ENGINE DIAGNOSTICS CONTD

6.0 ENGINE NOISE

When some parts in an engine become faulty, some of the time, engine noise develops. This noise generated can be listened to and the source located using a stethoscope. Another way of detecting the source of the noise is in the use of the end of a large screwdriver, a piece of hose and a long wooden dowel.

It is very important to locate the source of an engine noise before disassembling the engine.

6.1Types of Engine Noises

Engine noise can be caused as a result of various parts and locations of the engine. Some of the sources are:-

6.1.1 Accessory Noises

These are engine noise from the engine accessories like the coolant pump, alternators, fans bearing, fan belt, air-conditioning compressors etc. and they are most often difficult to locate. They are detected by isolating systems in the engine.

6.1.2 Crankshaft Noise

Crankshaft noise can be caused by various components around the crankshaft. They are generally deeper in pitch compared to other engine noises. Isolation of the source of the noise is important for proper and accurate diagnosis. Sounds/noises from faulty crankshafts are also referred to as “Knock Sounds”.

Front Main Bearing Knock: this noise results mainly from excessive clearance between the crankshaft and the main bearing and this excessive clearance leads to heavy knock. This knocking sound is majorly pronounced at engine speed range of 1500 -2500 rpm. This noise can be reduced by slacking the drive belts a bit.

Thrust Bearing Knock: During an operation of an engine, the crankshaft moves back and forth and this known as the end thrust. The crankshaft has a machined surface that controls this movement. When it is excessively worn, the backward and forward movement of the

crankshaft increases. This causes a hit sound when the vehicle leaves a stationary position. This noise is pronounced in vehicles with standard transmission.

Figure 6.0A: Thrust bearing that has melted on a side

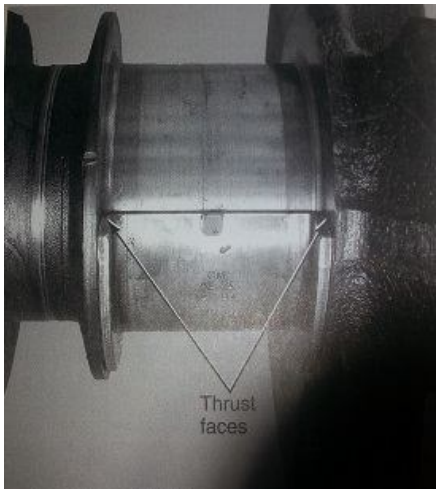

Figure 6.0B: Thrust insert limits the crankshaft end play

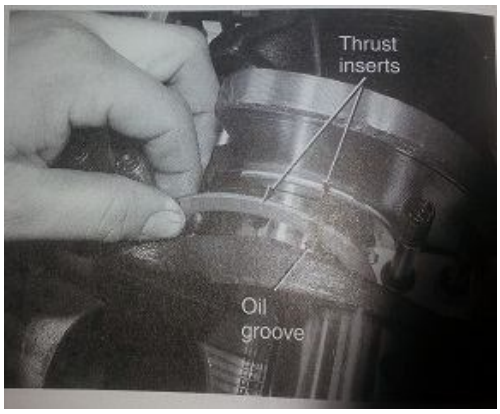

Figure 6.0C: Thrust insert or washer is installed next to the main bearing

Rod Knock: when the clearance between the connecting rod journal and the crankpin is excessive, this noise is developed. The noise (knocking sound) diminishes or disappears

during cylinder power test. This noise is noticed especially, when the oil pressure is low, during idling.

Other Sources of Noise

A loosed flywheel, torque converter or vibration damper can cause a very serious-sounding noise.

6.1.3 Piston Noise

Engine noise could emanate from the engine piston. The sources of noise from the piston could be from: a cracked piston, piston pin noise, piston slap, etc.

Cracked Piston

Some of the time engine noise emanates from a cracked piston. The following are how it is known:

- The noise is differentiated from a valvetrain noise because it occurs at a faster rate compared to a valvetrain noise and it has a higher pitch compared to a crank-related noise.
- Cracked piston occurs when the valve timing is incorrect or the timing chain is broken. This could lead to the hitting of the valve by the piston, which could lead to its crack.

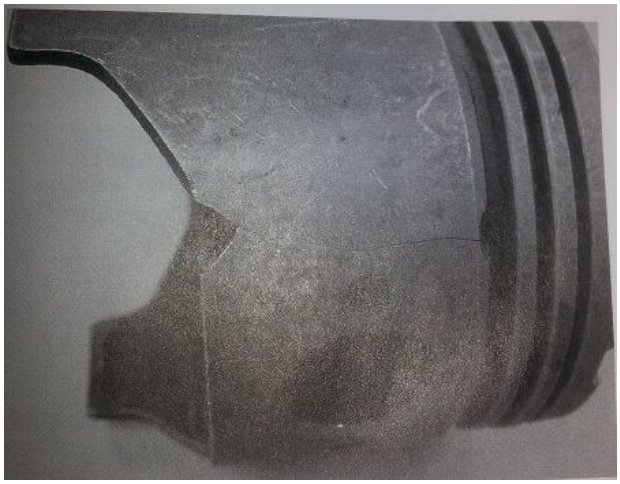

Figure 6.1: Cracked piston

Piston Pin Noise

This engine noise comes as a “Double Click” sound at idling speed and it usually reduces or disappears when the engine warms up. This noise is caused by piston inertia.

- This type of noise can be intense when the engine rings are replaced and gradually reduces when the rings wear.

Piston Slap

Piston slap which is an engine noise is caused by the excessive clearance between the piston skirt and the cylinder wall. This can be diagnosed through the following ways:

- This noise is pronounced in engines, during operation, when the engine is cold and it disappears when the engine warms up.
- Oval wear is observed on the piston rings and bores when there is piston slap at the TDC and BDC.
- When the piston skirt is worn, excessive cylinder wear is observed.

Other Piston Noise

Broken Piston Ring Noise: a rattling sound is heard during acceleration of the engine.

6.1.4 Valvetrain Noise

The valvetrain noise is one of the most common engine noises and this kind of noise comes as a loud "ticking" sound. Various sources of valvetrain noises are:-

Excessive Valve Stem-to-Guide Clearance:- This noise can be pin pointed when the engine is running. When oil sprayed fills this clearance between the valve stem and the valve guide during an engine's operation, the noise stop.

Sticking Valve:- A "popping" noise at throttle plate can develop as the burning gases escape into the intake manifold through the valve. This occurs as a result of sticky valves.

Worn Cam Lobe:- when an engine runs roughly when accelerated and make popping back sound through the intake valve to the intake manifold, while it runs smoothly at idle speed. A worn exhaust cam lobe is most likely to be the problem. This occurs because the burnt gases don't find their way out and this makes them flow back to the intake port.

Timing Components:- Valvetrain noise which emanates from the timing section could be caused by a loosed sprocket or gear, a bad timing chain or chain guide. The noise from this is a "rattle or knock sound" that intensifies during deceleration. In engines with timing chain tensioner, a rattling noise is heard when the engine floats or cruises between load and coast conditions, as the worn chain becomes loosed. In severe cases, the worn chain creates an opening in the timing chain cover and this leads to oil leak.

Note: Excessive timing slack can also be caused by severely worn cam bearings.

Excessive Valve Lash:- In engines with adjustable mechanical valve lash clearance, excessive valve lash due to wear of the valve train. Periodic valve adjustment should be done in these engines.

6.1.5 Lifter Noise

A noisy valve lifter is one of the common valve noise associated with a faulty valve lifter. Some lifters lose their oil when the engine is off and this leads to the occurrence of this noise when the engine is started. It disappears when pressurized oil reaches the lifter. This noise is considered normal for the engine, when the noise goes off within 15 seconds. Some other lifter noises and their causes are as follows:-

Intermittent Noise at Idle or Low Speed:- When this occurs, it is most likely to be as a result of dirt or wear in the lifter check valve.

When Noise at Idle goes away at Higher Speeds:- This implies the likelihood of excessive wear between the lifter body and its plunger. The noise could also be as a result of low oil pressure or fuel contaminated oil (making it loose its viscosity).

Smooth and Quite Operation at Idle and Noisy at High Speed:- This noise occurs when the oil level is higher than required and this makes the crankshaft whip the oil and makes it entrain air.

Note: Lifter noise at all engine speeds can be due to:

- Dirt build up inside the lifter
- Worn parts such as worn rocker arms or a cam lobe.
- Insufficient oil supply
- Too thin oil
- Low oil pressure

6.1.5 Pre-ignition, Detonation and Fuel Octane Number and Spark Advance

Pre-ignition

It is the auto-ignition of the air-fuel mixture (charge) in the cylinder, before the introduction of a timed spark by the spark plug in the combustion chamber. This is a form of abnormal combustion that occurs in spark ignition engines, basically as a result of hot spots in the combustion chamber. This event leads to engine knock, which is audible and uncomfortable to the ear and if it is not corrected, leads to the damage of engine components which leads to engine failure, after some few engine cycles.

Detonation

Detonation as it relates to combustion in internal combustion engines is a form of chemical reaction in the combustion chamber which generates supersonic wave. This combustion effect generates an audible sound that is not pleasant to the ear and damages engine components.

Fuel Octane Number and Spark Advance

Octane number of a fuel used in spark ignition engine gives information about the resistance of fuel to auto-ignition and this gives also gives information on the resistance of the engine running on this fuel to knock.

Advance in spark timing may lead to engine knock under some condition and that is why the knock sensor is installed in engines. They detect vibrations as a result of knock and send the necessary signals to the ECU which retards ignition to eliminate knock.

6.1.6 Broken Engine Mount

Engine mounts basically serve as dampers. When the mounts are broken, vibration is increased. This leads to noise and finally results in the failure of the components involved.