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THE INFLUENCE OF THE THERMAL MODE OF THE ENGINE ON THE POWER AND ENVIRONMENTAL PERFORMANCE OF THE ENGINE

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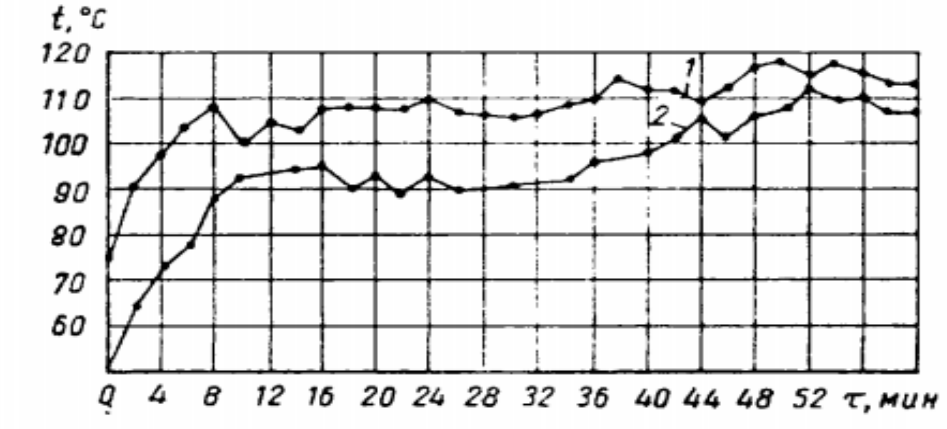
The performance of cars when operating them in hot climates and desert-sandy areas is largely due to the thermal regime of the engine and the impact of this mode on power and economic indicators, as well as on engine wear.

The thermal mode of operation of the engines of ZIL cars during operation in hot climates is much higher than recommended by manufacturers. In Fig. 1. A graph of the change in the temperature of the water leaving the engine and the engine oil in the crankcase when driving a ZIL car with a trailer on a sandy road is given. At an outside temperature of 40 ° C, the established water temperature in the cooling system was in the range of 110-112 ° C, and its maximum value reached 117-120 ° C.

The oil temperature in the engine crankcase was 110-115 ° C. The temperature of the air entering the carburetor was also elevated (65-70 ° C): its maximum value reached 80 ° C.

The results of micrometry of the main parts of the engines of two ZIL cars after a mileage of 25 thousand km in a hot desert area showed that their wear does not exceed the wear of the corresponding parts with the same mileage of cars in the middle lane. Bench studies made it possible to create identical test conditions and establish the effect of the increased temperature of the coolant, oil in the engine and the air entering the carburetor on the power and economic performance of the engine.



Rice. 1. Change in the thermal state of the engine of the ZIL car when driving with a trailer on a sandy road (outside temperature 40 ° C): 1-water temperature at the outlet of the engine; 2-oil temperature in the engine crankcase

The rate of wear of the piston rings was determined under load, speed and thermal conditions. The results are given in Table. 1.

Table 1.

Speed, load and thermal conditions of the ZIL engine

Speed mode, rpm	Gross mode, % of N_{ismax}	Temperature regime, °C		
		water at the engine outlet	oil in the engine crankcase	air at the entrance to the carburetor
2000	60 and 80	70, 90, 100, 110, 120	80-85	25-30
2000	60 and 80	80-85	70, 90, 105, 115	25-30
2000	60 and 80	80-85	80-85	20, 40, 60, 80
2000	60 and 80	120	115	80

The stand allowed to carry out the following modes and measurements:

- Change the temperature of water at the outlet of the engine, oil in the crankcase and air at the entrance to the carburetor, respectively, in the range of 50-120, 70-115 and 20-80 ° C;
- Observe and record the rate of wear of the piston rings, torque, engine speed, as well as the water temperature "at the exit from the engine and the entrance to it, the oil in the crankcase, the outside air, the air at the inlet to the carburetor and the working mixture;
- Determine fuel and air consumption;
- Change the speed and load modes within the necessary limits.

The overpressure in the cooling system of the stand was regulated from 0 to 1.0 N/cm2 by means of a steam valve.

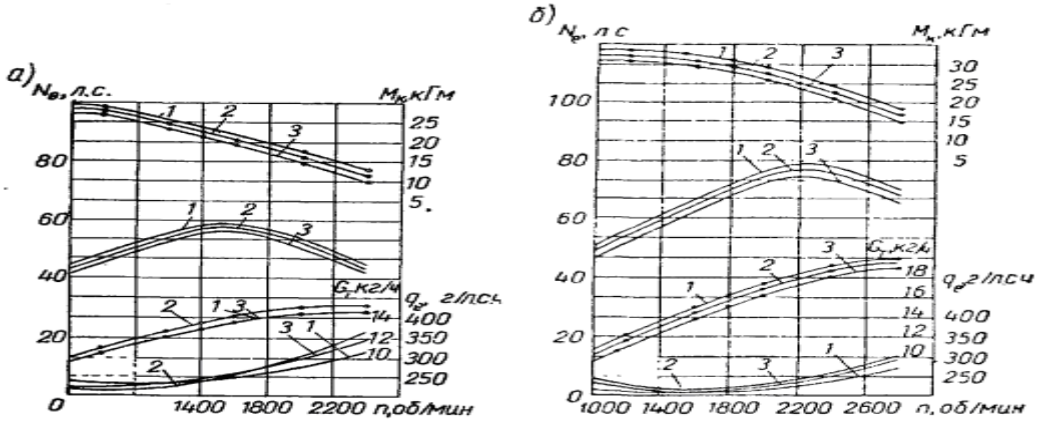
The water temperature was kept constant by a thermostat.

Torque was recorded by means of load cells.

The rate of wear of the piston rings was determined by the method of radioactive isotopes.

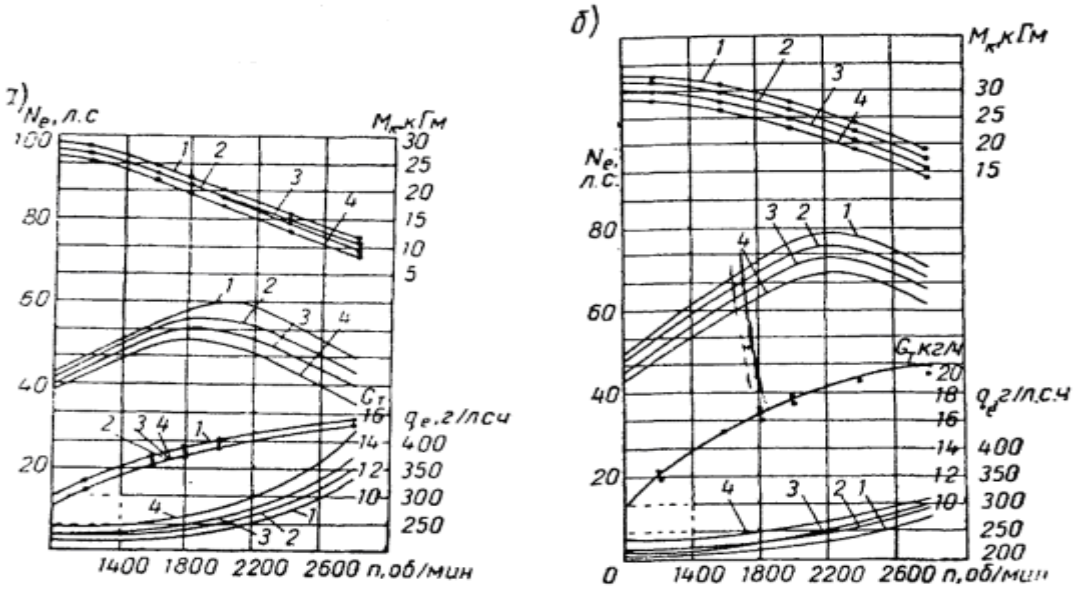
The engine speeds of the three different outlet water temperatures for the first load mode (60% N_e) are shown in Figure 3.7, and for the second load mode (80% $N_{e\ in}$ Figure 3.7). 2.b.

Based on the graphs, Table has been drawn up. 3.4., which shows the values of the reduction in engine power and the increase in fuel consumption with an increase in water temperature from 90 to 120 ° C for both load modes.



Rice. 2. Engine speed characteristics: a-at the first load mode; b-at the second load mode: for water temperature: 1 - 90 ° C; 2 - 60 ° C; 3 - 120 ° C

From the data of the table it follows that the power and economic indicators of the engine with an increase in water temperature at the outlet from 90 to 120 ° C decrease slightly.
The change in the oil temperature in the engine crankcase in the range of 70-115 ° C did not affect the power and economic indicators.



Rice. 3. Engine speed characteristics: a - at the first load mode; b - at the second load mode; for air temperature: 1 - 20 ° C; 2 - 40 ° C; 3 - 60 ° C; 4 - 80 ° C

The speed characteristics of the engine at different air temperatures at the entrance to the carburetor for the first load mode are shown in Fig. 3., a, and for the second load mode - in Fig. 3,b. From Fig. 3,b shows that with an increase in the air temperature at the entrance to the carburetor from 20 to 80 ° C, the engine power decreased from 77 to . s., i.e. by 15.6%. Specific fuel consumption, respectively, increased from 226 to 264 g / hp. h. i.e. by 16.7%. The same change in power and fuel consumption was observed when the engine was operating in the first load mode.65 л
Thus, the operation of the engine at an increased (up to 80 ° C) air temperature at the entrance to the carburetor leads to a significant decrease in power and efficiency.
In Fig. Fig. 3 shows the speed characteristics of the engine in "normal thermal conditions" (air temperature at the entrance to the carburetor 20-25 ° C, water temperature 90 ° C and oil temperature 80 ° C) and in conditions corresponding to the thermal state of the engine and the use of the ZIL car on unpaved roads in hot desert areas (air temperature at the entrance to the carburetor 80 ° C, water temperature 120 ° C and oil temperature 115 ° C).

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