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Influence Of Gasoline Evaporation Temperature For Engine Running

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ABSTRACT

The article analyzes the effect of the vaporization temperature of gasoline on the wear of engine parts and the efficiency of fuel consumption.

Low starting temperatures and 10% distillation, especially in hot weather, the power system generates vapors, the volume of which is 150-200 times more than the volume of gasoline, which causes interruptions or engine shutdown.

Due to poor evaporation of heavy fractions, oil films are washed out of the walls, and wear increases. Restrictions on the boiling point of 195^{0} C gasoline are proposed.

KEYWORDS

Volatility, Gasoline, Wear Of Parts, Combustion Efficiency, Fuels, Piston Rings, Starting Qualities, Engine, Low-Boiling Hydrocarbons.

INTRODUCTION

The volatility of gasoline is its main quality, which characterizes the rate of transition of the liquid phase into the gaseous phase. To assess the volatility, fractional distillation is performed and the temperature is determined at which 10, 50 and 90% of the fuel by volume evaporate (t-10%, t -50%, t-90%).

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The volatility of gasoline affects the ease of starting the engine, the duration of warm-up and the stability of the engine. The volatility of gasoline should ensure the optimal composition of the fuel-air mixture at all engine operating modes. It is known that only the fuel that is in a gaseous state burns in engines. Therefore, for the completeness of combustion, it is necessary that the entire liquid phase of the fuel passes into a vaporous phase, and there is a thorough mixing of fuel vapors with air to form a combustible mixture.

The boiling point of summer and winter gasoline by the standard should be at least 35°C. This condition limits the amount of low-boiling fractions in gasoline, which guarantees not only the prevention of the formation of vapor-air jams, but also the preservation of the starting properties of fuels. In the summer, a decrease in this temperature would inevitably lead to large losses from the evaporation of gasoline, as well as the occurrence of an explosive and fire-hazardous situation during the operation of such gasoline.

By the value of the temperature at which 10% of the fuel evaporates (t10%), the starting qualities of the fuel and engine are determined. Light fractions are needed only for the period of starting and warming up the engine. If there are not enough low-boiling fractions in the fuel composition, then when starting a cold engine, part of the gasoline does not have time to evaporate and enters the cylinders in a liquid state.

Since the used combustible mixture turns out to be depleted, it cannot be ignited with an electric spark. As a result, the engine cannot be started. Boiling of 10% gasoline should occur at a temperature of 55°C in winter and 70°C in summer. The lower these values, the easier it is to start a cold engine(Fig. 1).

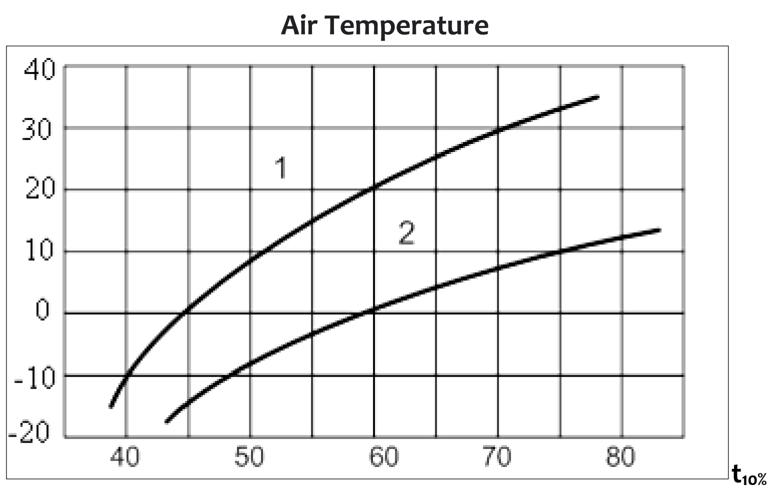


Fig. 1. The relationship between the distillation temperature of 10% gasoline and the starting properties of the engine:

1 - easy start of the engine; 2 - difficult start.

If gasoline has too low temperatures of the beginning of distillation and distillation of 10%, then when the engine is hot, especially in hot weather, the most low-boiling hydrocarbons can evaporate in the power system, forming vapors whose volume is 150-200 times greater than the volume of gasoline, which causes interruptions or engine shutdown.

In hot weather, the main problem is the formation of steam jams as a result of the evaporation of gasoline in the fuel pump and in the fuel supply pipelines, which limits the supply of fuel to the engine. This leads to impoverishment of the mixture and deterioration of pick-up or, in extreme conditions, to engine shutdown.

The duration of heating is particularly strongly influenced by the distillation temperature of 50°C of gasoline (t50%). The lower this temperature, the easier and more complete the evaporation of gasoline occurs at low temperatures and the engine warms up faster.

For a steady, uninterrupted transition of the engine from low revs to maximum, the distillation temperature of 50% gasoline should be:

summer gasoline – no higher than 115°C, winter gasoline - no higher than 100°C.

At the end of the warm-up at idle, there should be almost complete evaporation of fuel in the intake pipeline. Moreover, the lighter the fractional composition and the lower the distillation temperature t50%, the faster the engine warms up.

With poor evaporation, poorer combustible mixtures are formed, leading to an increase in the time required to accelerate an engine running on such fuels. The lower the t50%, the more homogeneous the hydrocarbon composition of the fuel, the more steeply the acceleration curve rises in its middle part, gasoline evaporates faster in the intake pipeline, filling the cylinders with a combustible mixture improves, as a result, the engine warms up faster, its power increases and its pick-up improves.

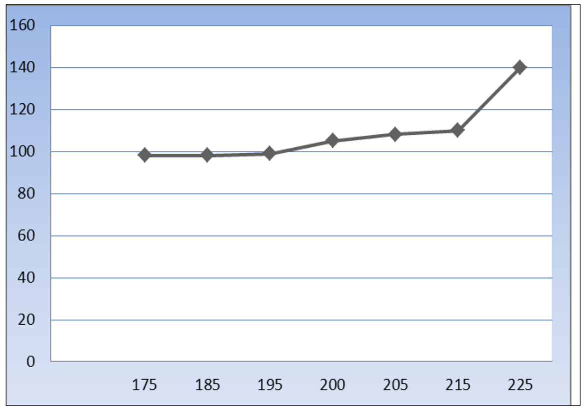
The standard value of t50% does not exceed 115°C for summer gasoline brands. For winter gasoline t50% not higher than 100-105°C. Gasoline with such a value of t50% after starting and warming up the engine ensures its smooth transfer from one high-speed operation mode to another. It has been experimentally proved that the fuel quality deteriorates slightly with a change in the distillation temperatures of t10%and t50% of the fuel volume, but decreases sharply with an increase of t50%. A further decrease of t50% does not lead to a significant improvement in the rapid warming up of the engine and its acceleration.

Non-evaporated gasoline does not burn, and flushes oil from the cylinder walls getting into the crankcase, reduces the viscosity of engine oil. The lubricating properties of the oil deteriorate, the flash point of the oil vapor decreases. The oil begins to burn in the cylinders, forming carbon deposits and causing oil overspending. This effect is maximum for an unheated engine. The amount of non-evaporated gasoline is characterized by a distillation temperature of 90% of fractions (t90%). With an increase in this temperature, as well as the boiling point temperature, not only engine wear increases, but also the relative consumption of gasoline.

It has been experimentally proved that the fuel quality deteriorates slightly with a change in the distillation temperatures of t10% and t90%of the fuel volume, but decreases sharply with an increase of t50%. A further decrease of t50%does not lead to a significant improvement in the rapid warming up of the engine and its acceleration.

At high values of the boiling point, heavy fractions of gasoline do not completely evaporate in the combustion chamber, and the non-evaporated part flows through the piston ring locks into the engine crankcase. In this case, the oil is washed off the cylinder walls, and the crankcase oil is liquefied and the wear of engine parts increases.

Fuel Consumption



end distillation temperature

Fig. 4. Influence of the temperature of the end of distillation on fuel consumption.

At the place of oil flushing, semi-dry friction of parts occurs, accompanied by increased wear. As the engine wears out, especially the cylinder-piston group, fuel consumption increases significantly (Fig. 4).

It can be seen from the figure that an increase in the boiling point of gasoline leads to increased wear of the cylinder-piston group of the engine and, accordingly, to an increase in fuel consumption.

The main reason for the rapid wear of engine parts when using fuels with poor evaporation is the flushing of oil from rubbing parts with non-evaporated fuel. The liquefaction of oil in the crankcase only indicates that the engine is flushing oil, causing increased wear.

In the long-term operation of gasoline engines, the direct connection between the evaporation of gasoline and the operation of the engine has been confirmed. This relationship is established on the basis of the operational evaluation of gasoline by their fractional composition. The study shows that in order to ensure optimal engine operating conditions, the distillation temperatures of the end of boiling gasoline should be: 90% boiling for summer gasoline - no higher than 180°C, and the temperature of the end of distillation - 195°C boiling 90% for winter - no higher than 160°C, and the temperature of the end of distillation - 185°C.

CONCLUSION

The use of fuel with a high boiling point not only leads to an increase in the wear of parts of the cylinder-piston group of the engine, but also the amount of carbon deposits in the combustion chamber and a decrease in engine power. Thus, in the conditions of the Republic of Uzbekistan, where winter grades of automobile fuels are not being developed, it is desirable to limit the boiling point of gasoline to 195°C, while maintaining t50% and t50%within 70°C and 105°C.

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