Bad Vibrations: A Closer Look at Engine Mounts

By **Mary VerDuin** - 29. June 2021

Engine mounting: febi offers one of the broadest ranges in the field of rubber to metal in the spare parts market.

The reduction of noise, vibrations, and harshness has become a technology in and of itself. Vehicle manufacturers strive to refine their vehicles with insulators and vibration countermeasures to reduce these characteristics.

- **Noise** is an unpleasant or disruptive sound that causes some sort of disturbance. An example of such would be the rattling of a worn bearing.
- **Vibrations** are the off-putting, repetitive motion of an object. A tire out of balance can cause the steering wheel to oscillate at certain speeds.
- **Harshness** is very subjective. It can be defined as a sudden, jarring feeling. A comparable feeling would be that of driving through a pothole.

The largest contributor of these characteristics is the internal combustion engine. This can be attributed to rotating parts, combustion, and variation in speed. These features are magnified even more in engines equipped with stop/start technology, cylinder deactivation, and increased compression ratios.

Vehicle manufacturers use a variety of shapes, sizes, and types of mounts to insulate the engine. This is meant to counteract these characteristics. The

type used depends on the vehicle's engine features, the costs involved, and brand quality perception.

The three main types of mounts used are: rubber, hydraulic, and electronically active.

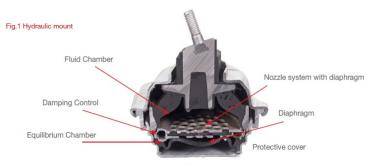
Rubber Mounts

The rubber mount is a traditional type of mount and is the most commonly used. It is available in numerous shapes and sizes ranging from a simple cotton real shape to a very complex rubber and metal formation. Stiffness is regulated within the properties of the elastomeric material used. The direction of movement is determined by the fixed links within the design of the mount.

Hydraulic Mounts

The hydraulic mount is more dynamic and combines the acoustic isolation functions of a conventional rubber engine mount, but with a balanced damping performance. Hydraulic engine mounts can adapt their characteristics depending on the induced load. The viscous liquid in the hydraulic mount acts as a damper to ensure optimal insulation.

Inside a hydraulic engine mount, the main rubber spring has an upper and lower chamber. The chambers are connected by a series of canals and separated by a rubber valve. The mainspring is filled with a viscous liquid. During impacts, the rubber valve opens and closes the bypass channel, redirecting the viscous liquid flow between the two chambers. This changes the stiffness of the mount, creating optimal damping characteristics for any road conditions. (Fig 1)



With a greater control required, one option for providing better regulation for the hydraulic engine mount was to use the properties of a vacuum. The negative pressure produced keeps the mounting soft at idle speed and in the lower rpm range. It keeps it firm in the higher rpm range as well.

The evolution of the hydraulic engine mount damping control comes from electronically switchable mounts which can be coupled with the vehicles engine management system. (Fig 2)

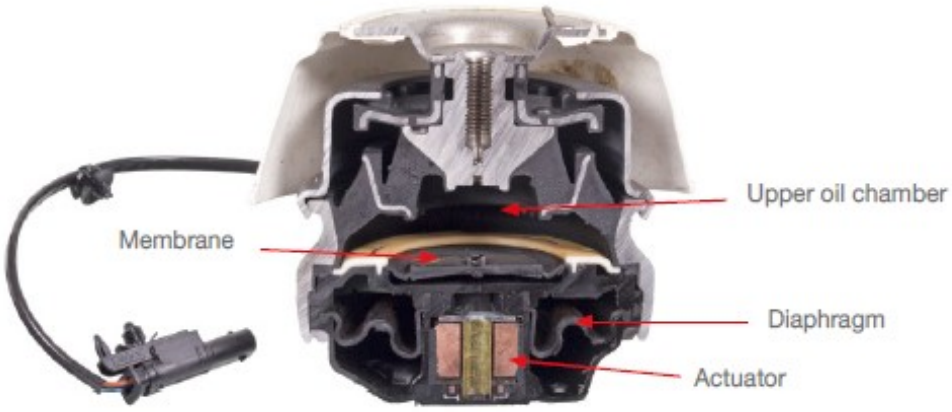


Fig.2 Electronically Switchable Hydraulic Mount

Electronically Active Mount

Electronically Active Mount

An electronically controlled engine mount meets damping requirements, but with a bit more control. The switching function causes the air suspension in the mount to be utilized in the neutral position. This provides a soft suspension when at idle or low rpm. When the vehicle is being driven, the mount switches to a hydraulic suspension and provides a firmer suspension between the engine and the vehicle's body.

The latest development for engine mountings is the active, intelligent mounting which is designed to meet the requirements of more demanding functionality. These are designed to save fuel and to be more in tune with driving dynamics to offer maximum comfort.

An active, electronically-switchable hydraulic mount is equipped with an actuator and sensors to provide feedback to the control unit. It can be actively controlled according to the required damping. This is driven by the actuator excitation frequency; the active mount dampens either hydraulically, passively, or actively. The isolation characteristics are calculated by the vehicle's control unit and converted by the actuator so that no vibration is transmitted to the body.

Cause of Wear and Failure

In time, all engine mounts have the potential to fail or wear out. This can reduce their damping countermeasures and can cause unwanted vibrations, noises, and harshness. This can come from the mount's deterioration from time and stress or, in the case of hydraulic mountings, leaking fluid.

The vacuum controlled mountings can have issues with leaking air and the vacuum system that controls them can falter or stop working. This can cause more than vibrations and may result in engine management problems.

The electronically-controlled mountings can also suffer from the same fatigue issues. However, they have the added complexity of electronics built within. Any electrical issues can be detected by the control unit and fault codes can be logged accordingly to help in the diagnosis process.

When replacing any engine or transmission mounting, ensure that all correct procedures are carried out to avoid reducing the life of the replacement part.