

LABORATORY 7

DETERMINATION OF THE FRACTIONAL COMPOSITION OF DIESEL FUEL

1. Purpose of the laboratory work:

1. To determine the physicochemical properties of diesel fuel.
2. To reinforce knowledge about diesel fuel grades and become familiar with GOST standards.
3. To evaluate the quality of the fuel and determine its operating conditions.

2. Tools and equipment required for the laboratory work:

1. Distillation flask
2. Graduated cylinders and test tubes
3. Thermometer
4. Cooling device

Task: Examine the given diesel fuel sample, determine its grade and type, compare the obtained indicators with GOST requirements, and indicate under what conditions the tested diesel fuel sample can be used. Become familiar with the standard diesel fuel samples available in the laboratory and determine the grade of the tested fuel sample by comparing its external appearance with those reference samples.

The fractional composition of diesel fuel is determined using a special distillation apparatus (Figure 1.3). It shows the relationship between the amount of fuel distilled off and the distillation temperature. The fractional composition of diesel fuel is evaluated by the temperatures at which 10%, 50%, and 90% of the fuel are distilled, as well as by the final boiling temperature. These indicators are specified in the relevant standards.

Procedure for performing the work

1. 100 ml of the fuel sample is measured and poured into the distillation flask. A thermometer is installed through a cork stopper (the mercury bulb of the thermometer must be aligned with the tube in the side neck of the flask).
2. The flask is placed on the heating plate so that the bottom of the flask lightly touches the asbestos support above the heater. The side tube of the flask is connected securely to the condenser using stoppers.
3. The measuring cylinder is placed at the outlet end of the condenser tube, and the top of the cylinder is lightly covered with cotton or thin paper.
4. Heating is carried out so that the first drop from the condenser falls within 5–10 minutes after heating begins. The temperature at which the first drop appears is taken as the initial distillation temperature.

5. After the first drop appears, heating is continued so that 2 drops per second fall from the condenser.



Figure 1. Apparatus for determining the fractional composition of fuels

Percentage of diesel fuel distilled, %	Temperature, °C
I.B.P. (<i>Initial Boiling Point</i>)	
10	
20	
30	
40	
50	

60	
70	
80	
90	
97.5	
F.B.P. (<i>Final Boiling Point</i>)	

The obtained results are presented in the form of a curve. The obtained indicators are then compared with the requirements of GOST, and it is determined under what conditions the tested diesel fuel sample can be used.

Determination of the cetane number of diesel fuel

The cetane number of diesel fuel can be calculated using the following formula:

$$\text{Ц.С.} = v^{20} + 17.8(1.5879/\rho^{20})$$

Here:

v^{20} - viscosity of the fuel at 20°C.

ρ^{20} — density of the fuel at 20°C.

$$\rho^{20} = \rho^t + \gamma (t-20)$$



Figure 3. Instrument for determining the cetane number