Noise, Vibration, and Harshness

Self Study Program
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Always check Technical Bulletins and the Volkswagen Worldwide Repair Information System for information that may supersede any information included in this booklet.

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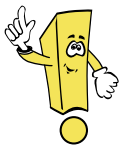

Important/Note!

The Self-Study Program provides you with information regarding designs and functions.

The Self-Study Program is not a repair manual.

For maintenance and repair work, always refer to the current technical literature.

Course Goals

This course will enable you to:

- Identify the terminology used in diagnosing Noise, Vibration, and Harshness (NVH) concerns
- Identify the different types of NVH
- Identify the steps of the NVH systematic diagnostic approach
- Identify the road test procedures necessary to isolate a noise or vibration
- Calculate NVH frequencies necessary for component classification
- Identify test equipment and tools used in diagnosing and correcting NVH concerns
- Identify, diagnose, and specify the component causing the NVH concern

Introduction

This Self-Study Program focuses on vehicle Noise, Vibration, and Harshness (NVH), their causes and diagnostic and service procedures to locate and correct NVH concerns.

Modern cars and trucks use a combination of systems to provide the driver with the safest, most responsive, and comfortable vehicle ever built. Today's driver has come to expect a smooth and quiet ride in all operating environments. When vehicle noise, vibration, or ride harshness exceeds the driver's expectations, it is up to the technician to correct the cause of the customer's concern.

Vehicle components are being manufactured using lighter weight metals. Lighter weight metals reduce the overall vehicle weight that reduce emissions and improve fuel economy. As technologies develop stronger and more lightweight metals this trend will continue. Lighter vehicle components do not absorb noises and vibrations as well as heavier components. This leads to an increase in NVH concerns.

Diagnosing NVH concerns has been developed into a logical and almost scientific procedure. This course will provide the Volkswagen technician with concepts to help understand and diagnose NVH concerns.

Characteristics of Noise, Vibration, Harshness

Noise is defined as any unpleasant or unexpected sound created by a vibrating object.

Vibration is defined as any objectionable repetitive motion of an object, back-and-forth or up-and-down.

Harshness is defined as an aggressive suspension feel or lack of "give" in response to a single input.

Generation of Noise and Vibration

A vibrating object normally produces sound, and that sound may be an annoying noise. In the case where a vibrating body is the direct source of noise (such as combustion causing the engine to vibrate), the vibrating body or source is easy to find. In other cases, the vibrating body may generate a small vibration only.

This small vibration may cause a larger vibration or noise due to the vibrating body's contact with other parts. When this happens, attention focuses on where the large vibration or noise occurs while the real source often escapes notice.

An understanding of noise and vibration generation assists with the troubleshooting process. The development of a small noise into a larger noise begins when a vibration source (compelling force) generates a vibration. Resonance amplifies the vibration with other vehicle parts. The vibrating body (sound generating body) then receives transmission of the amplified vibration.

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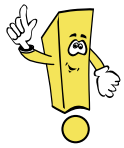
Sounds and Sound Waves

A sound wave's cycle, period, frequency, and amplitude determine the physical qualities of the sound wave. The physical qualities of sound are:

- Audible range of sound
- Pitch
- Intensity

All people have different capabilities for hearing sound. Some people may not hear sounds that other people can hear. Keep these facts in mind while diagnosing noise concerns. Most customers become tuned into a noise after hearing it repetitively.



When diagnosing a vehicle, it may be beneficial to have the customer reproduce the noise during a road test.

Audible Range of Sound

For sound to be heard, the resulting acoustic wave must have a range of 20 to 20,000 Hz, which is the audible range of sound for humans. While many vehicle noises are capable of being heard, some NVH noises are not in the audible range.

Low-speed droning is an example of a low frequency NVH concern that may have components not in the audible range. This condition exerts pressure on the driver's eardrum and can be extremely uncomfortable.

On the other end of the audible range of vehicle noises are wind noise and brake squeaking. The high frequencies of these NVH concerns produce a high-pitched noise that can be extremely annoying. The figure below illustrates the audible range of automotive noises.