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Validation of Temperature Effect on Lubricating oil for 4-Speed Automobile Gear box

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Abstract:- In automobile different power losses are occurring. Power loss due to air drag is proportional to the square of vehicle's speed. Out of the total power in engine, 25% of power is available at crank shaft. Out of this 25% of power, 4% is used up by accessories, 9% by friction and slippage in the mechanical system (transmission and differential) and only 12% of the fuel energy to be delivered to the wheels. Thermal analysis of gear box is carried out for different viscosity oils. For the analysis purpose design of maruti Omni's gear box is used. Comparison of thermal analysis is done for different viscosity oils.SAE 85W 140,SAE 80W 90,SAE 75W 90,SAE EDIB (Suggested Oil).

Keywords:- Viscosity ,Temperature, different oils, oil validation

I.INTRODUCTION

Gearboxes are used in almost every industry right from power to marine, and also include agriculture, textile, automobiles, aerospace, shipping etc. There are different types of gearboxes available for varying uses. These gearboxes are constructed from a variety of materials depending on their end use and the kind of industry they are being used in. The product has numerous industrial applications for providing high torque and smooth speed reductions. These gearboxes are also manufactured keeping certain Specifications in mind, which will also vary depending on the application. Control over power output, by means of the throttle pedal, simply regulates the rate at which the engine is doing work: at very high speeds, the power output will be correspondingly high but, as the torque output can at the same time be significantly less than at considerably lower speeds. In other words, maximum torque may be available over only a very limited speed range. Consequently, one needs to be able to regulate both the power output and the speed range of the engine relative to the range of speeds over which the vehicle is at any given time likely to be required to operate. Only in this way can the torque at the wheels be balanced against demands for either a steady speed uphill or downhill, or on the level, or for acceleration or deceleration. A gearbox is necessary, therefore, so that the driver can regulate torque by selecting the appropriate speed range or, in other words, the vehicle speed at which maximum torque is obtainable.

II. PROBLEM DEFINITION

The gear box performance is depends on viscosity of lubricant oil and due to the thermal effect of heat generated in side of oil span in gear box changes in properties of oil is taken place. Due to this, whatever changes taken place in viscosity of oil and due to that what will be the effect on gear box performance will study by analysis in CFD in gearbox. Then Comparison between CFD result and Experimental result has been carried out say that CFD result is validate to experimental result.

III. EXPERIMENTAL SETUP

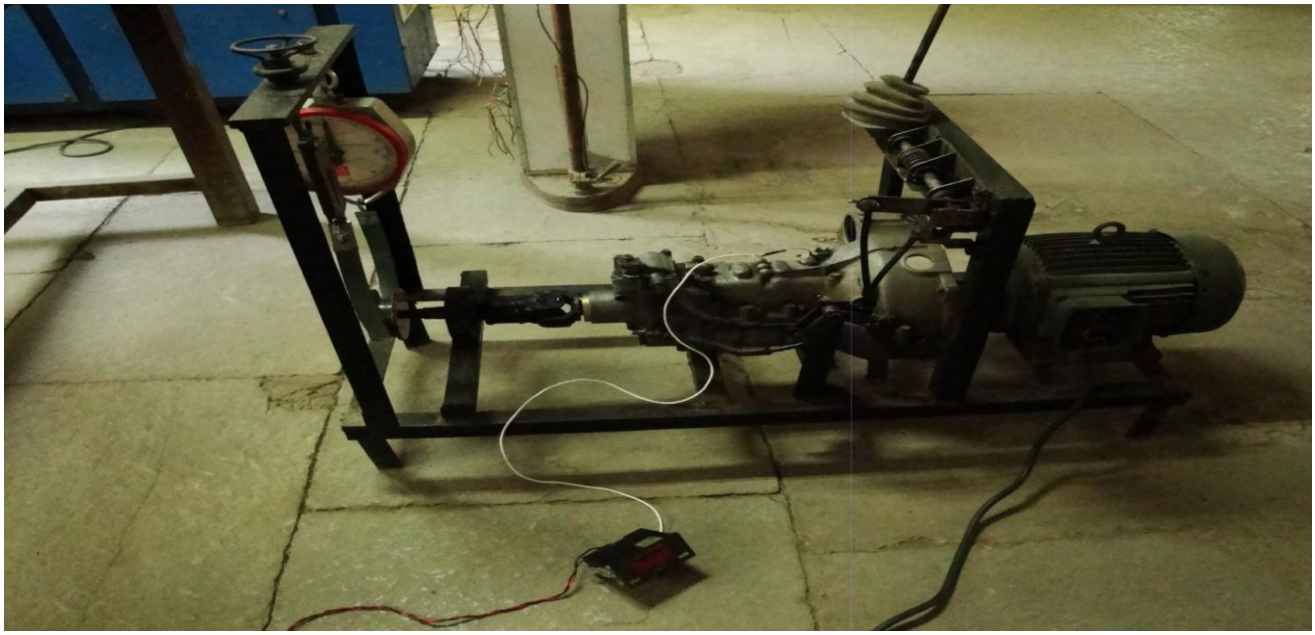

Figure 1 Experimental set up of power losses in manual transmission gear box.

Thermal analysis of gear box is carried out for different viscosity oils. For the analysis purpose design of Maruti Omni's gear box is used. Compression of thermal analysis is done for ansys result and experimental readings for different viscosity oils as listed below:

1) SAE 85W 140 (High Grade)
2) SAE 85W 140 (Commercial)
3) SAE 80W 90 (High Grade)
4) SAE 80W 90 (Commercial)
5) SAE 75W 90 (High Grade)
6) SAE 75W 90 (Commercial)
7) SAE EDIB (Suggested Oil)

3.1 CFD Modelling for our Experimental Set up

For CFD Analysis of gear box first of all modal of gear box is prepared in solid works which is shown in fig 2 After making the modal it is imported in ANSYS workbench. For CFD Analysis first of all meshing of gear box is done. The element chose for meshing by ANSYS is ten nodes tetrahedral shown in fig.2 this element is good for meshing in curvature area. After meshing required boundary conditions are inserted inpro processor. When you submit your final version, after your paper has been accepted, prepare it in two-column format, including figures and tables.

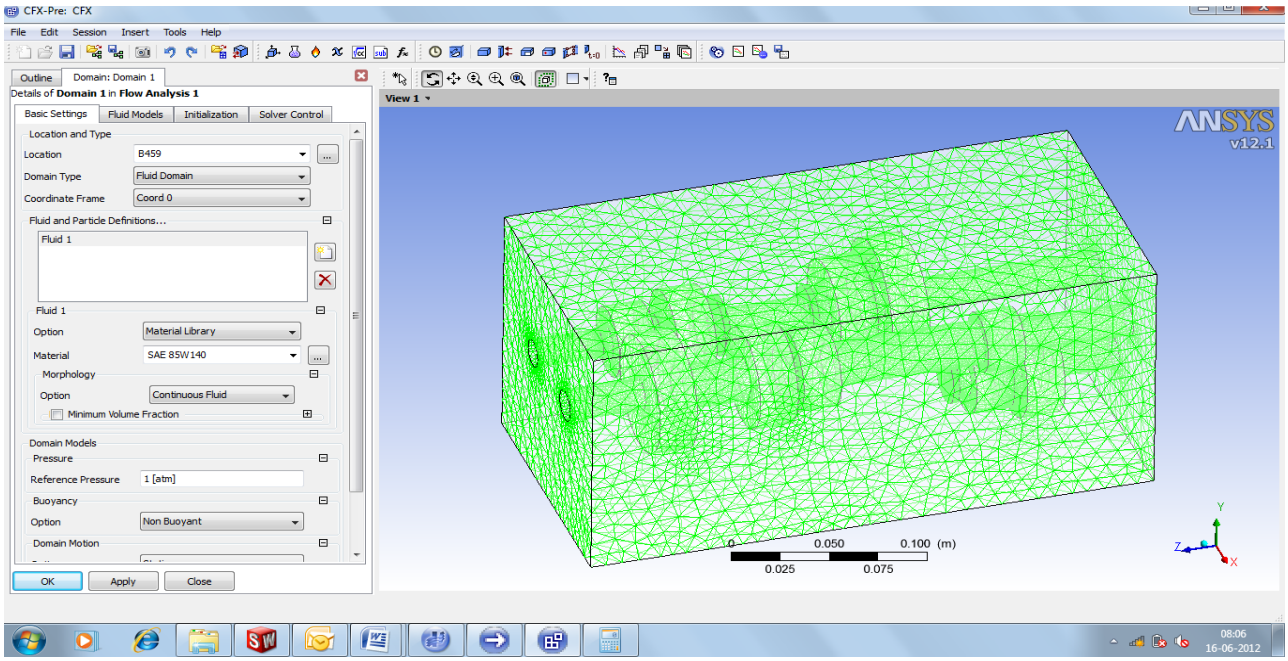

Figure 2 Details of domain in flow analysis

Number of Nodes	114633
Number of Elements	595456

Table 1 Meshing Details

3.2 **Properties of oils**

Name of oil	**Molar Mass Kgk/mol**	**Density Kg/m^3**	**Sp. Heat capacity**	**Sp. Heat type**	**Ref. Temp. c**	**Ref. Pr. (atm)**
SAE85W140(HG)	200.59	13546	3.2	Const. pr.	25	**1**
SAE80W90(HG)	92.09	1262	2.1	C.p	25	**1**
SAE75W90(HG)	46.07	887	1.88	C.p	25	**1**
SAE85W140(com.)	192.25	12347	3.1	c.p	25	**1**
SAE80W90(com.)	90.21	1024	1.9	c.p	25	**1**
SAE75W90(com.)	45.17	841	1.78	c.p	25	**1**
SAE EDIBLE	32.04	791	3.2	c.p	25	**1**

Table 2 Properties of Oils

	SAE 85W140 1	SAE 85W140 2	SAE 80W90 1	SAE 80W90 2	SAE 75W90 1	SAE 75W90 2	SUGGESTED OIL (SAE EDIB)
TEMPERATURE DIFFERENCE	65 K	64.7 K	63.2K	62.4 K	62.6K	61.9 K	70K
VISCOSITY	24.71 Cst	22.67 Cst	24.5 Cst	23.1 Cst	23.2 Cst	22.8 Cst	25.14 Cst
ECONOMICAL	1912.375 Rs/Liter	730 Rs/Liter	1574.37 Rs/Liter	395 Rs/Liter	2499.5 Rs/Liter	1112 Rs/Liter	2351.56 Rs/Liter

IV.RESULT

Table3 ANSYS Result

1= High Grade Oil

2= Commercial Oil

	SAE 85W140 1	SAE 85W140 2	SAE 80W90 1	SAE 80W90 2	SAE 75W90 1	SAE 75W90 2	SUGGESTED OIL (SAE EDIB)
TEMPERATURE DIFFERENCE	63 K	62.3 K	61.8 K	60 K	60 K	59.35 K	67 K
VISCOSITY	24.71 Cst	22.67 Cst	24.5 Cst	23.1 Cst	23.2 Cst	22.8 Cst	25.14 Cst
ECONOMICAL	1912.375 Rs/Liter	730 Rs/Liter	1574.37 Rs/Liter	395 Rs/Liter	2499.5 Rs/Liter	1112 Rs/Liter	2351.56 Rs/Liter

Table4. Experimental Result

4.1COMPARISION BETWEEN EXPERIMENTAL AND ANSYS RESULT

4.1.1FOR SAE85W140 HIGH GRADE, LOWGRADE OIL Vs TEMPERATURE DIFFERENCE

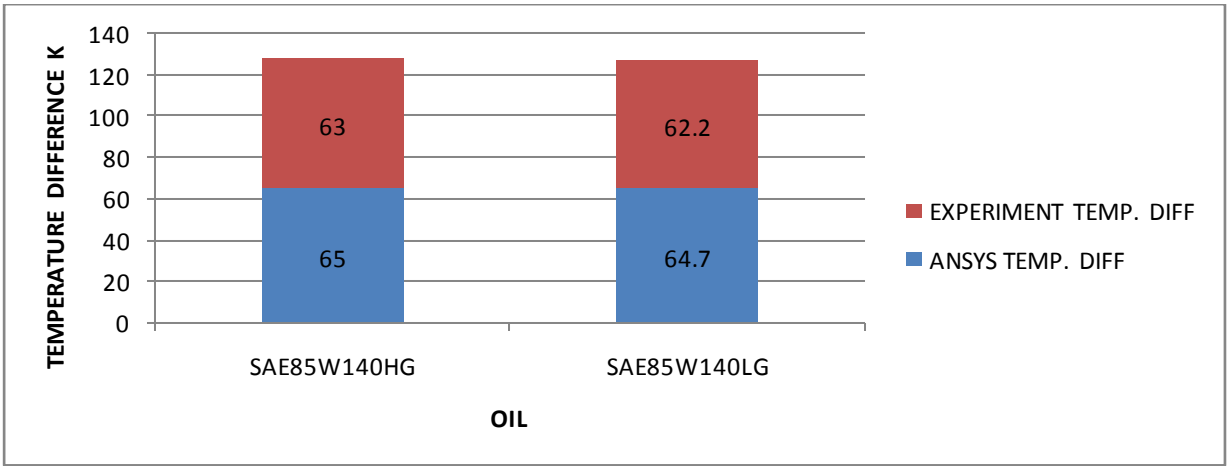

Figure3. Comparison between SAE85W140 oil Vs Temperature Difference

As per graph SAE85W140 HG oil 3.07% higher than Experimental result, SAE85W140 LG OIL 3.7% higher than the Experimental result because of density.

4.1.2FOR SAE75W90 HIGH GRADE, LOWGRADE OIL Vs TEMPERATURE DIFFERENCE

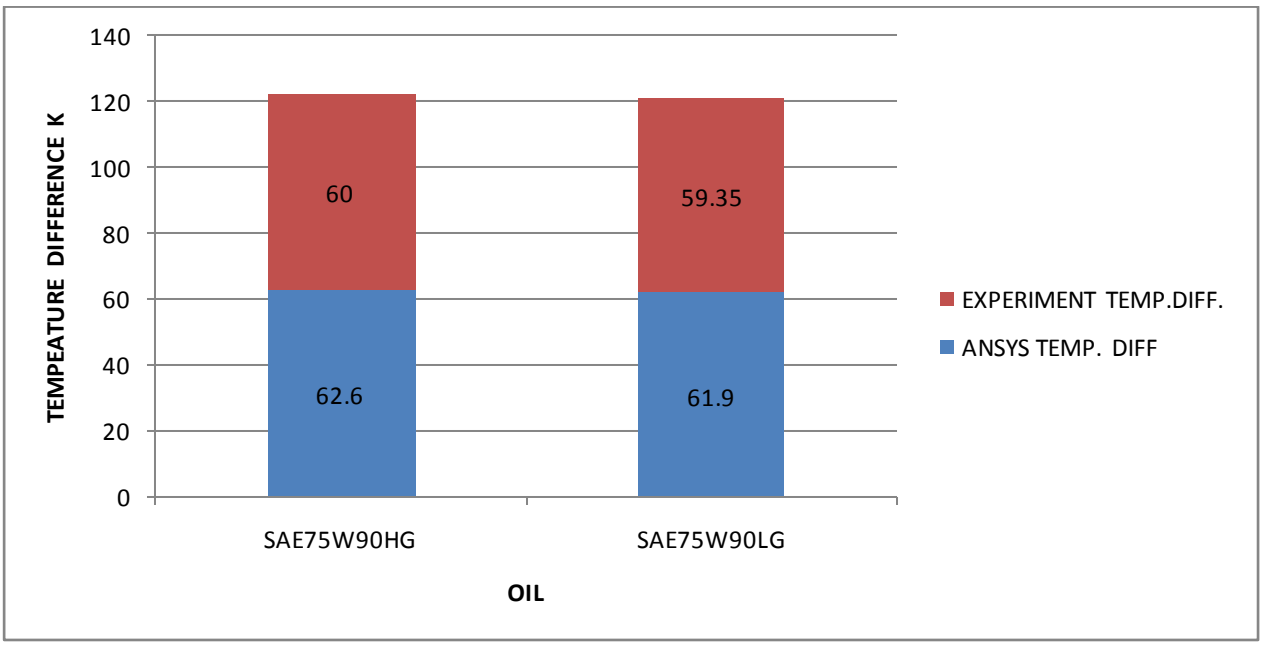

Figure 5.Comparison between SAE75W90 oil Vs Temperature Difference

As per graph SAE75W90 HG and LG oil 4.1% same results as experimental result.

4.1.3FOR EDIBLE OIL Vs TEMPERATURE DIFFERENCE

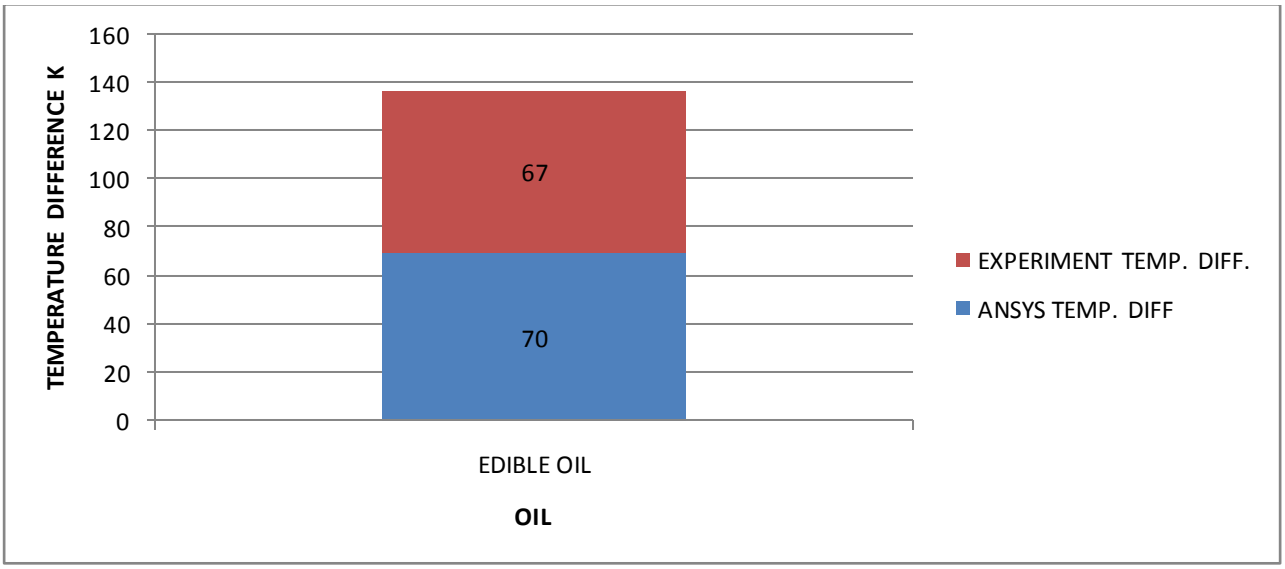

Figure 6. Comparison between EDIBLE oil Vs Temperature Difference

As per graph temperature difference for EDIBLE oil 4.2% higher than experimental result.

V CONCLUSION

Temperature Difference: Generally high grade oils can be used for life time and commercial oils can be used for certain kilometres. It has been observed that if the temperature difference increase the viscosity is decrease By the analytical work carried out on different oils having different viscosity and on the base of that it has been observed that different oils effects the performance of gearbox due to the occurrence of thermal effect. It has been also observed that the temperature difference of EDIBLE oil is the highest, as compared to all listed oils. Due to these phenomena, the efficiency of EDIBLE OIL oil is higher among all listed oils. So EDIBLE oil improve the performance of gearbox as compared to all listed oils.

Running kilometres: Though temperature difference and viscosity of above preferred oil is best among compared oils so one can use it in the automobile engine for higher running kilometres as compared to listed oils.

Cost: EDIBLE oil is little costly than listed oils but if we compared on the base of temperature difference, viscosity and higher running kilometres so it will be cheaper.

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