



## Propensity to Sedimentation of Motor Oils With the Engine Running

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### ABSTRACT

In the high temperature zone, the oil burns completely or carbonaceous particles remain, which cannot remain on the surface devoid of a binding medium. The products of deep oxidative polymerization, which differ in high temperature zones and flow back into the crankcase, as well as other precipitated deposits, continue to have a negative effect on the oil. The greatest danger of varnish deposition is for piston rings. By filling the gaps formed by the piston rings and the grooves drilled in the pistons, it reduces the mobility of the rings. It is here that high-carbon compounds are formed, which are deposited in the grooves in the form of films. To reduce or prevent the formation of carbon deposits, special surfactants called detergent-dispersing additives are introduced into engine oils. The effect of such additives is based on their ability to loosen, wash off deposits from the surface of parts and transfer insoluble substances into suspension and keep these particles in this state without enlargement.

### Keywords:

engine oils, additives, engine, oxidation, sedimentation, varnish deposits, carbonaceous particles, lubricating properties, wear, friction modifiers.

Modern oils with a high content of additives, getting into the combustion chamber, in the process of natural fumes burn with the formation of ash deposits. Deposited on the parts, these deposits worsen the heat sink, which leads to melting, cracking and burning of the pistons and exhaust valves (the intake valves are cooled by the incoming combustible mixture). Oils that are unstable to oxidation form precipitation faster and to a greater extent than stable oils.

In the high temperature zone of the engine, hydrocarbons and other components of oils are oxidized and form poorly evaporating, highly viscous, practically insoluble in oil oxyacids, asphaltenes and acid resins, which are deposited on the parts in the form of a thin shiny layer called a varnish deposit. Lacquer

deposits are carbon-rich substances formed as deposits in the grooves under the piston rings, on the skirts and inner walls of the pistons. The deposition of varnish causes the piston rings to burn and the parts on which these deposits were formed to overheat. Combustion of piston rings, which causes a breakthrough of gases into the crankcase and a decrease in compression in the cylinders, and as a result – a drop in engine power. The accumulation of carbonaceous deposits on the cylinder walls, pistons, rings, valves, etc., occurs not only due to oxidation products, but also as a result of purely thermal transformations of polycyclic hydrocarbons and resinous substances. At the same time, engine oil consumption increases significantly, wear increases, even bullying on

cylinder mirrors and piston rings breakage with piston jamming are possible.

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The ratio of substances that make up precipitation can change dramatically, but their content varies within the following limits (in weight percentages):

- oil (50-85%)
- water (5-35%)
- fuel (1-7%)
- acids (2-15%)
- asphaltenes (0.1-1.5%)
- carbenes, carboides (2-10%)
- ashes (1-7%).

The presence of precipitation in the engine is a great danger. They can clog oil ducts, oil pipelines and filters. If the oil pump receiver and oil lines are clogged with sediments, then the normal oil supply will be disrupted. As a result, melting of bearing liners, bulgy of crankshaft necks and even engine failure may occur. If the oil filter is clogged with sediments, then uncleaned contaminated oil enters the rubbing parts, as a result of which the wear of parts increases sharply, there is a danger of burning piston rings, etc.

If there is precipitation in the engine, the quality of freshly poured oil deteriorates sharply. In addition, sediments can condense and harden over time so that it is difficult to clean parts from them even by mechanical means.

A very significant factor affecting the appearance of precipitation is the mode of operation of the engine. Working on light

modes is the most dangerous. Since this creates the most favorable conditions for sedimentation. The operation of the vehicle in low-speed modes, with insignificant loads, frequent and prolonged stops, prolonged engine idling leads to lower operating temperatures in the engine, more severe contamination of the crankcase oil by products of incomplete combustion of fuel, oil liquefaction by fuel.

When idling for a long time, in order to reduce precipitation, it is recommended to maintain the coolant temperature at about 70 ° C.

Oils with special additives are less prone to sedimentation compared to pure oils, since additives make it possible to better retain insoluble impurities and better resist oxidation. Sediments in the engine are sticky oily substances from gray-brown to black, deposited during operation in the engine, crankcase, valve box, oil system and filters. Basically, it is an emulsion of water in oil contaminated with various impurities. The ingress of water into the crankcase oil is the main cause of precipitation. The composition of precipitation is variable and largely depends on the conditions under which it is formed.

One of the measures to combat varnish formation is the introduction of antioxidant and detergent additives into the oils, which inhibit the deposition of the resulting resinous-asphaltene substances and reduce the formation of varnish deposits and carbon deposits on hot surfaces of engine parts.

To reduce or prevent the formation of carbon deposits, special surfactants called detergent-dispersing additives are introduced into engine oils.

Currently, work is underway to create motor oils with ash-free dispersing additives. An example of such additives are succinimide products (dipol-45, LZ-325, C-5A), which differ in the number of amino groups, length and branching of aliphatic chains. Succinimides not only do not form abrasive particles, but also exceed many ash additives in terms of the dispersing effect. The effect of such additives is based on their ability to loosen, wash off deposits from the surface of parts and transfer

insoluble substances into suspension and keep these particles in this state without enlargement.

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