

ASTM Distillation D86: A Standard Test Method for Distillation of Petroleum Products

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Abstract :- This test method covers the atmospheric distillation of petroleum products and liquid fuels using a laboratory batch distillation unit to determine quantitatively the boiling range characteristics of such products as light and middle distillates, automotive spark ignition engine fuels with or without oxygen. This test method is designed for the analysis of distillate fuels; it is not applicable to products containing appreciable quantities of residual material. This test method covers both manual and automated instruments. The distillation characteristics of hydrocarbons have important effects on their safety and performance especially in the case of fuel and lubricants. The boiling range gives information on the composition, properties, and behavior of the fuel during storage and uses.

I. INTRODUCTION

The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, dating from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating end-use sensitivity on products and processes. The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the behaviour of the fuel during storage and use. Volatility is the major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapours. The distillation characteristics are critically important for both automotive and aviation gasoline's, affecting starting, warm-up, and tendency to vapour lock at high operating temperature or at high altitude, or both. The presence of high boiling point components in these and other fuels can significantly affect the degree of formation of solid combustion deposits. Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules. This test method can be applied to contaminated products or hydrocarbon mixture. This is valuable for fast product quality screening, refining process monitoring, fuel adulteration control, or other purpose including use as a portable apparatus for field testing. This test method can use an automatic micro distillation apparatus which gives fast results using small sample volume, and eliminates much of the operator time subjectivity in comparison to test method D86. This test method covers a procedure for determination of the distillation characteristics of petroleum products and liquid fuels having boiling range between 20°C to 400°C at atmospheric pressure using an automatic micro distillation apparatus. The test method is also applicable to hydrocarbons with a narrow boiling range, like organic solvent or oxygenated compounds. The method is designed for analysis of distillate products; it is not applicable to products containing appreciable quantities of residual material.

Some examples of ASTM (American Society for Testing and Materials) standards utilizing distillations are; D86 Test method for distillation of petroleum products at atmospheric pressure, D20-03 Standard test method for distillation of road tars, D1106 Test method for distillation of petroleum products at reduced pressure, D 323 Test Method for Vapor Pressure of Petroleum, D 396 Specification for Fuel Oils, D 850 Test-Method for Distillation of Industrial Aromatic Hydrocarbons and Related Materials, D 975 Specification for Diesel Fuel Oils, D 1078 Test Method for Distillation Range of Volatile Organic Liquids, D 2892 Test Method for Distillation of Crude Petroleum, D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products, D 4 177 Practice for Automatic Sampling of Petroleum and Petroleum Products, D 4953 Test Method for Vapor Pressure of Gasoline and Gasoline Oxygenate Blends.

II. EQUIPMENT DESCRIPTION



Fig. 1: ASTM Distillation Apparatus

A batch of liquid is charged to a still fitted with some sort of heating devices. The charge is boiled slowly the vapors are withdrawn as rapidly as they form to a condenser where they are liquefied and condensate is collected in the receiver. The distillation column consist of several trays which allows the simultaneous travel of liquid down the tray and vapor up the tray , allowing mixing of the two face and there for equilibrium . The liquid mixture that is to be processed is known as the feed. The feed tray divides the Colum in to a top (enriching or rectification) section and bottom section .The vapor movies up the column and as it exits the top of the unit, it is cooled by a condenser. The condensed liquid is stored in a holding vessel known as reflex drum .Some of this liquid is recycled back to the top of the column and this is called the reflux .The condensed liquid that is removed from the system is known as the top product or distillate.

*Parts of instruments : Distillation flask, cooling bath, heater, thermometer, receiving cylinder to collect distillate

III. PROCEDURE

100 ml of the sample is to be precisely poured in the receiving cylinder, and then the contents of the receiving cylinder is to be transferred as completely as particle in the distillation flask, ensuring that none of the liquids flows in the vapor tubes , the flask vapor tube as to be fitted with a rubber stopper tightly in to the condenser tube, apply heat to the distillation flask and condense with the drip tip of the final boiling point condenser away for the graduated cylinder. Regulate the heating at the stage so that there is a specific time interval between the first application of heat and initial boiling point. When the first drop appears at the lower end of the condenser tube, the thermometer reading (vapor temperature) is recorded, this temperature is the initial boiling point. Observe and record the initial boiling point to the nearest 0.5°C or 0.1°C as appropriate to the apparatus being used. Regulate the heating so that the uniform average rate of condensation from 5% (v/v) recovered to 5 ml residue in the flask is 4 ml per min to 5 ml per min. In the interval between the initial boiling point and the end of the distillation, observe and record data necessary for the calculation and reporting of the results of the test as required by the specification involved. When the residual liquid in the distillation flask is approximately 5ml, make final adjustment to the heat. The record the temperature at several volume percentage distilled up to the final boiling point is the maximum temperature observed on the distillation thermometer when a standard distillation is carried out observe and record the final boiling point or dry point or both us required and discontinue heating. After the distillation flask has cooled and no more vapors are observed disconnect the distillation flask from the condense ,pour its Constance in to 5 ml graduated cylinder and with the distillation flask suspended over the 5 ml graduated cylinder . Measure and record the volume in the graduated cylinder , to the nearest 0.1ml, as present residue.

3.1 Material Used

Material	Volume (ml)
Diesel	100
Kerosene	100
Gasoline	100
Gasoline Kerosene Mixture	50 Each

IV. OBSERVATIONS

1. Diesel (100 ml)

Sample	Volume distilled	Temperature in °C
Diesel	20	250
	40	280
	60	310
	80	330
	95	360
	F B P*	360

- Initial boiling point =180 °C
 - Final boiling point =360 °C
 - Total volume distilled = 96 ml
 - Residue left =2ml
 - Evaporated =2 ml
- *F B P – final boiling point

2. Kerosene (100 ml)

Sample	Volume distilled	Temperature in °C
Kerosene	20	187
	40	220
	60	235
	80	260
	97	275
	F B P	275

- Initial boiling point =160 °C
- Final boiling point =275 °C
- Total volume distilled = 97ml
- Residue left =1ml
- Evaporated =2 ml

3. Petrol (gasoline)

Sample	Volume distilled	Temperature in °C
Petrol	20	74
	40	94
	60	114
	80	141
	96	178
	F B P*	178

- Initial boiling point =54 °C
- Final boiling point =178 °C
- Total volume distilled = 96ml
- Residue left =2ml
- Evaporated =2 ml

4. Mixture Of Kerosene And Petrol (50 ml Each)

Sample	Volume distilled	Temperature in °C
Kerosene & Petrol	20	225
	40	230
	60	260
	80	280
	90	290
F B P		290

- Initial boiling point = 200 °C
- Final boiling point = 290 °C
- Total volume distilled = 90ml
- Residue left = 6ml
- Evaporated = 4 ml

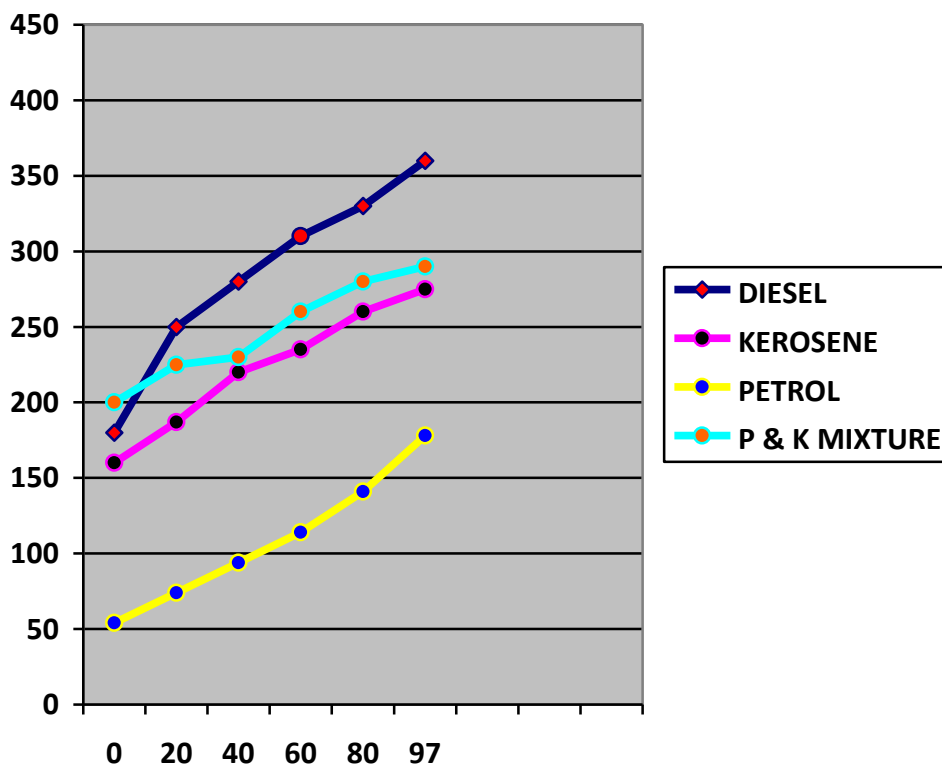


Fig. 2: Profile of Volume distilled in ml (X axis) & Temperature °C (Y axis)

V. CONCLUSION

Boiling point range is important property of petroleum products and they are extracted by specific boiling ranges. Tested samples are distilled based on their standard boiling points.

REFERENCES

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