

“ ISUZI ” TRUCKS
IN HIGH MOUNTAIN AND HOT CLIMATES

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ИССЛЕДОВАНИЕ ЭКСПЛУАТАЦИИ ГРУЗОВЫХ АВТОМОБИЛЕЙ “ISUZI” В
УСЛОВИЯХ ВЫСОКОГОРЬЯ И ЖАРКОГО КЛИМАТА

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Abstract: *this article presents scientific research on the “ ISUZI ” truck operating in the highlands and hot climate of the Republic of Uzbekistan. The operation of the “ ISUZI ” car in hot climates, transport operating conditions, road operating conditions, natural and climatic operating conditions have been studied, and the main factors influencing changes in the quality of engine oil during engine operation have been analyzed.*

Key words: *car, oils, lubricant, economy, operation, high mountains, hot climate, reliability, uninterrupted operation, resource.*

Аннотация: *в данной статье приведены научные исследование, грузового автомобиля “ISUZI” эксплуатирующийся в условиях высокогорья и жаркого климата Республике Узбекистан. Изучена эксплуатации автомобиля “ISUZI” в условиях жаркого климата, транспортная условия эксплуатации, дорожная условия эксплуатации, природно-климатические условия эксплуатации и проанализирован основные факторы, влияющие на изменение качество моторного масла в процессе работа двигателя.*

Ключевые слова: *автомобиль, масла, смазочный материал, экономия, эксплуатация, высокогорья, жаркий климат, надежность, бесперебойная работа, ресурс.*

Road transport, especially freight, plays a significant role in the country’s transport complex, regularly transporting important economic goods.

Over the years of independence of the Republic of Uzbekistan, the country's automobile fleet has been replenished with modern vehicles, such as Mercedes Benz, MAN, ISUZI , Iveco , Ford , Hyundai , Daewoo , MAZ, KAMAZ and others [1].

The operation of these vehicles is associated with a number of problems:

- cars are purchased for foreign currency and providing them with spare parts and operating materials requires large financial costs;
- various imported expensive oils from well-known manufacturers enter the lubricants market, but there is no information on the frequency of their replacement in severe hot and dusty conditions , as well as in high-altitude operation;
- for many brands of cars there are no regulatory and technical documentation for maintenance and repair during their operation in the Republic of Uzbekistan.

Reliable and uninterrupted operation of these vehicles largely depends on the quality and correct selection of the required range of lubricants and the establishment of their optimal service life.

Excessive and prolonged operation of oil in the engine reduces its reliability, at the same time, excessively frequent oil changes can lead to significant overconsumption, so it is necessary to find the optimal solution simultaneously for two directly opposite technical problems [2].

The correct solution to these issues will improve the reliability of automotive equipment and reduce the cost of transporting goods.

An increase in oil prices at the global level with a simultaneous expansion of the fleet of cars, machinery and mechanisms leads to the need for economical and rational use of fuel and energy resources, in particular lubricants.

Saving lubricants in automotive technology is achieved by correctly selecting them for specific operating conditions and justifying the timing of their replacement upon reaching the limiting value of the oil's performance. To do this, it is necessary to determine the rejection indicators and set the parameters for the rejection indicators of motor oils.

Taking into account the peculiarities of operating vehicles operating in dusty, hot climates and high mountains, the task was set to develop parameters for rejection indicators for assessing the quality of diesel oils using the example of ISUZU vehicles

Study of the operation of vehicles in hot climates . Vehicle operating conditions affect the operating modes of units and parts, accelerating or slowing down the change in the parameters of their technical condition. Under different operating conditions, the realized values of vehicle reliability indicators will differ, which will also affect the efficiency indicators of technical operation. Taking into account operating conditions is necessary when determining the need for resources (personnel, production technical base, spare parts and materials) [3].

The influence of operating conditions on the design of vehicles and the reliability of their operation are divided into groups:

- transport conditions;
- road conditions;
- natural and climatic conditions;
- traffic conditions.

In addition, the state of the production base of a motor transport enterprise has a great influence on the reliability of cars.

Transport operating conditions . Transport conditions include the type, volume and distance of cargo transportation, conditions of loading and unloading, organization of transportation, conditions of maintenance, repair and storage of rolling stock and predetermine the choice of the type and design of vehicles [4].

ISUZU trucks are used mainly in suburban traffic. Vehicle operating mode for 2023-2024: average vehicle speed is 40 km/h. The average daily mileage is 258 km, the average annual mileage is 23596.1 thousand km . The average operating time of a vehicle is 8.0 hours, the annual transportation volume is 1272 thousand tons, the average transportation distance is 283.7 km, the technical availability factor is 0.90, the fleet utilization factor is 0.71, and the mileage utilization factor is 0.82.

Conditions for loading and unloading truck cargo are mechanized.

The rolling stock is stored in an open area of the enterprise territory; maintenance and repairs are carried out in the production premises [5].

Road operating conditions . Road conditions are one of the most important factors that directly influence the technical and economic performance indicators, technical characteristics and design of vehicles. According to operational indicators, roads are characterized by the design speed and degree of safety of vehicle traffic, permissible axial load, maximum throughput, wheel adhesion to the road surface, longitudinal profile and plan profile.

During road operation, there is a significant change in the degree of evenness of the surface, which significantly affects the technical and economic performance of vehicles, their wear and service life. When driving on uneven roads, additional energy is consumed due to the impact of the wheels on the uneven road surface and vibrations of the vehicle and cargo, which are damped by the suspension. On hard-surface roads with a large number of uneven surfaces, the wear of vehicle parts and components increases sharply, the amount of maintenance and repair work increases, and the interval between repairs decreases.

Based on the results of road tests of cars, it was found that when driving on roads with uneven surfaces (cobblestones, crushed stone), fuel consumption is 25-30% more than on roads with improved capital surfaces [6].

The speed of movement also depends on visibility on the road and the width of the roadway, radii of curvatures, slopes, etc. On roads in flat areas, average speeds can be the highest, since visibility is not limited by turns and bends in the longitudinal profile. Making large radius curves creates good conditions for movement in terms of lateral stability. Vehicle speed is reduced by 13% on roads in rough terrain and by 35-40% on mountain roads. At the same time, in mountain conditions, according to experimental data, fuel consumption increases by 15-20%.

The economical operation of automobile vehicles is influenced not only by their performance and durability. The lack of good and equipped roads leads to a sharp deterioration in efficiency, as the driving speed decreases, rolling resistance increases, which sharply increases fuel consumption, the cost of which amounts to up to 15% of the total operating costs. Increasing efficiency is of paramount importance to reduce transportation costs [7]

Road conditions determine how the vehicle operates. They are characterized by the technical category of the road (five categories in total), the type and quality of the road surface, which determines the resistance to vehicle movement, and the elements of the road in plan and profile (road width, curvature radii, slope of ascents and descents). In turn, the operating mode of the vehicle affects the reliability and other properties of the vehicle and its components.

Wear and destruction of the road surface reduce the reliability of the car by 14 - 33%.

The only transport route connecting the Fergana Valley with other regions of the republic is the Tashkent – Osh road (A-373). For 76 km (section 116-196 km) the road crosses the Kurama mountain system through the Kamchik and Rezak passes.

Due to the complex, rugged terrain, this section of the road is characterized by a highly tortuosity of the route plan, a significant number of turning angles and prolonged slopes of the longitudinal profile. The highest elevation of the road at the Kamchik pass is 2203 meters relative to the Baltic height system [8].

The width of the carriageway varies between 17-19 m, the largest turning angle is 110°, the smallest turning radius is 40 m. The difficult ascent begins at 145 km and ends at 160 km. The rise on this

section of the road reaches 7%. To overcome inclines, drivers are forced to engage low gears, while the engine crankshaft will rotate at maximum speed. This mode of engine operation reduces the service life of engine oils.

Natural and climatic operating conditions. Conditions are characterized by ambient temperature, barometric pressure, relative humidity, wind speed, precipitation, solar radiation and air dust.

The territory of the Republic of Uzbekistan is part of the Central Asian region, belongs to the hot climate zone and is located in a hot desert area.

Environmental factors of a hot, dry climate have a significant impact on the reliability of operation of automobile vehicles [9].

Dust and sand storms that occur in desert and semi-desert areas of hot, dry climates have a very large additional impact on the reliability of vehicles. High ambient temperatures and intense solar radiation impair heat dissipation from parts and oil, causing their temperature to rise. This leads to a decrease in oil viscosity, a drop in the load-bearing capacity of the lubricant layer in the crankshaft bearings and between the rubbing surfaces of other components. All this brings their operating conditions closer to boundary friction. But even for oils with high lubricity, there is a maximum temperature limit, above which the coefficient of friction and wear of parts sharply increases. This can occur in heavily loaded components operating at high temperatures and difficult lubrication conditions (piston, rings, pin, cylinder wall, etc.)

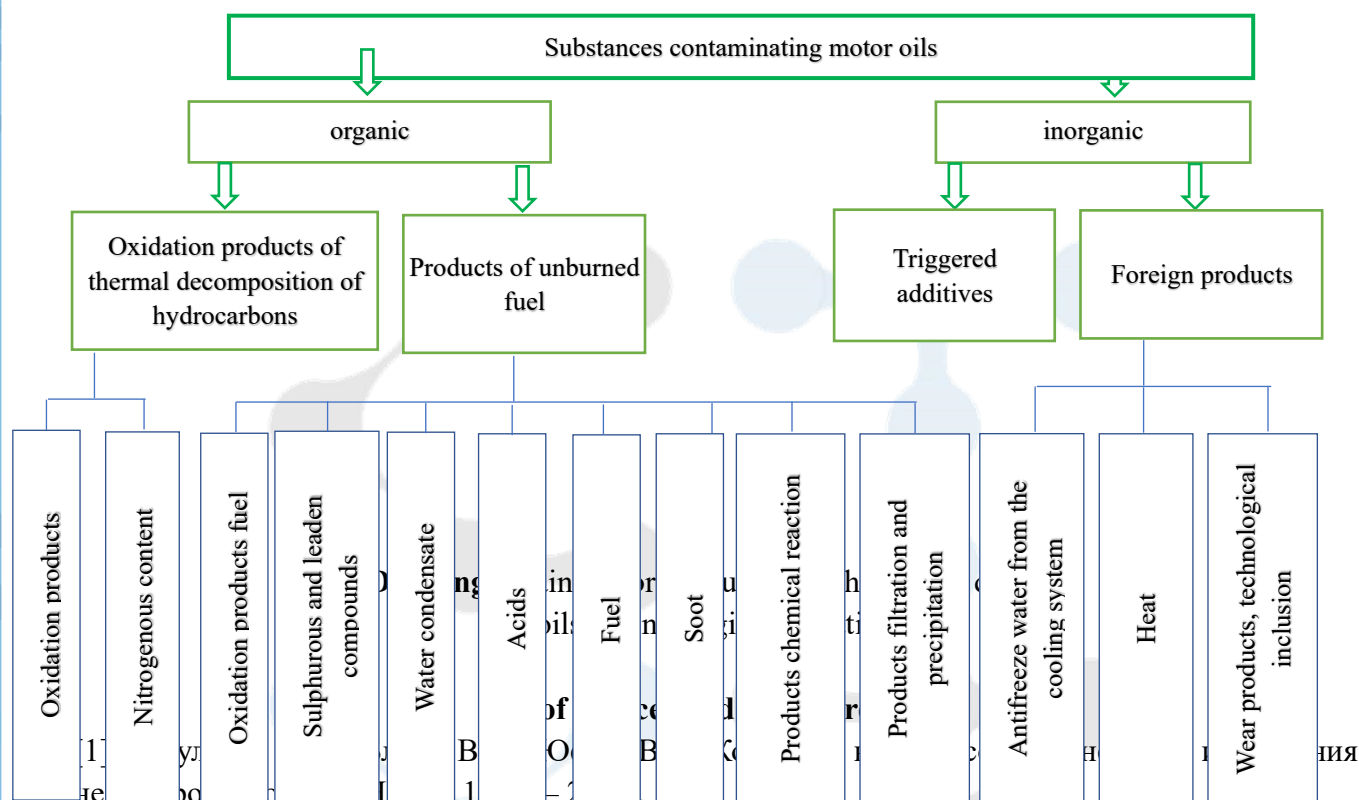
The air temperature in summer reaches + 50 °C, the daily difference is 25°C, air humidity is within 20...30% in summer 45-75% in winter. Barometric pressure is the average annual atmospheric pressure up to 10 GPa.

An increase in external temperature accelerates oxidative processes in the oil, promoting its aging and the activation of additives. Oil evaporation and waste losses also intensify. Sharp daily fluctuations in air temperature increase the water content in the oil as a result of condensation of atmospheric moisture on the crankcase walls and parts, which, in combination with oxidative phenomena, causes an increase in the aggressiveness of the oil and accelerates the decline in the base number. It has been established that the water content in oil accelerates the wear of piston rings by 1,8 - 2 times. An increase in oil water content worsens its filterability, reduces filter throughput, and contributes to damage during operation [10].

One of the main operational features of the Central Asian region, which has a negative impact on the operation of the lubrication system and the engine as a whole, is the high dust content of the roadside air layer and the high abrasive properties of the dust. At a height of 0.65 m above the ground surface, 66% of dust consists of fine particles up to 10 microns in size. It easily penetrates into the internal combustion engine crankcase through oil filler necks, oil level holes, and even the slightest leaks in the connections of external parts. The finest dust (up to 3 microns) passing through oil filters, being enveloped in oil oxidation and polymerization products, forms a thin colloidal suspension that does not increase friction and almost without negatively affecting the operation of the nodes. Particles with a size of 5 - 10 microns remain in an active state, quickly clog fine filters, increase their internal resistance and disrupt oil filtration. Getting into the gaps between rubbing parts, they cause intense wear of surfaces. Therefore, full-line fine oil purification in combination with more frequent replacement of filter elements is preferable [11]

Basic factors influencing changes in oil quality during engine operation. During operation, motor oils are exposed to various factors such as high temperature, intense contact with atmospheric oxygen

and fuel combustion products; catalytic effect of metals and alloys; changing engine speed and load conditions; technical condition of the engine, etc.



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