EXPERIMENT NO: 15

FLASH AND FIRE POINTS OF BITUMINOUS MATERIAL (CLEVELAND OPEN CUP METHOD)

AASHTO DESIGNATION: T 48-91
(ASTM DESIGNATION: D 92-85)



1. SCOPE AND SIGNIFICANCE

This method describes a test procedure for determining the flash and fire points (Cleveland Open Cup Tester) of all petroleum products except fuel oils and those having an open cup flash below 175^0F. The flash point is the temperature at which a bituminous material, during heating, will evolve vapors that will temporarily ignites or flash when a small flame is brought in contact with them. The fire point is the temperature at which the evolved vapors will ignite and continue to burn.

To make the test, the material is heated in an open cup, and at intervals a small flame is applied near its surface. The lowest temperature at which application of the test flame causes the vapors to ignite is recorded as the flash point while the temperature at which the vapors ignited and burn for at least 5 seconds is recorded as the fire point. The flash and fire point test is purely a safety test. It indicates the maximum temperature to which the material can be safely heated.

NOTE 1- It is the practice in the United Kingdom and in any other countries to use IP Method 35, Flash Point (Open) and Fire Points by Means of the Pensky-Martens Apparatus unless T73. Test flash point by Pensky-Martens Closed Tester is specified. This Method may occasionally be specified for the determination of the fire point of a fuel oil. For the determination of Flash points of fuel oils, use AASHTO T 73 IP 34, T 73 should be used when it is desired to determine the possible presence of small but significant concentrations of lower flash points substances which may escape detection by T 48. T79, Flash Point with Tag Open Cup Apparatus, may be employed if the flash point is below 79°C (175^0F) as determined by T 48.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards:

T 73 Flash Point by Pensky-Martens Closed Tester

T 79 Flash Point with Tag Open-Cup Tester

2.2 ASTM Standards:

E 1 Specification for ASTM Thermometers

2.3 Other Methods:

IP Method 35 Flash Point (Open) and Fire Point by Means of the pensky-Martens Apparatus.

3. APPARATUS AND MATERIALS

3.1 Cleveland Open Tester - The apparatus consists of the test cup, heating plate, test flame applicator, heater, and support as shown in Figure 15.1.



Figure 15.1: Cleveland Open Cup Tester

3.2 Shield - A shield 18 inch (46 cm) square and 24 in, (61 cm) high, is recommended but not essential.

3.3 Thermometer - ASTM thermometer having a range of 20^0F to 760^0F (-6˚C to + 400˚C).

4. PROCEDURE

4.1 Support the tester on a level steady table in a draft free room or compartment and shield the spot of the tester from strong light by any suitable means.

4.2 Clean the cup with an appropriate solvent and remove all gums, carbon deposit, and oxide coating from the inside of the cup with fine steel wool until a bright metallic surface is presented.

4.3 Support the thermometer in a vertical position with the bottom of the bulb 1/4 inch (0.635 cm) from the bottom of the cup and above a point halfway between the center and back of the cup.
Note 2- The immersion line engraved on the thermometer will be 5/64 inch (0.20 cm) below level of the rim of the cup when the thermometer is properly positioned.

4.4 Fill the cup at any convenient temperature (Note 3) so that the top of the meniscus is exactly at the filling line. When too much sample has been added to the cup, remove the excess, using a spoon or other suitable device; however, if there is sample on the outside of the apparatus, empty, clean. Destroy any air bubbles appear on the surface of the sample.

Note 3- Viscous samples should be heated until they are reasonably fluid before being poured in to the cup; however, the temperature during heating must not exceed 100°F (65°C) below the probable flash point.

4.5 Light the test flame and adjust it to a diameter of 1/8 to 3/16 in. (0.08 cm).

4.6 Apply heat initially so that the rate of temperature rise of the sample is 25 to 30^0F (13.9 to 16.7°C) per minute. When the sample temperature is approximately 100°F (56^0C) below the anticipated flash point, decrease the heat so that the rate of temperature rises for the last 50^0F (27.8°C) before the flash point is 10 + 1°F (5.5 + 0.6°C) per minute.

4.7 Starting at least 50°F (2.8°C) mark pass the test flame across the center of the cup, at right angles to the diameter which passes through the thermometer. With a smooth, continuous motion apply the flame either in a straight line or along the circumference of a circle having a radius of at least 6 inch (15 cm). The center of the test flame must move in a plane not more than 5/6" inch (0.2 cm) above the plane of the upper edge of the cup. The time consumed in passing the test flame across the cup shall be about 1 sec.

4.8 Record as the flash point the temperature read on the thermometer when a flash appears at any point on the surface of the sample but do not confuse the true flash with the bluish halo that sometimes surrounds the test flame.

4.9 To determine the fire point, continue heating so that the sample temperature increases at rate of 10 ± 1°F (5.5± 0.6^0C) per minute. Continue the application of the test flame at 5^0F (2.8°C) intervals until the vapor ignites and continues to burn for at least 5 sec. Record the temperature at this point as the fire point.

5. CALCULATION AND REPORT

5.1 Observe and record the barometric pressure at the time of the test. When the pressure differs from 760 mm Hg, correct the flash or fire point, or both, by means of the following equations:

- Corrected flash or fire point, or both = F + 0.06(760-P) or
- Corrected flash or fire point, or both = C + 0.03(760-P)

Where:

F = observed flash or fire point, or both, to the nearest 5°F
C = observed flash or fire point, or both, to the nearest 2°C.
P = barometric pressure, mm Hg.