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Standard Test Method for Kinematic Viscosity of Lubricating Oils.

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Abstract:
- The **viscosity** of a fluid is a measure of it's resistance to gradual deformation by shear stress or tensile stress.
- For liquids, it corresponds to the informal concept of "thickness"; for example, honey has a much higher viscosity than water.
- A **lubricant** is a substance introduced to reduce friction between surfaces in mutual contact, which ultimately reduces the heat generated when the surfaces move.
- It may also have the function of transmitting forces, transporting foreign particles, or heating or cooling the surfaces.
- The property of reducing friction is known as lubricity which is known to be good for other people's daily uses.
- Viscosity is an internal property of a fluid that offers resistance to flow.

Keywords: Viscosity, Viscometer, Lubricants, Oils, Fluids.

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I. INTRODUCTION

- The viscosity of a fluid is a measure of it's resistance to gradual deformation by shear stress or tensile tress.
- For liquids, it corresponds to the informal concept of "thickness"; for example, honey has a much higher viscosity than water.
- Viscosity is an internal property of a fluid that offers resistance to flow.
- Viscosity determines the fluidity of fluids.
- It is a very useful property in petroleum production refining and transportation.

Significance:

- It is used in reservoir simulators to estimate the rate of oil or gas flow during their production.
- It is required in calculation of power required for transfer of fluid.
- The amount of pressure drop in pipe or column.
- Flow measurement devices
- Design and operation of oil/water separators.
- A lubricant is a substance introduced to reduce friction between surfaces in mutual contact, which ultimately reduces the heat generated when the surfaces move.
- It may also have the function of transmitting forces, transporting foreign particles, or heating or cooling the surfaces.
- The property of reducing friction is known as lubricity which is known to be good for other people's daily uses.
- For a lubricant oil, viscosity is the most important factor that should be measured.
- Different lubricant oils vary with their viscosities.
- Different lubricant oil with different viscosity is needed.
- Hence by measuring the viscosities of lubricant oils, we can select suitable lubricant oil for the suitable purpose.

Behaviour Of Liquid And Gas Viscosities with temperature rise:

- When a **liquid** heats up, it's molecules become excited and begin to move. The energy of this movement is enough to overcome the forces that bind the molecules together, allowing the liquid to become more fluid and decreasing its viscosity.
- When the temperature increases in **gases,** it will increase the viscosity of gases where the molecules are more or less free except for discrete scattering events with the other molecules. Unless the gas is ionized, the collision cross section varies with impact velocity. Hence the molecules carry more momentum and collide more often. This means more momentum transport.

Viscosity Index(VI):

- Viscosity index is an arbitrary measure for the change of viscosity with variations in temperature.
- The lower the VI, the greater the change of viscosity of the oil with temperature and vice versa. It is used to characterize viscosity changes with relation to temperature in lubricating oil.
- The viscosity of liquids decreases as temperature increases.
- The viscosity of a lubricant is closely related to its ability to reduce friction.
- Generally, the least viscous lubricant which will still force the two moving surfaces apart is desired.
- If the lubricant is too viscous, it will require a large amount of energy to move; if it is too the surfaces will come in contact and friction will increase.

Objective:

- To determine the kinematic viscosity of lubricating oils of different brands**.**

Equipment:

1. 150 mL Viscometer
2. Timer
3. Temperature Measuring Device
1. Temperature Controller
2. Vacuum Device
3. Rubber Stopper
4. Holder
5. Oil Samples

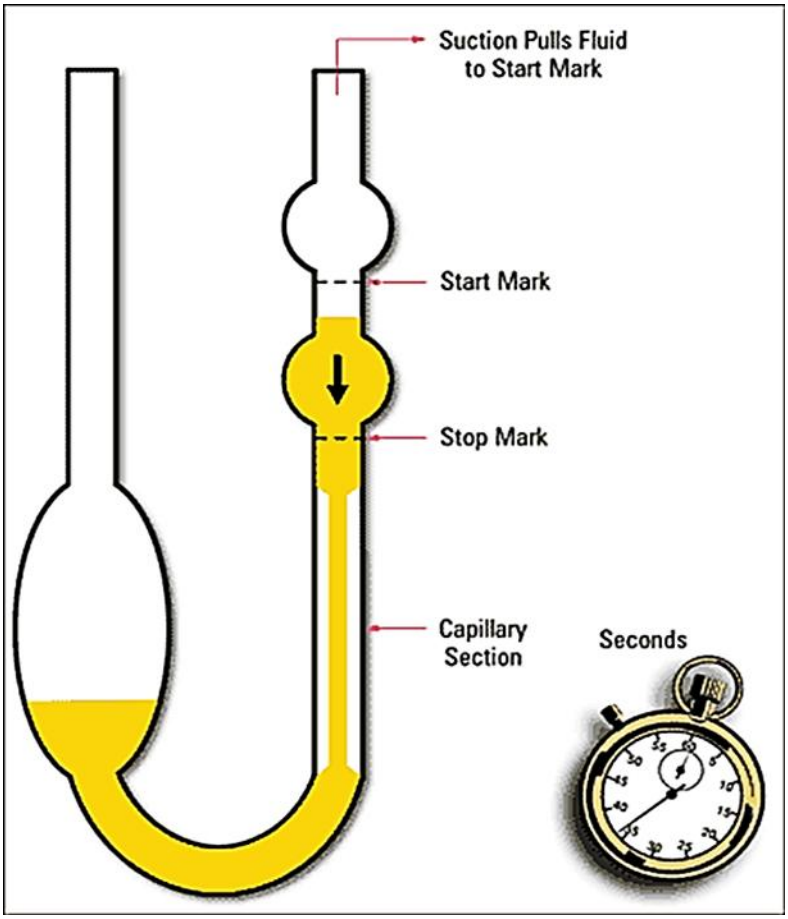

Figure 1: Viscometer

Figure 2.1: Viscometer Bath

Figure 2.2: Viscometer Bath (Lab Set Up)

Methodology:

- Adjust the viscometer bath at required test temperature.
- Select clean, dry, calibrated viscometer having range covering the estimated kinematic viscosity.
- Charge the viscometer and draw the test portion into the working capillary and timing bulb, place the rubber stoppers into the tubes to hold the test portion in place and insert the viscometer in the bath.
- Allow the viscometer to rea reach the bath temperature (10-15min).
- Remove the stopper from capillary arm and allow the sample to flow freely, measure in seconds within 0.1s.
- The time required for the meniscus to pass from the start flowing line to the end line (The flow time should not be less than 200s).
- Find the viscometer constant from the table and calculate the kinematic viscosity of the sample.

Calculations:

- Time = ___ seconds
- Viscometer constant (C) = $0.035 mm^2/S^{-1}$
- Density = ___ g/mL
- $\nu = C.t$
- $\nu = 0.035 \times t =$ ___ mm^2/S^{-1}
- $\mu = \nu.\rho cp$

Viscosity Index	Classification
..35	Low
35..80	Medium
80..110	High
110..	Very High

- The viscosity index can be calculated using the following formula:

$V = 100 (L-U)/(L-H)$ -(Equation 1)

where,
V indicates the viscosity index,
U the kinematic viscosity at 40°C (104 °F),
L & H are various values based on the kinematic viscosity at 100°C(212 °F) available in ASTM D2270.

II. RESULT

Brand	Kinematic Viscosity
Servo Super 20W-40	15
Castrol GTX 20W-50	22
Motul 3000 4T Plus 10W-30	18
Mobil 200 5W-50	20

III. CONCLUSION

- This study is primarily focused on quantification of how the viscosity of motor oil changes with temperature.
- Four different commercially distributed engine oils were used: Servo, Castrol, Motul and Mobil.
- The oils used are intended for motorcycle and car engines.
- The viscosity of a fluid is a measure of it's resistance to gradual deformation by shear stress or tensile stress. For liquids, it corresponds to the informal concept of "thickness".
- The kinematic viscosity is the ratio of the dynamic viscosity 'μ' to the density of the fluid 'ρ'.
- It is usually denoted by the Greek letter 'ν' (nu).
- It is used in reservoir simulators to estimate the rate of oil or gas to flow and their production, and it is needed in calculation of power required in mixers or to transfer fluid, the amount of pressure drop in pipe or column, flow measurement devices and design and operation of oil/water separators.
- Description of viscosity behavior of an engine oil as a function of its temperature is of great importance, especially when considering running efficiency and performance of combustion engines.
- Proposed models can be used for description and prediction of rheological behavior of engine oils.

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