



## EFFECT OF WORKING CONDITIONS ON CHANGE OF PROPERTIES OF ENGINE OILS AND WORKING FLUIDS

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### Abstract

This article provides information on the system of operating vehicles in difficult climate conditions and its complex aspects.

Also, motor oils, physico-chemical properties of motor oils and issues related to the process of contamination of working fluids are mentioned.

### Key words

engine, lubrication system, motor oils, physicochemical properties, working fluids, pollution process, filtered compounds, gas distribution mechanism, hydraulic drive parts, catalysts.

At the current stage of the economic independence of our country, it is necessary to carefully use the equipment installed in enterprises, to carry out preventive maintenance and repair in order to extend the period of their use. At the same time, it is today's demand to replace obsolete equipment with low-cost equipment produced abroad, to establish the production of oil industry equipment on the basis of the machine-building industry of our republic.

The natural and climatic conditions of Central Asia are very difficult, characterized by high temperatures, strong wind conditions and dust storms. Air temperature - from 25° C to +50° C, relative humidity in summer is 26-30%, strong radiation and complete absence of precipitation in summer-autumn period. In addition, there is a daily sharp change in air temperature, as well as a high amount of sand and dust in the atmospheric air. In most regions of Central Asia, solar radiation is up to 3% of ultraviolet rays, in the form of direct and diffuse radiation, and the direct intensity of heat flow reaches 125-160 kcal/cm<sup>2</sup> per year.

Such conditions complicate the operation of motor vehicles and increase the change in the physical and chemical properties of motor oils. In addition to changes in the physicochemical properties of motor oils and working fluids, contamination is constantly accumulated in the oils during operation. The process of contamination of engine and working fluids occurs due to its circulation through filters, where there are large particles, and the number of small particles remaining in engine oil and working fluids gradually increases [1]. A state of stabilization of pollutants occurs when the amount of impurities entering the working fluids is slightly different from the amount of filtered impurities.

Particles get into the gaps between the friction surfaces of the crankshaft and the gas distribution mechanism and hydraulic transmission parts, causing their accelerated wear. An analysis of the construction of the elements of the crankshaft and gas distribution mechanism and hydraulic transmission parts shows that the clearances in the specific holes are from 1 to 23 microns. Particles with a size of 5-23 microns are dangerous for crankshaft and gas distribution mechanism parts and hydraulic transmission of automobile equipment [2].

The analysis of the pollution of car oils and hydraulic fluids during operation showed that in most

cases the concentration of mechanical impurities significantly exceeds the permissible norm. Thus, when using cars, the amount of pollution of motor oils increases from the average (15-20) to 10-2 mg/l for every 1200-1600 km, which is 30-40% more than the permissible norm.

Contamination that enters the lubrication system of engines and hydraulic systems of cars during operation causes inorganic and organic substances. The main part of pollution is inorganic products: mineral dust, metal wear products, lead salts, water, etc. (75-80%). The content of organic products, as a rule, should not exceed 20-25%. Organic matter products are caused by the "wearing" of oils during operation. Oil aging is caused by the presence of metals due to temperature, pressure and contamination with mechanical impurities, dust, etc. due to the oxidation of hydrocarbons in it with oxygen in the air. As the oil ages, acidity increases and deposits form. Sediments are separated into degradable and non-degradable (solidified) organic compounds. The first type of precipitate dissolves in hot oil, but falls off when it cools [3]. They react with metal oxides and form salts. Non-degradable (hardened) sediments are neutral products of oxidation and polymerization. As a result of their poor solubility, they fall out of hot oil and settle on the crankshaft and gas distribution mechanism, as well as parts of hydraulic systems.

If the quality of the oil does not meet the requirements of GOST or TU, the increase in temperature, flash in the tank, and the oxidation process of the oil in the lubrication system and hydraulic system are accelerated. Also, oxidation is accelerated by light, water and metals, especially copper.

The oxidation process consists of several cycles. The initial oxidation period is called induction. They can be observed in fresh oils at low temperatures. During this period, although the oils absorb a certain amount of oxygen, they do not form oxidation products, because the oil contains natural antioxidants. Changes in the oil during this period cannot be detected by traditional technical analysis methods. Due to the increase in temperature and the influence of catalysts (metal, especially copper surfaces of the lubrication system and hydraulic system parts), the duration of the induction period is quickly reduced. During further work, stable oxidation products begin to accumulate in the oil: low molecular weight organic acids, water and some organic peroxides. The process is continuous, increasing and intensifying.

As a result of changes in the physico-chemical properties of oils, as a rule, their operational properties deteriorate. The main indicator describing the performance characteristics of oils is its resistance to oxidation. This indicator depends on the chemical composition of raw materials and the cleaning process. Many studies have shown that oxidation-resistant oil is obtained with the maximum amount of naphthene and aromatic hydrocarbons.

Oxidation processes directly depend on the size of the oil and air contact surface. The larger the surface area, the more favorable the conditions for oxygen diffusion, therefore, for oxidative polymerization. According to the catalytic effect on the oxidation of oils, metals are in the following order: copper > brass > nickel > iron > zinc > tin > aluminum.

The consumption of motor oils and working fluids in motor vehicles is about 3-5% of the main fuel consumption, which means that it is a significant part of the operating costs [4]. Therefore, it is an important national economic task to search for and implement methods of rational and economical use of motor oils and working fluids.

Among the main methods of rational use of motor oils and working fluids in the hot climate of Central Asia, the following should be noted:

- development of a structure to protect oils from damage;
- increasing the durability of oils through adsorption cleaning;
- it is recommended to use only recommended motor oils and operating fluids for motor vehicles.

In conclusion, it should be said that in modern cars and other machines, hydraulic drives are increasingly used to drive various mechanisms. Oils used as working fluids in them have a great advantage over gases and solids, they are almost incompressible and this property allows for smooth, vibration-free and noise-free power transmission.

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