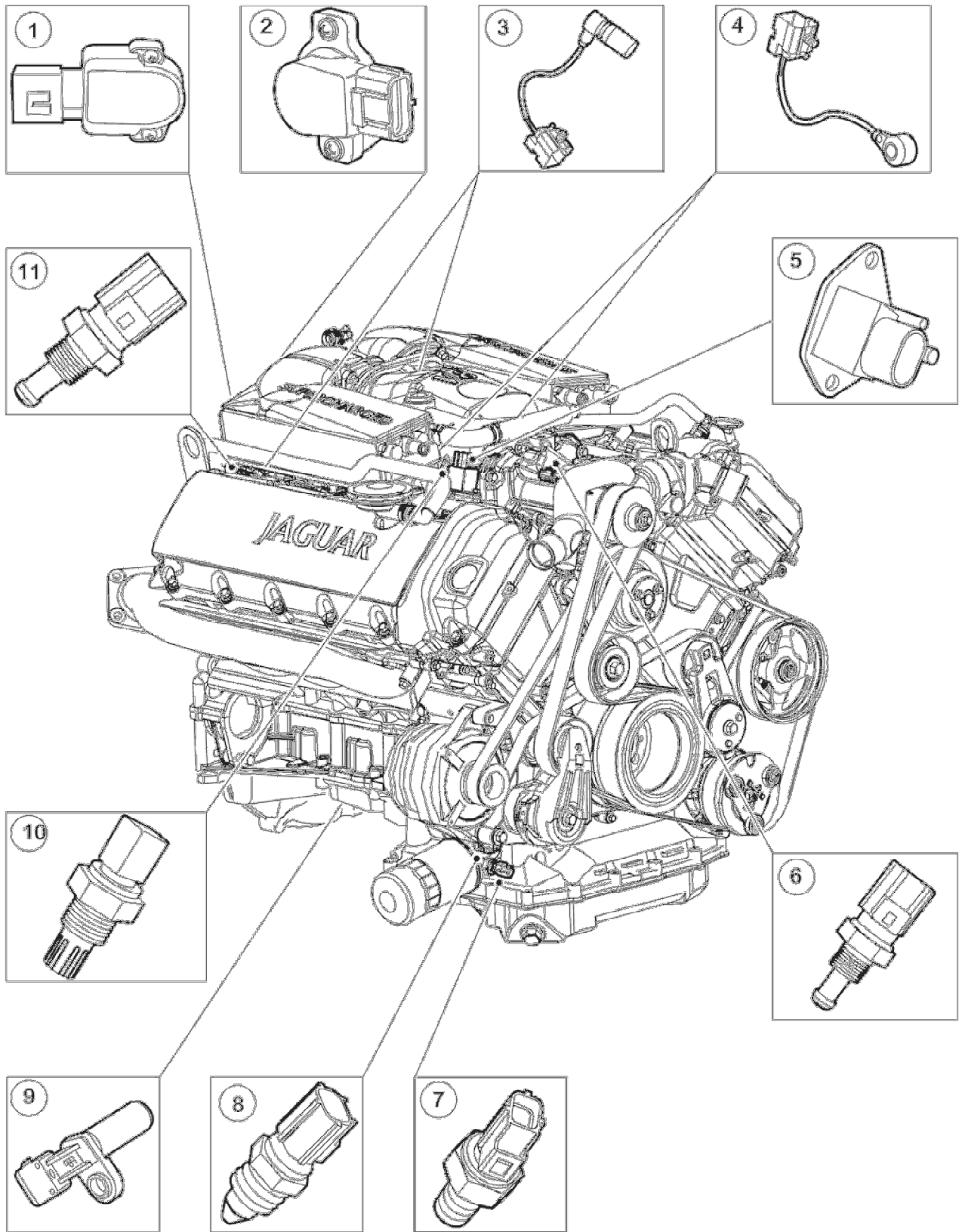


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Electronic Engine Controls

Vehicles with supercharger

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E37974

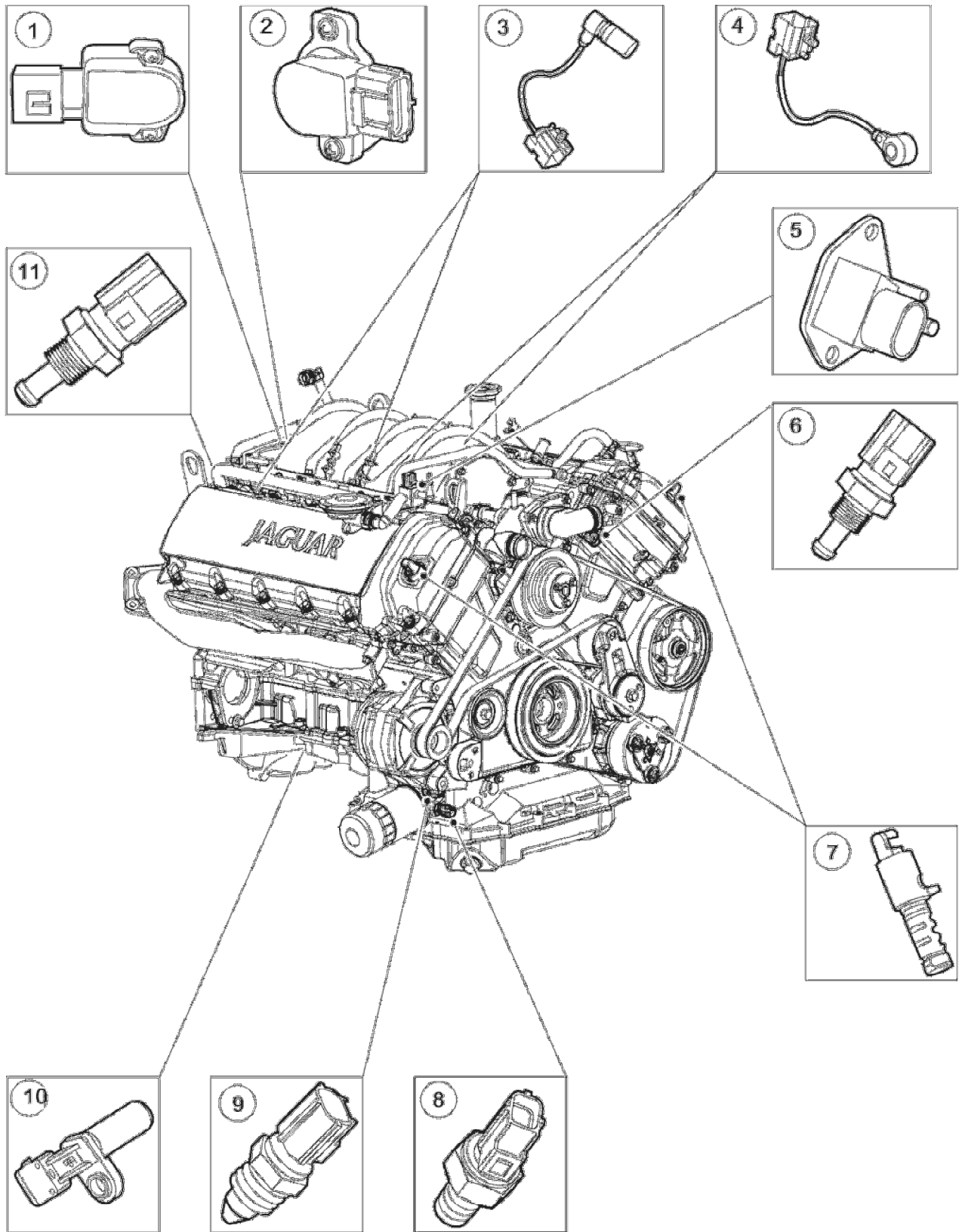
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LOFZ14

Item	Description
1	Throttle position (TP) sensor
2	Manifold absolute pressure (MAP) sensor
3	Camshaft position (CMP) sensor
4	Knock sensor (KS)
5	Fuel rail pressure (FRP) sensor
6	Engine coolant temperature (ECT) sensor
7	Oil pressure sensor
8	Oil temperature sensor
9	Crankshaft position (CKP) sensor
10	Intake air temperature (IAT) sensor
11	Fuel temperature sensor

Vehicles without supercharger

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E37973

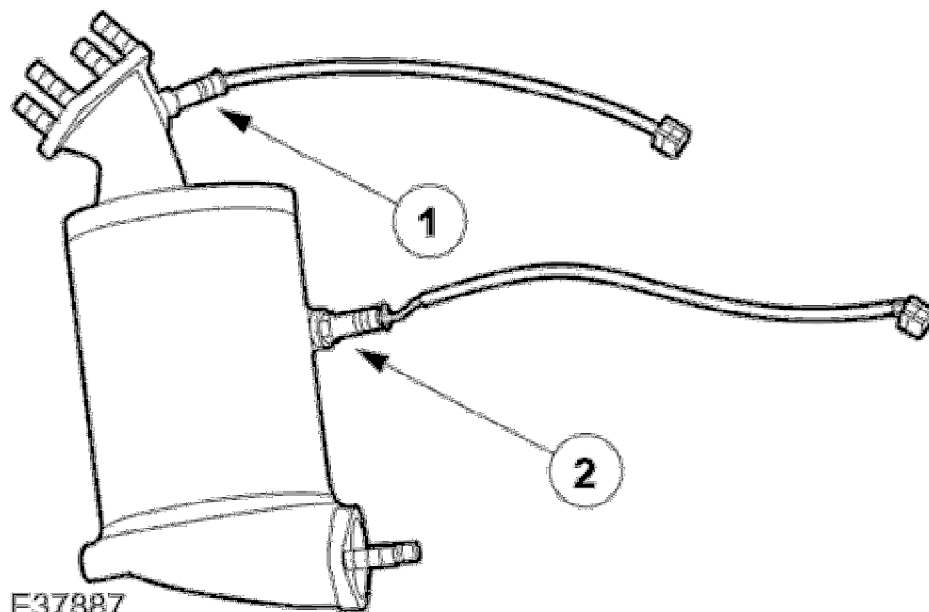
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E37873

Item	Description
1	Throttle position (TP) sensor
2	Manifold absolute pressure (MAP) sensor
3	Camshaft position (CMP) sensor
4	Knock sensor (KS)
5	Fuel rail pressure (FRP) sensor
6	Engine coolant temperature (ECT) sensor
7	Variable camshaft timing oil control solenoid
8	Oil pressure sensor
9	Oil temperature sensor
10	Crankshaft position (CKP) sensor
11	Fuel temperature sensor

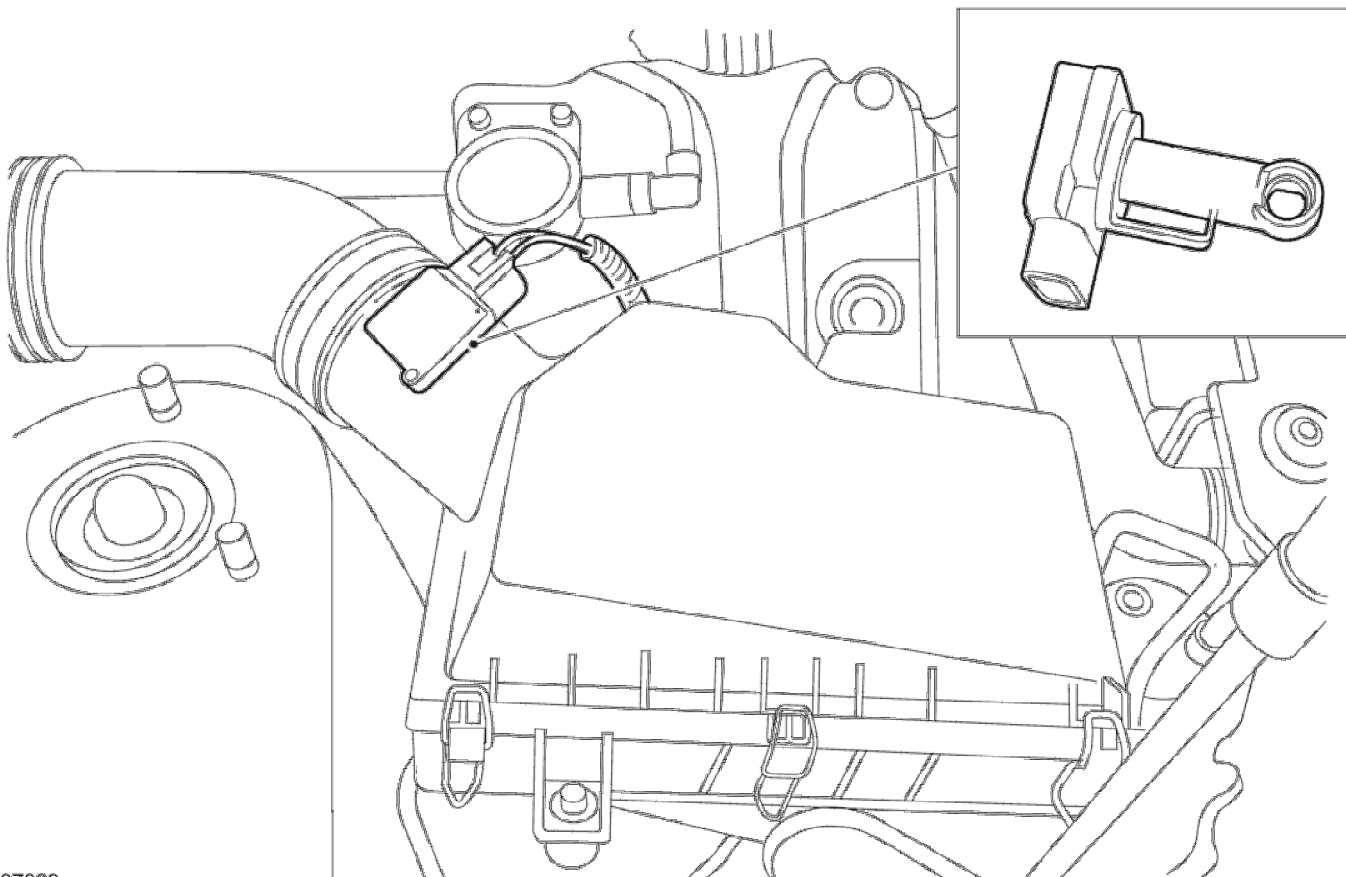
All vehicles

Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor



Item	Description
1	Heated oxygen sensor (HO2S)
2	Catalyst monitor sensor

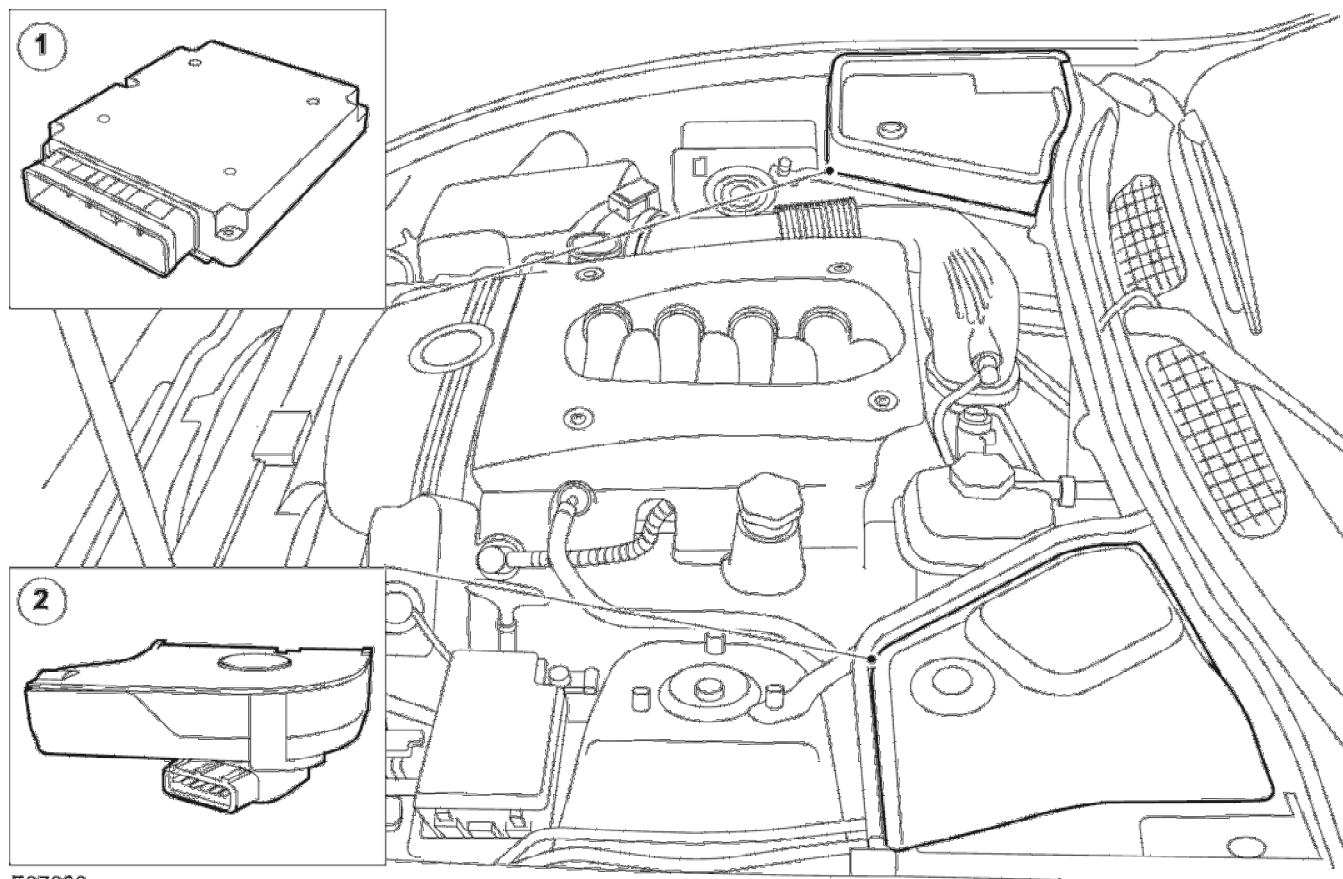
Mass Air Flow (MAF) Sensor



E37889

Engine Control Module (ECM) and Accelerator Pedal Position (APP) Sensor - Left-hand drive vehicles

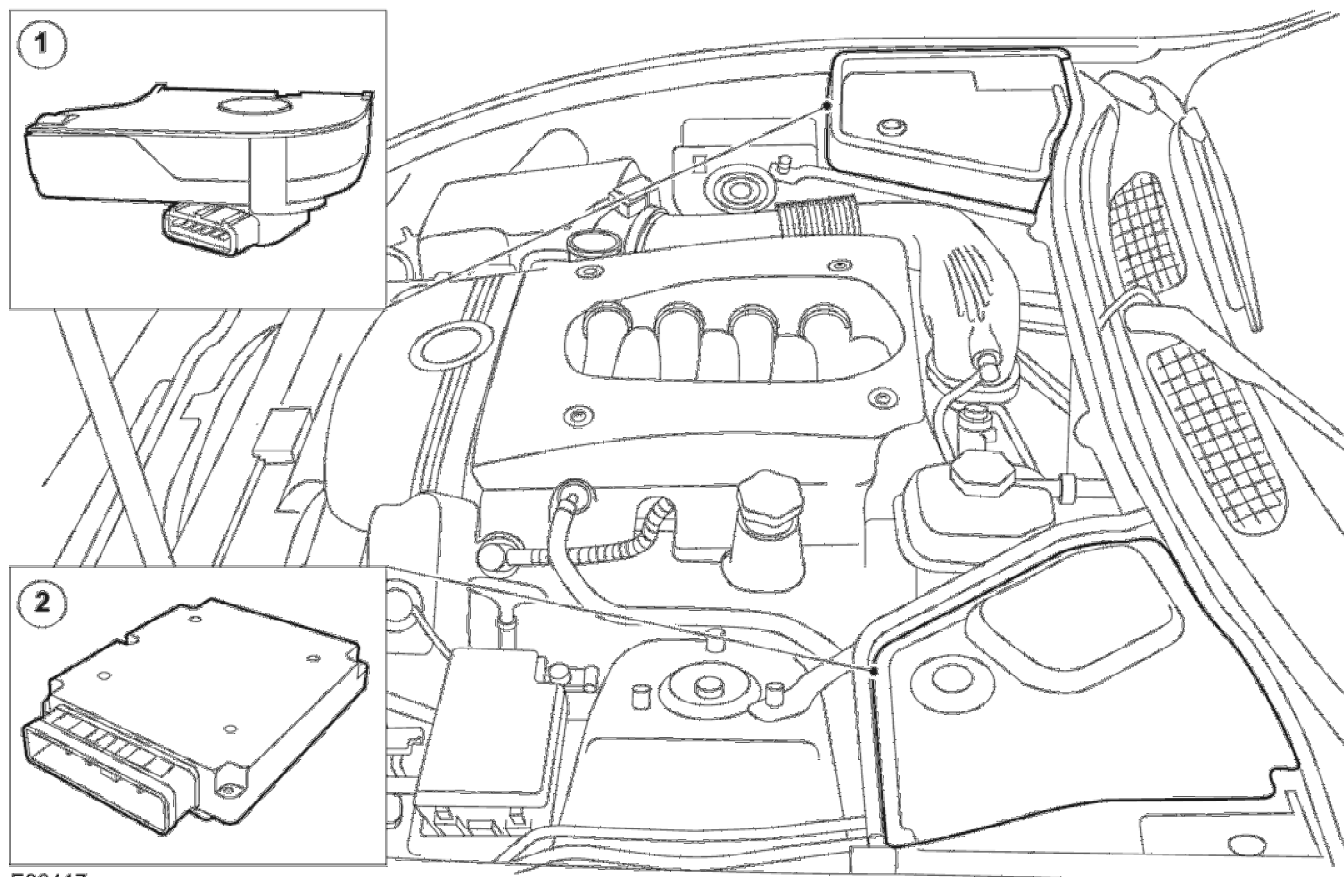
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E37888

Item	Description
1	Engine control module (ECM)
2	Accelerator pedal position (APP) sensor

Engine Control Module (ECM) and Accelerator Pedal Position (APP) Sensor - Right-hand drive vehicles



E38417

Item	Description
1	Accelerator pedal position (APP) sensor
2	Engine control module (ECM)

Engine Control Module (ECM)

The electronic engine control system consists of a engine control module (ECM), located behind the passenger side bulk head cover, and a number of sensing and actuating devices. The sensors supply the ECM with input signals which relate to the engine operating conditions and driver requirements. The sensor information is evaluated by the ECM using the results to activate the appropriate response from the actuating devices. The system provides the necessary engine control accuracy and adaptability to:

- Minimize exhaust emissions and fuel consumption.
- Provide optimum driver control under all conditions.
- Minimize evaporative emissions.
- Provide system diagnostics.

In addition to these functions the ECM also interfaces with other vehicle systems through the controller area network (CAN).

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensors monitor the position of both camshafts to allow the ECM to control the phase of the inlet camshafts relative to the position of the crankshaft.

Knock Sensors (KS)

The knock sensors (KS) detect combustion knock within the engine cylinders and sends a signal to the ECM. The ECM uses this information to gradually adjust the ignition timing until the combustion knock is eliminated.

Mass Air flow (MAF) Sensor

The mass air flow (MAF) sensor informs the ECM of the rate of air flow entering the engine by producing a voltage which is proportional to the rate of air flow into the engine. The voltage produced by the MAF sensor increases as the rate of air flow increases. The ECM takes into account the density of the air entering the air intake system so that it is possible to maintain the required air to fuel ratio, and to compensate for variations in atmospheric pressure.

Integral to the MAF sensor is the intake air temperature (IAT) sensor which measures the temperature of the air entering the air intake system. The ECM uses this information to compensate for higher than normal air intake temperatures.

Fuel Rail Pressure (FRP) Sensor

The fuel rail pressure (FRP) sensor is a pressure transducer device. A vacuum pipe connects to the intake manifold for manifold pressure. The ECM receives a voltage from the FRP sensor which is proportional to the fuel pressure in the fuel injection supply manifold.

Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor monitors the changes in pressure in the inlet manifold, sensing such changes as when the exhaust gas recirculation (EGR) valve is operated. If at any time the input signal to the ECM exceeds pre-defined thresholds due to low pressure readings for a calibrated period of time, a DTC is set.

Accelerator Pedal Position (APP) Sensor

The ECM monitors the angle of the accelerator pedal through the accelerator pedal position (APP) sensor. The APP sensor sends a signal to the ECM which is proportional to the angle of the accelerator. The APP sensor is connected to the accelerator pedal via an accelerator cable.

Throttle Position (TP) Sensor

The ECM monitors the angle of the throttle blade within the throttle housing through the throttle position (TP) sensor. The TP sensor sends a voltage to the ECM which is proportional to the angle of the throttle plate. The voltage from the TP sensor increases with the angle of the throttle plate. There are two sensor tracks within the TP sensor.

Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor is an inductive pulse generator, which scans protrusions on a pulse ring fitted to the front of the crankshaft to inform the ECM of the crankshaft position and speed. The CKP sensor produces an alternating voltage. The frequency of this voltage increases proportional to engine speed.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor type sensor that provides an input signal to the ECM which is proportional to the engine coolant temperature. The ECT sensor is a negative temperature coefficient

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(NTC) sensor and its resistance decreases with a proportional increase in engine coolant temperature.

Oil Temperature Sensor

The oil temperature sensor is a thermistor type sensor that provides an input signal to the ECM which is proportional to the engine oil temperature.

Oil Pressure Sensor

The oil pressure switch is connected to the instrument cluster and is not directly part of the electronic engine control system.

Heated Oxygen Sensor (HO2S)

The heated oxygen sensor (HO2S) is a linear characteristic type sensor, fitted forward of the exhaust system catalytic converter. The ECM uses this as its primary sensor to measure the oxygen content of the exhaust gasses within the exhaust system to provide closed-loop fueling control.

Catalyst Monitor Sensor

The catalyst monitor sensor is a non-linear characteristic type sensor fitted to the exhaust system catalytic converter. The ECM uses this as its secondary sensor to measure the oxygen content of the exhaust gases within the exhaust after they have passed through the catalytic converter. As well as providing additional closed-loop fuelling control the ECM uses this information to determine the efficiency of the catalytic converter.

Variable Camshaft Timing Oil Control Solenoid - Vehicles without supercharger

The variable camshaft timing oil control solenoid is a hydraulic actuator, which advances and retards the inlet camshaft timing, thereby altering the camshaft to crankshaft phasing for optimum engine performance.

Intake Air Temperature (IAT) Sensor - Vehicles with supercharger

Vehicles with supercharger have an additional intake air temperature (IAT) sensor located on the right-hand charge air cooler. The IAT sensor measures the temperature of the air entering the charge air cooler. The ECM uses this information to compensate for higher than normal intake air temperatures.