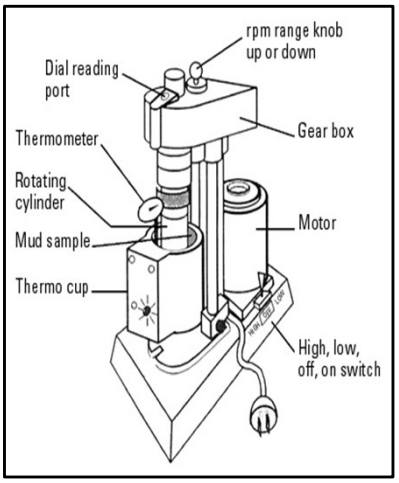
LAB EXPERIMENT: 6 SPEED VISCOMETER (FANN-35S)



To determine the viscosity of a given fluid sample using 6 speed viscometer

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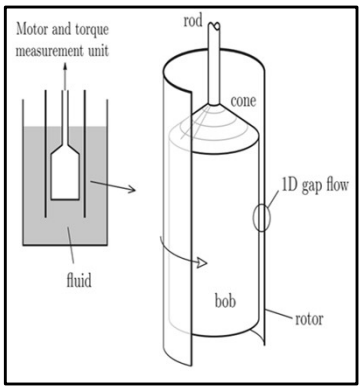
BASIC PRINCIPAL



$$\text{Shear stress} = \frac{Torsion\ Force}{Area}$$

$$\text{Shear rate} = \frac{Rotational\ Velocity}{Gap}$$

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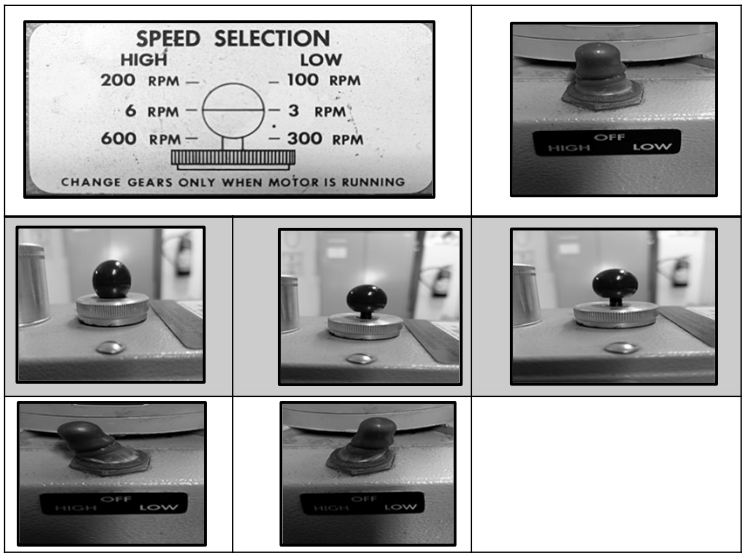
HOW TO CONTROL SPEED



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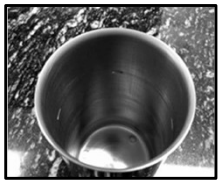

Procedure:

1. Ensure that the bob and sleeve is attached with the bob shaft and rotor.
2. Connect the instrument to a power source and on the power button.
3. Plug the FANN 35 motor to 110-volt voltage transformer.
4. Fill the sample cup with test sample up to 75% of the cup (approx. 170 ml).
5. If any temperature is prescribed for the sample, use the thermo-cup and thermometer to achieve that temperature for the sample.
6. Gently put the sample cup in the base of the instrument and raise the base till the sample touch the given marker on the sleeve.
7. Operate the RPM control liver and switch as per requirement.
8. Wait for stabilizing the reading.
9. Note down the viscosity in Cp with corresponding temperature and RPM.
10. Switch off the equipment and disconnect from the power source.
11. Remove the Thermo-cup containing fluid.
12. Rotate the rotor clockwise and gently pull it down to remove it.
13. To remove the bob, twist it clockwise while pulling down.
14. After experiment thoroughly clean the bob, bob shaft, sleeve and sample cup with fresh water and clean tissue paper.

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Precautions:

1. Always ensure that the fluid temperature does not go beyond 180 °F.
2. Do NOT try to move the "Gear shift Knob" if "Viscometer Switch" is off.
3. Do NOT try to rotate the Thermo-Cup knob beyond the marked position.
4. The rotor, bob and splash guard should be cleansed and dried after each operation.
5. Always handle carefully the rotor, bob and scribed line of cup during experiment.

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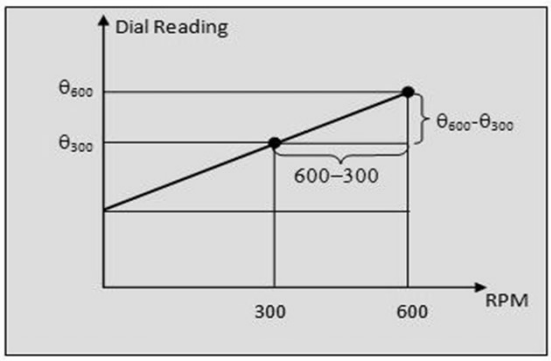
CALCULATION

Unit Conversion:
1 RPM = 1.703 s^{-1}
1 lb/100 ft^2 = 0.511 Pa

- **How to calculate Apparent Viscosity, Plastic Viscosity and Yield Point**
  1. **AV in cP = (600 RPM reading/2)**
  2. **PV in cP =** (600 **RPM** dial reading) – (300 **RPM** dial reading)
  3. **YP in (lb./100 ft^2) = (300 RPM dial reading) – (Plastic Viscosity)**



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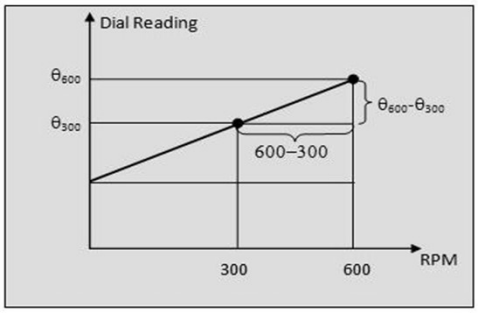
LAB EXERCISE

1. Derive the following formula for Yield Point.

YP in (lb./100 ft^2) = (300 RPM dial reading) – (Plastic Viscosity)

[Hint: Yield point is the intercept of the plot]

2. Tabulate the dial reading data corresponding to the set RPM and calculate viscosity.



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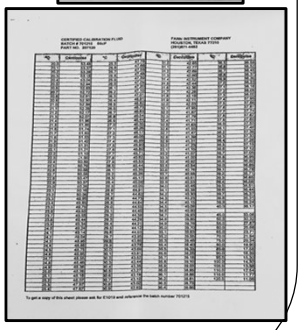
CALIBRATION PROCEDURE

1. Ensure that the bob and sleeve is attached with the bob shaft and rotor.
2. Connect the instrument to a power source and on the power button.
3. Plug the FANN 35 motor to 110-volt voltage transformer.
4. Fill the sample cup with standard calibration sample up to 75% of the cup (approx. 170 ml).
5. Take the sample temperature by using thermometer.
6. Gently put the sample cup in the base of the instrument and raise the base till the standard calibration sample touch the given marker on the sleeve.
7. Operate the RPM control liver and switch at 300 RPM .
8. Wait for stabilizing the reading.
9. Note down the viscosity in Cp with corresponding temperature and RPM.
10. Match the reading value with the standard calibration sheet value.
11. As per standard calibration sheet the tolerance value is ±1.5Cp.
12. After experiment thoroughly clean the bob, bob shaft, sleeve and sample cup with fresh water and clean tissue paper.



Calibration frequency:

- Once a month..

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VIDEO OF FANN-35S VISCOMETER:

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ASSIGNMENT:

Group-A Theory question

1. The viscosity of a fluid is primarily a function of ?

a) Density
b) Temperature
c) Pressure
d) velocity

2. What is the use of splash guard?

a) To protect the bearing
b) To protect the bob shaft
c) To protect the rotor
d) To protect the sleeve.

3. Sleeve is mount on the _____?

a) Splash guard
b) Rotor
c) Bob shaft
d) None of the above

Numerical question

Observe the viscometry data and deduce the following

RPM	Dial Reading lb/100 ft²
600	36
300	22

Determine the viscosity at 600 and 300 RPM?

Group-B Theory question

Numerical question

Observe the viscometry data and deduce the following

RPM	Dial Reading lb/100 ft²
600	30
300	19.

Determine the plastic viscosity and yield point?

Group-C Theory question

Numerical question

Observe the viscometry data and deduce the following

RPM	Dial Reading lb/100 ft²
600	36
300	12

Determine the plastic viscosity and yield point based on power law model?

Group-D Theory question

Numerical question

Observe the viscometry data and deduce the following

RPM	Dial Reading lb/100 ft²
600	30
300	19.

Determine the viscosity at 600 and 300 RPM?

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