

“Development of FEAD Rig using Alternator, Power Steering and Air Conditioning Compressor using Dynamometer”

Prof.S.B.Bansode¹, Aniket S. Tambe², Akshay S. Sonawane³, Priyanka P. Thigale⁴, Sonali A. Sonwalkar⁵

¹Professor Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune.

²B.E (Mechanical),, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune.

³B.E (Mechanical),, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune.

⁴B.E (Mechanical),, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune.

⁵B.E (Mechanical),, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune.

Abstract- Now days, at starting condition of the vehicle, the sufficient amount of power is available by the engine at the crank shaft to run the devices like Alternator, Air Conditioning Compressor, Power Steering Pump, etc. but at the running condition the actual condition changes from ideal one. Engine temperature increases, load gradually changes. And so vehicle can't generate that much amount of power which is required to run all the devices. Some of this is working properly and some of them are not. It is very important aspect to proper distribution of power along all devices of vehicle.

In this project we are going design a FEAD rig which is used for testing the power consumption of various devices which distribute sufficient amount of power that is the need of that device to work and giving power output. So that it will overcome the problem of power deficiency of vehicle on the road.

Keyword- FEAD Rig, Power Steering Pump, Air Conditioning Compressor, Alternator.

1. INTRODUCTION:

1.1 Problem Statement:

Effective design of air conditioning (AC) in vehicles has been the centre of attention of automotive manufacturers. Reduction of fuel consumption and tailpipe emission are two crucial targets for the auto industry. Air conditioning operation is proven to have a significant impact on the emissions and fuel economy. A clear understanding of the heating and cooling loads, encountered by the passenger cabin, is a key prerequisite for an efficient design of any mobile AC system. The function of AC system is to recompense for the according to continuous changes of cabin loads in order to maintain the passenger comfort.

1.2 Objective:

As the popularity of vehicles increases, the demand for more power can increase more rapidly than our ability to install

additional generating capacity. In the long term we expect that the supply and demand will become balanced. The function of AC system is to recompense for the according to continuous changes of cabin loads in order to maintain the passenger comfort. Effective design of air conditioning (AC) in vehicles has been the centre of attention of automotive manufacturers. A understanding of the heating and cooling loads, encountered by the passenger cabin, is a important aspect for an efficient design of any mobile AC system for the vehicle. When we start the vehicle, the temperature of engine is low, thus the efficiency of air conditioning compressor is high. But as vehicle runs continuously the engine temperature increases and thus efficiency of air conditioning compressor reduces. Thus to increases the efficiency of air conditioning compressor, alternator, and steering pump we are aiming to establish the system which distribute sufficient amount of power that needed to the devices to work and give output power.

1.3 Component Used:

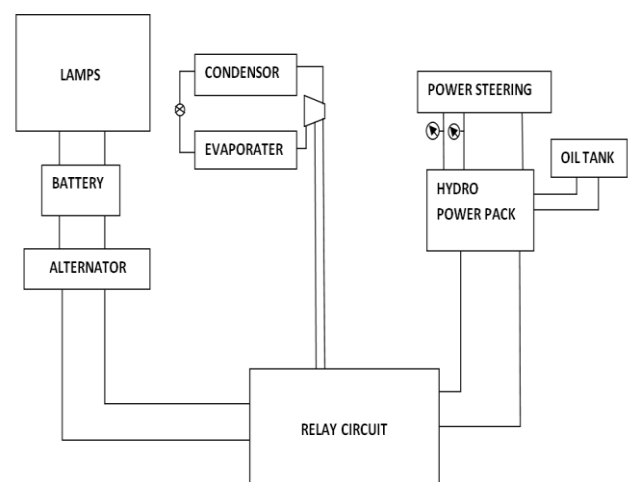


Figure-1: Block Diagram for FEAD Rig

Alternator: Are used in automobile sector for charging of battery and also provide power to electrical system of vehicle.

Battery: The purpose of the battery is to supply the necessary current to the starter motor and the ignition system while cranking to start the engine. It also supplies supplementary current when the demand is higher than the alternator.

Oil tank: It is made of mild steel sheet and is used as a reservoir to provide oil to the power steering pump.

Power steering: Is composed of a set of simple components that magnify the force that the driver applies to the wheel to steer the vehicle.

Hydro Power Pack: It consists of power steering pump and solenoid manual operated valves for loading and unloading of power steering pump.

Relay Circuit: The main function of a relay switch is to allow applications that normally require heavy currents to be switched on using minimal currents

Air conditioning compressor: Maintain vehicle compartment temperature for human comfort zone.

2. MATERIALS AND METHODOLOGY:

2.1 Design Aspects:

Before starting the actual designing, brief study of various aspects of the project was done. The material selection for FEAD rig was done as per the functional requirement. Maximum parts for assembly work are standard in order to maintain interchange ability. Factors considered for designing are listed below:

- 1) Safety
- 2) Cost
- 3) Aesthetics
- 4) Human Comfort
- 5) Material Handling

In every industry, safety has the prime importance. Hence while inspecting of alternator, power steering pump and air conditioning compressor on the test rig has various safety considerations which are taken into account in order to protect human being from accidental hazardous.

2.2 Test medium:

The test medium may be liquid or gas at ambient temperature as specified in each test description.

Liquid: Oil at ambient temperature unless the use of some other liquid is agreed between purchaser and manufacturer. The oil may contain soluble oil or a rust inhibitor and

anticorrosion and antifoam properties because it will not corrode or damaged to the system.

2.3 Test fixtures:

Test fixtures shall not subject the valve to externally applied stresses which may affect the results of the tests. For butt welding end valves when end plugs are used, the seal point shall be as close to the weld end as practical without over-stressing the weld preparation. A castor wheel is used to relatively easy movement of FEAD rig. Casters are used for special housings that include a wheel, facilitating the installation of wheels on objects.

2.4.1 Selection Criteria for Vane Pumps:

- Engine H.P. , Torque and Maximum RPM
- Pressure and oil velocity of oil
- Mounting and other requirements

2.4.2 Calculation for Alternator:

- Selection of Lamps
- Selection of Battery
- Current passing through each lamp: 5 Amp (Lamp of one filament)
- Number of lamps used: 16
- Voltage Capacity of Lamps: 12V, 55/60W
- Battery Capacity = No. of Lamps * Current
- $= 16 * 5$
- $= 80 \text{ Amp}$
- Power = Voltage * Current (Power Law Equation)
- $= 12 * 5$
- $= 60 \text{ W}$

2.5 FEAD Rig Testing:

We are done trial on CRDI engine on the basis of alternator, Power steering, And Air Conditioning compressor. We load all components on part and full load. Alternator is fully loaded by glowing 12 lamps while partly loaded by glowing 6 lamps only. In case of air conditioning compressor, the part load is given at starting condition of the engine when temperature of engine and other components is low so the engine runs at ideal condition and full load is given when engine runs at elevated temperatures and Power steering pump is loaded with separate two pressure lines giving supply of 50 bar pressure. At part load the pump is loaded with single line by 50 bar pressure and at full load the pump is loaded by giving supply through both lines giving total supply 100 bar pressure.

2.6 Results:

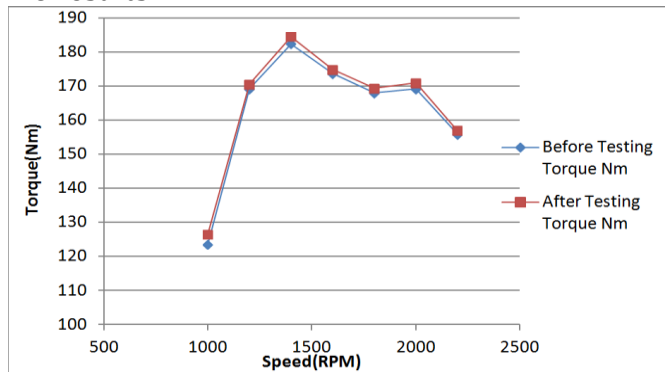


Chart -1: Graph of Speed vs. Torque

From the above graph it is very clear that, after implementing the FEAD rig on the engine giving the more torque by the engine which automatically results in more power output by the engine as compared to before implementation of the rig.

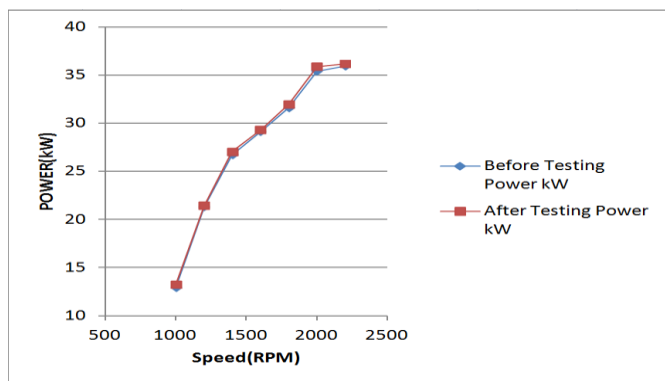


Chart -2: Graph of Speed vs. Power

From the above graph it is very clear that, after implementing the FEAD rig on the engine giving the more power by the engine which automatically results in more power output by the engine as compared to before implementation of the rig.

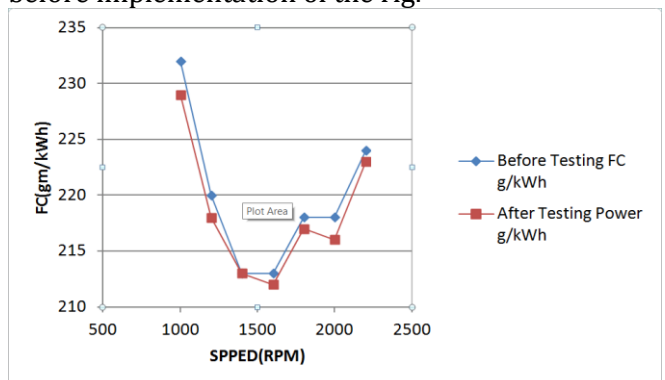


Chart -3: Graph of Speed vs. Fuel Consumption

From the above graph it is very clear that, after implementing the FEAD rig on the engine giving the less fuel consumption by the engine which automatically results in more efficiency by the engine as compared to before implementation of the rig.

3. CONCLUSIONS

By using FEAD rig the efficiency of the engine is increased and decreases the overcome power deficiency on the road. Also avoid overheating of vehicle and sufficient power distribution along all the components.

ACKNOWLEDGEMENT

This work was supported by R&D Department, Force Motors Pvt. Ltd., Akurdi, Pune Mumbai Highway.

REFERENCES

- [1] Behrooz Mashadi and Ehsan Zakeri, Design Of Front Engine Accessory Drive System (FEAD), Department of Automotive Engineering Iran University Science and Technology Tehran, Iran
- [2] Emilia Silvas , Eric Backx , Theo Hofman , Henk Voets and Maarten Steinbuch, Design Of Power Steering Systems, Eindhoven University of Technology, Control Systems Technology Group, Mechanical Engineering Dept., Page 3930-3935, Year 2014.
- [3] Md Shahid Imam, Dr.M.Shameer Basha, Dr.Md.Azizuddin and Dr. K.Vijaya Kumar Reddy, Design Of Air Conditioning System In Automobile, International Journal of Innovative Research in Science Engineering and Technology, ISSN: 2319-8753, vol 2, page 7460-7464, Year 2013
- [4] Rakesh Kumar Jha, Arvind S. Pande and Prof. Harpreet Singh, Design And Analysis Of Alternator, International Journal of Emerging Technology and Advanced Engineering , ISSN 2250-2459 , Vol 3, Page 651-656, Year 2013
- [5] Marcus Rosth, Hydraulic Power Steering System Design in Road Vehicles, Analysis, Testing and Enhanced Functionality, Linköping Studies in Science & Technology, Dissertations No.1068
- [6] Studies in Science and Technology Licentiate Thesis No. 1626. SE-581 83 Linköping, Sweden Linköping 2013.
- [7] R. K. Rajput "Thermal Engineering".