Design & Development in Machine Oil Viscosity Verify Through Experimental Set Up

Dr. M. S. Dhande[1], Dr. R. L. Himte[2], Dr. V. M. Nanoti[3]

[1]*Asst. Prof., Mechanical Engineering Department, Priyadarshini Institute of Engineering & Technology, Nagpur, M .S., India.*

[2]*Head of Mechanical Department, PIET, Nagpur.*

[3]*Principal, PIET, Nagpur.*

Corresponding author: M. S. Dhande

ABSTRACT:

Today the mechanism & machine design new methods are effectively implement in advanced machine. For the manufacturing of bearing, flywheel, coupling, different gears (spur, helical, bevel & worm), Flat- belt, V-belt, Chain Drives, Rope drives, Internal Combustion Engine parts(Piston head, Piston PIn, Piston Ring, Cylinder head, Crank Case, Crank Pin). In case of machine design element different rivets, fastners, spring, Pressur Vessel, Power Screws, clutches, shafts, Hub, Keys are the important parts of machine. There the different stresses developed in safe machine design. For the design consideration material factor, cost factor, life period, failuire factors need to be take account. THe basic principal such as beam bending movement diagram, shear force diagram, column, different stresses, facture mechanics, impact of energy, required in design method. Heat treatment processes, steel material, cast iron, alloys material, Powder metallurgical portion, mechanics of material effectively work here. Material properties & characteristics, different phase diagram is the major roll in machine design. Journal bearing, Rollar bearing, flanged coupling, flexible coupling are the majour roll in power plant design equipment. Neco Jaiswal casting division design process very effectively used. To increase the rate of machine design advanced software need to used. The mathematical analysis implement here.

Keywords*:* *Machine Drives, Machine elements, Static & Dyanamic Mechanism, Design Testing.*

1. INTRODUCTION:

Fluid testing inside the machine mechanism is the major roll in bearing, machine casing wear tear part. The different oils used to check the performance of machine & material quality. Corrosion effect due to the environmental changes is affect on machine running condition. As discussed in [1] for air bearing different forces acts on. The mechanism operats at different - different situation. Is in the below fig. shows actual experimental ser-up. Through this mechanism deside the effects of various oil at various load condition. The piston rod opperates inside the cylinder. Animal oil, cotton oil, mineral oil or vegetable oil can be tested over this experimental set-up for checking the viscosity.

Fig. 1. Design & Development Of Experimental Setup to Calculate & Verify The Viscosity of Various Fluids

2. LITERATURE SURVEY: Researcher did the many experiments on oil viscosity, but not get the exact reading. Decide to do the experiment in quite other way, which shown in fig. [1]. The how much quantity of oil spent & friction factor worked in bearing. Visited in different laboratories, industries for finding the viscosity foult. Personaly visited in Neco Casting Division, Hingna M. I. D. C., Nagpur. Discuss with the industrialist on the viscosity measurement technique. Visted in Bhilai Stel Plant, C.G. for look in this matter. in [8],[9] given the discussion viscosity concept. With taking these experimental visits, researcher works over same topic.

3. OBJECTIVES:

1] Fluid testing mechanism

2] Viscosity finding out

3] Fluid measurement Technique

4. PRINCIPLE OPERATION:

The shaft passes through the metal sleeve and supported by the bearing, as the one end of the shaft is coupled to the motor and other end is passes through pulley of dynamometer. The sleeve has two knobs, one is opening knob and other is closing. The sleeve if filled with certain fluid and close both knobs. As the dc source given to the motor the shaft starts rotating and the fluid in contact with shaft get displace. Because of rotation of shaft it exerts shear force on fluid and the speed is to be measure by using tachometer. At the dynamometer a specific load is applied to stop the rotation of shaft and measure required load to stop the shaft. This operation should carry at different speed and to check how much torque is require restricting shaft rotation. As shown in fig the one end of shaft is connected to the motor spindle. The sleeve is provided between the two bearings. The bearings are provided for support the shaft. The inlet port is provided at the upper side of sleeve and the two outlet port is provided at the bottom side of the sleeve. At the other end of shaft the rope break dynamometer is provided for measurement of the torque.

5. DIFFERENT COMPONENTS FOR ASSEMBLY DESIGN : Following are the components of experimental set up.

Fig.2. Bearing

Fig.3. Assembled Motor

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Fig.4. Coupling

Fig.5. Cylinder

Fig.6. Pully with Rope

Fig.7. Oil fill up in cylinder

Fig.8. Weight measurement

Fig.9. Clamp & Screw arrangement

In table 1 shows the constant variable & Movable variables

Table: 1 Constant & Movable variables, [1]:-

Experimental Model				
S. N.	**Constant Variables**	**Movable Variables**		Component Quantity
1	Bearing		A_1	2
2		Rope Material	A_2	1
3		Rope Lenght	A_3	1
4		Rope Diameter	A_4	1
5	Cylinder		A_5	1
6	Pulley		A_6	1
7		Oil	A_7	1
8	Motor		A_8	1
9		Spring Weight	A_9	1
10	Screw Clamp		A_{10}	2
11		Oil Filler	A_{11}	3

Table: 1 Constant & Movable variables, [1]

Above Table No.[1] variables values

6. PROCEDURE:

1) First of all to connect the DC motor to supply properly, check connection of motor before starting the supply.
2) First time take a reading without using any fluid i,e.dry run
3) As the motor start wait for constant speed of shaft and then measure the speed of the shaft by using tachometer.
4) Check the rope brake dynamometer is in free condition i.e. at no load condition.
5) After measuring the speed then apply gradual load on spring balance until the shaft stops rotating.
6) As the shaft stops rotating note down the load from apply load spring and dead load which is attached to the rope brake dynamometer which acts as brake power.
7) Take a no. of reading at different speed and note down all related parameter like speed, spring load and dead weight.
8) After dry run use different fluids one by one. For filling the fluid, Open the inlet port of the sleeve and pour the fluid in the sleeve, check the outlet ports of the sleeve are properly closed.
9) When the fluid is use the speed should kept same as use for dry run speed for all different speed reading.All the parameter note down same as earlier did for dry run.
10) After note down all the related data then first calculate the torque and power for all related speed for both dry and fluid run. Then calculate the power loss by subtracting the power required for dry run and fluid run.
11) From coming power loss find the new torque and by using that torque.
12) Both sides of equation solve separately and after that compare with each other.
13) If both sides become equal then the fluid is Newtonian and if both side become unequal then the fluid is Non –Newtonian.

7. DATA CALCULATION:-

General calculation:-

1. Torque=Force× Radius of pulley

2. Power=$\frac{2\pi NT}{60}$

3. Power Loss=power required for dry run –power required for using fluid run

Actual Torque=$\frac{powerloss\times 60}{2\pi\times N}$

Formula of Newton's Law of viscosity

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

To verify the type of fluid we have to solve both the Sides separately.

For Shear rate

$$=\mu.\frac{du}{dy}$$

Where,

μ= Dynamic viscosity of fluid ($N.s/m^2$)

du=Relative velocity(m/s)

=πDN/60

Where,

D= diameter of shaft

N=Speed of shaft

dy=Distance between shaft and sleeve

=0.0045m

For Shear stress

τ=F/A

Where,

τ=Shear Stress (N/m^2)

$$\tau=\frac{Shearforce}{shearArea}$$

F=Shear force (N)

A=Shear Area (m^2)

=πDL

Where, D=Shaft diameter

L=Length of shaft covered in sleeve

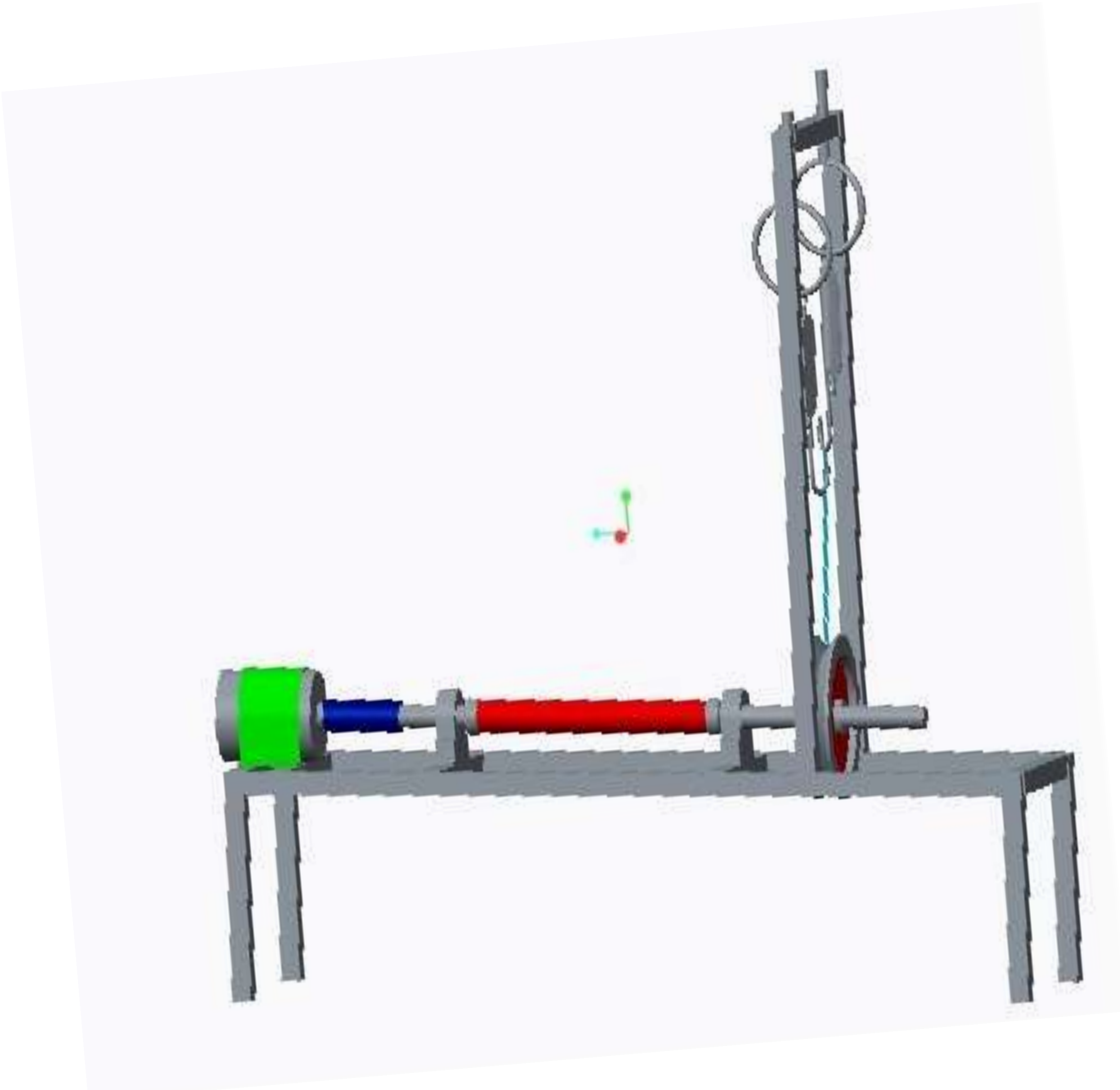


Fig. 10. Actual Project

8. OBSERVATIONS:

8.1. Observation table for dry run (without fluid):-

Sr. No.	Speed (RPM)	Spring load(kg)	Dead load (kg)	Torque (N.m)	Power (watt)
1.	600	2	0.3	1.666	105.85
2.	700	2.5	0.5	1.96	143.82
3.	800	`3.2	0.7	2.4	205.46
4.	900	4.5	0.8	3.6297	342.091

8.2. Observation table for Honey:-

Types pf fluid	Sr. No.	Speed (RPM)	Spring load (kg)	Dead load (kg)	Torque (N-m)	Power (watt)	Power loss(watt)
Honey	1.	600	1.2	0.2	0.98	61.63	44.21
	2.	700	1.5	0.3	1.17	86.29	57.52
	3.	800	3	1	1.962	169.36	91.098
	4	900	4	1	2.943	277.33	64.71

8.3. Observation table for Glycerine:-

Types pf fluid	Sr. No.	Speed (RPM)	Spring load (kg)	Dead load (kg)	Torque (N-m)	Power (watt)	Power loss(watt)
Glycerine	**1**	**600**	1.5	0	1.4715	92.45	13.39
	2	**700**	2	0.3	1.66	122.24	21.57
	3	**800**	**3**	**0.7**	**2.2563**	**189.02**	**16.93**
	4	**900**	**4**	**0.5**	**3.4335**	**323.59**	**18.49**

8.4 Observation table for Unburn Engine oil:-

Types pf fluid	Sr. No.	Speed (RPM)	Spring load (kg)	Dead load (kg)	Torque (N-m)	Power (watt)	Power loss(watt)
Engine oil	**1**	**600**	2	0.5	1.4715	92.45	13.39
	2	**700**	2	0.3	1.66	122.24	21.57
	3	**800**	**3**	**0.8**	**2.1582**	**180.804**	**24.65**
	4	**900**	**4**	**1**	**2.943**	**277.37**	**64.71**

9. RESULT :

Fig. 9.1 Graph for honey

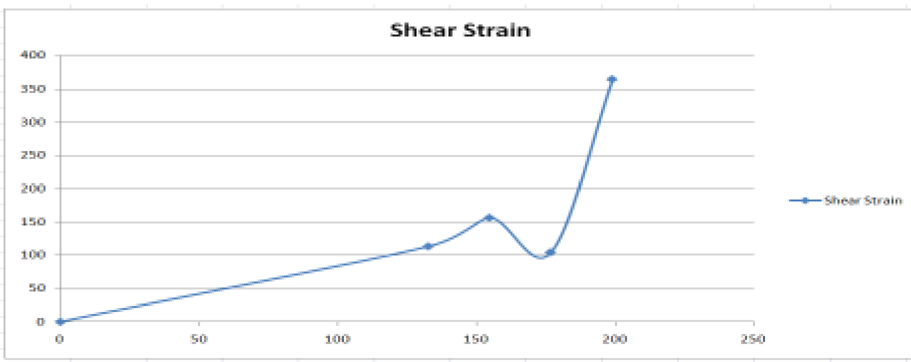


Fig. 9.2 Graph for glycerine

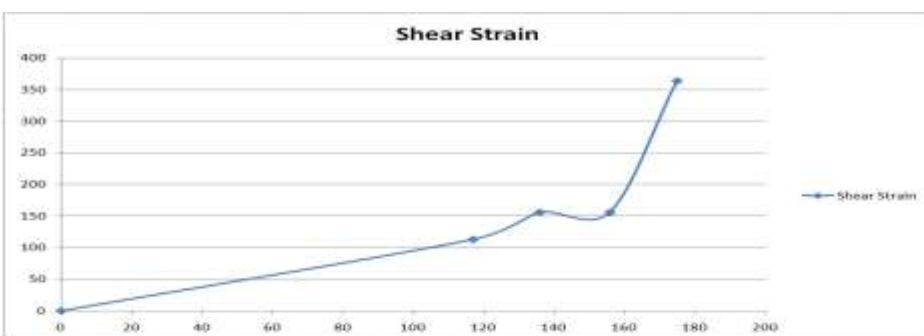
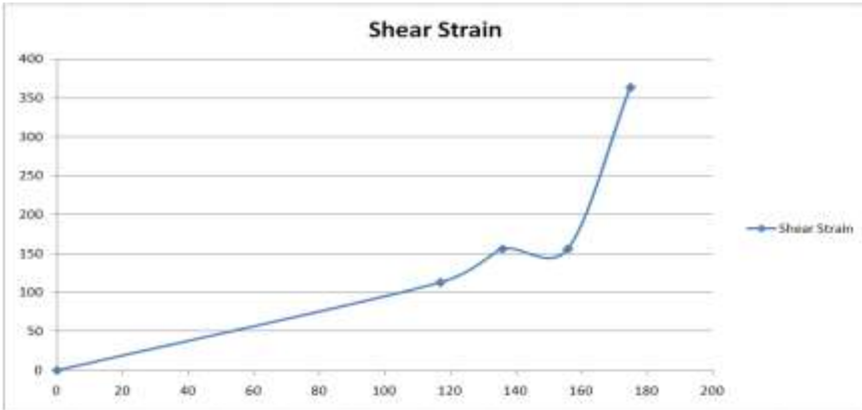


Fig. 9.3 Graph for engine oil



10. CONCLUSION:- Thus the experiment is carried out on the various fluid such as Water,Honey,Glycerine ,unburned Engine oil on the experimental setup to verifying the Newton's Law of Viscosity. After performing the experiment we observed that some fluid shows Newtonian behavior and some shows Non-Newtonian behavior. These setup is easy to operate, it can easily calculate the type of fluid either Newtonian or Non Newtonian. Hence viscosity of oil will find out.

11. REFERENCE:

[1] Stefano Morosi, 2011" Experimental Investigation of active air bearings", 1-10, Proceedings of Proceedings of ASME Turbo Expo 2012, Copenhagen, Denmark.

[2] R. Snoeys, F. AI-Bender, Development of improved externally pressurized gas bearing", KSME Journal, Vol. I, No.1, 81-88, 1987.

[3] Ulbrich H, Althaus J (1989), Actuator Design for Rotor Control. 12th Biennial ASME Conference on Vibration and Noise, Montreal, Canada; 17-21.

[4] Sim, K and Kim, D (2008), "Thermohydrodynamic Analysis of Compliant Flexure Pivot Tilting Pad Gas Bearings" 2008. Journal of Engineering for Gas Turbines and Power, vol. 130, no. 3, p. 032502.

[5] Snoeys, R., Devrieze, L. and Vanherck, P., 1977, "Self Aligning Aerostatic Shoe Bearings", Annals of the CIRP. Vol. 25/1, pp.205-210.

[6] Jack J. Jiang and Yu Zhang, 2002, "Chaotic vibration induced by turbulent noise in a two-mass model of vocal folds" J. Acoust. Soc. Am. 112 (5), Pt. 1. University of Wisconsin, Madison, Wisconsin 53792-7375, pp 2127-2133.

[7] K.Periyasamy, Theoretical analysis Of mathematical modelling in Non-Newtonian Fluid Mechanics, "International journal of creative research Thoughts", ISSN: 2320-2882 Volume5, Issue 4Nov.2017.

[8] Sudarshan B,Narayan U Rathod,Victor Seram, "Experimental investigation on Characteristics of Non-Newtonian Fluids", "International Journal of Engineering Development and Research", ISSN2321-9939,volume2,Issue 4.

[9] Fluid mechanics by yunus .A. Cengel and John M.Cimbala. Third edition(page No51-52).