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RX-0711

MRP DATASHEET: KNOCK SENSOR

What is it and what does it do?

Mounted directly on to the side of the Rotor housing or cylinder block, they “listen” for engine pinking and send an oscillating voltage signal to the ECU. The ECU uses this information to control the ignition timing.

Pinking is a phenomenon caused by the explosion in the combustion chamber taking place too early. When this occurs the flame front within the combustion chamber collides with the still rising piston or, in the case of a rotary, with the spinning rotor, causing the characteristic pinking or pinging noise which sounds like many marbles dropping onto a steel plate. In mild cases it results in decreased engine power, in severe cases it results in major engine damage.

The more advanced the ignition timing is set on an engine the higher the theoretical power, up to a limit. The limit is generally just before the point of pinking. It is the job of the Knock sensor, with the ECU, to keep the ignition timing at this peak setting.

The ECU will advance the ignition timing until pinking is detected then retard it by, say 10 degrees, this process is repeated many times per second. Some ECU's have the capability of advancing and retarding the timing individually per cylinder. (A four-cylinder engine might therefore have four different ignition-advance settings.) In any case, the actual setting achieved is a variation on a “timing map” within the ECU, which takes into consideration parameters such as engine speed, load and temperature.

The Knock sensor can also have a secondary role. The point at which pinking occurs is also the point at which peak NOx emissions are generated. By accurately controlling the timing, the emissions of an engine can be reduced.

How they work

When the sensor detects a “noise” within the frequency it is sensitive to, it generates a small electrical signal (a damped Sine wave signal of about plus and minus 2 volts). This signal is amplified and used by the engine management ECU accordingly.

The sensor is located in a position on the engine where knock can be detected across all cylinders or chambers. One sensor is generally used per four cylinders, so an 8 cylinder engine will have 2 sensors and on a Rotary engine the knock sensor is mounted on the side of the front Rotor housing.

The sensing element consists of a piezo-ceramic element and a seismic mass, which is clamped into place by the locating bolt. The sensor has a specific exciting frequency which is matched to the frequency vibration band within which pinking occurs.

Reasons for failure:

There are three main causes of Knock sensor failure:

1. Connector wire faults between the sensor and the ECU, due to corroded connectors or wire failure
2. Internal failure of the sensor due to the environment in which it operates
3. Corrosion between the sensor and its mating surface causes the sensor to lose sensitivity.

Testing:

In the case of the first two examples, testing is relatively simple. Warm the engine up, monitor the timing and tap the sensor with a small metal object such as a spanner. The timing should retard, continue tapping and the timing will remain retarded, stop tapping and the timing should advance back up again.

You could perform a variation of this test by plugging the sensor into an oscilloscope and tapping it with a spanner. You should see a blip in the output signal. This test could be carried out at the ECU end of the wiring loom; this will also check the condition of the interconnecting wires etc.

The condition of the spark plugs can also give clues to pinking. Premature wear/erosion and unusual noids/deposits over the electrodes are clues.
When a sensor fails, the driver is usually alerted to the problem by the illumination of the “MIL” lamp. Symptoms when driving the car include lack of performance and pinking noises (especially up hills with a hot engine). You should be aware that pinking can destroy an engine within seconds if severe, so ignore the warning signs at your peril.

Note: 1

The sensor is dependent upon the correct tightening torque being applied when fitting; please check the manufacturer’s workshop manual. Under no account should washers or any type of sealant be used when fitting the sensor.

Note: 2

Knock sensors tend to be very engine specific and we would recommend that the manufactures genuine part always be used.