear oils of the series Tribol 800

are CLP PG oils (in conformity with DIN 51502) and are manufactured from high-quality polyglycol base oils with a special additive combination specifically formulated to protect against wear. They by far exceed the minimum requirements to be met by CLP gear oils according to DIN 51517, part 3. They are available worldwide in the ISO viscosity grades 100 to 1000 and feature the following advantages in comparison with mineral oils:

- Good thermal stability at high operating temperatures
- High viscosity index
- Low pour point for easy start-up at low temperatures
- Reduced coefficient of friction especially in worm gear units
- Excellent wear protection properties

Synthetic gear oils of the series Tribol Food-Proof 1800

are also CLP PG oils (according to DIN 51502) and are produced from high-quality polyglycol base oils.

Tribol FoodProof 1800 synthetic gear oils are exclusively formulated from raw materials listed by the FDA i.e. they are in conformity with H1 and are physiologically safe. Therefore they can be applied everywhere in the food and beverage industry where despite a correct application of the lubricant a contamination of the foodstuff by the lubricant may occur.

Worm gear units are prone to wear i.e. the appropriate selection of a lubricant has great influence on the service life of gears.

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Especially gear units which operate at low speeds show a high degree of wear as no hydrodynamic lubricating film is formed at low speeds. As a result the roughness peaks may touch and even weld together.

As tests carried out by leading gear manufacturers have shown, the conversion from a mineral oil to a gear oil based on polyglycols such as Tribol 800 or Tribol FoodProof 1800 can result in a fivefold to tenfold wear reduction. (Figure 2)

Figure 2

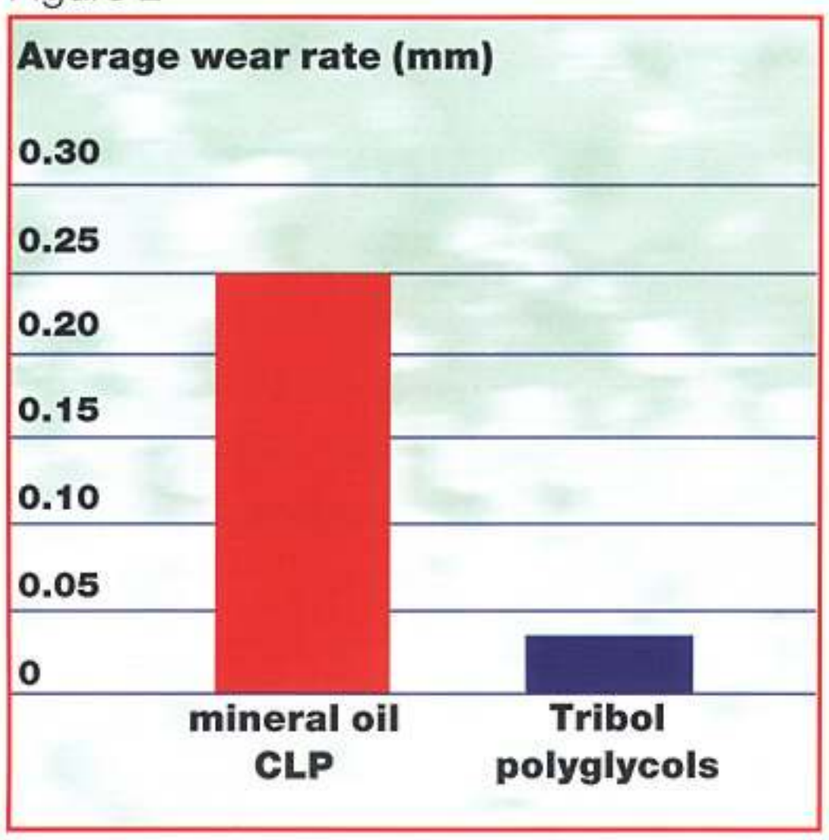


Figure 3

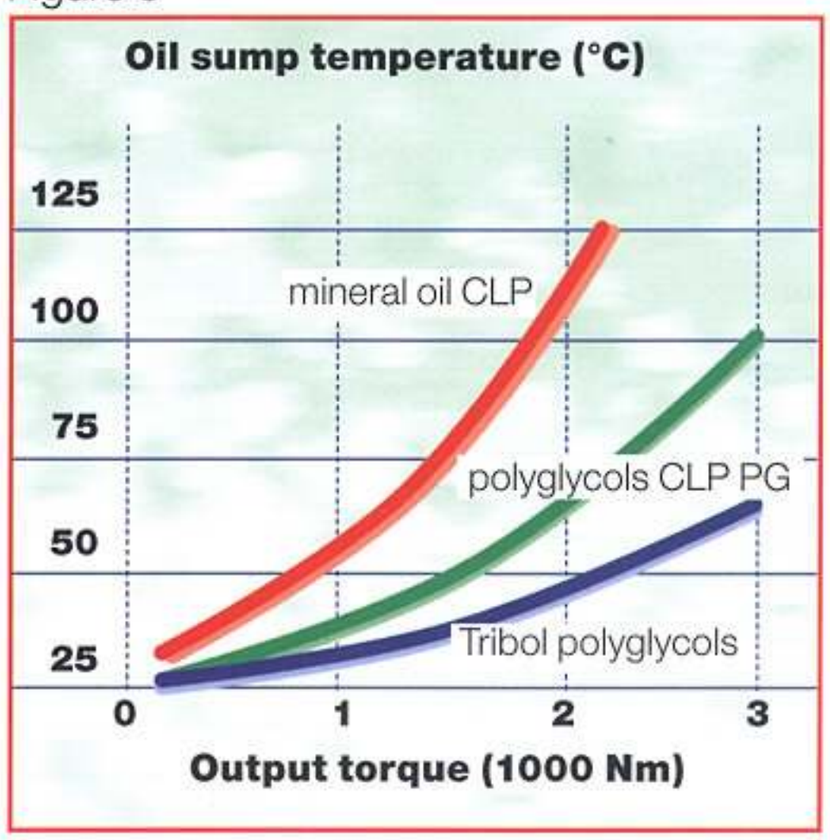


Figure 4

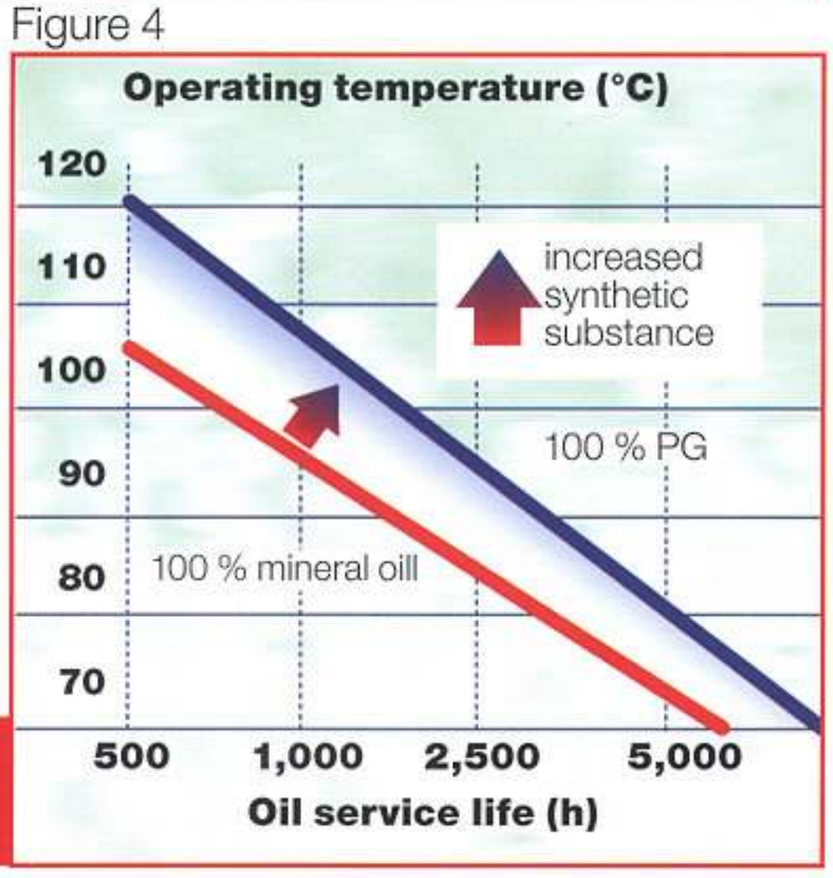
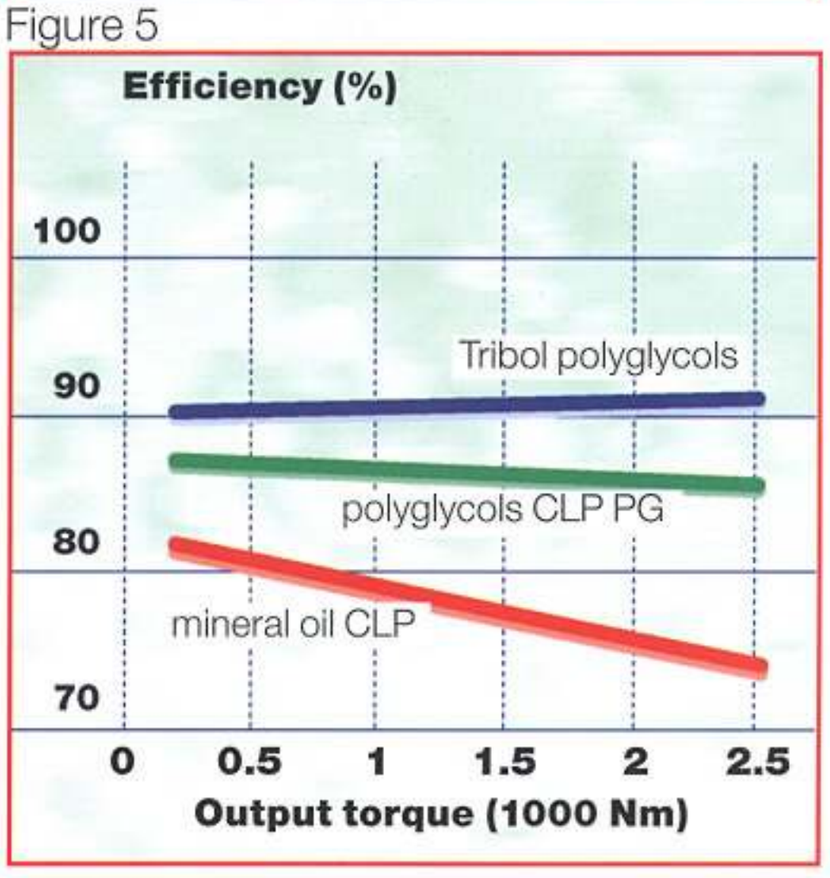


Figure 5



Due to the improved friction behaviour of Tribol 800 and Tribol FoodProof 1800 the temperature can be reduced in worm gear units by 5 K to 30 K, depending on the torque.

The low temperatures in the oil sump do not only effect the maximum transmission performance (heat limit) but also have a great influence on the lifetime of the oil filling. (Figure 3)

It is generally assumed that a temperature increase of 15 K reduces the service life of oils by half. The service life is even further extended by the high ageing stability of polyglycols.
Compared to mineral oils double to five times the service life can be obtained.

This makes the application of Tribol 800 or Tribol FoodProof 1800 in worm gears an economic and cost-efficient alternative to mineral oils despite the higher price. (Figure 4)

Reduced friction and lower temperatures generate a high efficiency in worm gear units. Positive consequences for the users: smaller sizes or higher power yield.

Tests in worm gears under different operating conditions have clearly proven that due to the application of Tribol 800 or Tribol FoodProof 1800 the efficiency can be considerably increased. (Figure 5)

Our gear oils on the basis of polyglycols, however, are not only suited for the lubrication of worm gear units.

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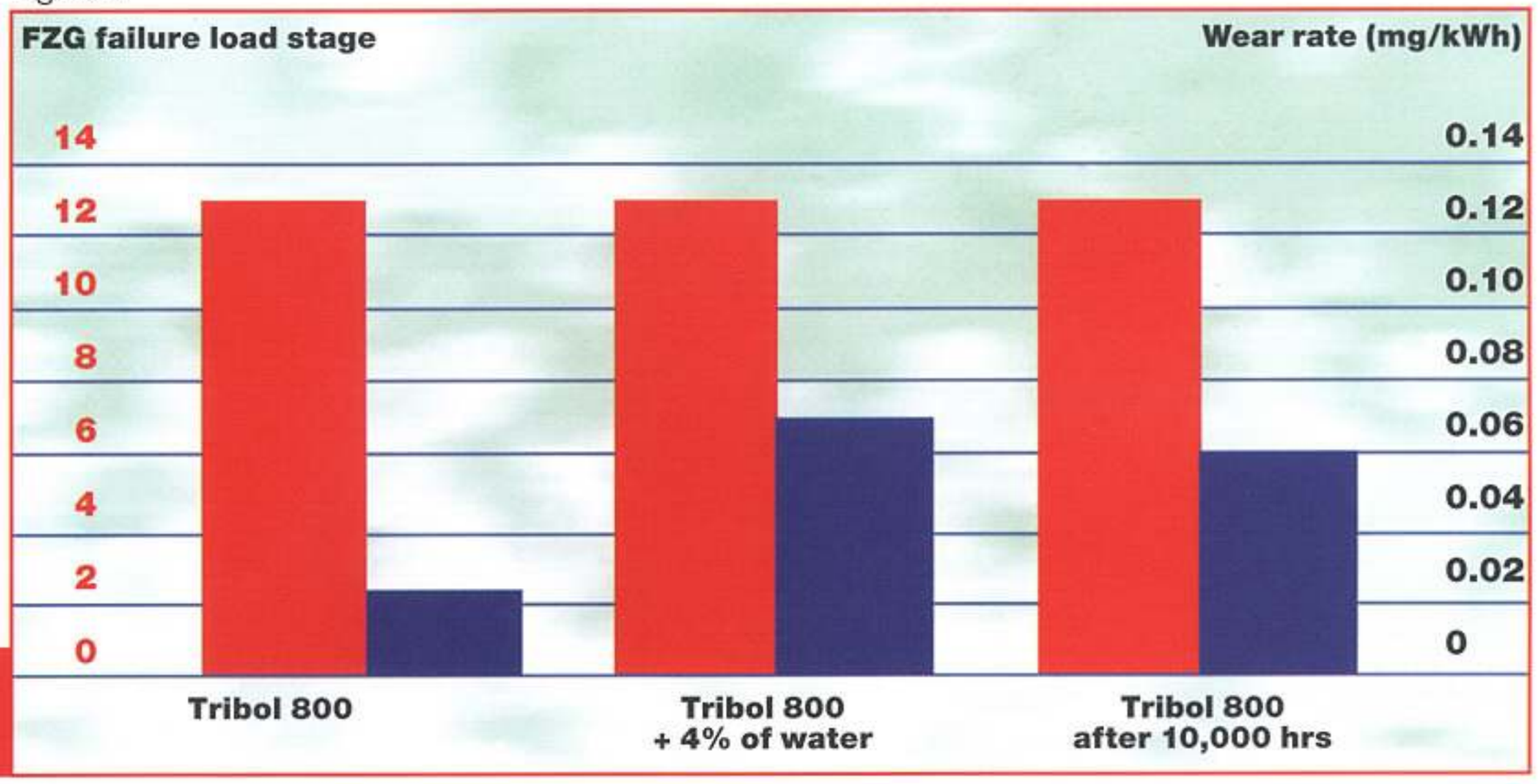
They also offer great advantages over gear oils based on mineral oil or polyalphaolefins in different types of gear units.
Polyglycols have a better frictional behaviour than mineral oils; this can be noticed in a temperature decrease even in spur, bevel and hypoid gears.

Besides, tests in the FE-8 rolling bearing wear test have documented that Tribol gear oils based on polyglycol feature extremely low coefficients of wear.

Figure 6



In the minimum requirements to be met by CLP gear oils in compliance with DIN 51517, part 3, the evaluation of the scuffing load carrying capacity is indicated as the failure load stage 12 in the FZG test according to DIN 51354.
Tribol 800 and Tribol FoodProof 1800 pass through the load stage 12 without failure.
The failure load stage reached in the FZG test is included in the gear design calculations of many gear manufacturers.

A high scuffing load carrying capacity ensures a reliable gear condition even after longer operating periods or after adding 4 % of water. (Figure 6)

The base oils used in the synthetic gear oils Tribol 800 and Tribol FoodProof 1800 are water-soluble polyglycols whose seal and paint compatibility has to be taken into consideration.

Tribol 800 and Tribol FoodProof 1800 are compatible with almost every reaction paints. Usually one-component paints are not resistant to polyglycols; in case of doubt their resistance should be tested.

The most conventional sealing materials such as NBR and FKM are resistant to our polyglycol-based gear oils. Even after a test duration of 1000 hours no leakages at the rotary shaft seals were detected. As far as the materials EPDM and VMQ are concerned we recommend to contact the technical department of Castrol Industrie GmbH. Materials such as polystyrene, styrene-butadiene and methacrylate are usually not compatible.

Miscibility

Tribol 800 and Tribol FoodProof 1800 are not miscible with mineral oils, esters or polyalphaolefins. We suggest a cleaning and flushing of the gear with fresh oil before it is refilled.

Synthetic gear oils of the series Tribol 800 are recommended by leading gear manufacturers and are applied for the first-fill of gears.

A worldwide network of service engineers and the application technology counselling provided by the Europe Headquarters in Mönchengladbach/Germany support our customers to select the optimum oil as well as keep them informed about the condition of the oil in use by means of used oil analyses.

Product	ISO VG DIN 51519	Application temperature	Application
Tribol® 800			**Synthetic gear oils**
Tribol® 800	100	-35 °C up to +160 °C	Modern worm and
	150	-30 °C up to +160 °C	spur gears, medium
	220	-30 °C up to +160 °C	to high loads,
	320	-25 °C up to +160 °C	rolling and sliding
	460	-25 °C up to +160 °C	bearings
	680	-25 °C up to +160 °C	
	1000	-35 °C up to +160 °C	
Tribol® FoodProof 1800 Synthetic gear oils for the food and beverage industry			
Tribol® FoodProof 1800	220	-30 °C up to +100 °C	Modern worm and
	320	-25 °C up to +100 °C	spur gears in the
	460	-25 °C up to +100 °C	food and beverage
	680	-20 °C up to +100 °C	industry,
			physiologically safe
Tribol® 1390			**Special anti-corrosion oils**
Tribol® 1390	46	-30 °C up to +160 °C	For the preservation
	220	-30 °C up to +160 °C	of gears and machinery or as
	320	-30 °C up to +160 °C	running-in oil if a
	460	-30 °C up to +160 °C	Tribol polyglycol
			oil is used as
			subsequent operating
			lubricant
Tribol® Polyglycol Flushing Oil			**Auxiliary material**
	(80)	-25 °C up to +120 °C	Flushing oil for the conversion
			to a polyglycol-based oil

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