

Technology, Machine-building, Geodesy

locomotive with a 317.5mm diameter bore after coating application using a high performance plasma gun and a feed rate of 500g/min.

Sulzer Metco has the knowledge of the complete process from premachining, through washing, surface activation, plasma coating, and smooth-surface finishing by diamond honing (mirror finishing). In order to be able to offer the complete process, Sulzer Metco has entered into partnerships with suppliers of all necessary equipment that Sulzer Metco does not produce in house.

Sulzer Metco, with its global presence, is able to supply a customized, industrial- scale SUMEBore solution package to almost any part of the world, including the necessary process support and maintenance on site[3].

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**MODERN GEAR OILS AND SPECIAL ASPECTS
OF THEIR PRODUCTION**

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In this article tendencies to improvement of gear oils quality for machines experiencing high loads are described. Gear oils are obtained by mixing of high viscosity index base with a package of additives.

Technological progress has made modern cars more complex and more perfect, so the performance requirements of oils increase. Gear oils were created for machines experiencing high loads.

Wherever the torque is transmitted to gear pairs (gearboxes, drive axles, transfer boxes, steering units) gear oils are used.

Today, there are two standard classifications which divide all gear oils into viscosity classes:

1. The Russian classification GOST 17479.1-85;
2. International Classification SAE.

The main purpose of gear oil is to transfer engine power, to lubricate and to cool down high speed and heavy-loaded gears in the transmission units.

Modern gear oils must possess the following properties [1]:

- Good anti-wear and antiscoring properties;
- Good viscosity-temperature characteristics;
- Low corrosiveness;
- High thermal stability that ensures constant viscosity during work cycle;
- High protective properties against rust;
- Small influence on the sealing material;
- Low toxicity.

The main physical and mechanical properties of gear oils include [2]:

- Kinematic viscosity;
- Dynamic viscosity;
- Pour point;
- Viscosity index.

The basic tribological properties of gear oils include:

- Scuffing load - the mode, when sliding of friction surfaces becomes difficult;
- Weld point - the force when the friction surfaces are not able to slip relative to each other;
- Load wear Index - an index indicating the efficiency of antiscoring properties in the range between the weld point and the scuffing load. The higher load wear index is, the better.

For the production of modern gear oils high viscosity index base and a package of additives are required.

There are following types of base:

- Mineral;
- Semi-synthetic;
- Synthetic;
- Hydrocracking.

Quantitative and qualitative composition of the additives is determined by each manufacturer individually, but gear oils must comply with the normative documents.

Gear oils are obtained by adding additives of various functional purpose or additive packages [3].

Detergent additives provide piston cleanliness and good mobility of the piston rings. Typically, in the oil combinations of different detergents are used which complement and improve the effectiveness of each other.

Depressant additives have good solubility in oils. They reduce the pour point and improve viscosity properties of oils.

Anticorrosion additives prevent and reduce corrosion in gear oils. They form a protective film on a metal surface. This film is catalytically inactive and is holds firmly on the surface.

Antiscoring additives prevent direct contact of metal surfaces at a very high load. This type of additive form very strong mono- or multimolecular film on the surface of the metal.

Viscosity additives help to keep the necessary viscosity at positive temperatures and don't have any negative influence at low temperatures.

Antifoam additives help to reduce foaming when they are used in transmission units. They also destroy already formed foam.

Antioxidant additives increase resistance to oxidation. When the engine works the oil undergoes deep chemical transformations - oxidation, polymerization, and alkylation.

It is experimentally determined that by adding to a high viscosity index base of the package containing detergent, depressant, anticorrosion, antiscoring, viscosity, antifoam and antioxidant additives in total amount of 5-10%, they obtain the gear oil LUKOIL - TM-5 (API GL-5; SAE 85W90) with the following parameters [1]:

Quality parameters of gear oil LUKOIL - TM-5

| Specification | Value |
|--|----------|
| Kinematic viscosity at 100°C, mm ² /s | 16,5 |
| Pour point, °C, max | -25 |
| Viscosity index, min | 90 |
| Flash point in o.c., °C, max | 180 |
| Weight fraction of active elements, %, S/P, min | 1,2/0,05 |

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DIAGNOSIS OF GEARBOXES AND MAIN GEARS

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Technical diagnosis is the process which determines the technical condition of the object to be diagnosed with certain accuracy. The result of the diagnosis is the conclusion about the technical condition of the vehicle including (if necessary) the place, the type and the cause of the fault. Diagnosis is used for routine maintenance, as well as for detecting defects in the maintenance.

The first task of technical diagnostics is the determination of technical condition, so that the vehicle status is to be related to one of the possible technical conditions.

Having established the fact of the efficiency loss, the failure or malfunction, the second problem started being solved: the search of the defects which have broken the condition and operation of the vehicle or caused malfunction.