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THE AGING PROCESS OF MOTOR OILS DURING OPERATION

Alimova Zebo Khamidullaevna

Professor, Tashkent State Transport University, Uzbekistan

Siddikov Faxriddin

Senior Lecturer, Tashkent State Transport University, Uzbekistan

ABSTRACT: - During the aging process, the composition of the oil becomes more complicated due to the accumulation of impurities in it, thermal or thermo-chemical decomposition of hydrocarbons and additives. These products enter into physical and chemical interactions with each other and with pollutants. There is also evaporation of light fractions of oil, the activation of additives, contamination with various mechanical impurities, water. To ensure minimal wear of engine parts, we suggest using oils of higher viscosity for hot climatic conditions.

KEYWORDS: Oil aging, high temperature, oxidizing environment, engine oils, deposits, viscosity, loads in the friction unit, oil film, carbon deposits.

INTRODUCTION

The working oil continuously changes under the influence of high temperature, oxidizing environment, external contaminants, catalysts (wear products of metal surfaces) and other factors. A set of processes accompanied by a change in the composition and properties of

the working oil in an unfavorable direction is called oil aging.

The aging of the oil occurs due to its contamination by atmospheric dust, wear products, gas formation, liquid and solid particles formed during the combustion of fuel, as well as a result of chemical and physico-chemical changes in the hydrocarbons of the base oil and the components of additives introduced into these oils. Oil aging (which in turn leads to the formation of high- and low-temperature deposits on engine parts) can cause:

- coking of piston rings, their burning and complete loss of mobility (jamming in the piston grooves)

- temperature increase due to deterioration of the heat sink

- jamming of valves in guide bushings

- burnout of valves

- reduction of the passage section of the intake and exhaust tracts

- contamination of the walls of the oil receivers of pumps, filters and oil channels of the lubrication system, drainage holes in the oil rings and the piston

- increase in oil viscosity and corrosion wear of cylinder-piston group parts

- increased corrosion of bearing alloys and iron-containing parts

- abrasive wear of parts by solid particles of contaminants.

During the aging process, the composition of the oil becomes more complicated due to the accumulation of impurities in it coming from the outside, as well as oxidation products of thermal or thermo-chemical decomposition of hydrocarbons and additives. These products enter into physical and chemical interactions with each other and with pollutants coming from outside. It is not possible to study in detail and trace all the diversity and multi-stage transformations of all the components of the starting oil. Therefore, usually the whole set of aging processes of diesel oils operating in diesel lubrication systems is conditionally divided into several main integrally evaluated processes.

These include:

- oxidation;

- evaporation;

- thermal or thermo-oxidative decomposition of hydrocarbons that form the basis of the oil;

- contamination by fuel and oil combustion products, dust, wear products;

- consumption of additives or depletion of their action due to the neutralization of inorganic acids, thermal decomposition, entrainment from the working oil into deposits on oil filters, chemical reactions of interaction with oxidation products of oil and fuel, etc.;

- watering of oil as a result of condensation of water and gases breaking into the crankcase, or violation of the tightness of the cooling system;

- dilution of oil by fuel due to malfunctions of the high-pressure fuel pump, injectors, violation of the tightness of the fuel supply system or prolonged idle operation.

The chemical composition of oils and their operational properties change dramatically during operation — under the influence of high temperatures, air oxygen, products of incomplete combustion of fuel, condensing water, crankcase gases, catalytic action of metals and old oxidation products.

In addition, evaporation of light oil fractions occurs, additives are triggered, contamination with various mechanical impurities, water.

The oil's resistance to oxidation by oxygen in the air (chemical stability) is one of the most important factors determining the behavior of oil in friction units during operation, as well as its service life before replacement. Oxidation leads to the formation of varnish and carbonaceous deposits (especially on hot surfaces such as pistons and piston rings), low—temperature deposits - sludge, corrosion and destruction of metals, for example, bearing liners formed by acidic products.

To ensure minimal wear of engine parts, it is better to use oils of higher viscosity. However, such an increase in viscosity, especially for engines that are not heated to operating temperature, causes starting wear and deterioration of fuel and economic indicators.

Defective indicators of working oils

№	Indicators	Values of oil indicators	
		Gasoline	Diesel
1.	Change in viscosity, % Increase Decline	 25 20	 35 20
2.	The content of impurities insoluble in gasoline, %,	1,0	3,0
3.	Base number, mg KOH/g	0,5 - 2,0[x]	1,0-3,0[x]
4.	Reduction of flash point, °C	20	20
5.	Water content, % max	0,5	03
6.	Fuel content, %, max	0.8	0,8

For GM Uz cars, especially those manufactured in recent years, the use of SAE 5W-30, 5W-40 class oils is recommended. The transition to the use of low-viscosity oils is primarily caused by the fact that nanotechnology is used in the manufacture of modern engines, the deviation in the size of parts is insignificant and, accordingly, the gaps between the rubbing parts are minimal.

More viscous, including medium-viscous oils, cannot penetrate all the gaps during the start-up period, and as a result, dry friction and maximum wear occur within a few seconds.

Therefore, when selecting motor oils, it is necessary to pay attention to the viscosity value of both the base oil (5W) and commercial oils (the following numbers after). During operation, in hot weather, especially in conditions of high dustiness of the air and roads, it is necessary to monitor the change in oil viscosity.

Studies conducted by us, as well as a number of authors, have shown a relatively rapid thickening of oils during the flight period, i.e. it is on hot and dry days when the dustiness of the air near roads increases several times.

Based on data showing an increase in viscosity by 20-30%, we consider it necessary to change oils after 5-6 thousand kilometers for mineral oils and after 8-10 thousand kilometers for polysynthetic and synthetic oils.

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