REDWOOD VISCOMETER

Ex.No : **Date:**

Aim :

To determine the kinematic viscosity and absolute viscosity of the given lubricating oil at different temperatures using Redwood Viscometer

Apparatus required :

Redwood Viscometer
Thermometer 0-100°c (2 Nos)
Stop watch
50 ml standard narrow necked flask
Given Sample of oil

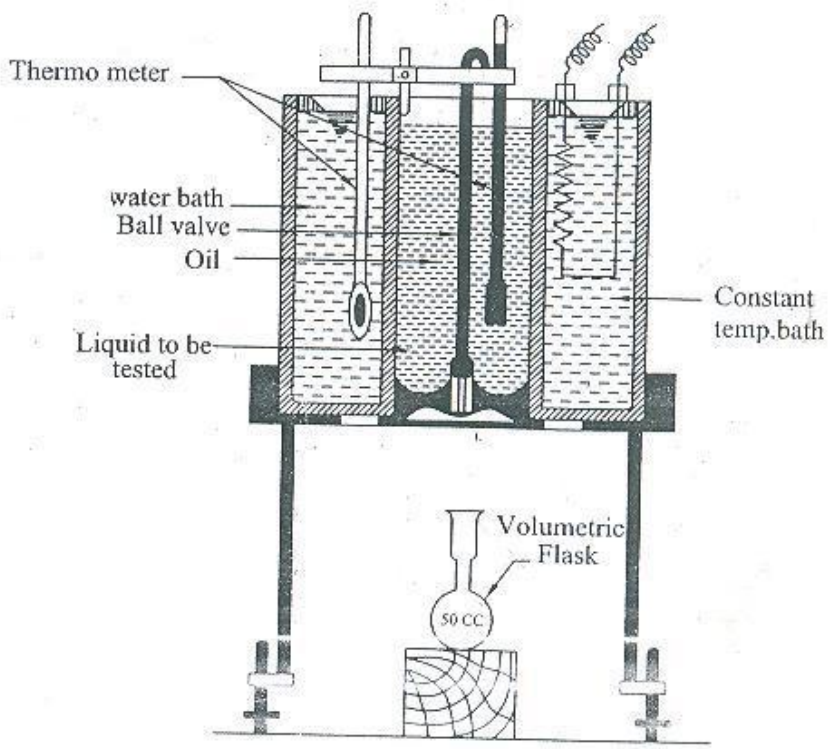
Description :

The redwood viscometer consist of vertical cylindrical oil cup with an orifice in the centre of its base . The orifice can be closed by a ball . A hook pointing upward serve as a guide mark for filling the oil . The cylindrical cup is surrounded by the water bath . The water bath maintain the temperature of the oil to be tested at constant temperature . The oil is heated by heating the water bath by means of an immersed electric heater in the water bath , The provision is made for stirring the water , to maintain the uniform temperature in the water bath and to place the thermometer ti record the temperature of oil and water bath . The cylinder is 47.625mm in diameter and 88.90mm deep . The orifice is 1.70mm in diameter and 12mm in length , This viscometer is used to determine the kinematic viscosity of the oil. From the kinematic viscosity the dynamic viscosity is determined .

Theory and Definition :

Viscosity is the property of fluid . It is defined as “The internal resistance offered by the fluid to the movement of one layer of fluid over an adjacent layer ‘ . It is due to the Cohesion between the molecules of the fluid . The fluid which obey the Newton law of Viscosity are called as Newtonian fluid .

The dynamic viscosity of fluid is defined as the shear required to produce unit rate of angular deformation .



Redwood Viscometer

Observation and tabulation

(1) Room temperature T_R = ……. °C

(2) Density of oil at room temperature = …….. gm/cm^2

S.No	Temperature of oil °C	Time taken to fill 50ml flask in 'Sec'	Kinematic Viscosity in 'Centi Stokes'	Density in gm/cc	Dynamic (or) Absolute viscosity ' Centi Poise'
1 2 3 4 5 6					

Formulae used :

Kinematic Viscosity = γ At - $\frac{B}{t}$ in stokes or in centi stokes

A = 0.0026

B = 1.72

A = 0.26

B = 172

t = Saybolt second

Density of oil at particular temperature ρ_t

$\rho_t = \rho_R - 0.00065 (T - T_R)$

T = Temperature at which the density is required

TR = Room Temperature

ρ_R = Density of oil at room temperature in gm / cm^3

= 0.84 (or) 0.85 gm/cm^3

i.e., $\tau = \mu \, du$ (or)

$\mu = \frac{\tau}{du/dy}$

where μ = Co-efficient of viscosity (or)
Dynamic viscosity (or)
Absolute viscosity

τ = Shear stress

du = Angular deformation (velocity gradient)

The unit of dynamic viscosity in SI system is

$\frac{N - Sec}{m^2}$ (or) $\frac{kg}{m\text{-}sec}$ (or) poise

In metric system :

$\frac{dynes - Sec}{m^2}$ or $\frac{gm}{cm\text{-} Sec}$

$$\frac{1\ N-S}{m^2} = 10\ \text{Poise}$$

The kinematic viscosity of the fluid is defined as the ratio of the dynamic viscosity toss density of the fluid . Its symbol is ‘r’

$$\gamma = \frac{\mu}{\rho} \quad ; \quad \rho = \text{mass density of oil}$$

The unit of kinematic viscosity

In SI system : m^2/sec

In metric system = $\frac{cm^2}{sec}$ or Stokes

$$1\ \frac{m^2}{sec} = 10^4\ \frac{cm^2}{sec} = 10^4 \text{ stokes}$$

One hundredth part of stoke is called Centi Stoke .

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Procedure :

(1) Clean the cylindrical oil cup and ensure the orifice tube is free from dirt .
(2) Close the orifice with ball valve.
(3) Place the 50 ml flask below the opening of the Orifice .
(4) Fill the oil in the cylindrical oil cup upto the mark in the cup .
(5) Fill the water in the water bath.
(6) Insert the thermometers in their respective places to measure the oil and water bath temperatures.
(7) Heat the by heating the water bath, Stirred the water bath and maintain the uniform temperature .
(8) At particular temperature lift the bal valve and collect the oil in the 50 ml flask and note the time taken in seconds for the collecting 50 ml of oil . A stop watch is used measure the time taken . This time is called Redwood seconds .
(9) Increase the temperature and repeat the procedure '8' and note down the Redwood seconds for different temperatures .

Graph : The following graph has to be drawn

(1)Temperature Vs Redwood seconds
(2)Temperature Vs Kinematic Viscosity
(3)Temperature Vs Dynamic Viscosity

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Result :

The kinematic and dynamic viscosity of given oil at different temperatures were determined .