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INVESTIGATION ON VIBRATION BEHAVIOUR OF FLUOROCARBON MATERIAL USED IN ENGINE MOUNTING

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Abstract: *Engine mounting are the rigid clamps or brackets by the help of which engine is mounted on the chassis of vehicle. They are made in such a way that they isolate the transfer of vibration from engine to frame or vice versa. The existing engine mount is made up of natural rubber. It has excellent shock resistance. However, natural rubber is vulnerable to oil and ozone. It may break due to increased vibration. So to avoid such things we are going to use FLUROCARBON (Vinton) which as more temperature and tear resistance. So that this project will overcome the defects of Rubber Engine Mounts. The methodology we have used as usually normal method to taking vibration values of rubber mount and fluorocarbon mount. The values we have collected from the sensor readings are put it in the DEWE software for analyzing, in this software can find out which mount will produce more vibration in different condition.*

Keywords: Natural Rubber, Vibration, fluorocarbon (Vinton), Dewed Software, Mounting, Temperature.

1. INTRODUCTION

To achieve the best vibration isolation for the power train, a mounting system is used to mount the power train in place. The mounting system will provide isolation that will in turn minimize the transmitted forces to/from the engine to the frame. On the other hand, it will also prevent engine bounce caused from shock excitation. This goal is achieved by making the dynamic stiffness and damping of the mounting system frequency and amplitude dependent. Elastomeric mounts, which are made of rubber, have been used to isolate engines since 1930s. A lot of changes have been made over the years to improve the performance of the elastomeric mounts. For proper vibration isolation, elastomeric mounts are designed for the necessary elastic stiffness rate characteristics in all directions. They are maintenance free, cost effective and compact. The elastomeric mounts can be represented by a Voigt model which consists of a spring and a viscous damping as shown in Fig. 1. It is difficult to design a mounting system that satisfies a broad array of design requirements. A mount with high stiffness or high damping rates can yield low vibration transmission at low frequency, but its performance at high frequency might be poor [2]. On the other hand, low stiffness and low damping will yield low noise levels but it will induce high vibration transmission. A compromise is needed to obtain balance between engine isolation and engine bounce. In order to achieve low vibration transmissibility, the mount stiffness must be as low as possible. However, this causes increased static deflection. Lower damping is also desirable for lower transmissibility at higher frequency range. One the other hand, handling and maneuverability are enhanced with higher stiffness. Elastomeric mounts provide a trade-off between competing requirements of low.

Static deflection and enhanced vibration isolation. Hydraulic mounts were first introduced in 1962 for use as vehicle mounting systems. Since then, their popularity has improved for two reasons. The first one is that the current vehicles tend to be small, lightweight and front wheel drive with low idle speeds. The second one is that the hydraulic mounts have developed into highly tunable devices. Three types of hydraulic mounts are in use these days and these are: hydraulic mount with simple orifice, hydraulic mount with inertia track, and hydraulic mount with inertia track and decouple. A general schematic diagram of the hydraulic mount is although there are differences between orifice and inertia track mounts, all of them cause damping at low frequency ranges. These mounts can be tuned to have high damping at the shock excitation frequency which is used to reduce the vibration levels. The dynamic stiffness of these mounts is usually higher than that of the elastomeric mounts. Although the damping in these mount is high at low frequency, the isolation at higher frequencies is degraded. This problem is handled by adding a decoupler to the hydraulic mount which operates as amplitude limited floating piston. It allows the mount to behave like an elastomeric mount to provide good vibration isolation at large displacement. On the other hand, it allows it to behave like a normal hydraulic mount providing the damping for shock excitation.

2. MATERIALS AND METHODS

In active vibration control, a counteracting dynamic force is created by one or more actuators in order to suppress the transmission of the system disturbance force. A general active mount consists of a passive mount (elastomeric or hydraulic), force generating actuator, a structural vibration sensor and an electronic controller. The passive mount is used to support the structure in case of an actuator failure. The controller can either be feedback or feed forward. The vibration control is implemented with a closed loop controller that utilizes the sensor measurement. The active mount stiffness is equivalent to the stiffness of the passive mount (elastomeric or hydraulic). The active mounts can overcome the limitations of passive mounts. Active elastomeric mounts can be very stiff at low frequencies and very soft at high frequencies. Meanwhile the active hydraulic mounts can be tuned to achieve adequate damping at engine bounce frequency and have very low dynamic stiffness at high frequency. Semi active mounts are used to improve the low frequency features of the system like increasing damping. By providing superior isolation, active engine mounts can allow large engine vibration levels. This may reduce balance shaft requirements and enable the vehicle chassis to be lighter. Engine mounts are used to connect a car engine to the car frame. They are usually made of rubber and metal. The metal portion connects to the engine on one side and to the frame on the other. The rubber is in-between to provide some flexibility (so engine shake doesn't cause the car to shake). Newer cars may use slightly different mounts; however, there purpose is the same. Provide the connection from the engine to the car frame. The number of motor mounts varies from vehicle to vehicle. The CAD modeling of die geometry is created and also modified by using software CREO 3.0

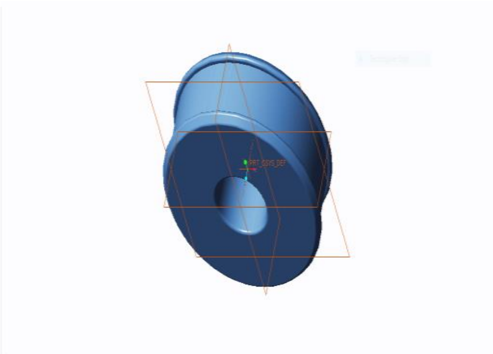


Fig.1. Preparation of Fluorocarbon Mount the CAD modeling of die geometry is created and also modified by using software CREO 3.0.

The materials are very important parts of the engine mounting. In this paper the ''fluorocarbon material'' used in the engine mounting, this materials are the very high shock absorbing material and also high fatigue strength. The fluorocarbon materials are supplied by Kovai seenu chemical company at Coimbatore, tamilnadu. Die casting machine utilized to made the engine mounting. The basic die casting process consists of injecting molten metal under high pressure into a steel mold called a die. Die casting machines are typically rated in clamping tons equal to the amount of pressure they can exert on the die. Machine sizes range from 400 tons to 4000 tons. Regardless of their size, the only fundamental difference in die casting machines is the method used to inject molten metal into a die. The two methods are hot chamber or cold chamber. A complete die casting cycle can vary from less than one second for small components weighing less than an ounce, to two-to-three minutes for a casting of several pounds, making die casting the fastest technique available for producing precise non-ferrous metal parts. In our project we have prepared the FKM mount using die casting process. In our project centre part is made of natural rubber and remaining part is made of fluorocarbon.

Fig. 2 Engine Mount

In this project Simpson's tractor diesel engine is selecting for analysis of vibration level in normal condition and with turbocharger. Simpsons became the first to recognize the potential of diesel as a fuel, and self-started the diesel era in the country in 1951. And in 1955, Simpsons became the first Indian Company to indigenously manufacture diesel engines for surface transport vehicles. An engine is a machine designed to convert energy into useful mechanical motion. Heat engines like internal combustion engines and external combustion engines (Steam Engine) burn fuel to create heat simply it is the conversion of chemical energy in to mechanical energy. The vibration measurement is taken with natural rubber mount at 750rpm & 1000rpm. The vibration measurement is taken with fluorocarbon rubber mount at 750rpm & 1000rpm. The both vibrations data's are stored for analysis purpose.

3. EXPERIMENTAL SPECIFICATION:

In this project Simpson's tractor diesel engine is selecting for analysis of vibration level in normal condition and with turbocharger. Simpsons became the first to recognize the potential of diesel as a fuel, and self-started the diesel era in the country in 1951 and in 1955, Simpsons became the first Indian Company to indigenously manufacture diesel engines for surface transport vehicles. An engine is a machine designed to convert energy into useful mechanical motion. Heat engines like internal combustion engines and external combustion engines (Steam Engine) burn fuel to create heat simply it is the conversion of chemical energy in to mechanical energy.

Fig. 3 Simpsons Tractor Engine

Fig. 4 Fluorocarbon rubber Mount

4. VIBRATION MESURING DEVICE:

DEWESoft is measurement software which can acquire data from much different measurement hardware and enables the user to do processing, storage and analysis in a simple way. The main idea of Dewesoft is to have two modes of operation: Acquisition and Analysis. The main difference is that Acquisition part works with a real hardware while Analysis works with stored file. But same math processing and visualization can be applied either during measurement or also on stored files. Therefore the parts of the manual describing the Measurement are valid also for analysis.

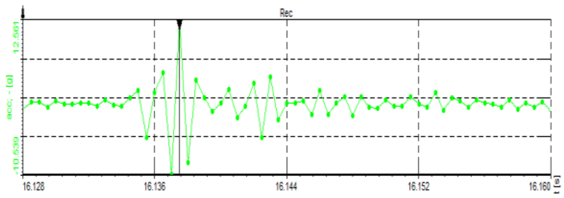
5. RESULTS AND DISCUSSION

The vibration test has been taken with natural rubber mount & fluorocarbon rubber mount. In this paper investigated in engine head and engine mount at 750, 1000 rpm speed of the engine. The following graphs are the vibration analysis of different types of engine mount materials.

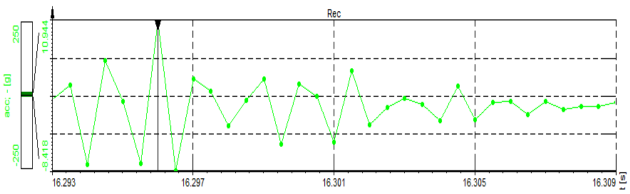
At 750rpm

(i) Engine head vibration

Normal rubber mount

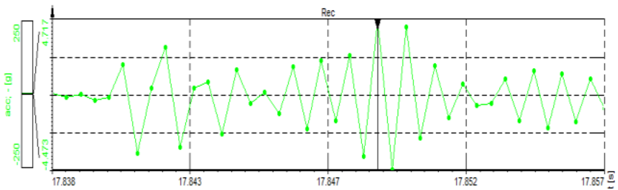


Fluorocarbon mount

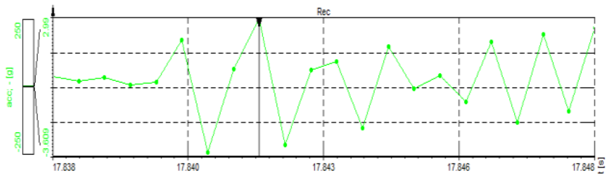


(ii) Mount vibration

Normal rubber mount



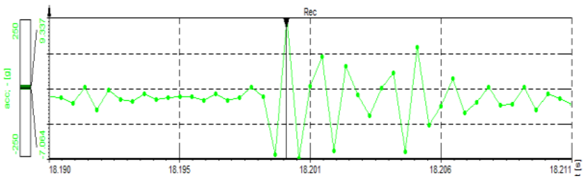
Fluorocarbon mount



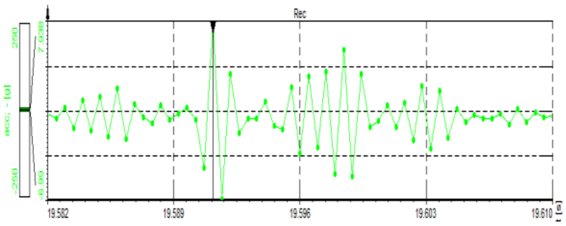
At 1000 rpm

(i) Engine head vibration

Normal rubber mount

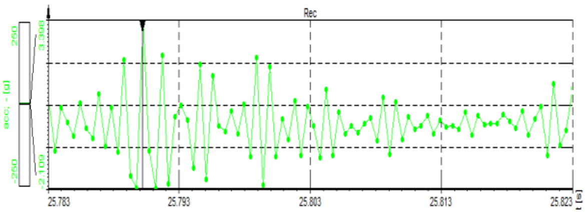


Fluorocarbon mount



(ii) Mount vibration

Normal rubber mount



Fluorocarbon mount

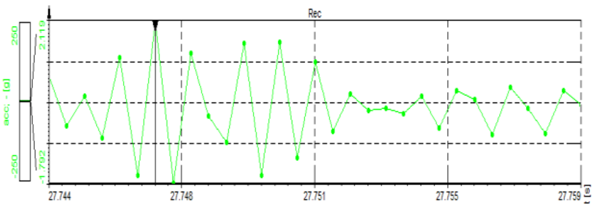


Table1.Testing values of different types of mounting materials.

Types of mount	Engine rpm	Vibration in Engine head (g)	Vibration in Mounting (g)
Natural Rubber	750	12.661	4.717
	1000	9.337	3.398
Fluorocarbon	750	10.944	2.99
	1000	7.938	2.119

From the above table we can infer that vibrations produced in the fluorocarbon mount is less the natural rubber mount.

6. CONCLUSION

This paper covers the brief study of Rubber and Fluorocarbon. Natural rubber consists of suitable polymers of the organic compound isoprene, with minor impurities of other organic compounds plus water. The engine mount is being used to absorb and reduce the engine vibrations. In engine run 750 rpm, the natural rubber produced higher vibration in the engine head (12.661). But the fluorocarbon material produced low vibration in the engine head (10.944). So the fluorocarbon materials having better vibration materials compare to natural rubber.

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