

Practical Lesson 8

DETERMINATION OF THE FLASH POINT OF OILS IN A CLOSED CUP

Under normal conditions, mineral oils do not oxidize for a long period of time. However, at temperatures of 50–60 °C, the oxidation process proceeds very intensively. In the high-temperature zones of an engine, oxidation and thermal decomposition lead to the formation of substances that were previously absent in the oil composition, such as acids, resins, and asphaltic compounds. The property of oil vapors to ignite when mixed with air and exposed to a flame is called the flash point. This parameter is one of the main diagnostic indicators that determine the serviceability and operational suitability of lubricating oils. The flash point characterizes the volatility of the oil. The higher the content of light fractions in the oil, the greater its evaporation rate and the lower its flash point. As a result, oil consumption in the engine increases. For example, when the flash point decreases from 200 °C to 140 °C, the oil consumption increases by approximately 50%.

1. Method for determining the flash point of oils in an open cup

Procedure

1. The inner crucible is washed with gasoline, then heated using a gas burner, cooled, and placed into the outer crucible filled with heated sand. The sand level should be 12 mm below the rim of the inner crucible. A 5–8 mm thick layer of sand must be present between the bottom of the inner and outer crucibles (Fig. 5.6).
2. The test oil is poured into the inner crucible so that the oil level is 12 mm below the rim of the crucible. During pouring, it is not permitted to splash oil onto the walls of the inner crucible or exceed the required level.
3. The crucible is installed on the ring of a laboratory stand, and a thermometer is inserted into the inner crucible. The thermometer must be fixed vertically in the center of the crucible using the stand. The mercury bulb should be

positioned approximately midway between the bottom of the crucible and the oil surface.

4. After the oil has been poured into the crucible, it should be heated using a gas burner so that the oil temperature initially increases at a rate of 10 °C per minute. When the temperature approaches 40 °C below the expected flash point, the heating rate should be reduced so that the temperature increases by about 4 °C per minute.



Figure 1. Apparatus for determining the flash point of oils in an open crucible

5. Procedure for flame application

5. When the temperature reaches 10 °C below the expected flash point, a test flame is passed 10–14 mm above the oil surface from the edge of the crucible using an ignition device.

The flame height should be about 4 mm, and it must be moved from one side of the crucible to the other within 2–3 seconds.

6. This test should be performed each time the temperature increases by 2 °C. The temperature at which a brief flame appears on the surface and immediately disappears is recorded from the thermometer and is taken as the flash point of the oil.

7. The measured flash point of the tested oil is checked for compliance with the relevant standard.

2. Method for determining the flash point of oils in a closed cup

Procedure



Figure 2. Apparatus for determining the flash point of oils in a closed cup

1. The inside of the crucible is washed with gasoline or alcohol and thoroughly dried.
The test oil is poured up to the marked level on the inner circular surface of the crucible.
The crucible is then placed into an air bath and closed with a lid.
A thermometer is installed in the inclined tube of the air bath.
2. Using a LATR (laboratory autotransformer), the heating element is connected to the power supply, and the heating rate of the liquid is regulated.
3. After the oil is introduced, it should be heated using a gas burner so that the temperature initially increases at a rate of 10 °C per minute.
When the temperature approaches 40 °C below the expected flash point, the heating rate should be reduced to 4 °C per minute.
4. When the temperature is 10 °C below the expected flash point, a test flame is passed 10–14 mm above the oil surface from the edge of the crucible.

The flame height should be about 4 mm, and it should be moved across the crucible within 2–3 seconds.

5. This test is repeated every time the temperature increases by 2 °C.

The temperature at which a momentary flash appears and immediately disappears is recorded and taken as the flash point of the oil.