ENGINE DIAGNOSTICS CONTD

5.5 PROBLEMS ASSOCIATED WITH OIL PRESSURE

When oil pressure is above or below the designed specification, the engine is diagnosed to have an oil pressure problem. Low oil pressure problem is mostly the oil pressure problem experienced in engines.

Oil pressure problems could arise when engine oil is not changed when due and regular oil level is not checked (which leads to running engines with low engine oil). This neglect leads to excessive wear of the bearings and other mating parts that are lubricated with oil under pressure.

5.5.1 Low Oil Pressure

Low oil pressure in an engine in operation could damage the mating parts of the engine that are lubricated with oil under pressure, within a short period of operation. To prevent these damages occurring in an engine, an indicator is installed in the vehicle's dashboard to warn the user when the oil pressure is low.

Low oil pressure in engines could also be caused by defective oil pumps. The pump's body could be loosed in the block or the intake screen loosed or partially plugged. The pump might have a sticky relief valve or it might be excessively worn.

5.5.2 High Oil Pressure

In rare cases, high oil pressure conditions could occur in engines. This could lead to high oil consumption, bursting of oil filters and washing of bearing materials from the bearing.

This condition can be caused by the blockage of the oil pressure relief valve in the pump or blocked oil passages in the cam and crankshafts.

5.6 COMPRESSION LOSS IN ENGINE

Compression loss in engine leads to poor performance of an engine or unavailability of the engine. It could be as a result of various reasons such as:- broken or worn piston rings, damaged piston, worn engine cylinder walls, burned valves, blown top cylinder gasket, broken valve springs, worn valve seats or too tight valve clearance.

5.6.1 Broken or worn piston rings or damaged piston

When the piston rings are worn or broken, the rings loses its sealing ability which makes it incapable of retaining the air-fuel mixture in the cylinder during compression which leads to increase in blow-by and overall loss in engine efficiency. A damage piston also leads to the engine losing its sealing ability during compression and this is increases blow-by and

reduces the engine's efficiency. A damaged piston (which is majorly due to knock) and its damaged rings are shown in Fig. 5.5.

Figure 5.5a: Broken or worn piston rings

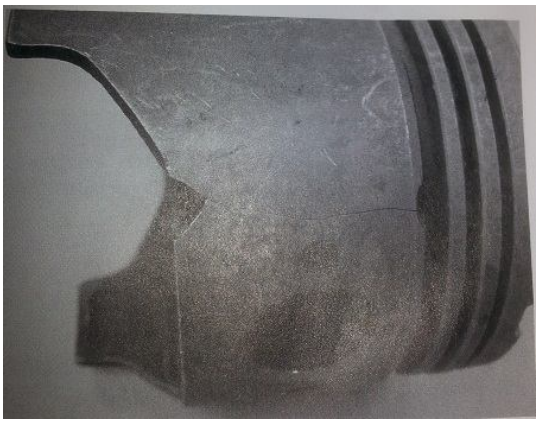

Figure 5.5b: Damaged piston

5.6.2 Worn engine cylinder walls

Worn engine cylinder walls leads to loss in the contact pressure of the piston ring and the sealing ability of the rings during compression stroke. It results in increase in blow-by and reduction in engine's performance as a result of low cylinder compression.

5.6.3 Burned valves or worn valve seats

Valves control the exchange of gases in the combustion chamber of an engine. When valves get burnt in engines, it is normally the exhaust (this mainly occurs when there is a leakage at the exhaust valve and this is allowed to continue over a period of time). If the valve is burnt or the seat is worn, leakage occurs even when they are closed. During compression stroke, both the intake and exhaust valves are closed. If any of the valves in the

cylinder is burnt or the seat is worn (too tight valves lead to wear on the valve faces and seats), the sealing ability of such valve is defeated and this causes loss of charge (air-fuel mixture or air alone) during compression stroke and this leads to reduction in the engine's efficiency. A burnt valve is shown in Fig. 5.6.

Figure 5.6: Burnt valve

5.6.4 Blown top cylinder gasket

While the top cylinder gasket ensures that there is no mixing of the engine's lubricant with the coolant, it also ensures that the cylinders are air tight during compression stroke. When the gasket is blown as shown in Fig. 5.7, the air-fuel mixture or air as the case may be, being compressed finds its way into the neighbouring cylinder, leading to compression loss and reduction in the engine's efficiency.

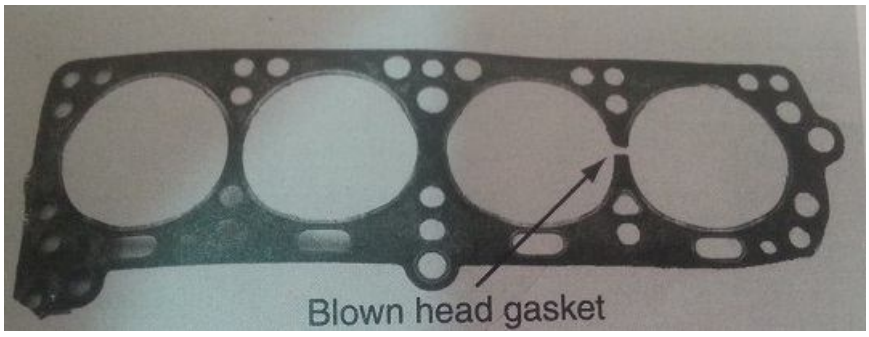

Figure 5.7: Blown Gasket

5.6.5 Broken Valve Springs

When the valve springs are broken (weak acid is also a by-product of combustion (CO and sulphur oxides reacting with steam) and this dilutes the engine oil overtime and also corrodes the surface of the spring and causes it to break), the valves lose its air-tight ability when they are meant to be closed. This results in loss of in cylinder compression.

Figure 5.8: Broken Valve Springs

5.6.6 Tight valve clearance

When the valve clearance is too tight, it does not give room for the proper sealing of the valves and it leads to leaks during the compression stroke which result in loss of compression in the engine.

5.7 PROBLEMS ON ENGINE BREATHING

As humans breathe to live, engines also breathe to operate. Just as breathing problems leads to discomforts and loss of efficiency in humans, same applies to engines. When engines do not breathe properly, the required compression is not developed, combustion is affected and this reduces the engine's efficiency.

Breathing problems could be as a result of blocked air filter, worn camshaft lobes, improper valve timing or blocked or collapsed laminated exhaust pipe.

5.7.1 Blocked Air-Filter

When the air-filter is blocked, the passage of air into the engine becomes restricted and insufficient for combustion in the engine. This leads to the burning of rich air-fuel mixture in the engine and the expulsion of incomplete combusted by-products. The blockage is majorly as a result of the accumulation of dust and other particles in the air-filter system. This can be solved by cleaning the air-filter.

5.7.2 Worn Camshaft Lobes

Worn camshaft lobes, leads to reduction in valvelift and duration of it dwell. This restricts the amount of air-fuel mixture that goes into the combustion chamber and is made available for combustion. This also affects the expulsion of burnt gases from the combustion

chamber (increased residue gas in the combustion chamber leads to poor performance of the engine). This is solved by the replacement of the affected camshaft.

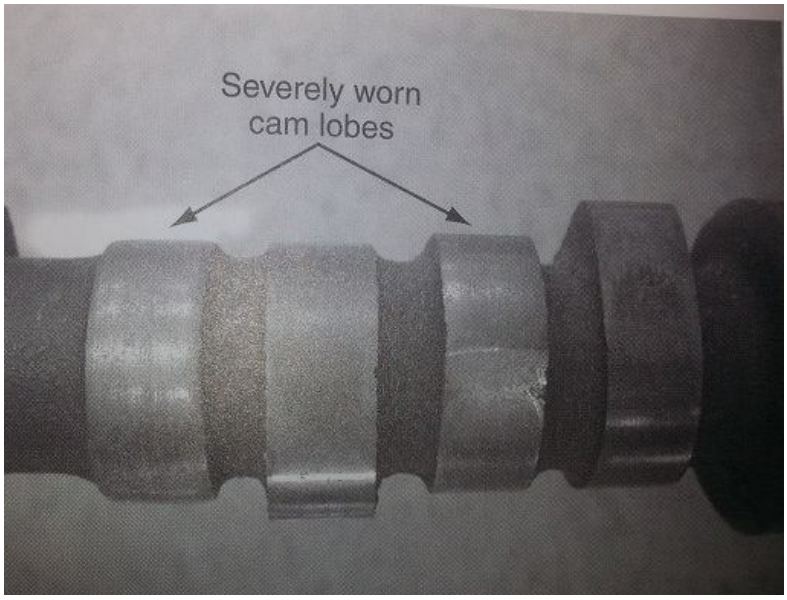

Figure 5.9: Worn Camshaft Lobes

5.7.3 Worn Timing Chain

When the timing chain of an engine is worn, it skips and could cause the valves to stay open, shorter than the set duration or to remain shut when it is meant to be open, thereby adversely affecting the breathing of the engine and its overall performance. This is solved by the replacement of the affected timing chain.

5.7.4 Blocked or Collapsed Laminated Exhaust Pipe

When the exhaust system is blocked as a result of plugged catalytic converter (after a prolonged running of the engine with ignition defect) or collapsed exhaust pipe, this leads to increase of residue gases in the engines combustion chamber which could lead to misfiring.

Figure 5.10: Collapsed exhaust pipe

Blockage in the exhaust line can lead to increased throttle pressure and shifting in automatic transmission.

This is solved by removing all restriction in the exhaust line and ensuring its causes are addressed.

5.8 TEST CONDITIONS FOR COMPRESSION LOSS IN ENGINES

For the operation of an engine to be certified okay, the following conditions are to be met:-

- The designed compression must be achieved.
- The design air-fuel mixture ratio range must be achieved.
- The ignition timing must be as designed.

5.8.1 Compression Test in Engines

The easiest and cheapest way of carrying out an engine compression test is by using a compression tester. This is a pressure gauge that is inserted into the plug hole of an engine. There are two styles that could be applied in measuring compression with the compression tester: (a) The tester could be held in place while cranking the engine or (a) it could be screwed to the spark plug thread in the top cylinder of the engine.

Figure 5.11a: Engine Compression Tester

Figure 5.11b: A throttle depressor used to hold the throttle wide open during the compression test

5.8.2 Procedure for Compression Test in Engines

- Remove the spark plug cords
- With compressed air, clean the surroundings of the spark plugs before removing the spark plugs.
- The throttle is to be held in the wide-open position.
- The compression test is done with the ignition switch "ON". The ignition system is disabled.
- The starter is connected in such a way as to power the kick starter.
- Insert the compression tester (pressure gauge) into the spark plug hole.
- Record the pressure readings obtained (the gauge moves four times for a four-stroke engine but what is taken note of is the compression stroke reading).

Note: if the engine is cranked without disabling the ignition system while the spark plug cords are disconnected, the ignition module or computer could be damaged.

5.8.3 Compression Test Result Interpretation

If the compression results obtained from each of the engine's cylinders are equal and as designed and stated in the engine's manual, the engine is certified fit. Any variation in compression result in each of the cylinders above 20% implies that the cylinder needs repairs.

Note: When compression loss is experienced in a cylinder in a multi-cylinder engine, it cause is most likely to be as a result of a burnt exhaust valve. When compression loss is experienced in two cylinders in the engine that are side-by-side, it indicated that the cause is most likely to be from a blown gasket.

5.8.4 Wet Compression Test

When a poor compression result is obtained from some of the cylinders of an engine, a further test is carried out known as a wet test. It involves the following:-

- A tablespoon of engine oil is introduced into each of the cylinders with loss compression. The oil makes a seal round the worn piston rings and improves the cylinder's compression.
- If there is improvement in the cylinder's compression, it implies that the rings are worn and needs to be replaced.