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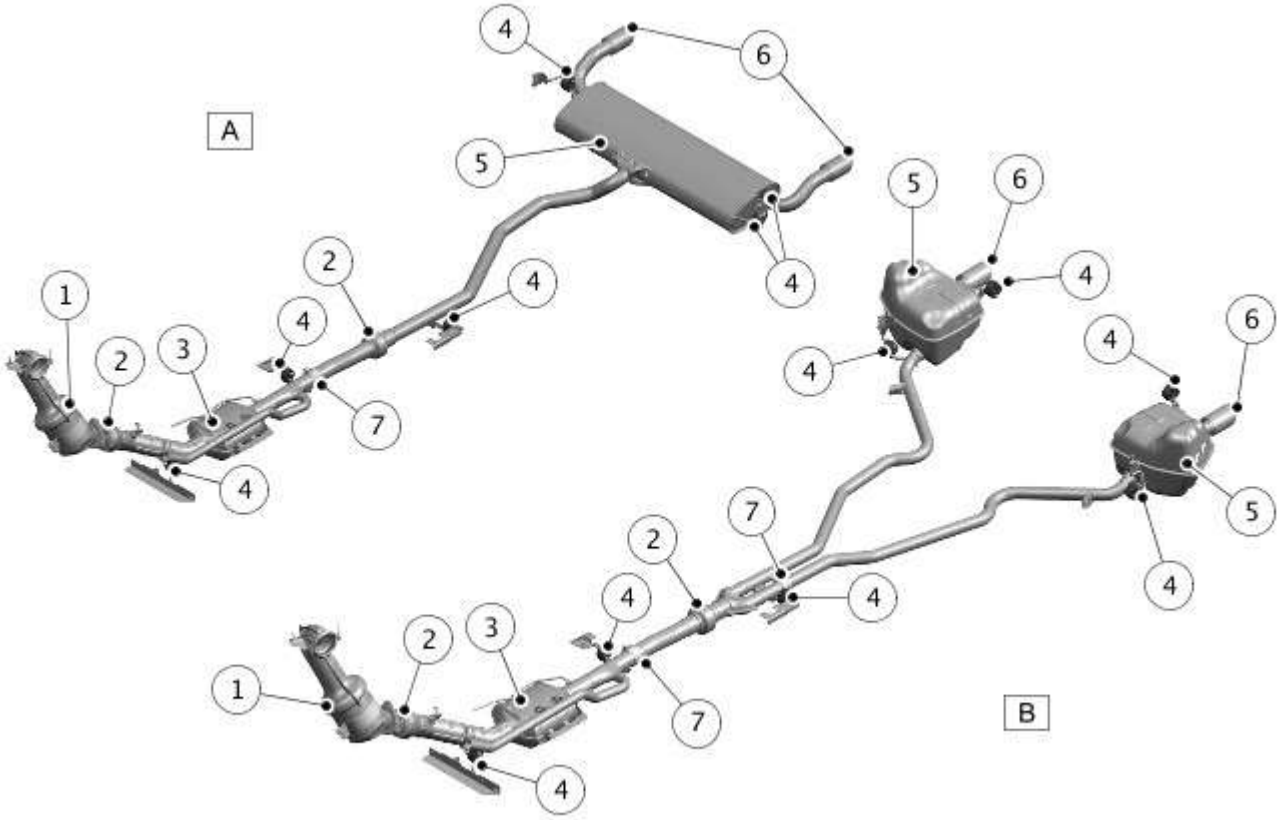
Exhaust System - INGENIUM I4 2.0L Diesel - Exhaust System

Description and Operation

COMPONENT LOCATION - SHEET 1 OF 2 - VEHICLES WITHOUT SELECTIVE CATALYST REDUCTION (SCR) SYSTEM



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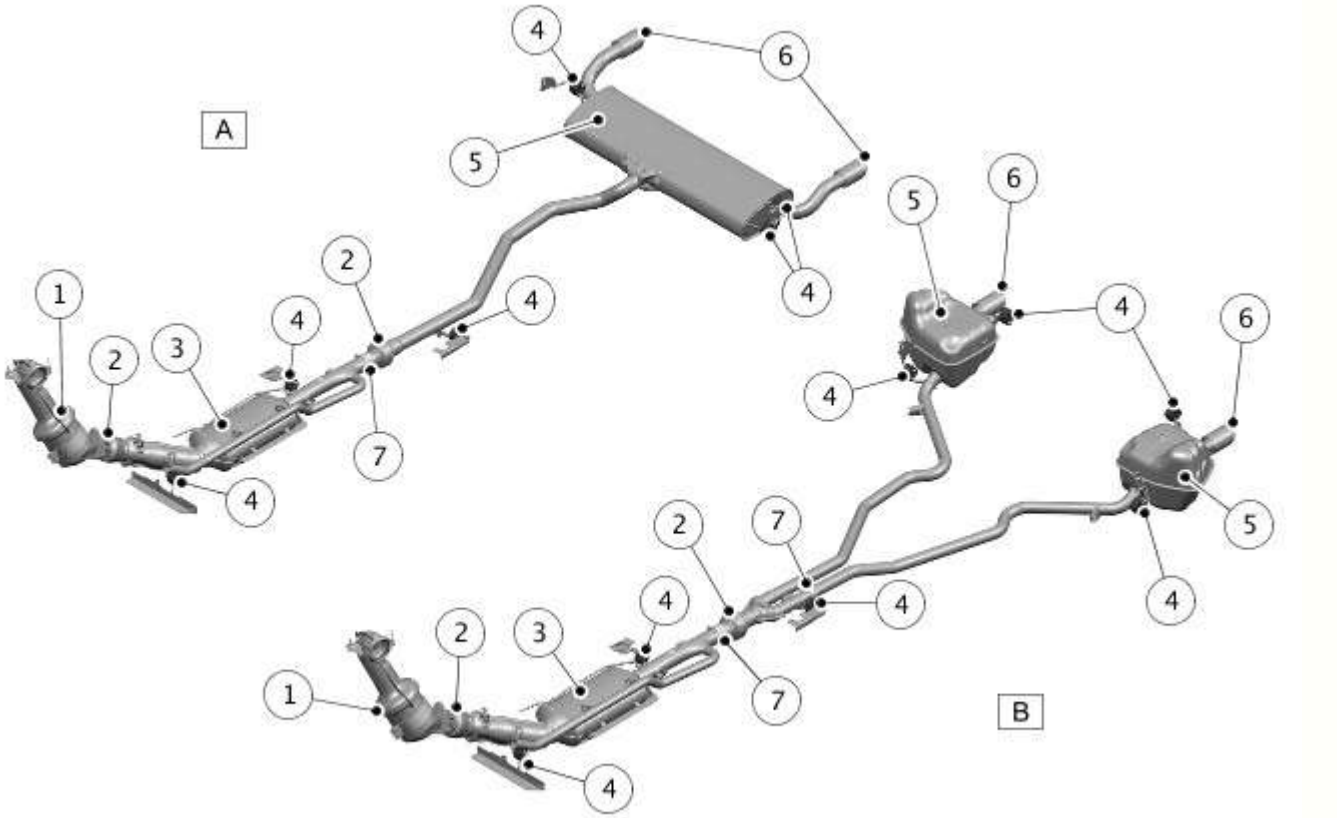
Item	Description
A	Vehicles with 5 seats
B	Vehicles with 7 seats
1	Catalytic converter
2	Flexible coupling
3	Diesel Particulate Filter (DPF)
4	Mounting rubber
5	Rear silencer
6	Outlet pipe
7	Clamp

COMPONENT LOCATION - SHEET 2 OF 2 - VEHICLES WITH SELECTIVE CATALYST REDUCTION (SCR) SYSTEM



Item	Description
A	Vehicles with 5 seats
B	Vehicles with 7 seats
1	Catalytic converter
2	Flexible coupling
3	Diesel Particulate Filter (DPF) and Selective Catalyst Reduction (SCR) catalytic converter assembly
4	Mounting rubber
5	Rear silencer
6	Outlet pipe
7	Clamp

OVERVIEW

The exhaust system is manufactured from stainless steel and is attached to the underside of the vehicle body with rubber mountings which are located on hanger bars that are welded to the exhaust system. The rubber mountings locate on adjacent hanger brackets which are bolted or welded to the underside of the vehicle body and the subframes.

The exhaust system comprises three separate sections:

- A front section, including a catalytic converter.
- A center section,
  - incorporating the Diesel Particulate Filter (DPF) and a connecting pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve on EU5 market vehicles.For additional information, refer to: Diesel Particulate Filter (309-00C, Description and Operation).
  - incorporating the Diesel Particulate Filter (DPF), the Selective Catalyst Reduction (SCR) catalytic converter and a connecting pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve on EU6 market vehicles.For additional information, refer to: Selective Catalyst Reduction (SCR) (309-00C, Description and Operation).
- A rear section,
  - comprising a single rear silencer with two outlet pipes on vehicles with 5 seats.
  - comprising two rear silencers on vehicles with 7 seats.

DESCRIPTION

Front Section

The front section has an inlet flange which mates with the turbocharger outlet. The flange is sealed with a stainless metallic gasket to the turbocharger and secured with a vee clamp onto the turbocharger housing.

An elbow from the flange is connected to the catalytic converter. The elbow contains a threaded boss for the installation of the Heated Oxygen Sensor (HO2S).

A support bracket with a stud is welded to the elbow. A mounting bracket is secured to the front section with a nut. The mounting bracket is connected to the top of the engine with three bolts, which secures the top of the front section to the engine. A band clamp is attached to the catalytic converter with a bolt to hold the front section in its position.

The catalytic converter is connected to a flange which mates with the flexible coupling of the center section.

Center Section - Vehicles Without Selective Catalyst Reduction (SCR) system

The center section is connected to the front section by a flange. It is sealed with a metal gasket and secured with three studs and nuts. The flange is connected to a flexible coupling with a pipe. The pipe comprises a threaded boss for the post-catalyst exhaust gas temperature sensor. A curved pipe from the flexible coupling is connected to the Diesel Particulate Filter (DPF). A threaded boss is welded to the pipe and provides the connection of the differential pressure sensor high pressure pipe. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the front subframe, to support the center section.

The DPF outlet pipe comprises threaded bosses for the post-DPF exhaust gas temperature sensor and the differential pressure sensor low pressure pipe. An additional pipe is welded to the outlet pipe, which routes the exhaust gases from the outlet pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the underside of the vehicle body, to support the center section.For additional information, refer to: (309-00C)

Diesel Particulate Filter (Description and Operation),
Diesel Particulate Filter (Description and Operation).

Center Section - Vehicles With Selective Catalyst Reduction (SCR) system

The center section is connected to the front section by a flange. It is sealed with a metal gasket and secured with three studs and nuts. The flange is connected to a flexible coupling with a pipe. The pipe comprises a threaded boss for the post-catalyst exhaust gas temperature sensor. A curved pipe from the flexible coupling is connected to the DPF and Selective Catalyst Reduction (SCR) catalytic converter assembly. A threaded boss is welded to the pipe and provides the connection of the differential pressure sensor high pressure pipe. A welded boss provides the attachment of the Diesel Exhaust Fluid (DEF) injector. A mixer plate is located in the exhaust pipe downstream of the DEF injector. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the front subframe, to support the center section.

The SCR outlet pipe comprises threaded bosses for the post-DPF exhaust gas temperature sensor, the differential pressure sensor low pressure pipe and the post-SCR nitrogen oxide (NOx) sensor. An additional pipe is welded to the outlet pipe, which routes the exhaust gases from the outlet pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the underside of the vehicle body, to support the center section.For additional information, refer to: Selective Catalyst Reduction (SCR) (309-00C, Description and Operation).

Rear Section - Vehicles With 5 Seats

If the vehicle is equipped with 5 seats, the exhaust system rear section comprises a single rear silencer. The rear section is connected to the center section with a clamp. The rear silencer is connected by a pipe to the center section and secured with a clamp.

The rear section inlet pipe comprises a flexible coupling and a welded hanger bar. A hanger bar is attached to the hanger bracket with a rubber mounting. The hanger bracket is bolted to the underside of the vehicle body.

The rear section inlet pipe is routed in a central position under the vehicle, with a slight deviation around the Rear Drive Unit (RDU), where it joins with the rear silencer. The rear silencer is supported by three rubber mountings. Two are attached to a hanger bracket bolted to the left side of the rear subframe and the third is attached to a hanger bracket on the right side of the rear subframe. The rear silencer has an outlet pipe at each end. Each outlet pipe is fitted with a stainless steel finisher.

Rear Section - Vehicles With 7 Seats

If the vehicle is equipped with 7 seats, the exhaust system rear section comprises two rear silencers. The rear section is connected to the center section with a clamp. The rear silencers are connected by two individual pipes to a 'Y' piece which the center section and secured with a clamp.

The rear section comprises a flexible coupling which is connected to the center section with a clamp. The flexible coupling outlet pipe is separated into two outlet pipes and a hanger bar and an exhaust brace are welded to the pipes to retain the system in position and reduce exhaust flexing. A hanger bar is attached to the hanger bracket with a rubber mounting. The hanger bracket is bolted to the underside of the vehicle body. The left rear silencer inlet pipe is connected to the rear section with a clamp. Inlet pipes to each rear silencer are routed with a slight deviation to each side of the RDU. Both inlet pipes have a welded hanger bar where it connects to the appropriate rear silencer. Rubber mountings and hanger brackets are attached to the hanger bars. The hanger brackets are bolted to the rear subframe on both side. Each rear silencer is connected to the rear armature via a welded hanger bar and rubber mounting. Each rear silencer has an outlet pipe at each end. Each pipe is fitted with a stainless steel finisher.

SYSTEM OPERATION

Catalytic Converter

The oxidizing catalytic converter is fitted in the front section of the exhaust system, after the Heated Oxygen Sensor (HO2S). The catalytic converter assembly is common to vehicles with or without the DPF, however, the catalyst coating specification varies depending on the market. The HO2S monitors the exhaust gases leaving the engine. The engine management system uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimise the exhaust emissions.For additional information, refer to: Electronic Engine Controls (303-14C, Description and Operation).

The catalytic converter further reduces the carbon monoxide and hydrocarbons content of the exhaust gases. In the catalytic converter the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called a 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing platinum, which is the active constituent for converting harmful emissions into inert by-products. The platinum adds oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

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Exhaust System - INGENIUM I4 2.0L Diesel - Diesel Particulate Filter

Diagnosis and Testing

Principle of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Diesel Particulate Filter (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:

If a control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

1. Verify the customer concern

2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
• Diesel particulate filter • Differential pressure sensor hoses • Differential pressure sensor metal pipes and unions • Differential pressure sensor mounting position integrity • Metal fatigue • Joints • Mountings • Clearance around components • Damaged diesel particulate filter	• Differential pressure sensor • Differential pressure sensor connector • Differential pressure sensor wiring harness • Electrical connector(s) • Sensor(s) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for DTCs and refer to the DTC Index

Symptom Chart

Symptom	Possible Causes	Action

Amber warning message on instrument cluster - DPF FULL REFER TO HANDBOOK -	• Blocked regeneration • Customer driving routine does not allow the system to clean the particulate filter	If DTC is P246B-00 or AMBER DPF FULL REFER TO HANDBOOK message is displayed with no other reported messages. No repair is required, if the vehicle is driven on a highway AS DIRECTED IN THE HANDBOOK then the light will be extinguished and the system self healed, nothing more than this is required
Lack of power	• Air intake system fault • Restricted exhaust system • Low fuel pressure • Exhaust Gas Recirculation (EGR) valve(s) fault • Turbocharger fault • Diesel Particulate filter fault	Check the air intake system. Check for a blocked catalytic converter or muffler, install new components as necessary. Check the fuel pressure. For EGR and turbocharger tests, refer to the relevant section of the workshop manual

DTC Index

NOTES:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component

Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer approved diagnostic system)

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals

DTC	Description	Possible Cause	Action
P0031-11	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit short to ground	• Front heated oxygen sensor heater control circuit short circuit to ground • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to ground • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0032-12	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit short to battery	• Front heated oxygen sensor heater control circuit short circuit to power • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor heater control circuit for short circuit to power • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

P0030-29	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Signal Invalid	• Front heated oxygen sensor heater control circuit high resistance, open circuit • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check the front heated oxygen sensor heater control circuit for high resistance, open circuit • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0135-29	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1 - Signal Invalid	• Exhaust system leak • Fuel control system fault • Front heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front heated oxygen sensor failure	• Refer to the relevant section of the workshop manual and check for and rectify any exhaust leak between cylinder head and catalytic converter. Check front heated oxygen sensor is correctly installed in exhaust manifold • Check fuel control system for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check the front heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0131-11	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) - Circuit Short To Ground	• Exhaust system leak • Fuel control system fault • Front heated oxygen sensor to engine control module wiring shield high resistance • Front heated oxygen sensor failure	• Check for and rectify any exhaust leak between cylinder head and catalytic converter. Check front heated oxygen sensor is correctly installed in exhaust manifold • Check fuel control system for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check front heated oxygen sensor to engine control module wiring shield for high resistance • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0132-12	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) - Circuit Short To Battery	• Exhaust system leak • Fuel control system fault • Front heated oxygen sensor to engine control module wiring shield high resistance • Front heated oxygen sensor failure • Fuel control system over fuelling • Front heated oxygen sensor failure	• Check for and rectify any exhaust leak between cylinder head and catalytic converter • Check front heated oxygen sensor is correctly installed in exhaust manifold • Check fuel control system for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check front heated oxygen sensor to engine control module wiring shield for high resistance • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0544-22	Exhaust Gas Temperature Sensor Circuit - Bank 1 Sensor 1 - Signal Amplitude > Maximum	• Exhaust gas temperature sensor circuit, short circuit to power, short circuit to ground, open circuit • Exhaust gas temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure, exhaust gas temperature sensor circuit, for short circuit to power, short circuit to ground, open circuit • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

P0545-16	Exhaust Gas Temperature Sensor Circuit Low - Bank 1 Sensor 1 - Circuit Voltage Below Threshold	• Exhaust gas temperature sensor circuit, short circuit to power, short circuit to ground, open circuit • Exhaust gas temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure, exhaust gas temperature sensor circuit, for short circuit to power, short circuit to ground, open circuit • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0546-17	Exhaust Gas Temperature Sensor Circuit High - Bank 1 Sensor 1 - Circuit Voltage Above Threshold	• Exhaust gas temperature sensor circuit, short circuit to power • Exhaust gas temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure, exhaust gas temperature sensor circuit, for short circuit to power • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P064D-00	Internal Control Module O2 Sensor Processor Performance Bank 1 - No sub type information	• Fuel control system fault • Front Heated Oxygen sensor to engine control module wiring shield high resistance • Front Heated Oxygen sensor failure	• Refer to the electrical circuit diagrams and check front heated oxygen sensor circuit for short circuit to power, short circuit to ground, open circuit • Check front heated oxygen sensor harness for signs of damage caused by chaffing or heat • Check front heated oxygen sensor for damage • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2031-22	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 2 - Signal Amplitude > Maximum	• Pre-catalyst temperature sensor contaminated • Pre-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Pre-catalyst temperature sensor failure	• Check the pre-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the pre-catalyst temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install a new pre-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2032-16	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 2 - Circuit Voltage Below Threshold	• Pre-catalyst temperature sensor contaminated • Pre-catalyst temperature sensor circuit short circuit to ground • Pre-catalyst temperature sensor failure	• Check the pre-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the pre-catalyst temperature sensor circuits for short circuit to ground • Check and install a new pre-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2033-17	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 2 - Circuit Voltage Above Threshold	• Pre-catalyst temperature sensor contaminated • Pre-catalyst temperature sensor circuit short circuit to power	• Check the pre-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the pre-catalyst temperature sensor circuits for short circuit to power • Check and install a new pre-catalyst temperature sensor as required. Refer to the warranty policy and procedures

		• Pre-catalyst temperature sensor failure	manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2080-62	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 1 - Signal Compare Failure	• Exhaust Gas temperature sensor contaminated • Exhaust Gas temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Exhaust Gas temperature sensor failure	• Check the Exhaust Gas temperature sensor for contamination • Refer to the electrical circuit diagrams and check the exhaust gas temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2080-64	Exhaust Gas Temperature Sensor Circuit Range/Performance - Bank 1 Sensor 1 - Signal plausibility failure	• Exhaust gas temperature sensor circuit, short circuit to power, short circuit to ground, open circuit • Exhaust gas temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure, exhaust gas temperature sensor circuit, for short circuit to power, short circuit to ground, open circuit • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2084-62	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 2 - Signal Compare Failure	• Pre-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit • Pre-catalyst temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Check and install a new pre-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2251-13	O2 Sensor Negative Current Control Circuit / Open - Bank 1, Sensor 1 - Circuit Open	• Front heated oxygen sensor circuit open circuit, high resistance • Front heated oxygen sensor failure	• Refer to the electrical circuit diagrams and check the front heated oxygen sensor circuit for open circuit, high resistance • Check and install a new front heated oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2478-84	Exhaust Gas Temperature Out of Range - Bank 1 Sensor 1 - Signal Below Allowable Range	• Exhaust Gas temperature sensor contaminated • Exhaust Gas temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Exhaust Gas temperature sensor failure	• Check the Exhaust Gas temperature sensor for contamination • Refer to the electrical circuit diagrams and check the exhaust gas temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
	Exhaust Gas	• Exhaust Gas temperature sensor contaminated	• Check the Exhaust Gas temperature sensor for contamination

P2478-85	Temperature Out of Range - Bank 1 Sensor 1- Signal Above Allowable Range	• Exhaust Gas temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Exhaust Gas temperature sensor failure	• Refer to the electrical circuit diagrams and check the exhaust gas temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install a new exhaust gas temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2479-22	Exhaust Gas Temperature Out of Range - Bank 1 Sensor 2 - Signal Amplitude > Maximum	• Pre-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit • Pre-catalyst temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Check and install a new pre-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2479-85	Exhaust Gas Temperature Out of Range - Bank 1 Sensor 2 - Signal Above Allowable Range	• Pre-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit • Pre-catalyst temperature sensor failure	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Check and install a new pre-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242A-22	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 3 - Signal Amplitude > Maximum	• Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Post-catalyst temperature sensor failure	• Check the post-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242B-62	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 3 - Signal Compare Failure	• Catalyst damaged • Air leak intake air system • Diesel particulate filter damaged • Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Post-catalyst temperature sensor failure	• Check the catalyst for damage • Check intake air system for leakage • Check the diesel particulate filter for damage • Check post-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

P242B-64	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 3 - Signal plausibility failure	• Post-catalyst temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor failure	• Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to power, short circuit to ground, open circuit, high resistance • Check post-catalyst temperature sensor for contamination • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242C-16	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 3 - Circuit Voltage Below Threshold	• Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor circuit short circuit to ground • Post-catalyst temperature sensor failure	• Check the post-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to ground • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242D-17	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 3 - Circuit Voltage Above Threshold	• Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor circuit short circuit to power • Post-catalyst temperature sensor failure	• Check the post-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to power • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P244A-95	Diesel Particulate Filter Differential Pressure Too Low(Bank1) - Incorrect Assembly	• Diesel particulate filter hose line removed or crossed over	• Check that the hoses coming from the diesel particulate filter to the sensor at the rear of the cylinder head are installed correctly, secure and in good condition • Check differential pressure sensor hose lines are not frozen • Check differential pressure sensor hose lines are installed correctly • Check differential pressure sensor hose lines for mechanical integrity • Refer to the electrical circuit diagrams and check the differential pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new differential pressure sensor as required • Using the manufacturer approved diagnostic system carry out 'Diesel particulate filter differential pressure sensor replacement' routine (perform routine - Reset Specified Information) • Using the manufacturer approved diagnostic system clear all stored DTCs using the Diagnosis Menu tab and retest
P2452-08	Diesel Particulate Filter (DPF) Pressure Sensor A Circuit Low	• Harness fault - diesel particulate filter, differential pressure sensor • Diesel particulate filter, differential	• Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage • Check the sensor harness for chaffing or heat damage • Refer to the electrical circuit diagrams and check the diesel particulate filter, differential pressure sensor signal circuit for open circuit, short circuit to ground, short to other circuits • Check the sensor ground circuit for open circuit, short circuit to power, high resistance

	- Bus Signal / Message Failures	pressure sensor failure. no longer communicating with the engine control module	• Check the sensor power supply circuit for open circuit, short circuit to ground, high resistance • Repair wiring as required, if there are no wiring faults. Check and install a new diesel particulate filter, differential pressure sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2463-00	Diesel Particulate Filter Restriction - Soot Accumulation (Bank 1) - no sub type information	• Maximum soot mass	• Check engine control module for DPF related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system carry out a service regeneration procedure • Check charge air system for leakage, split pipework, loose hose clips & damaged hoses • Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals 0x0466 Turbocharger/Supercharger Boost Pressure A - Desired • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P247A-84	Exhaust Gas Temperature Out of Range - Bank 1 Sensor 3 - Signal Below Allowable Range	• Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor circuit short circuit to ground • Post-catalyst temperature sensor failure	• Check the post-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to ground • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P247A-85	Exhaust Gas Temperature Out of Range - Bank 1 Sensor 3	• Post-catalyst temperature sensor contaminated • Post-catalyst temperature sensor circuit short circuit to ground • Post-catalyst temperature sensor failure	• Check the post-catalyst temperature sensor for contamination • Refer to the electrical circuit diagrams and check the post-catalyst temperature sensor circuits for short circuit to ground • Check and install a new post-catalyst temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

Pinpoint Tests

PINPOINT TEST A : DTC CHECK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR OTHER DTCS	
	1 Using the manufacturer approved diagnostic system, check engine control module for DPF related DTCs
	Are any DTCs stored? **Yes** Refer to the relevant DTC Index and carry out the relevant repair procedure. **Only after the repair,** using the manufacturer approved diagnostic system clear the DTC and re-test **No** Proceed to next step
A2: EXHAUST PIPE AND JOINTS	
	1 Check all exhaust pipes and joints for leaks
	2 Check for external damage to the diesel particulate filter metalwork
	Are any of the exhaust pipes leaking, or is there external damage to the diesel particulate filter metalwork? **Yes** Repair leaking exhaust joints as required Check and install a new diesel particulate filter as requiredRefer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

	No Proceed to next step
A3: DIESEL PARTICULATE FILTER PRESSURE SENSOR PIPES	
	1 Check differential pressure sensor pipes for cracks, mis-routing or hoses crossed
	Are any of the differential pressure sensor pipes cracked, mis-routed or hoses crossed? **Yes** Repair as required, clear DTC and retest **No** Proceed to next step
A4: HARNESS DIFFERENTIAL PRESSURE SENSOR	
	1 Check wiring harness to the differential pressure sensor, include any inline connectors
	Was the wiring harness to the differential pressure sensor damaged? **Yes** Repair wiring harness as required, clear DTC and retest **No** Proceed to next step
A5: CONNECTOR INTEGRITY DIFFERENTIAL PRESSURE SENSOR	
	1 Check differential pressure sensor connector for damage and terminal corrosion
	Was the differential pressure sensor connector damaged or terminal corrosion present? **Yes** Refer to the electrical circuit diagrams and check connections are secure and wiring integrity. Repair as required, clear DTC and retest **No** Proceed to next step
A6: FUNCTIONAL CHECK DIFFERENTIAL PRESSURE SENSOR	
	NOTES: The Particulate Filter Differential Pressure Sensor measured voltage with the ignition on checks the sensor output with no variation/pressure in the exhaust system, checking the Particulate Filter Differential Pressure Sensor adaption is working. The measured voltages at engine idle and 4000 RPM will be considerably different depending on the diesel particulate filter soot loading. The idle value tells us that the Particulate Filter Differential Pressure Sensor is working if it goes up from the ignition on value. The 4000 RPM value tells us how much soot is in the diesel particulate filter. A diesel particulate filter which is recoverable measures less than 1 Volt / 93mbar at 4000 RPM If a new differential pressure sensor or hose lines have been installed, incorrectly routed, or any differential pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new differential pressure sensor offset value. The following conditions must be met to allow the differential pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store differential pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa 1 Using the manufacturer approved diagnostic system check datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) under the conditions described below. Allow the voltage to stabilize before recording the value for approximately 7 seconds • Ignition is ON and engine speed is 0 RPM • Engine idle speed • Engine speed is 4000 RPM
	Was datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) - value approximately 0.4 Volts when ignition ON and engine speed is 0 RPM?Was datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) - value less than 1 Volt when engine speed at idle?Was datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) - value less than 1 Volt when engine speed at 4000 RPM? (0.5volt = 14mbar, 1 volt = 106mbar at 4000RPM) **Yes** Proceed to next step **No** Check and install a new differential pressure sensor as requiredRefer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/componentUsing the manufacturer approved diagnostic system clear the DTC and re-test NOTE: If a new differential pressure sensor or hose lines have been installed, incorrectly routed, or any differential pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new differential pressure sensor offset value. The following conditions must be met to allow the differential pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system,

	clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store differential pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa
A7: ACCELERATION SMOKE TEST	
	 NOTE: Ensure the engine is at normal operating temperature 1 Increase the engine speed momentarily to 4000RPM and allow the engine to settle back to idle
	2 Carry out above step 3 times
	3 Carry out visual check for excessive black smoke leaving the tailpipe during each of the 3 tests
	Is excessive black smoke visible leaving the tailpipe during each of the 3 tests? **Yes** Note: Only install a new diesel particulate filter if black smoke is visible leaving the tailpipe Check and install a new diesel particulate filter as requiredRefer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/componentUsing the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer **No** Check and install a new differential pressure sensor as requiredCarry out differential pressure sensor adaption process

PINPOINT TEST B : RED WARNING MESSAGE DPF FULL VISIT DEALER IS DISPLAYED AND DTC P2463-00 IS LOGGED

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: VIN INFORMATION	
	1 Record the full vehicle identification number for the vehicle under test, as this information may later be required by dealer technical support
	Has the vehicle identification number been recorded? **Yes** Proceed to the next step **No** Record the vehicle identification number and proceed to the next step
B2: VEHICLE MILEAGE	
	1 Record the full mileage for the vehicle under test, as this information may later be required by dealer technical support
	Has the mileage been recorded? **Yes** Proceed to the next step **No** Record the mileage and proceed to the next step
B3: VEHICLE SOFTWARE PART NUMBER	
	1 Using the manufacturer approved diagnostic system, record the software part number for the Engine Control Module (ECM)
	Has the software part number been recorded? Is the software installed to the vehicle to the latest relevant level? **Yes** Proceed to the next step **No** Record the software part number and proceed to the next step
B4: RECORD ALL ENGINE CONTROL MODULE (ECM) DTCS	
	1 Using the manufacturer approved diagnostic system, check Engine Control Module (ECM), for related DTCs
	Are other DTCs logged? **Yes** Proceed to the next step **No** Proceed to step 7
B5: DTC P2459-65 IS LOGGED	
	1 Using the manufacturer approved diagnostic system, the logged mileage for DTCs can be seen by viewing the snapshot data
	Was DTC P2459-65 logged at a mileage up to 625 miles (1000KM) before the diagnostic trouble P2463-00 was logged? **Yes** Suspect the customer has ignored the AMBER DPF FULL REFER TO HANDBOOK message. The customer should be advised of this and the repair may become chargeable Proceed to step 7 **No** Proceed to the next step
B6: OTHER RELATED ENGINE CONTROL MODULE (ECM) DTCS	

	1 Related Engine Control Module (ECM) DTCs other than P2459-65 and P2463-00 are logged
	Are related Engine Control Module (ECM) DTCs other than P2459-65 and P2463-00 logged? **Yes** Refer to the relevant DTC Index. Repair as required. Using the manufacturer approved diagnostic system clear the DTCs and re-test **No** Proceed to step 7
B7: DIESEL PARTICULATE FILTER REGENERATION CYCLE	
	NOTE: Using the manufacturer approved diagnostic system begin to perform a service regeneration cycle, **DO NOT** drive the cleaning cycle. **Record the grams of soot only** 1 With the engine at running temperature check the pre catalyst oxygen sensor operation as follows:-
	2 Using the manufacturer approved diagnostic system check datalogger signals - Oxygen Sensor Voltage - (0xF424) • Idle vehicle and record, should be (0.7 ~ 1 volt) • Idle to 100% pedal, during acceleration record, should be 0 ~ 0.2 volts • Accelerate to 4500RPM (stationary) and close throttle, should read 1.15 ~ 1.2 volts
	Does the pre catalyst oxygen sensor meets this criteria? **Yes** Pre catalyst oxygen sensor is operating correctlyNote: **DO NOT** carry out the adaption process on the pre catalyst oxygen sensor, as this resets the adaption to 0Proceed to step 8 **No** Pre catalyst oxygen sensor adaption cycle is required Pre catalyst oxygen sensor adaption cycle is **NOT** possible while DTCs are loggedUsing the manufacturer approved diagnostic system, carry out FIT NEW PARTICULATE FILTER PROCESS only and clear the DTCsAfter completing FIT NEW PARTICULATE FILTER PROCESS continue with pre catalyst oxygen sensor adaption cycle as follows:-1. Idle vehicle for 10 minutes2. Set car in command shift 3rd gear3. Accelerate to 3800RPM (where achievable) and overrun / coastdown without braking until revs drop below 1500 RPM4. Repeat step 3 a further 3 times5. Check for any DTCs, if adaption failed a DTC will be evident and the sensor will require replacement6. Check oxygen sensor adaption is now complete by returning to B7 item 27. Using the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer
B8: SOOT ESTIMATOR IS ACCURATE AND THE DIFFERENTIAL PRESSURE SENSOR READING IS WORKING CORRECTLY	
	1 Using the manufacturer approved diagnostic system check datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) • Record value with ignition ON • Idle engine record value • Hold engine speed at 4000RPM and record value • Note: 0.7volt = 37mbar, 1 volt = 93mbar at 4000RPM
	Have the values been recorded for each of the conditions? **Yes** Proceed to step 9 **No** Record values for each of the conditions and proceed to step 9
B9: EXHAUST GAS TEMPERATURES	
	1 Using the manufacturer approved diagnostic system check datalogger signals • Exhaust Gas Temperature Bank 1 Sensor 2 - (0x03F5) • Exhaust Gas Temperature Bank 1 Sensor 1 - (0x03F4) • Exhaust Gas Temperature Bank 1 Sensor 2 - (0x03F5) • Exhaust Gas Temperature Bank 1 Sensor 3 - (0x03F6)
	2 Hold engine speed at 2000RPM for 2 minutes and record values (By doing this we are trying to establish if the system can recognize heat in the exhaust during regeneration)
	Are all of the exhaust gas temperature sensors showing reasonable values between 120°C and 400°C? **Yes** Proceed to step 10 **No** Check and install new exhaust gas temperature sensors as required. Refer to the new module/component installation note at the top of the DTC Index Using the manufacturer approved diagnostic system clear the DTCs and re-test
B10: COMPARISON OF SOOT MASS IN DIESEL PARTICULATE FILTER AND PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR VOLTAGE	
NOTE: Using the results from steps 7 and 8 establish if the Soot Mass estimator and the differential pressure sensor are aligned, in terms of their assessment of soot in the filter. If the soot mass is less than 35 grams the diesel particulate filter is recoverable.	
	1 Using the results from step 7 check soot mass is less than 35 grams

	2 Using the results from step 8 check particulate filter differential pressure sensor voltage at 4000RPM is less than 1 Volt (93mbar)
	Is diesel particulate filter soot mass value less than 35 grams and particulate filter differential pressure sensor voltage at 4000RPM less than 1 Volts (93mbar)? **Yes** If the diesel particulate filter soot mass value is greater than 35 grams and the differential pressure sensor voltage is between 0.5Volts and 1 Volt then the diesel particulate filter is low on soot but has not been driven to allow pressure correction of the diesel particulate filter, if other issue from the tests performed are evident. Proceed to next step **No** If the diesel particulate filter soot mass value is greater than 35 grams and the differential pressure sensor voltage greater than 1 Volt then the diesel particulate filter has a high soot contentIf no other issue from the tests performed are evident then the vehicle has a soot generated fault not detected by DTCs. Refer to the relevant section of the workshop manual and check for boost pressure leakage using the manufacturer approved leak check toolContact dealer technical support for further advice
B11: SOOT MASS REDUCTION	
	1 With the vehicle fully up to temperature and in Park maintain 2500RPM for 3 minutes
	2 Return to step 7, check diesel particulate filter soot mass value
	Has the diesel particulate filter soot mass reduced from the original reading to less than 26 grams? **Yes** Proceed to next step **No** Proceed to step 13
B12: DRIVE VEHICLE	
	CAUTION: At all times during this procedure you should observe all relevant speed limits, laws, and regulations 1 Drive the vehicle until the engine reaches normal operating temperature. The engine should **NOT** be left idling to achieve working temperature. Drive the vehicle for a further twenty minutes, keeping the vehicle at a constant speed between 75 km/h (45 mph) and 120 km/h (75 mph). Keeping a constant speed enables the diesel particulate filter to regenerate more efficiently. It is therefore recommended that cruise control is used to achieve this, if possible (Do NOT carry out diesel particulate filter service regeneration)
	Is the diesel particulate filter soot mass less than 15 grams? **Yes** Using the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer **No** Contact dealer technical support with all of the recorded values from the above tests
B13: CARRY OUT FIT NEW PARTICULATE FILTER PROCESS	
	WARNING: **DO NOT** carry out this process on any other occasion without first installing a new diesel particulate filter 1 Using the manufacturer approved diagnostic system, select SPECIAL APPLICATIONS ~ POWERTRAIN ~ carry out FIT NEW PARTICULATE FILTER PROCESS
	2 Carry out diesel particulate filter service regeneration. Record grams of soot following diesel particulate filter service regeneration
	Is the diesel particulate filter soot mass less than 15 grams? **Yes** Using the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer **No** Contact dealer technical support with all of the recorded values from the above tests

Diesel particulate filter regeneration procedure

CAUTION: The regeneration procedure produces high temperatures in the diesel particulate filter. Heat can be felt radiating from beneath the vehicle, which is normal and not a cause for concern. However, the vehicle should not be parked over combustible material, particularly during dry weather. The heat generated could be sufficient to start a fire when in close proximity to combustible material such as long dry grass, paper etc

If DPF FULL SEE HANDBOOK appears in the message center, carry out the following procedure

CAUTION: At all times during this procedure you should observe all relevant speed limits, laws, and regulations

1. Drive the vehicle until the engine reaches normal operating temperature. The engine should **NOT** be left idling to achieve working temperature

2. Drive the vehicle for a further twenty minutes, keeping the vehicle at a constant speed between 75 km/h (45 mph) and 120 km/h (75 mph)

NOTE: The ideal speed and conditions for regeneration are 100 km/h (62 mph) ~ 120 km/h (75 mph), in Drive. Keeping a constant speed enables the diesel particulate filter to regenerate more efficiently. It is therefore recommended that cruise control is used to achieve this, if possible

3. If regeneration is successful the warning message will be extinguished, once the message is extinguished please keep driving for 10 minutes to ensure that the diesel particulate filter is completely clean

4. If the message remains repeat the process

NOTE: When driving off-road during the regeneration process, greater accelerator pedal use may be required

DTC Index

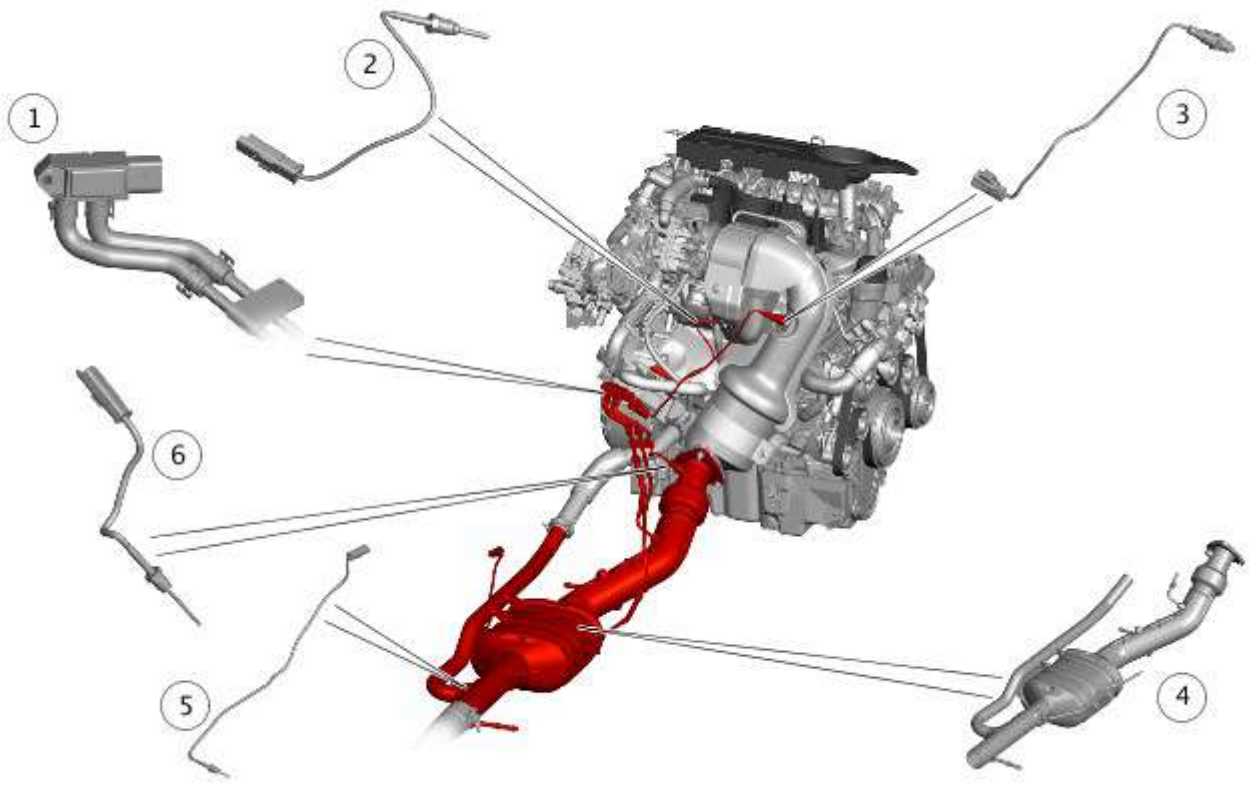
For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - INGENIUM I4 2.0L Diesel, DTC: Engine Control Module (ECM) B10A2-07 to P034B-76 (100-00 General Information, Description and Operation).

Published: 21-Jul-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Diesel Particulate Filter - Component Location

Description and Operation

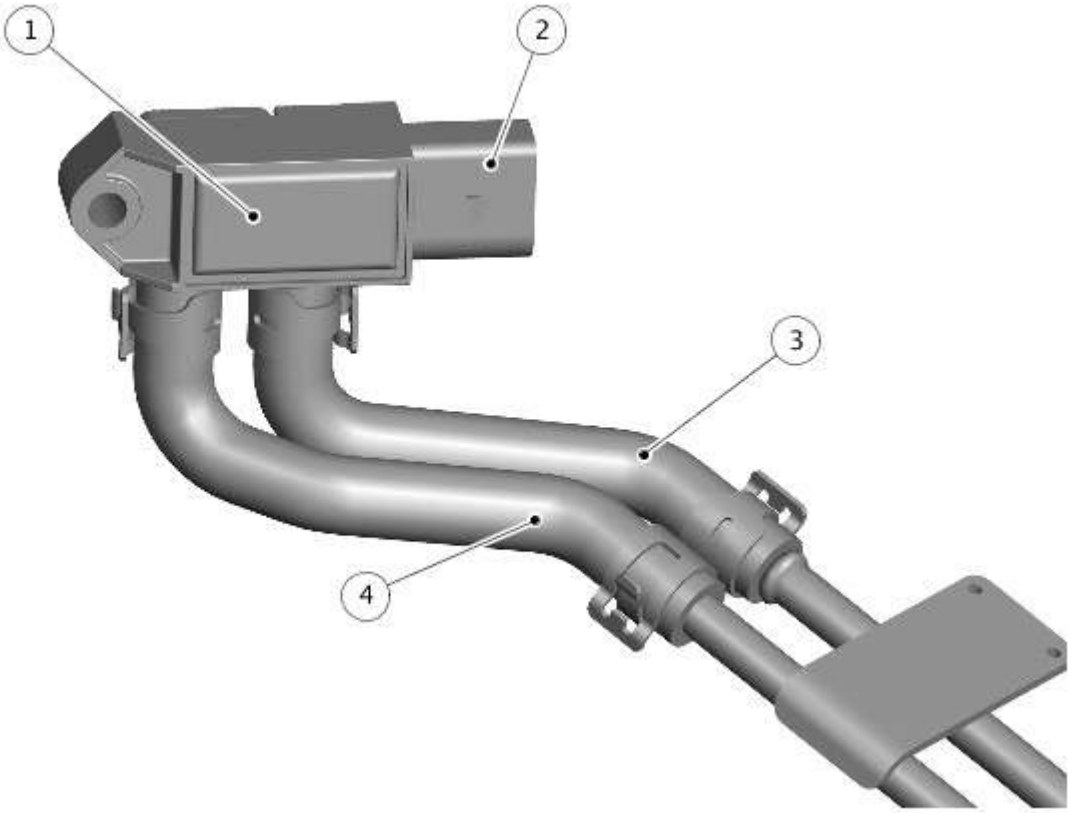
COMPONENT LOCATION - SHEET 1 OF 3 - DIESEL PARTICULATE FILTER (DPF)



E181167

Item	Description
1	Differential pressure sensor
2	Pre-catalytic converter exhaust gas temperature sensor
3	Heated Oxygen Sensor (HO2S)
4	Diesel Particulate Filter (DPF)
5	Post-Diesel Particulate Filter (DPF) exhaust gas temperature sensor
6	Pre-Diesel Particulate Filter (DPF) exhaust gas temperature sensor

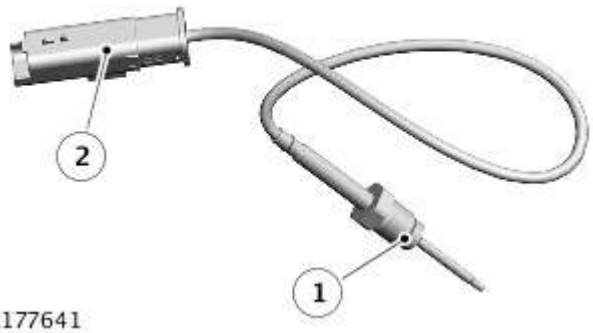
COMPONENT LOCATION - SHEET 2 OF 3 - DIFFERENTIAL PRESSURE SENSOR



E181168

Item	Description
1	Differential pressure sensor
2	Electrical connection
3	Differential pressure sensor pipe - low
4	Differential pressure sensor pipe - high

COMPONENT LOCATION - SHEET 3 OF 3 - EXHAUST GAS TEMPERATURE SENSOR



E177641

Item	Description
1	Exhaust gas temperature sensor
2	Electrical connection

Published: 18-Aug-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Exhaust System DTC: Selective Catalytic Reduction (SCR)

Diagnosis and Testing

Principle of Operation

For a detailed description of the Exhaust System, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Selective Catalyst Reduction (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:

If a control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern

2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
• Leaks • Metal fatigue • Correct installation • Selective catalyst reduction muffler • Muffler(s) • Joints • Mountings • Clearance around components • Diesel exhaust fluid injector • Diesel exhaust fluid line • Diesel exhaust fluid tank • Diesel exhaust fluid filler assembly • Diesel exhaust fluid level • Diesel exhaust fluid quality	• Battery • Engine junction box • Rear junction box • Fuses • Wiring harnesses and connectors • Engine control module • Sensor(s) • Actuator(s) • DEF relay

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index

5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

Symptom Chart

Symptom	Possible Causes	Action
		• Using the manufacturer approved diagnostic system check engine control module for related DTCs and refer to relevant DTC index • Check and correct the diesel exhaust fluid level

Engine malfunction lamp illuminated	• Selective catalyst reduction system failure • Diesel exhaust fluid level too low • Power or ground failure • Diesel exhaust fluid pressure too low • Diesel exhaust fluid pressure too high • Diesel exhaust fluid injection pump • Diesel exhaust fluid injector • Diesel exhaust fluid relay • Diesel exhaust fluid heater control unit • Pre selective catalytic reduction NOx sensor • Pre selective catalyst reduction Nox sensor module • Post selective catalyst reduction NOx sensor • Post selective catalyst reduction Nox sensor module • Post selective catalyst reduction soot sensor • Post selective catalyst reduction soot sensor module • Diesel sub net CAN communication bus	• Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check sensor, relays/fuses and control module power feeds and grounds • Check system for correct installation of components • Check system mechanical and fluid integrity • Check system for mechanical integrity • Check system for leakage • Check system for blockage
• Engine will not crank	• Vehicle battery failure • Diesel exhaust fluid level too low • Harness failure - Wiring integrity	• Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and correct the diesel exhaust fluid level • Using the manufacturer approved diagnostic system carry out any required routines
• Message warning	• Selective catalyst reduction system failure • A monitor of the historical diesel exhaust fluid consumption rate, allied with a direct reading of the diesel exhaust fluid level in the tank, predicts that the distance to emptying the tank is less than 2400km	• Using the manufacturer approved diagnostic system check engine control module for related DTCs and refer to relevant DTC index • Check and correct the diesel exhaust fluid level

Control module cavity

Control Module Cavity	Description	DTC
Circuit reference RALS	PWM input to the engine control module	• P203B-02 • P203B-16 • P203B-17 • P203B-31 • P203C-00 • P203D-00 • P205B-84 • P205B-85 • P205C-16 • P205D-17 • P205E-64
Circuit reference RAPM	PWM output from the engine control module	• P208A-13 • P208B-4B • P208C-11 • P208D-12
Circuit reference RAMV_L	PWM output from the engine control module	• P202E-4B • P2047-13 • P2048-11 • P2049-12
		• P202E-4B • P2047-13

Circuit reference RAMV_H	PWM output from the engine control module	• P2048-11 • P2049-12
Circuit reference CAN_3_H	Diesel sub net CAN communication bus (High)	• P2200-13 • P2200-14 • P2201-28 • P2201-2F • P2202-16 • P2203-17 • P2209-01 • P220A-01 • P220B-01 • P225C-85 • P225D-84 • P225E-85 • P225F-84 • P229E-13 • P229E-14 • P229F-28 • P229F-2F • P22A0-16 • P22A1-17 • P22A7-01 • P22FA-27 • P22FB-64 • P22FB-84 • P22FB-85 • P22FE-2A • P22FE-64 • P22FE-84 • P22FE-85 • U029D-87 • U029E-87 • U02A5-87 • U05A6-08 • U3009-00 • U300C-00 • U300F-00
Circuit reference CAN_L_3	Diesel sub net CAN communication bus (Low)	• P2200-13 • P2200-14 • P2201-28 • P2201-2F • P2202-16 • P2203-17 • P2209-01 • P220A-01 • P220B-01 • P225C-85 • P225D-84 • P225E-85 • P225F-84 • P229E-13 • P229E-14 • P229F-28 • P229F-2F • P22A0-16 • P22A1-17 • P22A7-01 • P22FA-27 • P22FB-64 • P22FB-84 • P22FB-85 • P22FE-2A • P22FE-64 • P22FE-84 • P22FE-85 • U029D-87 • U029E-87 • U02A5-87 • U05A6-08 • U3009-00 • U300C-00 • U300F-00

Circuit reference SCRMRLY	PWM output from the engine control module	• P21C7-13 • P21C8-11 • P21C9-12
Circuit reference RAPP	PWM output from the engine control module	• P20FA-13 • P20FC-11 • P20FD-12

Diagnostic routines

Routine number	Routine description	Routine action
0x0406	Reset all adaptions	Value 0x0F - To Reset Selective Catalyst Reductant (SCR) Inducement System Start Inhibit
0x4026	Reset Specified Information	Value 0x2C – To Reset Selective Catalyst Reductant (SCR) Quality Monitor
0x4076	Selective Catalytic Reductant Preparation	This routine forms part of the DEF prime routine to be carried out at end of line and in service if components are replaced
0x4077	Selective Catalytic Reductant Dosing Measuring Test	This routine carries out a leak and dosing quantity test by using inputs from the tool. If all inputs from the tool are zero, then the test is a visual inspection for leaks while under pressure, quantity tests are done by comparing the reductant amount delivered with the amount requested
0x4078	Selective Catalytic Reductant Emptying	This routine empties/purges the hydraulic lines of the DEF system which will be necessary in service to renew aged diesel exhaust fluid
0x4092	Test Reductant System Lines	This routine tests the integrity of the DEF lines at low pressure (1 - 2 bar)
0x4093	Test The Pump Emptying The High Pressure Reductant System	This routine is used to test the back flow pump which empties the DEF lines when the system is drained
0x4094	Test Dosing Valve Dynamic Behavior	This routine tests the quantity of DEF delivered with the injector opened for a given period of time
0x4095	Test Measured Static Reductant Dosing Quantity	This routine tests the quantity of DEF delivered against an expected value
0x4096	Test Reductant Spray Pattern	This routine tests the pattern of DEF injected from the dosing module as there is often a build-up of residue around the actual injector.
0x4097	Prime Reductant System For First Fill	This routine is used to prime the reductant system following component replacement and includes a short pressure test to confirm the integrity of the pipework
0x409A	Reductant First Fill And Pressure Test	Selective reductant catalyst system end of line first fill and pressure test routine. This routine will prime and test the system

Parameter Identifier (PID)

PID	Description	Action
0x043C	Reductant Tank Temperature - Raw	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in Deg C - Circuit reference I_T_RALS - Input to the engine control module PWM signal for DEF tank temperature
0x0441	Reductant Injector Duty Cycle	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in % - Circuit reference O_T_RAMV_L - Output from the engine control module PWM signal to drive the DEF injector
0x05C1	Reductant Tank Fluid Level	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in mm - Circuit reference I_T_RALS - Input to the engine control module PWM signal for DEF tank level
		• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals

0x05C2	Reductant Tank Sensor Duty Cycles	- Signal is displayed in % - Signal value is read from internal memory location internal to engine control module over CAN communication bus
0x05CF	Reductant Purge Pump Duty Cycle - Commanded	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in % - Circuit reference O_T_RAPM - Output from the engine control module PWM signal to drive the DEF pump
0x05D0	Reductant Pump Duty Cycle - Commanded	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in % - Circuit reference O_T_RAPM - Output from the engine control module PWM signal to drive the DEF pump
0x05D1	Selective Catalyst Reductant Relay State - Commanded	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed as off/on - Circuit reference O_T_SCRMRLY - Output from the engine control module PWM signal to drive the DEF relay
0x05FB	Learnt Heater Current Threshold For Heater Run Dry Detection - Frozen Cavity Detection In Urea Tank	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in mA - Signal value is read from internal memory location internal to engine control module over CAN communication bus
0x05FC	Total Mass Of Fluid Injected By Urea Dosing System	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in Kg - Signal value is read from internal memory location internal to engine control module over CAN communication bus
0x05FD	Total Time Of Urea Dosing Valve Exceeding Upper Temperature Threshold	• Diagnosis may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in s - Signal value is read from internal memory location internal to engine control module over CAN communication bus
0xDD02	Main ECU Voltage Supply	• Diagnosis of these symptoms may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in volts - Signal value is read from internal memory location internal to engine control module over CAN communication bus
0xD940	Particulate Matter Sensor Meander Temperature – Raw	• Diagnosis of these symptoms may require using the manufacturer approved diagnostic system check datalogger signals - Signal is displayed in Deg C - Signal value is read from internal memory location internal to engine control module over CAN communication bus

Diesel Exhaust Fluid (DEF) Level

The level of DEF in the tank is checked via the Instrument Cluster (IC) menu. When selected the message center displays the approximate amount of DEF remaining, providing an estimated km/miles figure remaining, prior to emptying the tank

The DEF tank is fitted with combined temperature/ultrasonic level sensors. Circuit continuity and plausibility of the signals received are checked within the ECM. An ultrasonic "no echo malfunction" is set if no valid echo from the ultrasonic sensor is detected during a predefined time. This typically happens when the ultrasonic signal of the sensor is blocked, or if the DEF tank is overfilled (the air pocket at the top of the DEF tank is no longer present). The vehicle message center display's an advisory/warning system, which activates in low DEF conditions. If no corrective action is made, the engine will eventually not restart. The stages in the warning system are listed in the following tables

 NOTE: None of the listed stages will activate the MIL. The stages are automatically cleared if the DEF level is increased

Stages	Cause	Warning	Message	Description
Stage 1	DEF range <1500mls/2400km	Message at engine start	Low Diesel Exhaust Fluid	• The DEF is running low. Fill DEF at the earliest convenience - The volumes of DEF are consumption and DEF tank geometry dependant
Stage 2	DEF range <940mls/1500km	Amber symbol	Refill Diesel Exhaust Fluid	• The DEF is running low - The volumes of DEF are consumption and DEF tank geometry dependant
Stage 3	DEF range <515mls/830km	Amber symbol	No engine restart possible soon. Diesel Exhaust Fluid	• The DEF is running low. Fill DEF immediately or engine will not start - The volumes of DEF are consumption and DEF tank geometry dependant
Stage 4	DEF range <100mls/160km	Amber symbol	No engine restart possible soon. Diesel Exhaust Fluid	• The DEF is running critically low. Fill DEF immediately or engine will not start - The volumes of DEF are consumption and DEF tank geometry dependant
Stage 5	DEF range <0mls/0km	Red symbol	No engine restart possible	• The DEF tank is empty. Fill DEF to the minimum restart level condition - The volumes of DEF are consumption and DEF tank geometry dependant

Diesel Exhaust Fluid (DEF) Quality

The DEF quality is monitored after refilling of the DEF tank. The monitoring begins when refilling is identified. In order to recognize a poor quality DEF, the OBD system uses the SCR catalytic converter NOx efficiencies, returned by the passive SCR catalytic converter monitoring, to build long and short term records of the average NOx conversion efficiencies. If the short term record becomes significantly different to the long term record, the malfunction is attributed to the quality of the DEF. The message center warning system is activated when such a malfunction is detected. Simultaneously, the MIL is directly activated on the first occurrence of the malfunction detection

Stages	Cause	Warning	Message	Description
Stage 1	Incorrect DEF quality is detected	Amber symbol	Incorrect Diesel Exhaust Fluid quality detected	The DEF does not meet manufacturer specifications. The system must be checked by a Jaguar Land Rover service department
Stage 2	Incorrect DEF quality is detected	Amber symbol	No engine restart possible in 515mls/ 830km. Incorrect Diesel Exhaust Fluid quality detected	The DEF does not meet manufacturer specifications. The system must be checked by a Jaguar Land Rover service department
Stage 3	Incorrect DEF quality is detected	Amber symbol	No engine restart possible soon. Incorrect Diesel Exhaust Fluid quality detected	The DEF does not meet manufacturer specifications. The system must be checked by a Jaguar Land Rover service department
Stage 4	Incorrect DEF quality is detected	Red symbol	No engine restart possible. Incorrect Diesel Exhaust Fluid quality detected	The DEF does not meet manufacturer specifications. The system must be checked by a Jaguar Land Rover service department

Diesel Exhaust Fluid (DEF) Quality

Prior to the NOx sensor and the monitoring function becoming operational, the sensor must have reached its 'dew point'. This is the point where the moisture content in the exhaust gas has evaporated and can no longer damage the NOx sensor. In normal ambient conditions, this process typically takes around 6 to 10 minutes. If a malfunction is detected during the operation of the NOx sensor, a reversible fault is stored. If a malfunction is detected over two (NAS variants) or three (EU6 variants) consecutive drive cycles, a permanent fault is stored and the MIL is activated

The following monitoring is performed on the NOx sensors

- Signal plausibility and correction factor limits
- Circuit continuity between the sensor control unit and probe element

- Operating temperature reached after a defined heating period

Private CAN Bus - Monitoring

The following components are connected to the ECM via a private CAN bus. The ECM provides a gateway, for communication to the vehicle CAN bus

- Heater control unit
- NOx sensor control unit(s)

The following CAN communication monitoring applies to these components

- Signal time-out
- Signal check sum

The DEF injector, DEF pump, temperature and level sensors are hardwired to the ECM and do not involve CAN communication

Diesel Exhaust Fluid (DEF) Supply and Metering System Malfunctions

The OBD system monitors components and the functionality of the DEF supply and metering system. If a malfunction is detected a message center warning is displayed. If no action is taken to rectify the warning malfunction, this will eventually lead to a 'No engine restart' situation

Stages	Cause	Warning	Message	Description
Stage 1	Supply system or monitoring component malfunction	Amber symbol	No engine restart possible in 515mls/830km. Diesel Exhaust Fluid system malfunction	The DEF supply system or component used for monitoring is malfunctioning. The system must be checked by a Jaguar Land Rover service department
Stage 2	Supply system or monitoring component malfunction	Red symbol	No engine restart possible. Diesel Exhaust Fluid system malfunction	The DEF supply system or component used for monitoring is malfunctioning. The system must be checked by a Jaguar Land Rover service department

Diesel Exhaust Fluid (DEF) Supply and Metering System Malfunctions

The following DEF supply and metering system malfunctions may trigger the message center warning system

- Pressure build up in the supply line
- Metering/injection time to closed loop
- Over pressure in supply line
- Under pressure in supply line
- Injection valve open circuit
- SCR system relay open circuit
- Solenoid pump(s) open circuit
- Combined temperature/level sensor open circuit
- Missing communication with upstream NOx sensor (NAS variants only)
- Missing communication with downstream NOx sensor

Diesel exhaust fluid

DTC	Description	Purpose and Cause	Action
P05ED-16	Reductant Heater Control Module Supply Voltage - Circuit voltage below threshold	NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit under voltage • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Diesel exhaust fluid heater control unit power and ground circuits open circuit • Diesel exhaust fluid heater control unit circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check diesel exhaust fluid heater control unit power and ground circuits for open circuit • Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P05ED-17	Reductant Heater Control Module Supply Voltage - Circuit voltage above threshold	 NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit over voltage • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Diesel exhaust fluid heater control unit power or ground circuit short circuit to ground, circuit short circuit to power • Diesel exhaust fluid heater control unit circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check diesel exhaust fluid heater control unit power and ground circuits for short circuit to ground, circuit short circuit to power • Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for short circuit to ground, circuit short circuit to power • inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P05F1-73	Reductant Pump Supply Voltage Circuit Stuck On - Actuator stuck closed	 NOTE: To monitor diesel exhaust fluid relay. Diesel exhaust fluid relay stuck closed • The engine control module has not detected any motion, upon commanding the operation of a motor, solenoid or relay to open some piece of equipment • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Diesel exhaust fluid relay circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid relay failure • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the diesel exhaust fluid relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid relay as required • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P05F2-72	Reductant Pump Supply Voltage Circuit Stuck Off - Actuator stuck open	 NOTE: To monitor diesel exhaust fluid relay. Diesel exhaust fluid relay stuck open • The engine control module has not detected any motion, upon commanding the operation of a motor, solenoid or relay to close some piece of equipment • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Diesel exhaust fluid relay circuit short circuit to ground, short circuit to power, open circuit, high resistance	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the diesel exhaust fluid relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid relay as required • Check and install a new diesel exhaust fluid tank module as required

		• Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid relay failure • Diesel exhaust fluid tank module failure	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P05F8-13	Reductant Heater Control Module Performance - Circuit open	 NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit missing voltage • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid heater control unit power or ground circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P05F8-4B	Reductant Heater Control Module Performance - Over temperature	 NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit over temperature • The engine control module detected an internal temperature above the expected range • Diesel exhaust fluid heater control unit circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P05F8-66	Reductant Heater Control Module Performance - Signal has too many transitions / events	 NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit non volatile memory error • The engine control module monitored a parameter over time within specified limits and detected more than the expected number of transitions • Diesel exhaust fluid heater control unit circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
			• Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals

P16A3-00	SCR System - EOL - Failure During Emptying Test - No sub type information	• Selective catalytic reduction dosing system prime routine failed during the empty phase • Selective catalytic reduction priming routine did not complete successfully • DEF back flow pump did not empty the pressure line correctly • DEF pressure line leakage • Routine aborted at ignition off	- 0x05C1 Reductant Tank Fluid Level - 0x043C Reductant Tank Temperature - Raw - Check that the DEF tank has at least 25mm of fluid (0x05C1) - Check the DEF tank temperature is within -5 to + 70 °C (0x043C) • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check the DEF pressure line for leakage • Using the manufacturer approved diagnostic system carry out routine 0x409A - Reductant First Fill And Pressure Test. Check that the ignition stays on throughout the whole duration of the routine • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P16A4-00	SCR System - EOL - Failure During First Fill Test - No sub type information	• Selective catalytic reduction dosing system prime routine failed during the first fill phase • Selective catalytic reduction priming routine did not complete successfully • Pressure and DEF back flow pump not activated correctly • Routine aborted at ignition off	• Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level - 0x043C Reductant Tank Temperature - Raw - Check that the DEF tank has at least 25mm of fluid (0x05C1) - Check the DEF tank temperature is within -5 to + 70 °C (0x043C) • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check the DEF pressure line for leakage • Using the manufacturer approved diagnostic system carry out routine 0x409A - Reductant First Fill And Pressure Test. Check that the ignition stays on throughout the whole duration of the routine • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P16A5-00	SCR System - EOL - Failure During Pressure Test - No sub type information	• Selective catalytic reduction dosing system prime routine failed during the pressure preparation phase • Selective catalytic reduction priming routine did not complete successfully • Pressure pump is not pressurizing the line correctly • DEF pressure line leakage • Routine aborted at ignition off	• Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level - 0x043C Reductant Tank Temperature - Raw - Check that the DEF tank has at least 25mm of fluid (0x05C1) - Check the DEF tank temperature is within -5 to + 70 °C (0x043C) • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check the DEF pressure line for leakage • Using the manufacturer approved diagnostic system carry out routine 0x409A - Reductant First Fill And Pressure Test. Check that the ignition stays on throughout the whole duration of the routine • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
	SCR System - EOL	• Selective catalytic reduction dosing system prime routine aborted during cycle	• Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level - 0x043C Reductant Tank Temperature - Raw - Check that the DEF tank has at least 25mm of fluid (0x05C1)

P16A6-00	- Unfinished Tests - No sub type information	• Selective catalytic reduction priming routine did not complete successfully • The routine has been aborted by the user • Routine aborted at ignition off	- Check the DEF tank temperature is within -5 to + 70 °C (0x043C) • Using the manufacturer approved diagnostic system carry out routine 0x409A - Reductant First Fill And Pressure Test. Check that the ignition stays on throughout the whole duration of the routine • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P16A7-00	SCR System - Tampering At Connector 1 - No sub type information	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance - DEF pump circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance - DEF pump circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P16A8-00	SCR System - Tampering At Connector 2 - No sub type information	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance - DEF heater - DEF level - DEF relay circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance - DEF heater - DEF level - DEF relay circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P202A-13	Reductant Tank Heater Control Circuit/Open - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid heater control unit circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P202B-11	Reductant Tank Heater Control Circuit Low - Circuit short to ground	• The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Diesel exhaust fluid heater control unit circuit short circuit to ground • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit short circuit to ground • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P202B-13	Reductant Tank Heater Control Circuit Low - Circuit open	NOTE: To monitor diesel exhaust fluid heater for open circuit, high resistance • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid heater control unit circuit open circuit, high resistance • CAN communication diesel exhaust fluid tank module - DEF heater controller circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for open circuit, high resistance • Refer to the electrical circuit diagrams and check the CAN communication diesel exhaust fluid tank module - DEF heater controller circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P202C-12	Reductant Tank Heater Control Circuit High - Circuit short to battery	• The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Diesel exhaust fluid heater control unit circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P202C-15	Reductant Tank Heater Control Circuit High - Circuit short to battery or open	• The engine control module has detected a power measurement or open circuit for a period longer than expected or has detected a power measurement or open circuit when another value was expected • Diesel exhaust fluid heater control unit circuit short circuit to power open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit short circuit to power open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P202E-4B	Reductant Injection Valve Circuit Range/Performance Bank 1 Unit 1 - Over temperature	• The engine control module detected an internal temperature above the expected range • Diesel exhaust fluid heater control unit circuit open circuit, high resistance • CAN communication diesel exhaust fluid tank module - DEF heater controller circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for open circuit, high resistance • Refer to the electrical circuit diagrams and check the CAN communication diesel exhaust fluid tank module - DEF heater controller circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required

		• Diesel exhaust fluid heater control unit failure	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P203B-02	Reductant Level Sensor "A" Circuit Range/Performance - General signal failure	NOTE: Monitoring of the diesel exhaust fluid level sensor (level) • Diesel exhaust fluid tank module level reading not possible • Diesel exhaust fluid tank module communication error • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	NOTE: Key On. Tank unfrozen, drive for 10 Km • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P203B-16	Reductant Level Sensor "A" Circuit Range/Performance - Circuit voltage below threshold	NOTE: Monitoring of the diesel exhaust fluid level sensor (level) • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Diesel exhaust fluid tank module level signal range check too low • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	NOTE: Key On • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P203B-17	Reductant Level Sensor "A" Circuit Range/Performance - Circuit voltage above threshold	• The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
	Reductant Level	NOTE: Monitoring of the diesel exhaust fluid level sensor (level) • The engine control module does not detect a signal which ought to be present • Diesel exhaust fluid tank module level reading not possible	NOTE: Key On. Tank unfrozen, drive for 10 Km

P203B-31	Sensor "A" Circuit Range/Performance - No signal	• Diesel exhaust fluid tank module communication error • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P203C-00	Reductant Level Sensor, A, Circuit Low - No sub type information	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P203D-00	Reductant Level Sensor "A" Circuit High - No sub type information	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2047-13	Reductant Injection Valve Circuit/Open Bank 1 Unit 1 - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid injector circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid injector failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid injector circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid injector as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2048-11	Reductant Injection Valve Circuit Low Bank 1 Unit 1 - Circuit short to ground	• The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Diesel exhaust fluid injector circuit short circuit to ground • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid injector failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid injector circuit for short circuit to ground • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid injector as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		• The engine control module has detected a vehicle power measurement for a	

P2049-12	Reductant Injection Valve Circuit High Bank 1 Unit 1 - Circuit short to battery	period longer than expected or has detected a vehicle power measurement when another value was expected • Diesel exhaust fluid injector circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid injector failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid injector circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid injector as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P205B-84	Reductant Tank Temperature Sensor "A" Circuit Low - Signal below allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Diesel exhaust fluid tank module circuit short circuit to ground, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P205B-85	Reductant Tank Temperature Sensor "A" Circuit Low - Signal above allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Diesel exhaust fluid tank module circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P205C-16	Reductant Tank Temperature Sensor "A" Circuit High - Circuit voltage below threshold	• The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Diesel exhaust fluid tank module circuit short circuit to ground, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P205D-17	Reductant Tank Temperature Sensor "A" Circuit Intermittent/Erratic - Circuit voltage above threshold	• The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Diesel exhaust fluid tank module circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		• The engine control module detected plausibility failures	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for

P205E-64	Reductant Tank Temperature Sensor Circuit Intermittent/Erratic - Signal plausibility failure	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P208A-13	Reductant Pump "A" Control Circuit/Open - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid tank module circuit open circuit, high resistance - output from the ECM to DEF pump control • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for open circuit, high resistance - output from the ECM to DEF pump control • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P208B-00	Reductant Pump "A" Control Performance/Stuck Off - No sub type information	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance - DEF back flow pump • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance - DEF back flow pump • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P208B-4B	Reductant Pump "A" Control Performance/Stuck Off - Over temperature	• The engine control module detected an internal temperature above the expected range • Diesel exhaust fluid tank module circuit short circuit to power - output from the ECM to DEF pump control • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to power - output from the ECM to DEF pump control • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P208B-64	Reductant Pump "A" Control Performance/Stuck Off - Signal plausibility failure	NOTE: To monitor for the pump pressure. Diesel exhaust fluid injection pump range performance • The engine control module detected plausibility failures • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid injection pump failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance - monitor for the pump pressure build up • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P208C-11	Reductant Pump "A" Control Circuit Low - Circuit short to ground	• The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to ground - output from the ECM to DEF pump control • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground - output from the ECM to DEF pump control • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P208D-12	Reductant Pump "A" Control Circuit High - Circuit short to battery	• The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to power - output from the ECM to DEF pump control • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to power - output from the ECM to DEF pump control • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P208E-73	Reductant Injection Valve Stuck Closed Bank 1 Unit 1 - Actuator stuck closed	NOTE: To monitor diesel exhaust fluid injector opening / closing. Diesel exhaust fluid injector is stuck closed • The engine control module has not detected any motion, upon commanding the operation of a motor, solenoid or relay to open some piece of equipment • Diesel exhaust fluid injector failure	• Check and install a new diesel exhaust fluid injector as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P209F-16	Reductant Tank Heater Control Circuit Performance - Circuit voltage below threshold	NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit voltage too low • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Diesel exhaust fluid heater control unit circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		NOTE: To monitor diesel exhaust fluid heater control unit.	

P209F-17	Reductant Tank Heater Control Circuit Performance - Circuit voltage above threshold	Diesel exhaust fluid heater control unit voltage too high • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Diesel exhaust fluid heater control unit circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P209F-18	Reductant Tank Heater Control Circuit Performance - Circuit current below threshold	NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit current too low • The engine control module has measured current flow below a specified range • Diesel exhaust fluid heater control unit circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P209F-19	Reductant Tank Heater Control Circuit Performance - Circuit current above threshold	NOTE: To monitor diesel exhaust fluid heater control unit. Diesel exhaust fluid heater control unit current too high • The engine control module has measured current flow above a specified range • Diesel exhaust fluid heater control unit circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid heater control unit failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid heater control unit as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20B9-13	Reductant Heater "A" Control Circuit/Open - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid tank module circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P20BA-16	Reductant Heater "A" Control Circuit Performance - Circuit voltage below threshold	NOTE: To monitor diesel exhaust fluid line heater • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Diesel exhaust fluid line heater circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid line heater failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid line heater circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid line heater as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20BA-17	Reductant Heater "A" Control Circuit Performance - Circuit voltage above threshold	NOTE: To monitor diesel exhaust fluid line heater • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Diesel exhaust fluid line heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid line heater failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid line heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid line heater as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20BA-18	Reductant Heater "A" Control Circuit Performance - Circuit current below threshold	NOTE: To monitor diesel exhaust fluid line heater • The engine control module has measured current flow below a specified range • Diesel exhaust fluid line heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid line heater failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid line heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid line heater as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20BA-19	Reductant Heater "A" Control Circuit Performance - Circuit current above threshold	NOTE: To monitor diesel exhaust fluid line heater • The engine control module has measured current flow above a specified range • Diesel exhaust fluid line heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid line heater failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid line heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid line heater as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P20BB-11	Reductant Heater "A" Control Circuit Low - Circuit short to ground	• The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to ground • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20BC-12	Reductant Heater "A" Control Circuit High - Circuit short to battery	• The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20E8-84	"Reductant Pressure Too Low - Signal below allowable range	 NOTE: If modelled pressure falls below 2 bar system is purged and pressure is built up again. If this happens 12 times during driving cycle error is set (Fast path due to air bubbles) • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • DEF injector dosing too high. Diesel Exhaust Fluid injection pump delivers to much DEF • Diesel exhaust fluid line leakage • Diesel exhaust fluid line air bubbles • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Check diesel exhaust fluid line for leakage • Using the manufacturer approved diagnostic system carry out diagnostic routine 0x4092 • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		 NOTE: To monitor for diesel exhaust fluid line under pressure error. If modelled pressure falls below 4.5 bar the system is purged and pressure is built up again. If this occurs during a drive cycle the error is set • The engine control module has determined failures where some circuit quantity,	• Check Diesel exhaust fluid line for leakage

P20E8-85	"Reductant Pressure Too Low - Signal above allowable range	reported via serial data, is above a specified range • DEF injector dosing too high. Diesel Exhaust Fluid injection pump delivers to much DEF • Diesel exhaust fluid line leakage • Diesel exhaust fluid line air bubbles • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Using the manufacturer approved diagnostic system carry out diagnostic routine 0x4092 • Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20E9-84	"Reductant Pressure Too High - Signal below allowable range	NOTE: To monitor for over pressure (slow). If modelled pressure rises above 8,5 bar system is purged and pressure is built up again. If this happens 5 times during driving cycle error is set • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Diesel exhaust fluid line frozen / blocked • Diesel exhaust fluid line heater frozen • Diesel exhaust fluid injector frozen / blocked • Diesel exhaust fluid tank module frozen	• Check diesel exhaust fluid line for blockage • Check diesel exhaust fluid injector for blockage • Check diesel exhaust fluid tank module for blockage • Check diesel exhaust fluid line is not frozen • Check diesel exhaust fluid injector is not frozen • Check diesel exhaust fluid tank module is not frozen • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20E9-85	"Reductant Pressure Too High - Signal above allowable range	NOTE: To monitor for over pressure (fast). If modelled pressure rises above 10 bar, system is purged and pressure is built up again. If this happens 5 times during driving cycle error is set • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Diesel exhaust fluid line frozen / blocked • Diesel exhaust fluid line heater frozen • Diesel exhaust fluid injector frozen / blocked • Diesel exhaust fluid tank module frozen	• Check diesel exhaust fluid line for blockage • Check diesel exhaust fluid injector for blockage • Check diesel exhaust fluid tank module for blockage • Check diesel exhaust fluid line is not frozen • Check diesel exhaust fluid injector is not frozen • Check diesel exhaust fluid tank module is not frozen • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		NOTE: Monitors SCR Nox catalyst efficiency - reduced catalyst Nox efficiency • SCR - reduced catalyst Nox conversion efficiency detected by passive	

P20EE-00	SCR NOx Catalyst Efficiency Below Threshold Bank 1 - No sub type information	monitoring but not detected by active monitoring; on two consecutive occasions • The SCR device ammonia storage capability is greatly reduced or the device is missing • Defective SCR catalyst (aged) • Deficient DEF reagent delivery • Diesel exhaust fluid injector partial delivery • Damaged exhaust metal work • SCR catalyst damage	 NOTE: Drive vehicle at urban speeds until SCR catalyst warm and exhaust Nox sensors active. Ensure the vehicle is not in DPF active regeneration and drive at urban speeds for 20min (50 / 60mph) • Check for damaged or removed SCR catalyst • Check for deposits on front face of SCR catalyst • Check diesel exhaust fluid injector for deposits or corrosion • Check exhaust metal work for damage • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20FA-13	Reductant Pump "B" Control Circuit/Open - Circuit open	 NOTE: To monitor DEF back flow pump for open circuit • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid tank module circuit open circuit, high resistance - DEF back flow pump • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for open circuit, high resistance - DEF back flow pump • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20FB-00	Reductant Pump "B" Control Performance/Stuck Off - No sub type information	• Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance - DEF back flow pump • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance - DEF back flow pump • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20FC-11	Reductant Pump "B" Control Circuit Low - Circuit short to ground	 NOTE: To monitor DEF back flow pump for short circuit to ground • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to ground - DEF back flow pump • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground - DEF back flow pump • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P20FD-12	Reductant Pump "B" Control Circuit High - Circuit short to battery	NOTE: To monitor DEF back flow pump for short circuit to power • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to power - DEF back flow pump • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to power - DEF back flow pump • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P20FE-00	Reductant Metering Unit Performance - No sub type information	• Monitors DEF reagent delivery performance to the SCR device • An active overdosing of the SCR is performed following a passive monitoring event (lack of apparent SCR efficiency). The reagent delivery provided by the dosing valve is monitored during this process • Defective DEF reagent delivery • Defective SCR catalyst (aged) • Deficient DEF reagent delivery • Diesel exhaust fluid injector partial delivery • Damaged exhaust metal work • SCR catalyst damage	NOTE: Drive vehicle at urban speeds until SCR catalyst warm and exhaust Nox sensors active. Ensure the vehicle is not in DPF active regeneration and drive at urban speeds for 20min (50 / 60mph) • Damaged/Removed dosing module • Dosing module stuck closed / stuck by deposits • Deposits on SCR device front face • Damaged/Removed SCR catalyst • Deposits on front face of SCR catalyst • Check diesel exhaust fluid injector for deposits or corrosion • Check exhaust metal work for damage
P214E-19	Reductant Pump "A" Current Too High - Circuit current above threshold	• The engine control module has measured current flow above a specified range • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance - DEF pump circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance - DEF pump circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P21C5-64	Reductant Level Sensor "A" Stuck - Signal plausibility failure	• The engine control module detected plausibility failures • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P21C7-13	Reductant Control Module Power Relay/Relays Control Circuit/Open - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Diesel exhaust fluid relay circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid relay failure • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the diesel exhaust fluid relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid relay as required • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P21C8-11	Reductant Control Module Power Relay/Relays Control Circuit Low - Circuit short to ground	• The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Diesel exhaust fluid relay circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid relay failure • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the diesel exhaust fluid relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid relay as required • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P21C9-12	Reductant Control Module Power Relay/Relays Control Circuit High - Circuit short to battery	• The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Diesel exhaust fluid tank module circuit short circuit to ground, short circuit to power, open circuit, high resistance • Diesel exhaust fluid relay circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Diesel exhaust fluid relay failure • Diesel exhaust fluid tank module failure	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid tank module circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the diesel exhaust fluid relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new diesel exhaust fluid relay as required • Check and install a new diesel exhaust fluid tank module as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P2200-13	NOx Sensor Circuit Bank 1 Sensor 1 - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2200-14	NOx Sensor Circuit Bank 1 Sensor 1 - Circuit short to ground or open	• The engine control module has detected a ground measurement or open circuit for a period longer than expected or has detected a ground measurement or open circuit when another value was expected • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2201-28	NOx Sensor Circuit Range/Performance Bank 1 Sensor 1 - Signal bias level out of range / zero adjustment failure	• Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2201-2F	NOx Sensor Circuit Range/Performance Bank 1 Sensor 1 - Signal erratic	• Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2202-16	NOx Sensor Circuit Low Bank 1 Sensor 1 - Circuit voltage below threshold	• The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required

		• Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2203-17	NOx Sensor Circuit High Bank 1 Sensor 1 - Circuit voltage above threshold	• The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2209-01	NOx Sensor Heater Sense Circuit Range/Performance Bank 1 Sensor 1 - General electrical failure	• Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P220A-01	NOx Sensor Supply Voltage Circuit Bank 1 Sensor 1 - General electrical failure	• Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P220B-01	NOx Sensor Supply Voltage Circuit Bank 1 Sensor 2 - General electrical failure	NOTE: Post selective catalytic reduction NOx sensor heater circuit error • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P225C-85	NOx Sensor Performance - Signal Biased/Stuck High	• The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required

	Bank 1 Sensor 1 - Signal above allowable range	• Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P225D-84	NOx Sensor Performance - Signal Biased/Stuck Low Bank 1 Sensor 1 - Signal below allowable range	 NOTE: Range check pre selective catalytic reduction NOx sensor. Pre selective catalytic reduction NOx sensor signal out of range at low load negative deviation • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	 NOTE: NOx sensor released, the dew point detection function is initiated (after engine start there is a strategy to avoid activation if water is present in the exhaust, the function integrates the warmth quantity seen by the sensor and then releases it, then the sensor is heated and starts measuring) • Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P225E-85	NOx Sensor Performance - Signal Biased/Stuck High Bank 1 Sensor 2 - Signal above allowable range	 NOTE: Range check post selective catalytic reduction NOx sensor. Post selective catalytic reduction NOx sensor signal out of range at low load positive deviation • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	 NOTE: NOx sensor released, the dew point detection function is initiated (after engine start there is a strategy to avoid activation if water is present in the exhaust, the function integrates the warmth quantity seen by the sensor and then releases it, then the sensor is heated and starts measuring) • Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P225F-84	NOx Sensor Performance - Signal Biased/Stuck Low Bank 1 Sensor 2 - Signal below allowable range	 NOTE: Range check post selective catalytic reduction NOx sensor. Post selective catalytic reduction NOx sensor signal out of range at low load negative deviation • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	 NOTE: NOx sensor released, the dew point detection function is initiated (after engine start there is a strategy to avoid activation if water is present in the exhaust, the function integrates the warmth quantity seen by the sensor and then releases it, then the sensor is heated and starts measuring) • Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P229E-13	NOx Sensor Circuit (Bank 1 Sensor 2) - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Post selective catalytic reduction NOx sensor circuit open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P229E-14	NOx Sensor Circuit (Bank 1 Sensor 2) - Circuit short to ground or open	• The engine control module has detected a ground measurement or open circuit for a period longer than expected or has detected a ground measurement or open circuit when another value was expected • Post selective catalytic reduction NOx sensor circuit short circuit to ground, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P229F-28	NOx Sensor Circuit Range/Performance (Bank 1 Sensor 2)Signal bias level out of range / zero adjustment failure	• Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P229F-2F	NOx Sensor Circuit Range/Performance (Bank 1 Sensor 2) - Signal erratic	• Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22A0-16	NOx Sensor Circuit Low (Bank 1 Sensor 2) - Circuit voltage below threshold	• The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

		• Post selective catalytic reduction NOx sensor failure	
P22A1-17	NOx Sensor Circuit High (Bank 1 Sensor 2) - Circuit voltage above threshold	• The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22A7-01	NOx Sensor Heater Sense Circuit Range/Performance (Bank 1 Sensor 2) - General electrical failure	• Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FA-27	NOx Sensor Performance - Slow Response High too low Bank 1 Sensor 1 - Signal rate of change above threshold	• The signal transitions more quickly than is reasonably allowed • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FB-64	NOx Sensor Performance - Sensing Element Bank 1 Sensor 1 - Signal plausibility failure	• The engine control module detected plausibility failures • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FB-84	NOx Sensor Performance - Sensing Element Bank 1 Sensor 1 - Signal below allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

		• Pre selective catalytic reduction NOx sensor failure	
P22FB-85	NOx Sensor Performance - Sensing Element Bank 1 Sensor 1 - Signal above allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Pre selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Pre selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new pre selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FE-2A	NOx Sensor Performance - Sensing Element Bank 1 Sensor 2 - Signal stuck in range	• Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FE-64	NOx Sensor Performance - Sensing Element Bank 1 Sensor 2 - Signal plausibility failure	• The engine control module detected plausibility failures • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FE-84	NOx Sensor Performance - Sensing Element Bank 1 Sensor 2 - Signal below allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Post selective catalytic reduction NOx sensor circuit short circuit to ground, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P22FE-85	NOx Sensor Performance - Sensing Element Bank 1 Sensor 2 - Signal above allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Post selective catalytic reduction NOx sensor circuit short circuit to power • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P241D-00	SCR Inducement - Forced Engine Shutdown - No sub type information	• Engine restart is prevented. The inducement system countdown has run out • Final inducement - No engine restart is allowed • Other related DTCs • Vehicle has run out of inducement system allowed mileage	NOTE: With the inducement countdown at 0; stop engine. Ignition off. Power latch. Ignition on (after power latch). Carry out routine 0x0406 Value 0x0F - To Reset Selective Catalyst Reductant (SCR) Inducement System Start Inhibit to allow restart from this point onwards. The routine can be used each time the mileage countdown goes to 0 • Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level - Check that the DEF tank has at least 25mm of fluid (0x05C1) • Using the manufacturer approved diagnostic system check engine control module for related DTCs and refer to relevant DTC index • Re fill diesel exhaust fluid tank with correct specification diesel exhaust fluid • Using the manufacturer approved diagnostic system carry out the refill and bleed procedures • After repair, use routine 0x0406 Value 0x0F - To Reset Selective Catalyst Reductant (SCR) Inducement System Start Inhibit to allow a temporary mileage allowance (50km / 31mi) in order to run the vehicle and the OBD system to confirm repair • The inducement system will clear automatically upon acknowledgment of repair by the OBD system • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P249C-00	Excessive Time To Enter Closed Loop Reductant Injection Control - No sub type information	• Other DEF related DTCs • DEF system for mechanical integrity - DEF tank module - DEF line heater - DEF injector - DEF injection pump - DEF heater control unit - DEF line - DEF tank - DEF filler assembly • DEF system for electrical integrity - Harness failure - Wiring integrity short circuit to ground, short circuit to power, open circuit, high resistance - DEF tank module - DEF line heater - DEF injector - DEF injection pump - DEF heater control unit • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Check engine control module for DEF related DTCs and refer to relevant DTC index • Check DEF system for mechanical integrity - DEF tank module - DEF line heater - DEF injector - DEF injection pump - DEF heater control unit - DEF line - DEF tank - DEF filler assembly • Check DEF system for electrical integrity - Refer to the electrical circuit diagrams and check connections are secure and wiring integrity - DEF tank module - DEF line heater - DEF injector - DEF injection pump - DEF heater control unit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion
P249D-00	Closed Loop Reductant Injection Control At Limit - Flow Too Low - No sub type information	NOTE: Selective catalytic reduction, reduced catalyst Nox conversion efficiency, dosing system cannot reach dosing setpoint. The system cannot reach target efficiency • Defective SCR catalyst (aged) • Deficient DEF reagent delivery	• Check for damaged or removed SCR catalyst • Check for deposits on front face of SCR catalyst • Check diesel exhaust fluid injector for deposits or corrosion • Check exhaust metal work for damage

		• Diesel exhaust fluid injector partial delivery • Damaged exhaust metal work • SCR catalyst damage	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P249E-00	Closed Loop Reductant Injection Control At Limit - Flow Too High - No sub type information	 NOTE: Selective catalytic reduction, reduced catalyst Nox conversion efficiency, dosing system cannot prevent ammonia slip (ammonia is found at the back of the selective catalytic reduction catalyst) • Defective SCR catalyst (aged) • Deficient DEF reagent delivery • Diesel exhaust fluid injector partial delivery • Damaged exhaust metal work • SCR catalyst damage	• Check for damaged or removed SCR catalyst • Check for deposits on front face of SCR catalyst • Check diesel exhaust fluid injector for deposits or corrosion • Check exhaust metal work for damage • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24AE-1C	Particulate Matter Sensor Circuit -Circuit voltage out of range	• The engine control module has detected a voltage outside of the expected range, but not identified as too high or too low • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24AE-96	Particulate Matter Sensor Circuit - Component internal failure	• The engine control module has received an indication about the component that indicates a failure e.g. an intelligent actuator or sensor is indicating an internal fault • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		• The value of the signal measured by the engine	

P24AF-29	Particulate Matter Sensor Circuit Range/Performance - Signal invalid	control module is not plausible given the operating conditions • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24AF-96	Particulate Matter Sensor Circuit Range/Performance - Component internal failure	• The engine control module has received an indication about the component that indicates a failure e.g. an intelligent actuator or sensor is indicating an internal fault • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24B0-96	Particulate Matter Sensor Circuit Low - Component internal failure	• The engine control module has received an indication about the component that indicates a failure e.g. an intelligent actuator or sensor is indicating an internal fault • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		• The engine control module has received an indication about the component that indicates a failure e.g. an intelligent actuator or sensor is indicating an internal fault • Post selective catalyst reduction soot sensor circuit	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor

P24B1-96	Particulate Matter Sensor Circuit High - Component internal failure	short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24B3-00	Particulate Matter Sensor Heater Control Circuit/Open - No sub type information	• Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24B5-92	Particulate Matter Sensor Heater Control Circuit Low - Performance or incorrect operation	• The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24B6-92	Particulate Matter Sensor Heater Control Circuit High - Performance or incorrect operation	• The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required

		• Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24C6-00	Particulate Matter Sensor Temperature Circuit - No sub type information	• Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24C6-84	Particulate Matter Sensor Temperature Circuit - Signal below allowable range	• The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24C7-62	Particulate Matter Sensor Temperature Circuit Range/Performance - Signal compare failure	NOTE: Monitoring of the meander starting temperature for plausibility. Power feed to the post selective catalyst reduction soot sensor module fell below 9 volts for longer than 0.4 seconds • The engine control module detected failure when comparing two or more input parameters for plausibility • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

P24C7-64	Particulate Matter Sensor Temperature Circuit Range/Performance - Signal plausibility failure	NOTE: Monitoring of the dynamic meander temperature for plausibility • The engine control module detected plausibility failures • Post selective catalyst reduction soot sensor incorrectly installed • Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure • DPF outlet temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • SCR catalyst blocked • Exhaust system mechanical integrity	NOTE: Monitor runs 220seconds after post selective catalyst reduction soot sensor completes regeneration (requires driving for around 20 minutes and regeneration end visible via temperature DID D940 drops from 785Deg C down to ~ 200Deg C) - keep low rpm • Check post selective catalyst reduction soot sensor for correct installation • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Refer to the electrical circuit diagrams and check the DPF outlet temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check SCR catalyst for blockage • Check exhaust system for mechanical integrity • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P24D0-00	Particulate Matter Sensor Supply Voltage Circuit Low - No sub type information	• Post selective catalyst reduction soot sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the post selective catalyst reduction soot sensor circuit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2BA7-7B	NOx Exceedance - Empty Reagent Tank - Low fluid level	NOTE: To monitor diesel exhaust fluid level • The engine control module has detected that a fluid level is too low for proper operation of the system • Diesel exhaust fluid level is low • Diesel exhaust fluid tank is empty	• Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level • Check and correct diesel exhaust fluid level • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
		NOTE: To monitor the selective catalytic reduction system for sudden reduction in catalyst Nox conversion efficiency by passive monitoring • Selective catalytic reduction - Nox conversion efficiency is below threshold. The diesel exhaust fluid quality	NOTE: With ignition on - run once routine 0x4026 Value 0x2C – To Reset Selective Catalyst Reductant (SCR) Quality Monitor. Drive vehicle at urban speeds until SCR catalyst warm and exhaust Nox sensors are active. Ensure the vehicle is not in DPF active regeneration and drive at urban speeds for 20minutes (50 / 60mph)

P2BA9-00	NOx Exceedance - Insufficient Reagent Quality - No sub type information	is reduced or the selective catalytic reduction catalyst is missing • Monitor to prioritize the diesel exhaust fluid detection when a sudden drop in Nox conversion efficiency is detected • Diesel exhaust fluid quality is reduced • Defective SCR catalyst (missing) • Deficient DEF reagent delivery • Diesel exhaust fluid injector blockage/failure	• Using the manufacturer approved equipment measure DEF quality to check it conforms to specification • Drain and refill DEF if not to specification • Check for damaged or removed SCR catalyst • Check for deposits on front face of SCR catalyst • Check diesel exhaust fluid injector for blockage/failure • Check for deposits on mixer • Check and install a new diesel exhaust fluid injector as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2BA9-92	NOx Exceedance - Insufficient Reagent Quality - Performance or incorrect operation	NOTE: To monitor the selective catalytic reduction system for minimum catalyst Nox conversion efficiency by passive monitoring not met after function reset • The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way • Selective catalytic reduction - the minimum conversion efficiency of the catalytic device is not met after function reset • The diesel exhaust fluid quality is not meeting manufacturer specifications or the SCR catalyst is removed • Diesel exhaust fluid quality is reduced • Defective SCR catalyst (missing) • Deficient DEF reagent delivery • Diesel exhaust fluid injector blockage/failure	NOTE: With ignition on - run once routine 0x4026 Value 0x2C – To Reset Selective Catalyst Reductant (SCR) Quality Monitor. Drive vehicle at urban speeds until SCR catalyst warm and exhaust Nox sensors are active. Ensure the vehicle is not in DPF active regeneration and drive at urban speeds for 20minutes (50 / 60mph) • Using the manufacturer approved equipment measure DEF quality to check it conforms to specification • Drain and refill DEF if not to specification • Check for damaged or removed SCR catalyst • Check for deposits on front face of SCR catalyst • Check diesel exhaust fluid injector for blockage/failure • Check for deposits on mixer • Check and install a new diesel exhaust fluid injector as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
P2BAE-00	NOx Exceedance - NOx Control Monitoring System - No sub type information	• Stage 1 This monitor shows at the first level of the driver advisory message - DEF low • Stage 2 This monitor shows at the second level of the driver advisory message - DEF low - Refill DEF now • Diesel exhaust fluid level is low • Other related DTCs	NOTE: The fault path responsible for the inducement level may require driving cycle conditions • Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level • Check and correct diesel exhaust fluid level • Check engine control module for related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest • The inducement system will clear automatically upon acknowledgment of repair by the OBD system
	NOx System Driver	• The DTC is set at first, second and third levels of final driver warning for inducement system • To monitor for low diesel exhaust fluid level	NOTE: The fault path responsible for the inducement level may require driving cycle conditions • Diagnosis of this DTC may require using the manufacturer approved diagnostic system check datalogger signals - 0x05C1 Reductant Tank Fluid Level

P2BAF-00	Inducement Active - No sub type information	• To monitor diesel exhaust fluid quality • To monitor selective catalyst reduction system hardware • Diesel exhaust fluid level is low • Other related DTCs	• Check and correct diesel exhaust fluid level • Check engine control module for related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest • The inducement system will clear automatically upon acknowledgment of repair by the OBD system
U029D-87	Lost Communication With NOx Sensor "A" - Missing message	• The engine control module has not received the expected CAN signal from the pre selective catalytic reduction NOx sensor / diesel sub net CAN within the specified time interval • Pre and post NOx sensor connectors are crossed • Pre selective catalytic reduction NOx sensor / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Check pre and post NOx sensor connectors are not crossed • Refer to the electrical circuit diagrams and check the pre selective catalytic reduction NOx sensor / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U029E-87	Lost Communication With NOx Sensor "B" - Missing message	• The engine control module has not received the expected CAN signal from the post selective catalytic reduction NOx sensor / diesel sub net CAN within the specified time interval • Pre and post NOx sensor connectors are crossed • Post selective catalytic reduction NOx sensor / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Check pre and post NOx sensor connectors are not crossed • Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U02A3-13	Lost Communication With PM Sensor - Circuit open	• The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • The engine control module has not received the expected CAN signal from the diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN within the specified time interval • Particulate matter soot sensor / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

U02A3-87	Lost Communication With PM Sensor - Missing message	• The engine control module has not received the expected CAN signal from the diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN within the specified time interval • Particulate matter soot sensor / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U02A5-87	Lost Communication with Reductant Heater Control Module - Missing message	• The engine control module has not received the expected CAN signal from the diesel exhaust fluid heater control unit / diesel sub net CAN within the specified time interval • Diesel exhaust fluid heater control unit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion	• Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U04A4-02	Invalid Data Received From PM Sensor - General signal failure	• The engine control module has not received the expected CAN signal from the diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN within the specified time interval • Particulate matter soot sensor / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalyst reduction soot sensor failure	• Check diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN for related DTCs and refer to relevant DTC index • Refer to the electrical circuit diagrams and check the diesel exhaust fluid particulate matter soot sensor / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalyst reduction soot sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U05A6-08	Invalid Data Received from Reductant Heater Control Module - Bus signal / message failures	NOTE: To check CAN communication between engine control module and diesel exhaust fluid heater control unit • The engine control module has not received the expected CAN signal from the diesel exhaust fluid heater control unit / diesel sub net CAN within the specified time interval • Diesel exhaust fluid heater control unit / diesel sub net CAN circuit short circuit to ground, short circuit to power, open circuit, high resistance	• Check diesel exhaust fluid heater control unit / diesel sub net CAN for related DTCs and refer to relevant DTC index • Refer to the electrical circuit diagrams and check the diesel exhaust fluid heater control unit / diesel sub net CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check connections are secure and wiring integrity

		• Connector is disconnected, connector pin is backed out, connector pin corrosion • Harness failure - Diesel exhaust fluid heater control unit	• Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U3009-00	Control Module Ground "B" - No sub type information	 NOTE: To monitor removal detection post selective catalytic reduction NOx sensor • Post selective catalytic reduction NOx sensor not installed in the exhaust system • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	 NOTE: NOx sensor released, the dew point detection function is initiated (after engine start there is a strategy to avoid activation if water is present in the exhaust, the function integrates the warmth quantity seen by the sensor and then releases it, then the sensor is heated and starts measuring) • Check post selective catalytic reduction NOx sensor is correctly installed in the exhaust system • Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U300C-00	Ignition Input Off/On/Start - No sub type information	 NOTE: To monitor removal detection post selective catalytic reduction NOx sensor • Post selective catalytic reduction NOx sensor not installed in the exhaust system • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	 NOTE: NOx sensor released, the dew point detection function is initiated (after engine start there is a strategy to avoid activation if water is present in the exhaust, the function integrates the warmth quantity seen by the sensor and then releases it, then the sensor is heated and starts measuring) • Check post selective catalytic reduction NOx sensor is correctly installed in the exhaust system • Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest
U300F-00	Ignition Input Accessory - No sub type information	 NOTE: To monitor removal detection post selective catalytic reduction NOx sensor • Post selective catalytic reduction NOx sensor not installed in the exhaust system • Post selective catalytic reduction NOx sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Post selective catalytic reduction NOx sensor failure	 NOTE: NOx sensor released, the dew point detection function is initiated (after engine start there is a strategy to avoid activation if water is present in the exhaust, the function integrates the warmth quantity seen by the sensor and then releases it, then the sensor is heated and starts measuring) • Check post selective catalytic reduction NOx sensor is correctly installed in the exhaust system • Refer to the electrical circuit diagrams and check the post selective catalytic reduction NOx sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new post selective catalytic reduction NOx sensor as required • Using the manufacturer approved diagnostic system clear all stored DTCs using the 'Diagnosis Menu' tab and retest

DTC Index

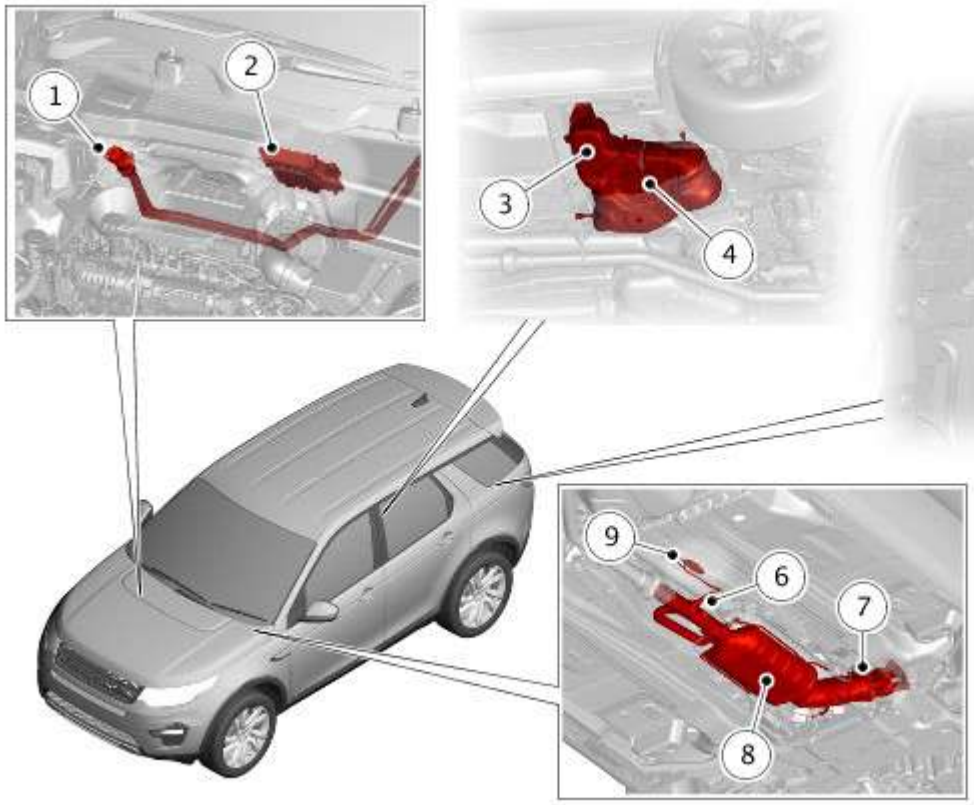
For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - INGENIUM I4 2.0L Diesel, DTC: Engine Control Module (ECM) (100-00 General Information, Description and Operation).

Published: 21-Jul-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Selective Catalyst Reduction

Description and Operation

COMPONENT LOCATION



Item	Description
1	Diesel Exhaust Fluid (DEF) filler assembly
2	Engine Control Module (ECM)
3	Diesel Exhaust Fluid (DEF) tank
4	Diesel Exhaust Fluid (DEF) tank module
5	Diesel Exhaust Fluid (DEF) heater control unit
6	Post - Selective Catalyst Reduction (SCR) nitrogen oxide (NOx) sensor
7	Diesel Exhaust Fluid (DEF) injector
8	Selective Catalyst Reduction (SCR) catalytic converter
9	Nitrogen oxide (NOx) sensor control module

OVERVIEW

The Selective Catalyst Reduction (SCR) system is an exhaust gas aftertreatment solution used to reduce the nitrogen oxides within the exhaust gas.

For this purpose, a specified amount of Diesel Exhaust Fluid (DEF) is injected into the exhaust system, downstream of the DPF. The injected DEF into the exhaust system is converted to ammonia (NH3) and carbon dioxide (CO2). The resulting ammonia (NH3) is used within a special catalyst in the exhaust stream. The resulting reaction converts the unwanted nitrogen oxides (NOx) into harmless nitrogen (N2) and water (H2O) vapor.

DESCRIPTION

Diesel Exhaust Fluid (DEF)

Diesel Exhaust Fluid (DEF) is a pure, odorless, colorless, synthetically manufactured, 32.5% aqueous solution of urea, used for the aftertreatment of exhaust gases in a Selective Catalyst Reduction (SCR) catalytic converter.

The SCR catalytic converter can be contaminated by low quantities of metals and thus the quality of the DEF fluid is held to closely controlled standards. DEF cannot be substituted by urea used in agriculture or diluted with any other fluid.

DEF is not categorized as a dangerous substance, it is non-flammable and non-toxic, and there is no danger in the event of spills. DEF can be stored on board vehicles, despite the limitation that it crystallizes at temperatures below -11°C (12°F).

In Europe, DEF is also known as AdBlue®, the fluid is specified by ISO22241.

Diesel Exhaust Fluid (DEF) Tank

E181365

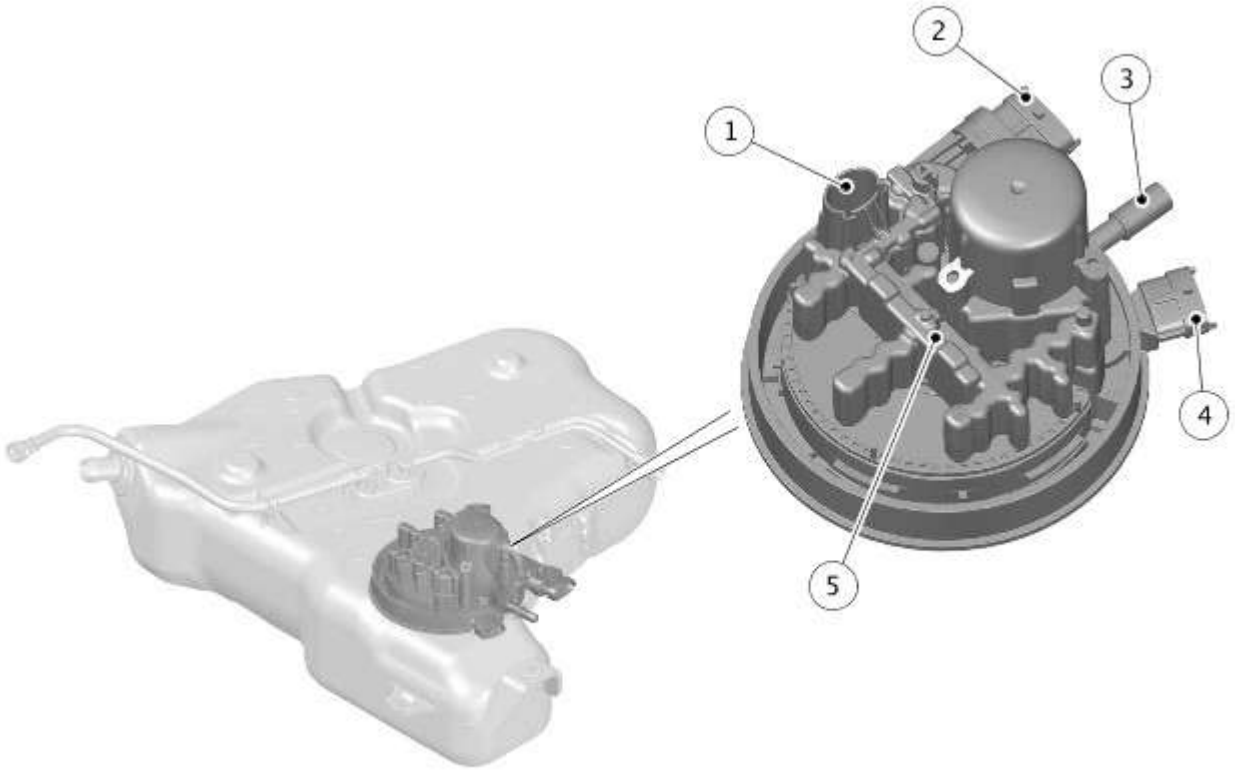
The Diesel Exhaust Fluid (DEF) tank is blow molded from High Density Polyethylene (HDPE). The tank is located under the right side of the fuel tank and it is secured to the underside of the vehicle in common with the fuel tank by the fuel tank support strap and a bolt secures the DEF tank to the rear left side member. The DEF tank contains the DEF tank module which is welded into the tank, and supplied as a unit. An additional shield protects the DEF tank module. The protection shield is attached to the DEF tank and the fuel tank heatshield with four screws. The tank includes a 12% unusable volume to protect the internal components as a result of fluid expansion under freezing conditions.

If the ambient temperature falls below -11°C (12°F), the DEF will freeze in the DEF tank, this will provide difficulty with the refill procedure. In order to thaw the DEF in the DEF tank, place the vehicle in a warm place for up to 2 hours before attempting to refill the tank.

The volume of the DEF tank is different on all JLR products, but has been designed so that refills are minimized outside of the vehicle service intervals.

When the vehicle consumes more DEF than anticipated, for example extended vehicle use in extreme temperatures, 'at altitude' or aggressive drive cycles, a warning message will be displayed in the Instrument Cluster (IC) message center to add DEF to the tank.

Diesel Exhaust Fluid (DEF) Tank Module



E181366

Item	Description
1	Diesel Exhaust Fluid (DEF) level sensor
2	Diesel Exhaust Fluid (DEF) tank module electrical connection
3	Diesel Exhaust Fluid (DEF) pressure line connection
4	Diesel Exhaust Fluid (DEF) injection pump electrical connection
5	Diesel Exhaust Fluid (DEF) heater element

The Diesel Exhaust Fluid (DEF) tank module is located at the bottom of the DEF tank. The module is welded into the tank and can only be replaced as a complete assembly. The DEF tank module includes a life-time fit filter, a fluid level and temperature sensor and a heater element to defrost the DEF in extreme cold climates. The DEF level sensor is an ultrasonic device located in the DEF tank module, which sends the DEF level value to the Engine Control Module (ECM) via Pulse Width Modulation (PWM) signals. The ultrasonic cone angle is ±10° and the readings are most accurate when the vehicle is stationary and on level ground.

The heater element is a Positive Temperature Coefficient (PTC) type heater, which provides safe operation to the system. Increased heater element temperature results in decreased current drawn from the DEF heater control module, which actuates the power supply of the heater element. Under normal operation the maximum current is 6A.

The DEF tank module has a fused power supply from the Battery Junction Box (BJB). The ECM controls the power supply of the DEF tank module via the DEF control relay located in the Rear Junction Box (RJB).

Diesel Exhaust Fluid (DEF) Injection Pump

E168830

The Diesel Exhaust Fluid (DEF) tank module comprises a DEF injection pump which is an assembly of two solenoid pumps. The DEF injection pump provides 6.5 bar operating pressure. The 6.5 bar pressure is required to maintain the complete DEF atomization in the exhaust gas. The purge pump is used to purge the DEF from the DEF pressure line at engine shut-down to prevent freezing in the DEF injector at low temperatures. The pumps have a fused power supply from the Rear Junction Box (RJB). The ECM controls the ground connection of the pumps individually via hardwired connections.

Diesel Exhaust Fluid (DEF) Line

The Diesel Exhaust Fluid (DEF) line provides hydraulic connection between the DEF injection pump and the DEF injector. The DEF line is manufactured from a plastic material which is specifically designed for use with DEF. A copper based resistor wire DEF line heater is installed within the DEF line with an electrical connector. The DEF line heater enables electrical heating of the DEF at low-ambient temperatures. The DEF line heater has hardwired connections to the DEF heater control unit, which actuates the power supply for the heater element, controlled by the ECM via the Private Controller Area Network (CAN) bus.

Diesel Exhaust Fluid (DEF) Injector

The Diesel Exhaust Fluid (DEF) injector is located in the exhaust system downstream of the catalytic converter and it is secured to the S-shaped exhaust pipe with a clamp. Due to the position of the injector on the S-shaped exhaust pipe, the DEF is injected axially to the exhaust gas flow direction ensuring the DEF is mixed well and distributed evenly within the exhaust gas. The DEF injector consists of an injector and a passive cooling heat sink to protect the injector from overheating due to the high exhaust temperatures.

The DEF injector works at high pressures to obtain the complete atomization of the injected DEF, this ensures the SCR catalytic converter is working to its optimum performance. The DEF injector is controlled by the ECM with PWM signals.

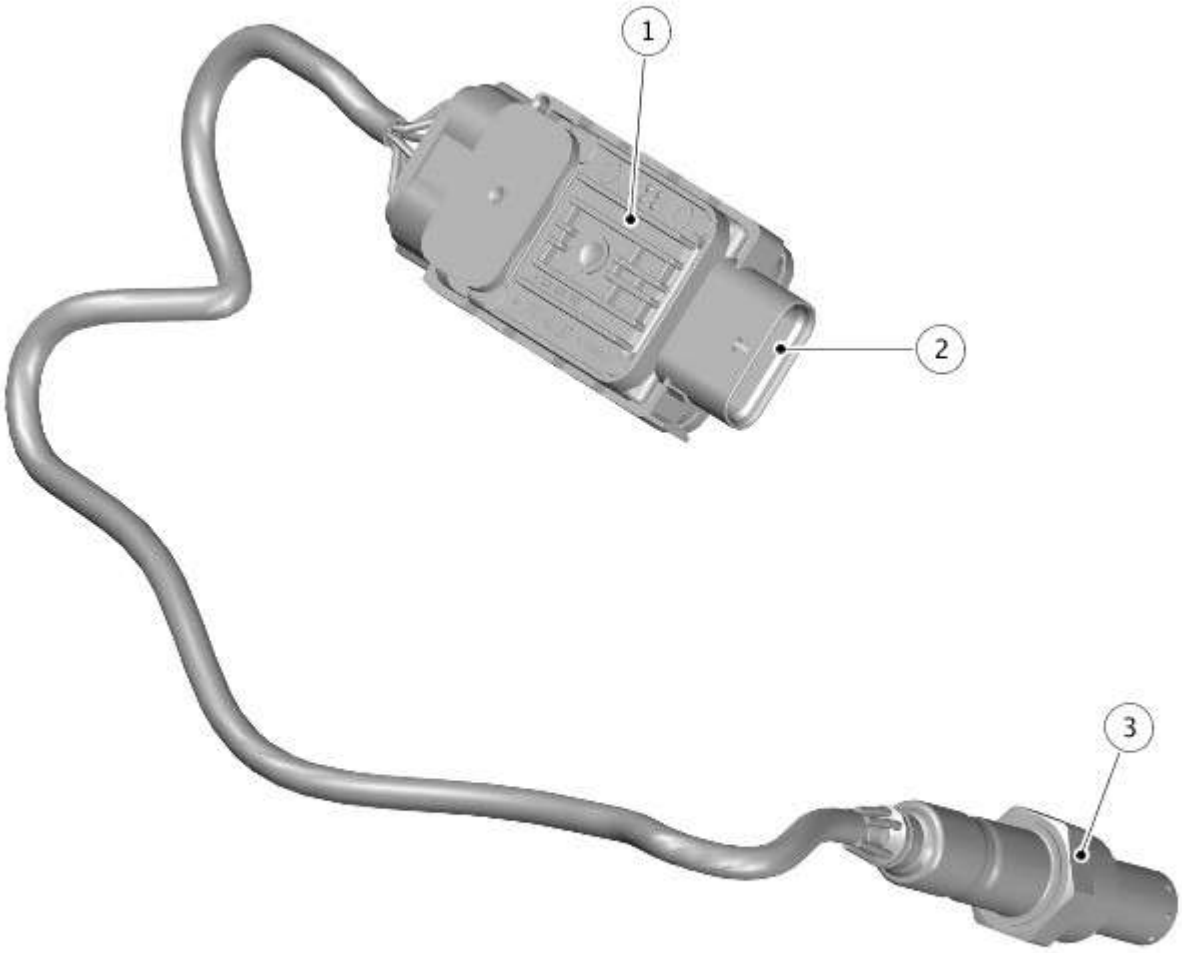
Diesel Exhaust Fluid (DEF) Heater Control Unit

E168833

The Diesel Exhaust Fluid (DEF) heater control unit is located on the left side of the luggage compartment, behind the side trim panel. The heater system enables rapid SCR system operation in the event of frozen DEF and ensures an adequate quantity of defrosted DEF is available at all operating points. The DEF heater control unit has a fused power supply from the RJB and it receives an ignition signal from the ECM relay located in the BJB. Operation of the ECM relay is controlled by the ECM.

The DEF heater control unit has hardwired connections to the DEF tank module and the DEF line heater. If the ambient air temperature is below -7°C (19.4°F), the ECM switches on the DEF heater control unit via the Private CAN bus. The DEF heater control unit energizes the DEF tank module heater element and the DEF line heater. The DEF heater control unit has on-board diagnostics to detect and report faults to the ECM via the Private CAN bus.

Nitrogen Oxide (NOx) Sensor



E181367

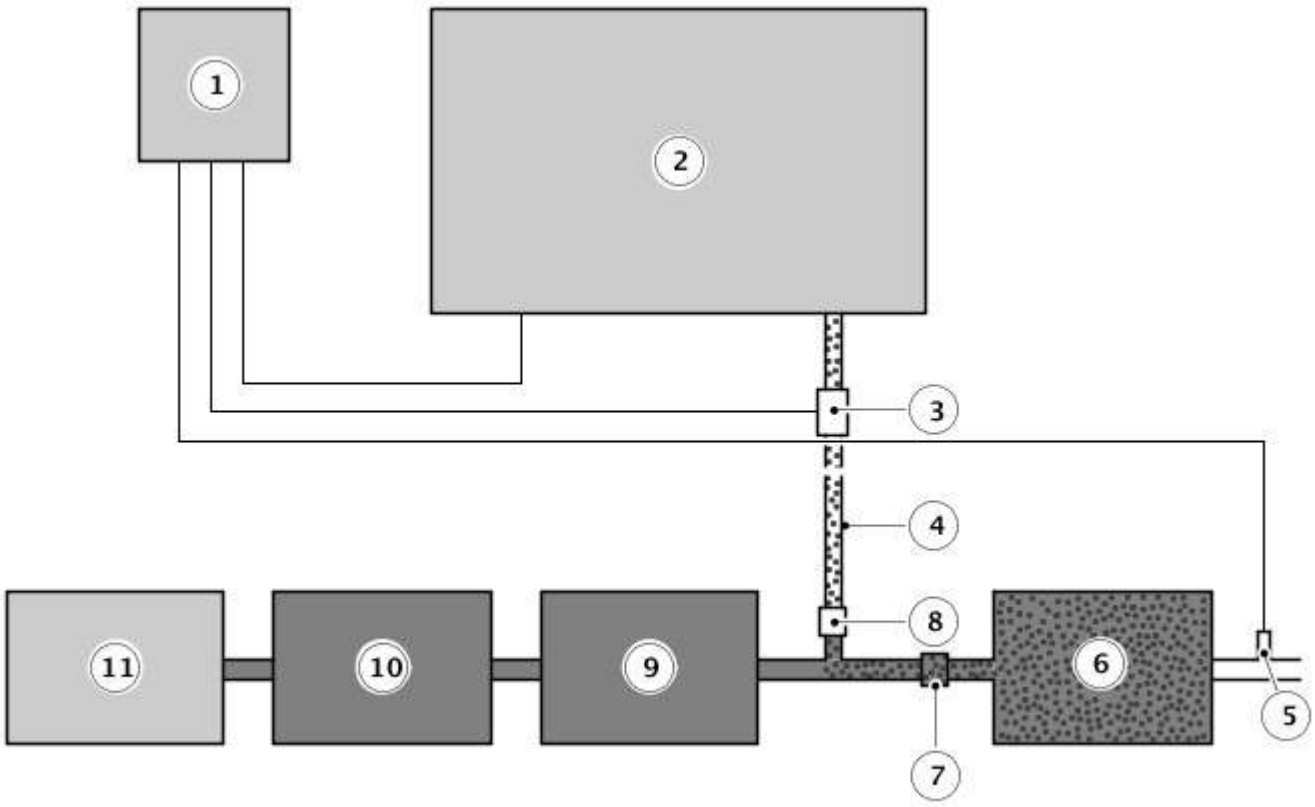
Item	Description
1	Post - selective catalyst reduction (SCR) nitrogen oxide (NOx) sensor control module
2	Electrical connection
3	Post - selective catalyst reduction (SCR) nitrogen oxide (NOx) sensor

The Post - selective catalyst reduction (SCR) nitrogen oxide (NOx) sensor is located in the exhaust pipe downstream of the SCR catalytic converter. The NOx sensor comprises a sensor element attached to a dedicated control module with a hardwired connection.

The sensor and the control module are replaced as an assembly. The NOx sensor is an evolution of the wide band oxygen sensor. The sensor element is constructed from special ceramics and contains two oxygen density detecting chambers that work together to determine the NOx concentration in the exhaust gas. The control module sends a message via the Private CAN bus to the ECM for monitoring the effectiveness of the SCR system.

OPERATION

Schematic Diagram - Selective Catalyst Reduction (SCR) System



E176442

Item	Description
1	Engine Control Module (ECM)
2	Diesel Exhaust Fluid (DEF) tank with Diesel Exhaust Fluid (DEF) tank module
3	Diesel Exhaust Fluid (DEF) injection pump
4	Diesel Exhaust Fluid (DEF) line
5	Post - Selective Catalyst Reduction (SCR) nitrogen oxide (NOx) sensor
6	Selective Catalyst Reduction (SCR) catalytic converter
7	Mixer plate
8	Diesel Exhaust Fluid (DEF) injector
9	Diesel Particulate Filter (DPF)
10	Catalytic converter
11	Engine

The SCR catalytic converter reaches the operating temperature at 150 °C (302°F). The temperature of the exhaust gas is measured by the post DPF exhaust gas temperature sensor, which is connected to the ECM.

The DEF injection pump supplies the DEF from the DEF tank at a pressure of 6.5 bar to the DEF injector via the heated DEF line. The DEF injector is controlled with a Pulse Width Modulation (PWM) signal by the ECM.

The injected DEF is carried along by the exhaust gas flow and is evenly distributed in the exhaust gas by the mixer plate. The mixer plate is located in the exhaust pipe upstream of the SCR catalytic converter and downstream of the DEF injector. After the injection, the DEF is converted into ammonia (NH3) and carbon dioxide (CO2) during chemical reactions.

In the SCR catalytic converter, the ammonia (NH3) reacts with the nitrogen oxides (NOx) to produce nitrogen (N2) and water (H2O) vapor. The SCR system's efficiency is registered by the post SCR NOx sensor.

In order to optimise the SCR system's efficiency, the correct amount of ammonia (NH3) is required in the exhaust gas. The ECM achieves this by operating in two modes:

- Storage mode
- On-line mode

For example, storage mode will operate during low speed driving condition; the on-line mode will operate at high speed driving condition.

Storage Mode

When the system operates in storage mode, the ammonia (NH3) is stored on the SCR catalytic converter and used as a function of the NOx feed. In this mode, the objective of the control system is to ensure that a pre-determined amount of NH3 is available on the SCR catalytic converter at any given time. As a consequence, it may be difficult to diagnose dosing system problems when the system is in storage mode.

On-line Mode

When the system operates in on-line mode, the NOx is measured by the pre-SCR NOx sensor (or the model value) and the amount of ammonia (NH3) is injected as a function of the NOx feed. In this mode, the dosing system is 'easy' to diagnose if it is functioning correctly as the pulses from the DEF injector are frequent.

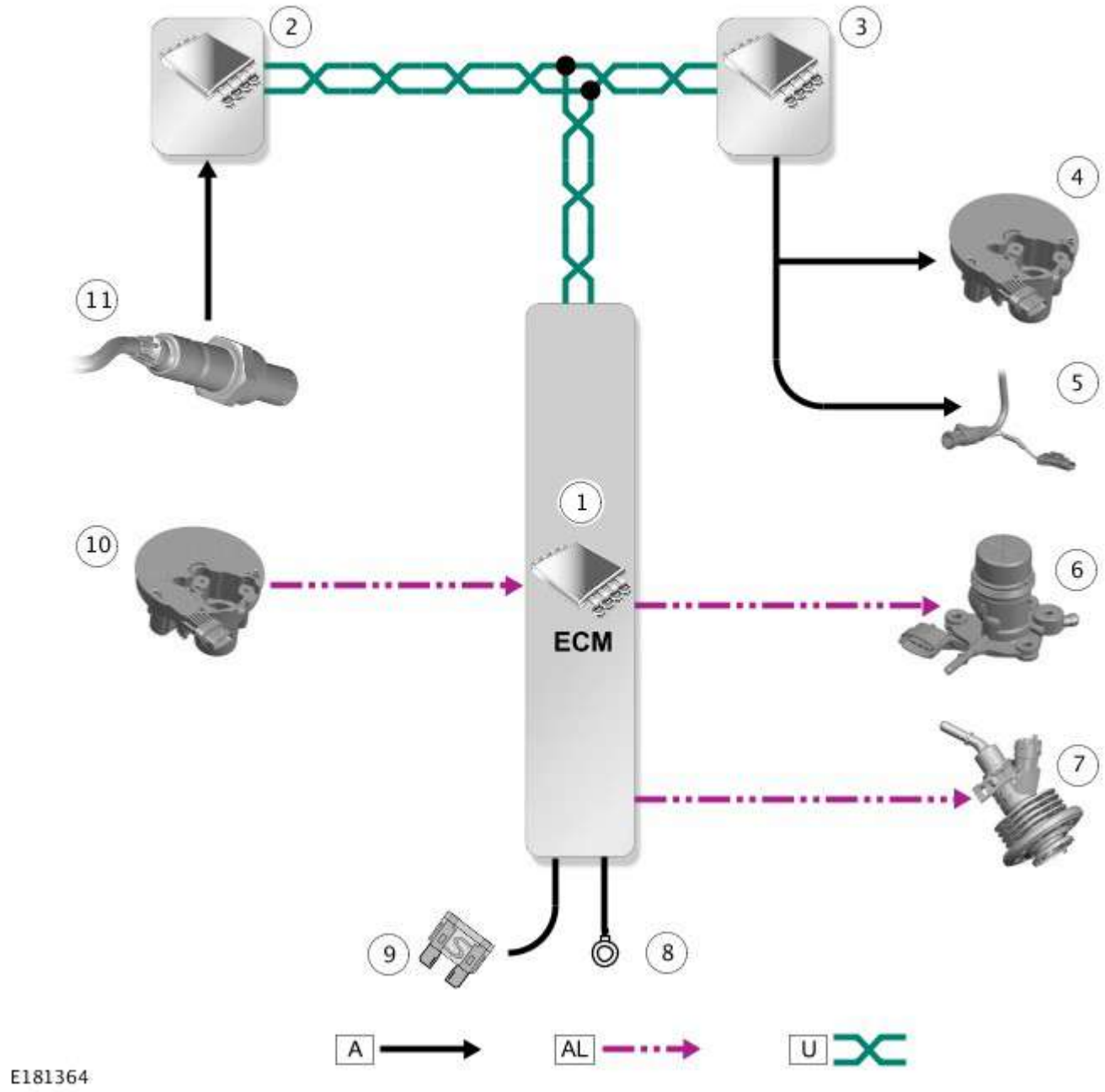
Warning Messages

It is a legal requirement for the driver to be informed of SCR system faults. If the performance of the SCR system is reduced a message will be displayed in the Instrument Cluster (IC) message center. There are three possible routes to receive a fault message on the IC:

- Low DEF volume in the tank
- Incorrect DEF quality supplied to the SCR System
- Efficiency of the SCR System is reduced in the event of a system fault.

In case of low DEF level, a warning is given 800km (497 miles) ahead of any vehicle restriction in order to allow time to visit an authorized Land Rover dealer to refill the DEF tank. If the DEF fluid is not replenished within this distance, and the engine is turned off, the vehicle will fail to start. In this event customers can use two standard size refill bottles as a short term solution to restart the vehicle, a complete refill of the DEF tank will still be required by an authorized Land Rover dealer.

INPUT/OUTPUT DIAGRAM



A = Hardwired; AL = Pulse Width Modulation (PWM); U = Private Controller Area Network (CAN) bus.

Item	Description
1	Engine Control Module (ECM)
2	Post-Selective Catalyst Reduction (SCR) nitrogen oxide (NOx) sensor control module
3	Diesel Exhaust Fluid (DEF) heater control unit
4	Diesel Exhaust Fluid (DEF) tank module heater element
5	Diesel Exhaust Fluid (DEF) line heater
6	Diesel Exhaust Fluid (DEF) injection pump
7	Diesel Exhaust Fluid (DEF) injector
8	Ground
9	Power supply
10	Diesel Exhaust Fluid (DEF) level sensor
11	Post Selective Catalyst Reduction (SCR) NOx sensor

Published: 02-Mar-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Exhaust System

Diagnosis and Testing

Principles of Operation

For a detailed description of the Exhaust System, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Exhaust System (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

NOTES:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.

Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern

2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical
• Exhaust gas leaks • Restrictions or blockages • Metal fatigue • Pipes, mufflers and catalytic converters • Joints or gaskets • Exhaust mountings • Clearance around components • Heat shields

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index

5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

Symptom Chart

Symptom	Possible Causes	Action
Exhaust excessively noisy	• Exhaust system leaking • Exhaust system fouling body, transmission, etc	• Check the exhaust system for leaks • Check the exhaust system for foul conditions
	• Exhaust system restricted/blocked	• Check the exhaust system for restrictions and blockages • Check the catalytic converter for blockage or damage

Loss of engine performance	• Catalytic converter blocked or damaged • Fuel system fault • Ignition system fault • Engine system fault	• Refer to the relevant section of the workshop manual and check the fuel system • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index

DTC Index

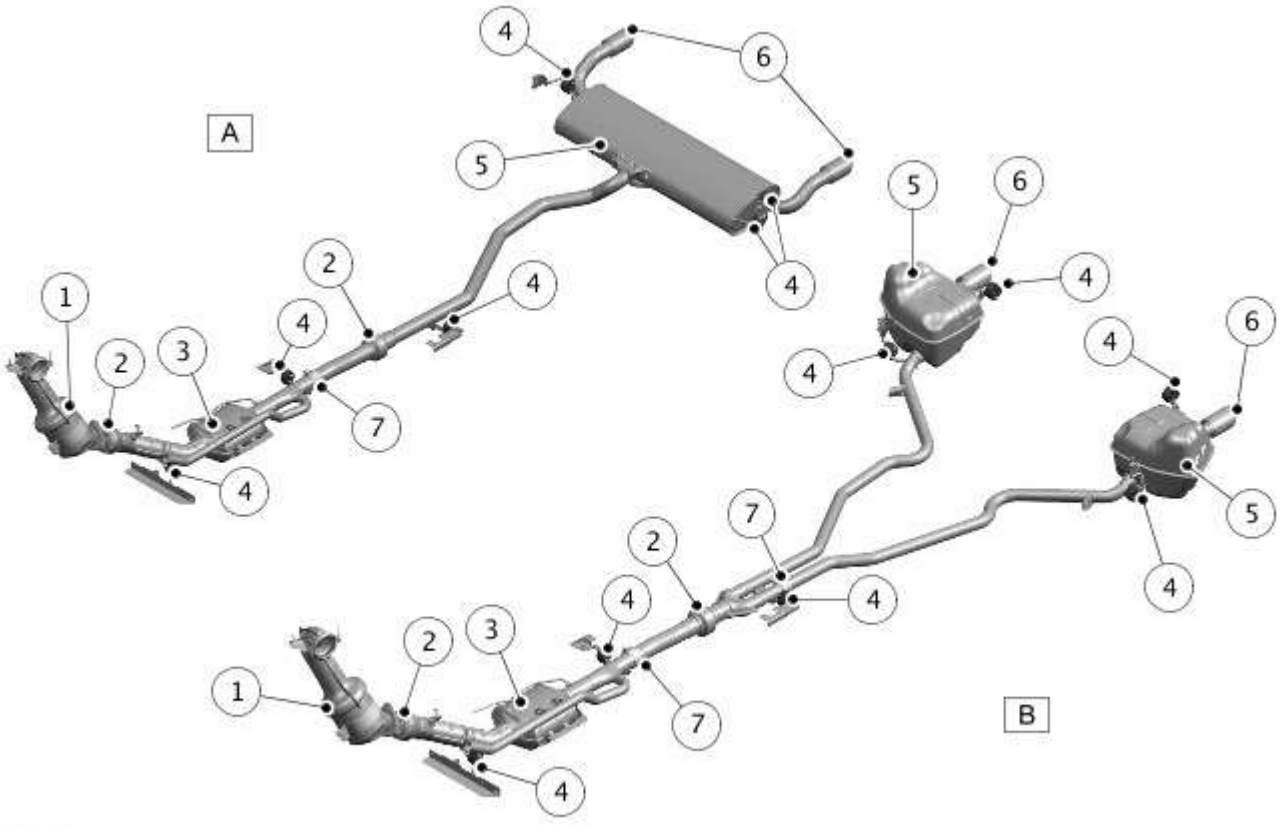
For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - INGENIUM I4 2.0L Diesel, DTC: Engine Control Module (ECM) (100-00, Description and Operation).

Published: 21-Jul-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Exhaust System

Description and Operation

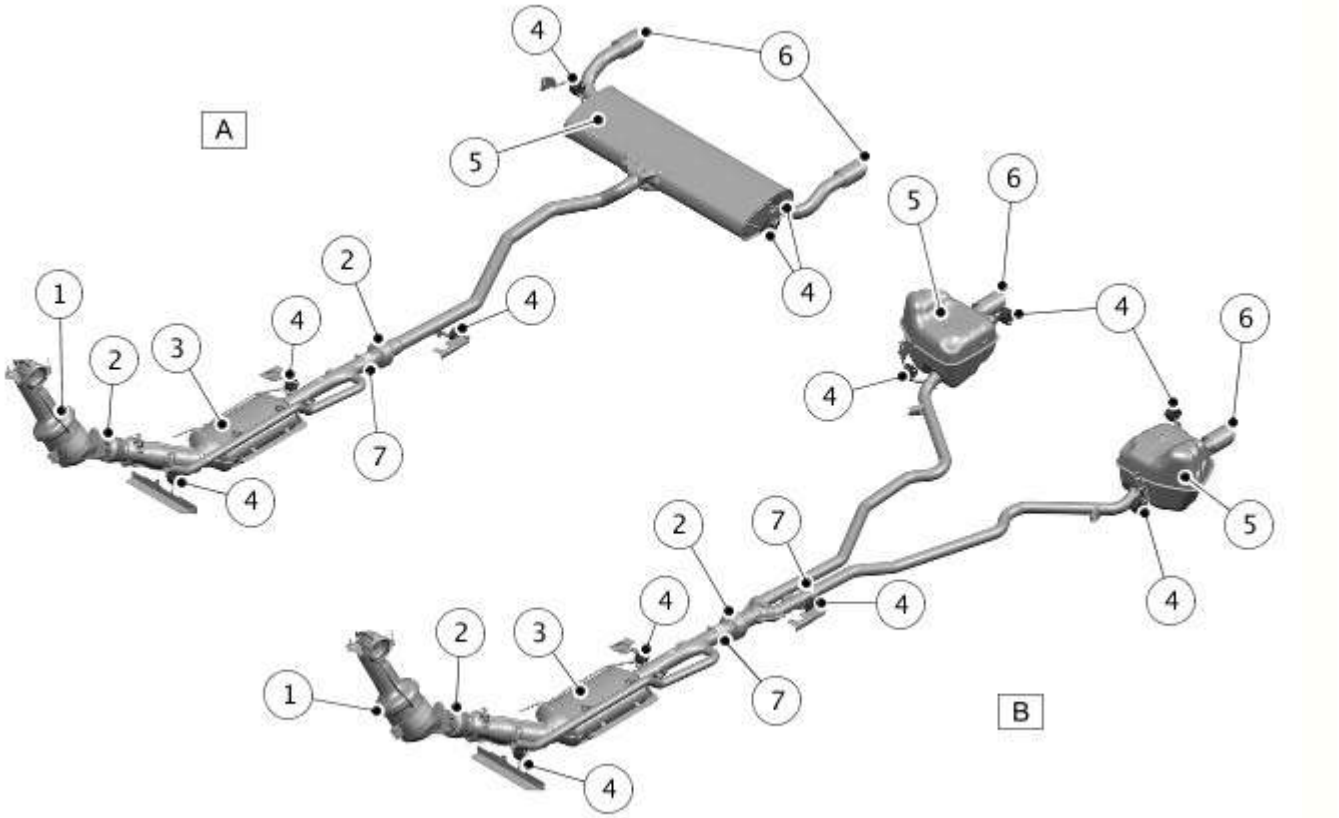
COMPONENT LOCATION - SHEET 1 OF 2 - VEHICLES WITHOUT SELECTIVE CATALYST REDUCTION (SCR) SYSTEM



E181277

Item	Description
A	Vehicles with 5 seats
B	Vehicles with 7 seats
1	Catalytic converter
2	Flexible coupling
3	Diesel Particulate Filter (DPF)
4	Mounting rubber
5	Rear silencer
6	Outlet pipe
7	Clamp

COMPONENT LOCATION - SHEET 2 OF 2 - VEHICLES WITH SELECTIVE CATALYST REDUCTION (SCR) SYSTEM



Item	Description
A	Vehicles with 5 seats
B	Vehicles with 7 seats
1	Catalytic converter
2	Flexible coupling
3	Diesel Particulate Filter (DPF) and Selective Catalyst Reduction (SCR) catalytic converter assembly
4	Mounting rubber
5	Rear silencer
6	Outlet pipe
7	Clamp

OVERVIEW

The exhaust system is manufactured from stainless steel and is attached to the underside of the vehicle body with rubber mountings which are located on hanger bars that are welded to the exhaust system. The rubber mountings locate on adjacent hanger brackets which are bolted or welded to the underside of the vehicle body and the subframes.

The exhaust system comprises three separate sections:

- A front section, including a catalytic converter.
- A center section,
  - incorporating the Diesel Particulate Filter (DPF) and a connecting pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve on EU5 market vehicles.For additional information, refer to: Diesel Particulate Filter (309-00C, Description and Operation).
  - incorporating the Diesel Particulate Filter (DPF), the Selective Catalyst Reduction (SCR) catalytic converter and a connecting pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve on EU6 market vehicles.For additional information, refer to: Selective Catalyst Reduction (SCR) (309-00C, Description and Operation).
- A rear section,
  - comprising a single rear silencer with two outlet pipes on vehicles with 5 seats.
  - comprising two rear silencers on vehicles with 7 seats.

DESCRIPTION

Front Section

The front section has an inlet flange which mates with the turbocharger outlet. The flange is sealed with a stainless metallic gasket to the turbocharger and secured with a vee clamp onto the turbocharger housing.

An elbow from the flange is connected to the catalytic converter. The elbow contains a threaded boss for the installation of the Heated Oxygen Sensor (HO2S).

A support bracket with a stud is welded to the elbow. A mounting bracket is secured to the front section with a nut. The mounting bracket is connected to the top of the engine with three bolts, which secures the top of the front section to the engine. A band clamp is attached to the catalytic converter with a bolt to hold the front section in its position.

The catalytic converter is connected to a flange which mates with the flexible coupling of the center section.

Center Section - Vehicles Without Selective Catalyst Reduction (SCR) system

The center section is connected to the front section by a flange. It is sealed with a metal gasket and secured with three studs and nuts. The flange is connected to a flexible coupling with a pipe. The pipe comprises a threaded boss for the post-catalyst exhaust gas temperature sensor. A curved pipe from the flexible coupling is connected to the Diesel Particulate Filter (DPF). A threaded boss is welded to the pipe and provides the connection of the differential pressure sensor high pressure pipe. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the front subframe, to support the center section.

The DPF outlet pipe comprises threaded bosses for the post-DPF exhaust gas temperature sensor and the differential pressure sensor low pressure pipe. An additional pipe is welded to the outlet pipe, which routes the exhaust gases from the outlet pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the underside of the vehicle body, to support the center section.For additional information, refer to: (309-00C)

Diesel Particulate Filter (Description and Operation),
Diesel Particulate Filter (Description and Operation).

Center Section - Vehicles With Selective Catalyst Reduction (SCR) system

The center section is connected to the front section by a flange. It is sealed with a metal gasket and secured with three studs and nuts. The flange is connected to a flexible coupling with a pipe. The pipe comprises a threaded boss for the post-catalyst exhaust gas temperature sensor. A curved pipe from the flexible coupling is connected to the DPF and Selective Catalyst Reduction (SCR) catalytic converter assembly. A threaded boss is welded to the pipe and provides the connection of the differential pressure sensor high pressure pipe. A welded boss provides the attachment of the Diesel Exhaust Fluid (DEF) injector. A mixer plate is located in the exhaust pipe downstream of the DEF injector. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the front subframe, to support the center section.

The SCR outlet pipe comprises threaded bosses for the post-DPF exhaust gas temperature sensor, the differential pressure sensor low pressure pipe and the post-SCR nitrogen oxide (NOx) sensor. An additional pipe is welded to the outlet pipe, which routes the exhaust gases from the outlet pipe to the Low Pressure (LP) Exhaust Gas Recirculation (EGR) valve. A welded hanger bar with a rubber mounting is connected to a common bracket which in turn bolted to the underside of the vehicle body, to support the center section.For additional information, refer to: Selective Catalyst Reduction (SCR) (309-00C, Description and Operation).

Rear Section - Vehicles With 5 Seats

If the vehicle is equipped with 5 seats, the exhaust system rear section comprises a single rear silencer. The rear section is connected to the center section with a clamp. The rear silencer is connected by a pipe to the center section and secured with a clamp.

The rear section inlet pipe comprises a flexible coupling and a welded hanger bar. A hanger bar is attached to the hanger bracket with a rubber mounting. The hanger bracket is bolted to the underside of the vehicle body.

The rear section inlet pipe is routed in a central position under the vehicle, with a slight deviation around the Rear Drive Unit (RDU), where it joins with the rear silencer. The rear silencer is supported by three rubber mountings. Two are attached to a hanger bracket bolted to the left side of the rear subframe and the third is attached to a hanger bracket on the right side of the rear subframe. The rear silencer has an outlet pipe at each end. Each outlet pipe is fitted with a stainless steel finisher.

Rear Section - Vehicles With 7 Seats

If the vehicle is equipped with 7 seats, the exhaust system rear section comprises two rear silencers. The rear section is connected to the center section with a clamp. The rear silencers are connected by two individual pipes to a 'Y' piece which the center section and secured with a clamp.

The rear section comprises a flexible coupling which is connected to the center section with a clamp. The flexible coupling outlet pipe is separated into two outlet pipes and a hanger bar and an exhaust brace are welded to the pipes to retain the system in position and reduce exhaust flexing. A hanger bar is attached to the hanger bracket with a rubber mounting. The hanger bracket is bolted to the underside of the vehicle body. The left rear silencer inlet pipe is connected to the rear section with a clamp. Inlet pipes to each rear silencer are routed with a slight deviation to each side of the RDU. Both inlet pipes have a welded hanger bar where it connects to the appropriate rear silencer. Rubber mountings and hanger brackets are attached to the hanger bars. The hanger brackets are bolted to the rear subframe on both side. Each rear silencer is connected to the rear armature via a welded hanger bar and rubber mounting. Each rear silencer has an outlet pipe at each end. Each pipe is fitted with a stainless steel finisher.

SYSTEM OPERATION

Catalytic Converter

The oxidizing catalytic converter is fitted in the front section of the exhaust system, after the Heated Oxygen Sensor (HO2S). The catalytic converter assembly is common to vehicles with or without the DPF, however, the catalyst coating specification varies depending on the market. The HO2S monitors the exhaust gases leaving the engine. The engine management system uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimise the exhaust emissions.For additional information, refer to: Electronic Engine Controls (303-14C, Description and Operation).

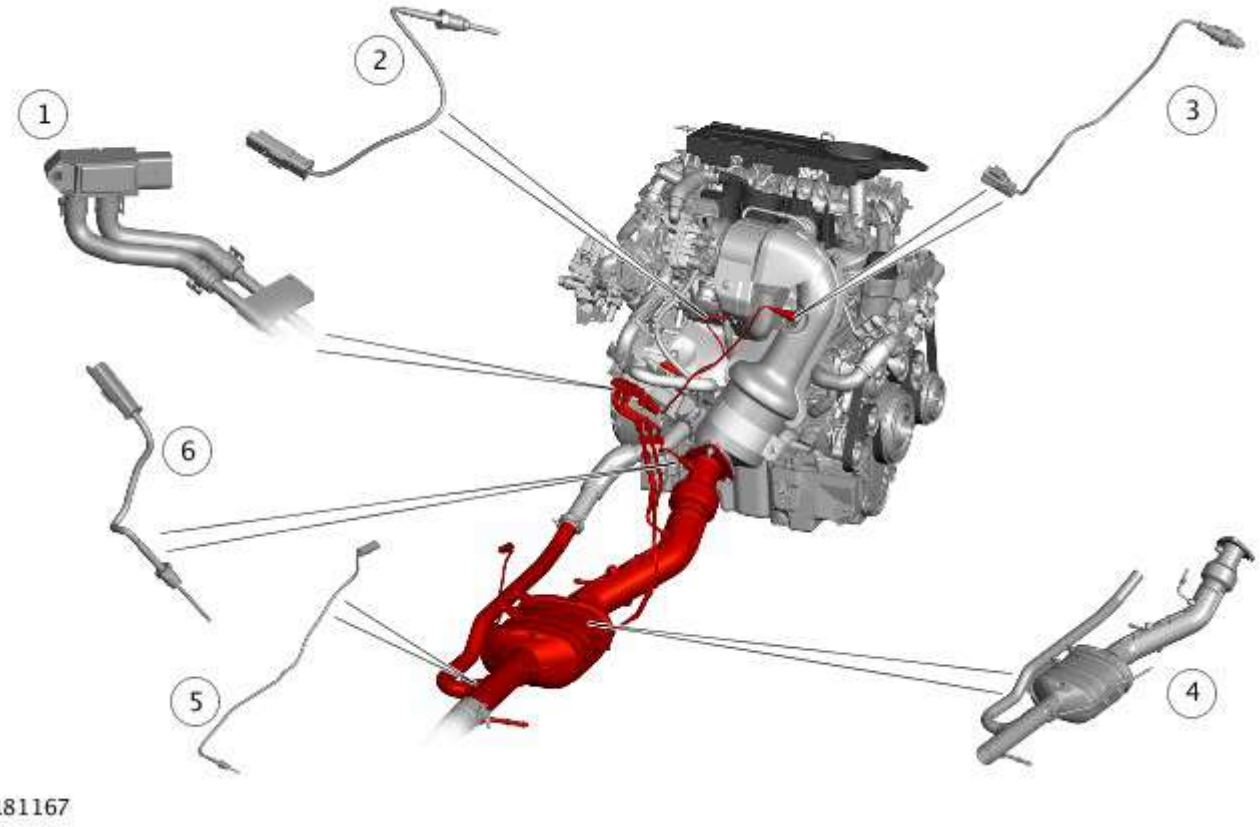
The catalytic converter further reduces the carbon monoxide and hydrocarbons content of the exhaust gases. In the catalytic converter the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called a 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing platinum, which is the active constituent for converting harmful emissions into inert by-products. The platinum adds oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

Published: 21-Jul-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Diesel Particulate Filter - Component Location

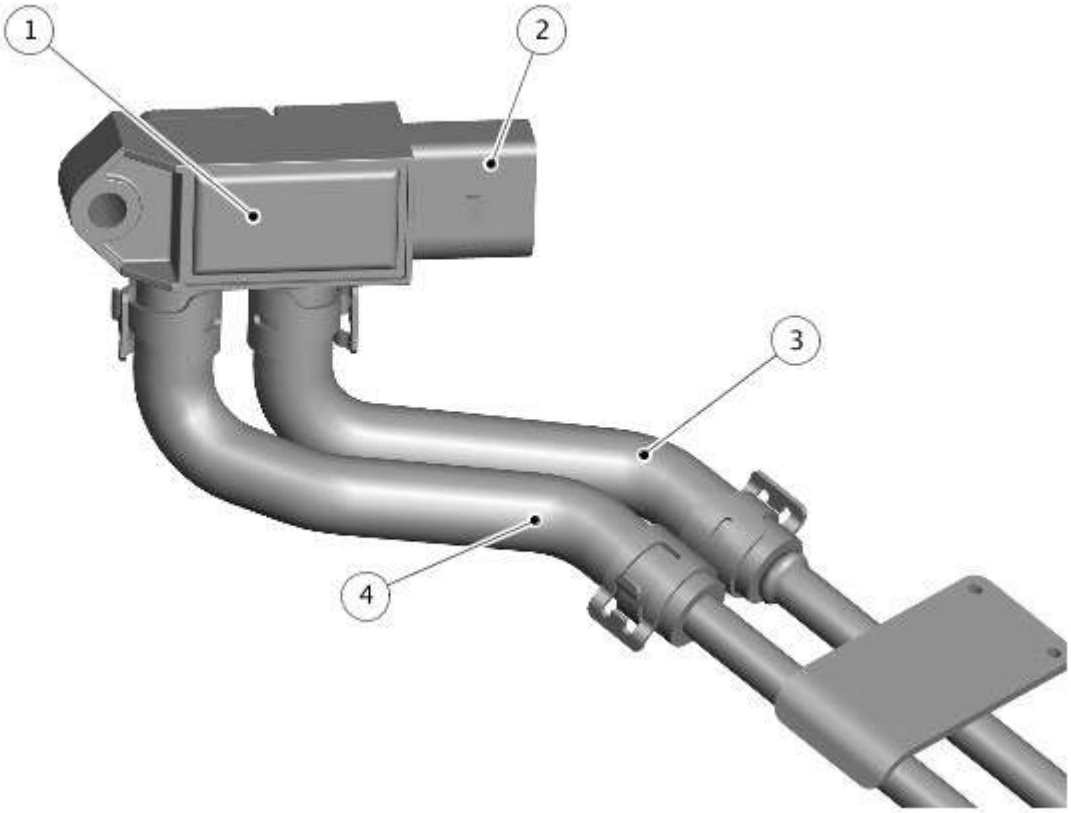
Description and Operation

COMPONENT LOCATION - SHEET 1 OF 3 - DIESEL PARTICULATE FILTER (DPF)



Item	Description
1	Differential pressure sensor
2	Pre-catalytic converter exhaust gas temperature sensor
3	Heated Oxygen Sensor (HO2S)
4	Diesel Particulate Filter (DPF)
5	Post-Diesel Particulate Filter (DPF) exhaust gas temperature sensor
6	Pre-Diesel Particulate Filter (DPF) exhaust gas temperature sensor

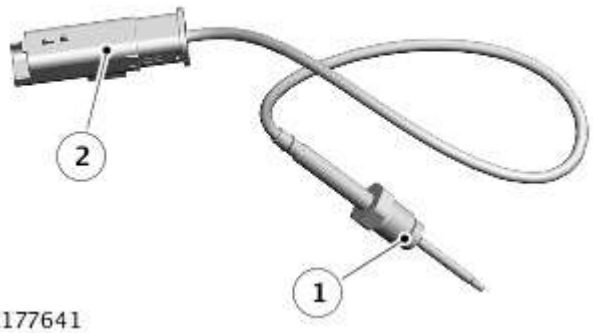
COMPONENT LOCATION - SHEET 2 OF 3 - DIFFERENTIAL PRESSURE SENSOR



E181168

Item	Description
1	Differential pressure sensor
2	Electrical connection
3	Differential pressure sensor pipe - low
4	Differential pressure sensor pipe - high

COMPONENT LOCATION - SHEET 3 OF 3 - EXHAUST GAS TEMPERATURE SENSOR



E177641

Item	Description
1	Exhaust gas temperature sensor
2	Electrical connection

Published: 15-May-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Diesel Particulate Filter - System Operation and Component Description

Description and Operation

System Operation

DIESEL PARTICULATE FILTER (DPF)

Two processes are used to regenerate the DPF; passive and active.

Passive Regeneration

Passive regeneration requires no special engine management intervention and occurs during normal engine operation. The passive regeneration involves a slow conversion of the particulate matter deposited in the DPF into carbon dioxide. This process occurs when the DPF temperature exceeds 250°C (482°F) and is a continuous process when the vehicle is being driven at higher engine loads and speeds.

During passive regeneration, only a portion of the particulate matter is converted into carbon dioxide. This is because the chemical reaction, which utilises nitrogen dioxide, is slower than the rate of engine production of particulate matter and is effective from 250°C (482°F).

Above 580°C the conversion efficiency of the particulates into carbon dioxide rapidly increases. These temperatures are generally only be achieved using the active regeneration process.

Active Regeneration

Active regeneration starts when the particulate loading of the DPF reaches a threshold as monitored or determined by the DPF control software. The threshold calculation is based on driving style, distance travelled and back pressure signals from the differential pressure sensor.

Active regeneration generally occurs every 250 miles (400 km) although this is dependant on how the vehicle is driven. For example, if the vehicle is driven at low loads in urban traffic regularly, active regeneration will occur more often. This is due to the rapid build-up of particulates in the DPF than if the vehicle is driven at high speeds when passive regeneration will have occurred.

The DPF software incorporates a mileage trigger which is used as back-up for active regeneration. If active regeneration has not been initiated by a back pressure signal from the differential pressure sensor, regeneration is requested based on distance travelled.

Active regeneration of the DPF is commenced when the temperature of the DPF is increased to the combustion temperature of the particles. The DPF temperature is raised by increasing the exhaust gas temperature. This is achieved by introducing post-injection of fuel after the pilot and main fuel injections have occurred.

It is determined by the DPF software monitoring the signals from the two DPF temperature sensors to establish the temperature of the DPF. Depending on the DPF temperature, the DPF software requests the Engine Control Module (ECM) to perform either one or two post-injections of fuel:

- The first post-injection of fuel is associated with retarded combustion to increase the temperature of the exhaust gas and therefore allow the oxidation catalyst to reach it's operational temperature.
- The second post-injection of fuel is injected late in the power stroke cycle. The fuel is not intended to combust in the cylinder, and hence unburnt fuel passes into the exhaust where it creates an exothermic event within the catalytic converter, further increasing the temperature of the DPF.

The active regeneration process takes up to 20 minutes to complete. The first phase increases the exhaust gas temperature to ensure the catalytic converter is active. The second phase further increases the DPF temperature to the optimum temperature for particle combustion. This temperature is then controlled for 15-20 minutes to ensure complete oxidation of the particles within the DPF. The oxidation process converts the carbon particles to carbon dioxide.

The active regeneration temperature of the DPF is closely monitored by the DPF software to maintain a target temperature at the DPF inlet. The temperature control ensures that the temperatures do not exceed the operational limits of the turbocharger and the catalytic converter. The turbocharger inlet temperature must not exceed 830°C (1526°F), the catalytic converter brick temperature must not exceed 800°C (1472°F) and the exit temperature must remain below 875°C (1382°F).

Air management control during DPF regeneration

The DPF air management function controls the following:

- EGR control
- Turbocharger boost pressure control
- Intake mass air flow

During active regeneration, the EGR operation is disabled and the closed-loop activation of the turbocharger boost controller is calculated. The air management function controls the air in the intake manifold to a predetermined mass flow. This control is required to achieve the correct in-cylinder conditions for stable and robust combustion of the post injected fuel.

The function controls the intake mass air flow by actuating the throttle and by adjustment of the turbocharger boost pressure control.

If, due to vehicle usage and/or driving style, the active regeneration process cannot take place or is unable to regenerate the DPF, the dealer can force regenerate the DPF. This is achieved by driving the vehicle until the engine is at its normal operating temperature and then driving for approximately a further 20 minutes at speeds between 60 km/h to 120 km/h (40 mph to 70 mph). It is possible that the regeneration process will occur at lower speeds, but the events may take longer at a 48 km/h (30 mph) average speed.

DPF Control

The DPF requires constant monitoring to ensure that it is operating at its optimum efficiency and does not become blocked. The ECM contains DPF software which controls the monitoring and operation of the DPF system and also monitors other vehicle data to determine regeneration periods and service intervals.

The DPF software can be divided into three separate control software functions; a DPF supervisor function, a DPF fuel management function and a DPF air management function.

These three functions are controlled by a fourth software function known as the DPF co-ordinator function. The co-ordinator function manages the operation of the other functions when an active regeneration is requested.

DPF Fuel Management Function

The DPF fuel management function controls the following:

- Timing and quantity of the four split injections per stroke (pilot, main and two post injections).
- Injection pressure and the transition between the three different calibration levels of injection.

The fuel management calculates the quantity and timing for the four split injections, for each of the three calibration levels for injection pressure, and also manages the transition between the levels.

The two post injections are required to separate the functionality of increasing in-cylinder gas temperatures and the production of hydrocarbons. The first post injection is used to generate the higher in-cylinder gas temperature while simultaneously retaining the same engine torque output produced during normal (non-regeneration) engine operation. The second post injection is used to generate hydrocarbons by allowing unburnt fuel into the catalytic converter without producing increased engine torque.

DPF Air Management Function

The DPF air management function controls the following:

- EGR control
- Turbocharger boost pressure control
- Intake mass air flow

DPF Co-ordinator Fuction

The DPF co-ordinator function reacts to a regeneration request from the supervisor function by initiating and co-ordinating the following DPF regeneration requests:

- EGR cut-off - except for overrun condition
- Turbocharger boost pressure control
- Engine load increase
- Control of mass air flow
- Fuel injection control.

When the supervisor function issues a regeneration request, the co-ordinator function requests EGR cut-off and a regeneration specific turbocharger boost pressure control. It then waits for a feedback signal from the EGR system confirming that the EGR valve is closed.

When the EGR valve is closed, the co-ordinator function initiates requests to increase engine load by controlling the intake mass air flow.

Once confirmation is received that intake conditions are controlled or a calibration time has expired, the co-ordinator function then changes to a state awaiting an accelerator pedal release manoeuvre from the driver. If this occurs or a calibration time has expired, the co-ordinator function generates a request to control fuel injections to increase exhaust gas temperature.

DIFFERENTIAL PRESSURE SENSOR

As the amount of particulates trapped by the DPF increases, the pressure at the inlet side of the DPF increases in comparison to the DPF outlet. The DPF software uses this comparison, in conjunction with other data, to calculate the accumulated amount of trapped particulates.

By measuring the pressure difference between the DPF inlet and outlet and the DPF temperature, the DPF software can determine if the DPF is becoming blocked and requires regeneration.

Component Description

DIESEL PARTICULATE FILTER (DPF)

The DPF system reduces diesel particulate emissions to negligible levels to meet current standards for:

- European stage 5 and 6 emissions
- NAS LEV3 emissions

The particulate emissions are the black fumes emitted from the diesel engine under certain load conditions. The emissions are a complex mixture of solid and liquid components with the majority of the particulates being carbon microspheres on which hydrocarbons from the engine's fuel and lubricant condense.

The DPF system comprises the following components:

- Diesel Particulate Filter (DPF)
- DPF temperature sensors
- DPF control software incorporated in the ECM
- Differential pressure sensor.

The DPF is located in the exhaust system, downstream of the catalytic converter. Its function is to trap particulate matter in the exhaust gases leaving the engine. A major feature of the DPF is its ability for regeneration. Regeneration is the burning of particulates trapped by the filter to prevent obstruction to the free flow of exhaust gasses. The regeneration process takes place at calculated intervals and is not noticeable by the driver of the vehicle.

Regeneration is most important, since an overfilled filter can damage the engine through excessive exhaust back pressure and can itself be damaged or destroyed. The material trapped in the filter is in the most part carbon particles with some absorbed hydrocarbons.

The DPF uses a filter technology based on a filter with a catalytic coating. The DPF is made from silicon carbide housed in a steel container and has excellent thermal shock resistance and thermal conductivity properties. The DPF is designed for the engine's operating requirements to maintain the optimum back pressure requirements.

The porous surface of the filter consists of thousands of small parallel channels positioned in the longitudinal direction of the exhaust system. Adjacent channels in the filter are alternately plugged at the end. This design forces the exhaust gasses to flow through the porous filter walls, which act as the filter medium. Particulate matter which are too big to pass through the porous surface are collected and stored in the channels.

The collected particulate matter, if not removed, can create an obstruction to exhaust gas flow. The stored particles are removed by a regeneration process which incinerates the particles.

Diesel Particulate Filter Temperature Sensors

The sensors measure the temperature of exhaust gas exiting the turbocharger and before it passes through the DPF and provides the information needed to calculate the DPF temperature.

The information is used, in conjunction with other data, to estimate the amount of accumulated particulates and to control the DPF temperature.

Instrument Cluster (IC) Indications

For drivers who make regular short journeys at low speeds, it may not be possible to efficiently regenerate the DPF. In this case, the DPF software will detect a blockage of the DPF from signals from the differential pressure sensor and will alert the driver as follows:

The driver will be alerted to this condition by a message 'EXHAUST FILTER NEARLY FULL'. See 'HANDBOOK'. As detailed in the Owners Handbook, the driver should drive the vehicle until the engine is at its normal operating temperature and then drive for approximately a further 20 minutes at speeds between 60 km/h to 120 km/h (40 mph to 70 mph). It is possible that the regeneration process will occur at lower speeds, but the events may take longer at a 48 km/h (30 mph) average speed. Successful regeneration of the DPF is indicated to the driver by the 'EXHAUST FILTER NEARLY FULL' message no longer being displayed. If the DPF software detects that the DPF is still blocked, the message will continue to be displayed or an additional message 'EXHAUST FILTER FULL VISIT DEALER' will be displayed. The driver should take the vehicle to an authorized dealer to have the DPF force regenerated using an approved diagnostic system.

If, due to vehicle usage and/or driving style, the active regeneration process cannot take place or is unable to regenerate the DPF, the dealer can force regenerate the DPF. This is achieved by driving the vehicle until the engine is at its normal operating temperature and then driving for approximately a further 20 minutes at speeds between 60 km/h to 120 km/h (40 mph to 70 mph). It is possible that the regeneration process will occur at lower speeds, but the events may take longer at a 48 km/h (30 mph) average speed.

Diesel Particulate Filter Side Effects

The following section details some side effects caused by the active regeneration process.

Engine Oil Dilution

Engine oil dilution can occur due to small amounts of fuel entering the engine crankcase during the post-injection phases. This has made it necessary to introduce a calculation based on driving style to reduce oil service intervals if necessary. The driver is alerted to the oil service by a message in the instrument cluster.

The DPF software monitors the driving style and the frequency of the active regeneration and duration. Using this information a calculation can be made on the engine oil dilution. When the DPF software calculates the engine oil dilution has reached a predetermined threshold (fuel being 7% of engine oil volume) a service message is displayed in the IC.

Depending on driving style, some vehicles may require an oil service before the designated interval. If a service message is displayed, the vehicle will be required have a full service and the service interval counter will be reset.

Fuel consumption

During the active regeneration process of the DPF, there will be an increase in fuel consumption.

However, because active regeneration occurs infrequently, the overall effect on fuel consumption is approximately 2%. The additional fuel used during the active regeneration process is accounted for in the instantaneous and average fuel consumption displays in the instrument cluster.

DIFFERENTIAL PRESSURE SENSOR

The differential pressure sensor is used by the DPF software to monitor the condition of the DPF. Two pipe connections on the sensor are connected by pipes to the inlet and outlet ends of the DPF. The pipes allow the sensor to measure the inlet and outlet pressures of the DPF.

Aftermarket DPF cleaning fluids

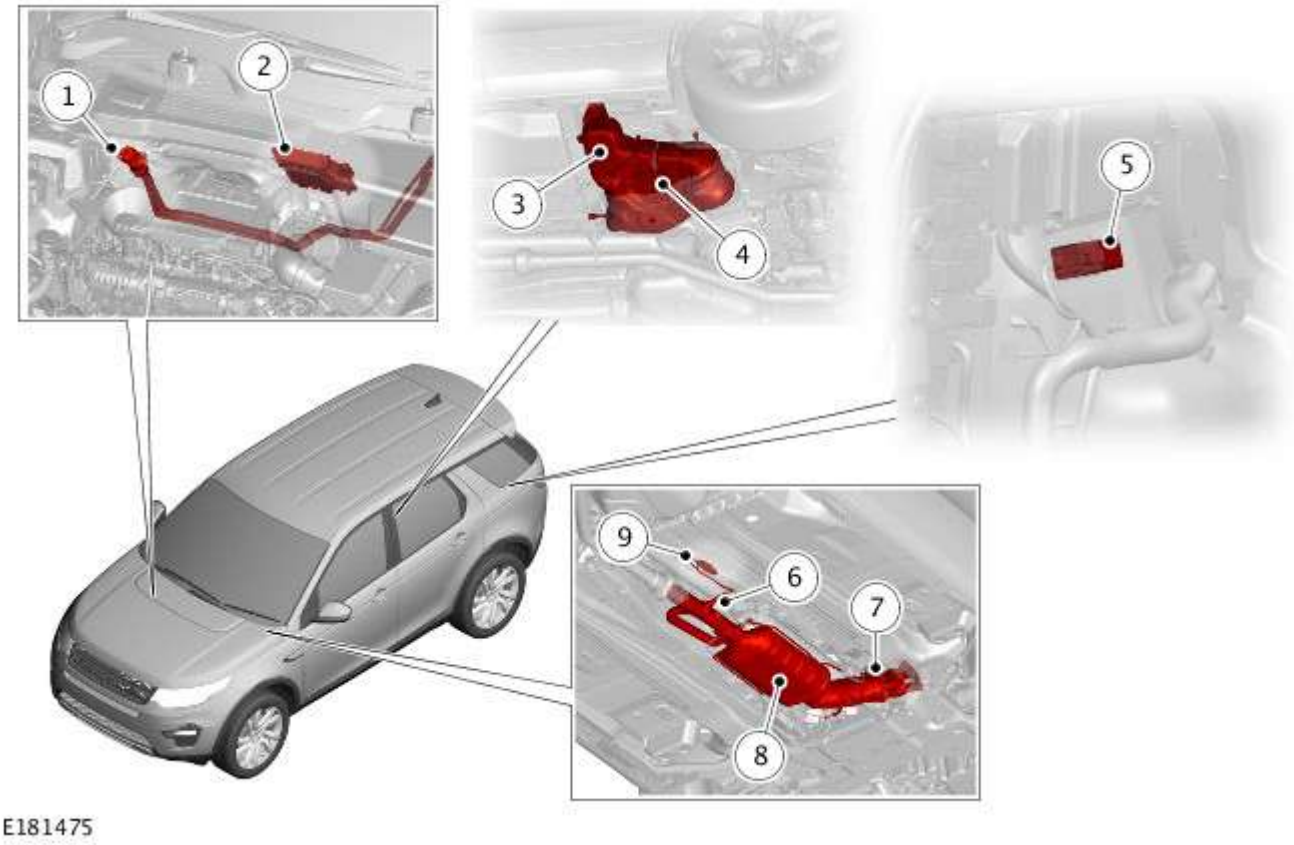
Recent years have seen the introduction of 'DPF cleaning fluids' to (non JLR approved) aftermarket sales. These products claim to reduce the temperature that the soot reaction takes place. It should be stressed that, during the vehicle development activity, every effort is made to generate DPF regeneration temperatures whilst maintaining safe levels for all other vehicle components. Unauthorized use of the aftermarket fluids produces a significant risk to soot burn rates and DPF peak temperatures real world driving conditions. These fluids are not authorised for JLR use.

Published: 21-Jul-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Selective Catalyst Reduction

Description and Operation

COMPONENT LOCATION



Item	Description
1	Diesel Exhaust Fluid (DEF) filler assembly
2	Engine Control Module (ECM)
3	Diesel Exhaust Fluid (DEF) tank
4	Diesel Exhaust Fluid (DEF) tank module
5	Diesel Exhaust Fluid (DEF) heater control unit
6	Post - Selective Catalyst Reduction (SCR) nitrogen oxide (NOx) sensor
7	Diesel Exhaust Fluid (DEF) injector
8	Selective Catalyst Reduction (SCR) catalytic converter
9	Nitrogen oxide (NOx) sensor control module

OVERVIEW

The Selective Catalyst Reduction (SCR) system is an exhaust gas aftertreatment solution used to reduce the nitrogen oxides within the exhaust gas.

For this purpose, a specified amount of Diesel Exhaust Fluid (DEF) is injected into the exhaust system, downstream of the DPF. The injected DEF into the exhaust system is converted to ammonia (NH3) and carbon dioxide (CO2). The resulting ammonia (NH3) is used within a special catalyst in the exhaust stream. The resulting reaction converts the unwanted nitrogen oxides (NOx) into harmless nitrogen (N2) and water (H2O) vapor.

DESCRIPTION

Diesel Exhaust Fluid (DEF)

Diesel Exhaust Fluid (DEF) is a pure, odorless, colorless, synthetically manufactured, 32.5% aqueous solution of urea, used for the aftertreatment of exhaust gases in a Selective Catalyst Reduction (SCR) catalytic converter.

The SCR catalytic converter can be contaminated by low quantities of metals and thus the quality of the DEF fluid is held to closely controlled standards. DEF cannot be substituted by urea used in agriculture or diluted with any other fluid.

DEF is not categorized as a dangerous substance, it is non-flammable and non-toxic, and there is no danger in the event of spills. DEF can be stored on board vehicles, despite the limitation that it crystallizes at temperatures below -11°C (12°F).

In Europe, DEF is also known as AdBlue®, the fluid is specified by ISO22241.

Diesel Exhaust Fluid (DEF) Tank

E181365

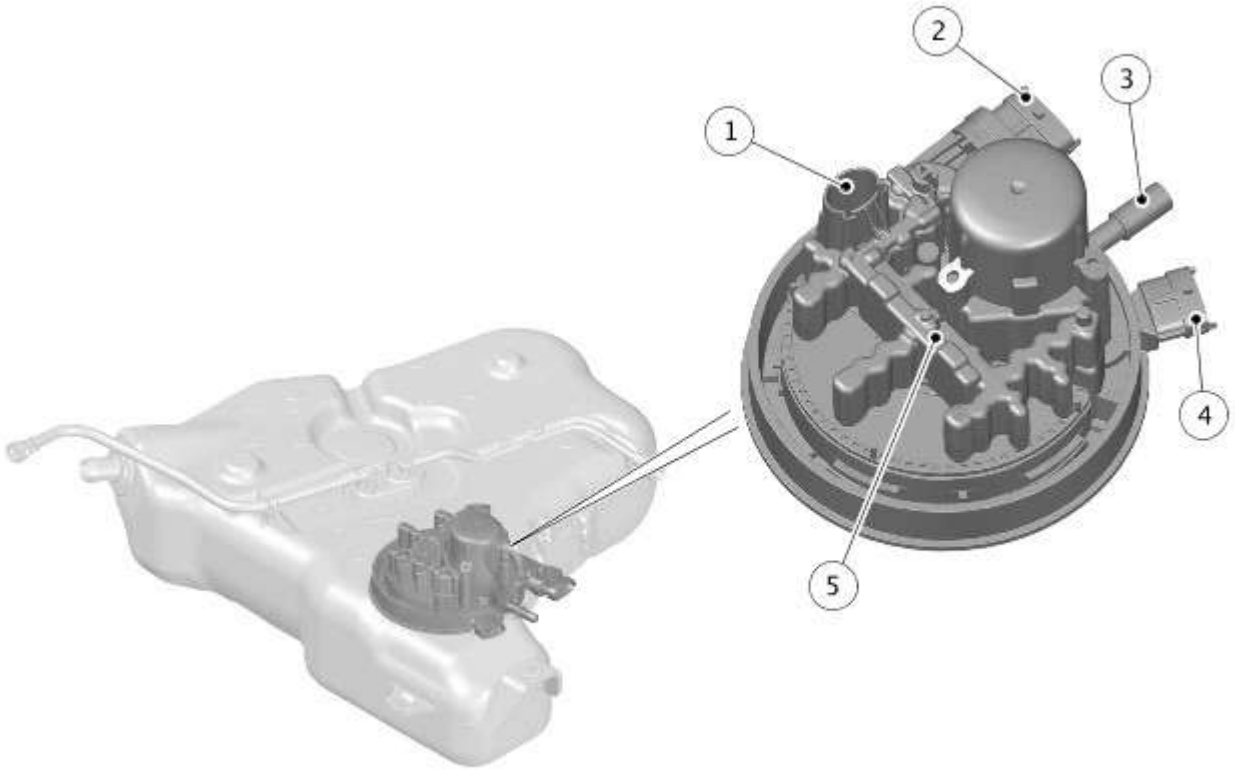
The Diesel Exhaust Fluid (DEF) tank is blow molded from High Density Polyethylene (HDPE). The tank is located under the right side of the fuel tank and it is secured to the underside of the vehicle in common with the fuel tank by the fuel tank support strap and a bolt secures the DEF tank to the rear left side member. The DEF tank contains the DEF tank module which is welded into the tank, and supplied as a unit. An additional shield protects the DEF tank module. The protection shield is attached to the DEF tank and the fuel tank heatshield with four screws. The tank includes a 12% unusable volume to protect the internal components as a result of fluid expansion under freezing conditions.

If the ambient temperature falls below -11°C (12°F), the DEF will freeze in the DEF tank, this will provide difficulty with the refill procedure. In order to thaw the DEF in the DEF tank, place the vehicle in a warm place for up to 2 hours before attempting to refill the tank.

The volume of the DEF tank is different on all JLR products, but has been designed so that refills are minimized outside of the vehicle service intervals.

When the vehicle consumes more DEF than anticipated, for example extended vehicle use in extreme temperatures, 'at altitude' or aggressive drive cycles, a warning message will be displayed in the Instrument Cluster (IC) message center to add DEF to the tank.

Diesel Exhaust Fluid (DEF) Tank Module



E181366

Item	Description
1	Diesel Exhaust Fluid (DEF) level sensor
2	Diesel Exhaust Fluid (DEF) tank module electrical connection
3	Diesel Exhaust Fluid (DEF) pressure line connection
4	Diesel Exhaust Fluid (DEF) injection pump electrical connection
5	Diesel Exhaust Fluid (DEF) heater element

The Diesel Exhaust Fluid (DEF) tank module is located at the bottom of the DEF tank. The module is welded into the tank and can only be replaced as a complete assembly. The DEF tank module includes a life-time fit filter, a fluid level and temperature sensor and a heater element to defrost the DEF in extreme cold climates. The DEF level sensor is an ultrasonic device located in the DEF tank module, which sends the DEF level value to the Engine Control Module (ECM) via Pulse Width Modulation (PWM) signals. The ultrasonic cone angle is ±10° and the readings are most accurate when the vehicle is stationary and on level ground.

The heater element is a Positive Temperature Coefficient (PTC) type heater, which provides safe operation to the system. Increased heater element temperature results in decreased current drawn from the DEF heater control module, which actuates the power supply of the heater element. Under normal operation the maximum current is 6A.

The DEF tank module has a fused power supply from the Battery Junction Box (BJB). The ECM controls the power supply of the DEF tank module via the DEF control relay located in the Rear Junction Box (RJB).

Diesel Exhaust Fluid (DEF) Injection Pump

E168830

The Diesel Exhaust Fluid (DEF) tank module comprises a DEF injection pump which is an assembly of two solenoid pumps. The DEF injection pump provides 6.5 bar operating pressure. The 6.5 bar pressure is required to maintain the complete DEF atomization in the exhaust gas. The purge pump is used to purge the DEF from the DEF pressure line at engine shut-down to prevent freezing in the DEF injector at low temperatures. The pumps have a fused power supply from the Rear Junction Box (RJB). The ECM controls the ground connection of the pumps individually via hardwired connections.

Diesel Exhaust Fluid (DEF) Line

The Diesel Exhaust Fluid (DEF) line provides hydraulic connection between the DEF injection pump and the DEF injector. The DEF line is manufactured from a plastic material which is specifically designed for use with DEF. A copper based resistor wire DEF line heater is installed within the DEF line with an electrical connector. The DEF line heater enables electrical heating of the DEF at low-ambient temperatures. The DEF line heater has hardwired connections to the DEF heater control unit, which actuates the power supply for the heater element, controlled by the ECM via the Private Controller Area Network (CAN) bus.

Diesel Exhaust Fluid (DEF) Injector

The Diesel Exhaust Fluid (DEF) injector is located in the exhaust system downstream of the catalytic converter and it is secured to the S-shaped exhaust pipe with a clamp. Due to the position of the injector on the S-shaped exhaust pipe, the DEF is injected axially to the exhaust gas flow direction ensuring the DEF is mixed well and distributed evenly within the exhaust gas. The DEF injector consists of an injector and a passive cooling heat sink to protect the injector from overheating due to the high exhaust temperatures.

The DEF injector works at high pressures to obtain the complete atomization of the injected DEF, this ensures the SCR catalytic converter is working to its optimum performance. The DEF injector is controlled by the ECM with PWM signals.

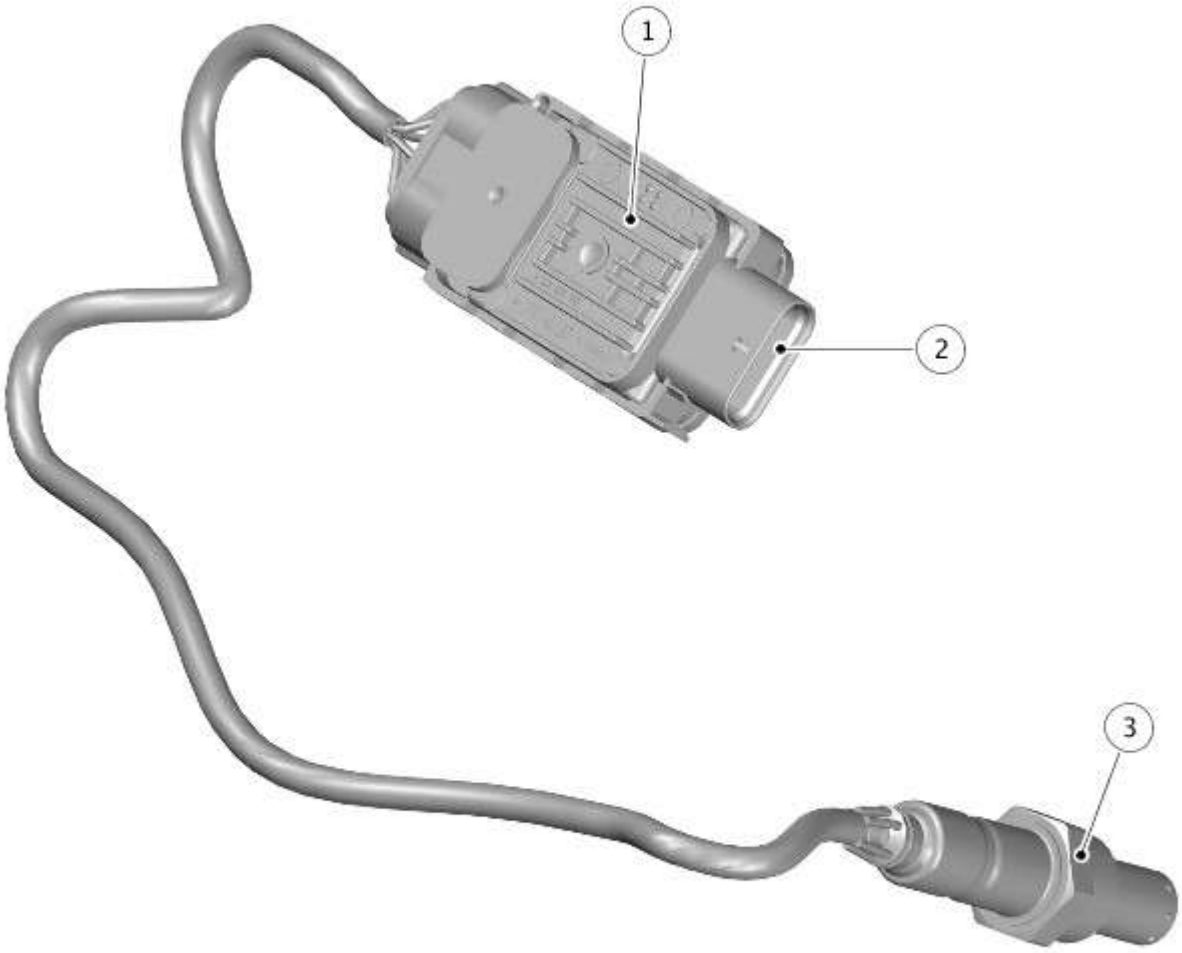
Diesel Exhaust Fluid (DEF) Heater Control Unit

E168833

The Diesel Exhaust Fluid (DEF) heater control unit is located on the left side of the luggage compartment, behind the side trim panel. The heater system enables rapid SCR system operation in the event of frozen DEF and ensures an adequate quantity of defrosted DEF is available at all operating points. The DEF heater control unit has a fused power supply from the RJB and it receives an ignition signal from the ECM relay located in the BJB. Operation of the ECM relay is controlled by the ECM.

The DEF heater control unit has hardwired connections to the DEF tank module and the DEF line heater. If the ambient air temperature is below -7°C (19.4°F), the ECM switches on the DEF heater control unit via the Private CAN bus. The DEF heater control unit energizes the DEF tank module heater element and the DEF line heater. The DEF heater control unit has on-board diagnostics to detect and report faults to the ECM via the Private CAN bus.

Nitrogen Oxide (NOx) Sensor



E181367

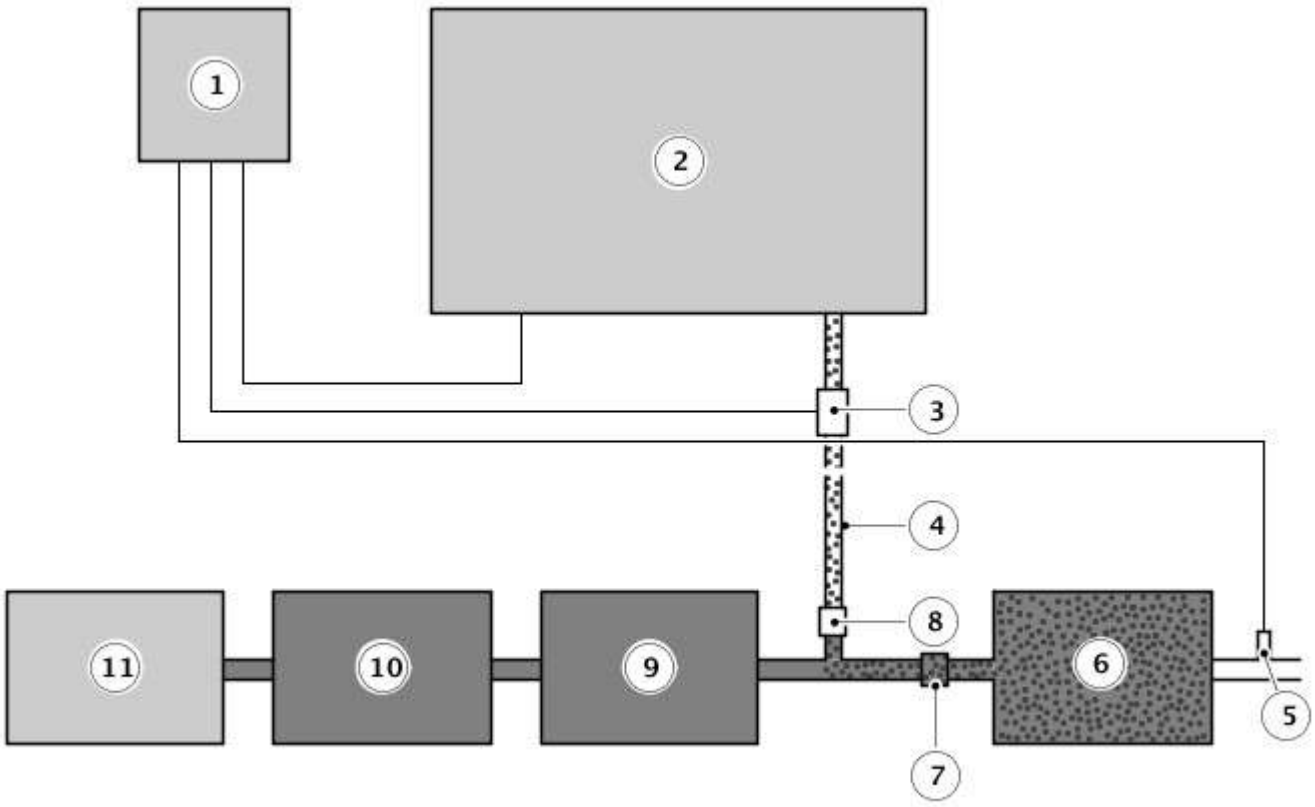
Item	Description
1	Post - selective catalyst reduction (SCR) nitrogen oxide (NOx) sensor control module
2	Electrical connection
3	Post - selective catalyst reduction (SCR) nitrogen oxide (NOx) sensor

The Post - selective catalyst reduction (SCR) nitrogen oxide (NOx) sensor is located in the exhaust pipe downstream of the SCR catalytic converter. The NOx sensor comprises a sensor element attached to a dedicated control module with a hardwired connection.

The sensor and the control module are replaced as an assembly. The NOx sensor is an evolution of the wide band oxygen sensor. The sensor element is constructed from special ceramics and contains two oxygen density detecting chambers that work together to determine the NOx concentration in the exhaust gas. The control module sends a message via the Private CAN bus to the ECM for monitoring the effectiveness of the SCR system.

OPERATION

Schematic Diagram - Selective Catalyst Reduction (SCR) System



E176442

Item	Description
1	Engine Control Module (ECM)
2	Diesel Exhaust Fluid (DEF) tank with Diesel Exhaust Fluid (DEF) tank module
3	Diesel Exhaust Fluid (DEF) injection pump
4	Diesel Exhaust Fluid (DEF) line
5	Post - Selective Catalyst Reduction (SCR) nitrogen oxide (NOx) sensor
6	Selective Catalyst Reduction (SCR) catalytic converter
7	Mixer plate
8	Diesel Exhaust Fluid (DEF) injector
9	Diesel Particulate Filter (DPF)
10	Catalytic converter
11	Engine

The SCR catalytic converter reaches the operating temperature at 150 °C (302°F). The temperature of the exhaust gas is measured by the post DPF exhaust gas temperature sensor, which is connected to the ECM.

The DEF injection pump supplies the DEF from the DEF tank at a pressure of 6.5 bar to the DEF injector via the heated DEF line. The DEF injector is controlled with a Pulse Width Modulation (PWM) signal by the ECM.

The injected DEF is carried along by the exhaust gas flow and is evenly distributed in the exhaust gas by the mixer plate. The mixer plate is located in the exhaust pipe upstream of the SCR catalytic converter and downstream of the DEF injector. After the injection, the DEF is converted into ammonia (NH3) and carbon dioxide (CO2) during chemical reactions.

In the SCR catalytic converter, the ammonia (NH3) reacts with the nitrogen oxides (NOx) to produce nitrogen (N2) and water (H2O) vapor. The SCR system's efficiency is registered by the post SCR NOx sensor.

In order to optimise the SCR system's efficiency, the correct amount of ammonia (NH3) is required in the exhaust gas. The ECM achieves this by operating in two modes:

- Storage mode
- On-line mode

For example, storage mode will operate during low speed driving condition; the on-line mode will operate at high speed driving condition.

Storage Mode

When the system operates in storage mode, the ammonia (NH3) is stored on the SCR catalytic converter and used as a function of the NOx feed. In this mode, the objective of the control system is to ensure that a pre-determined amount of NH3 is available on the SCR catalytic converter at any given time. As a consequence, it may be difficult to diagnose dosing system problems when the system is in storage mode.

On-line Mode

When the system operates in on-line mode, the NOx is measured by the pre-SCR NOx sensor (or the model value) and the amount of ammonia (NH3) is injected as a function of the NOx feed. In this mode, the dosing system is 'easy' to diagnose if it is functioning correctly as the pulses from the DEF injector are frequent.

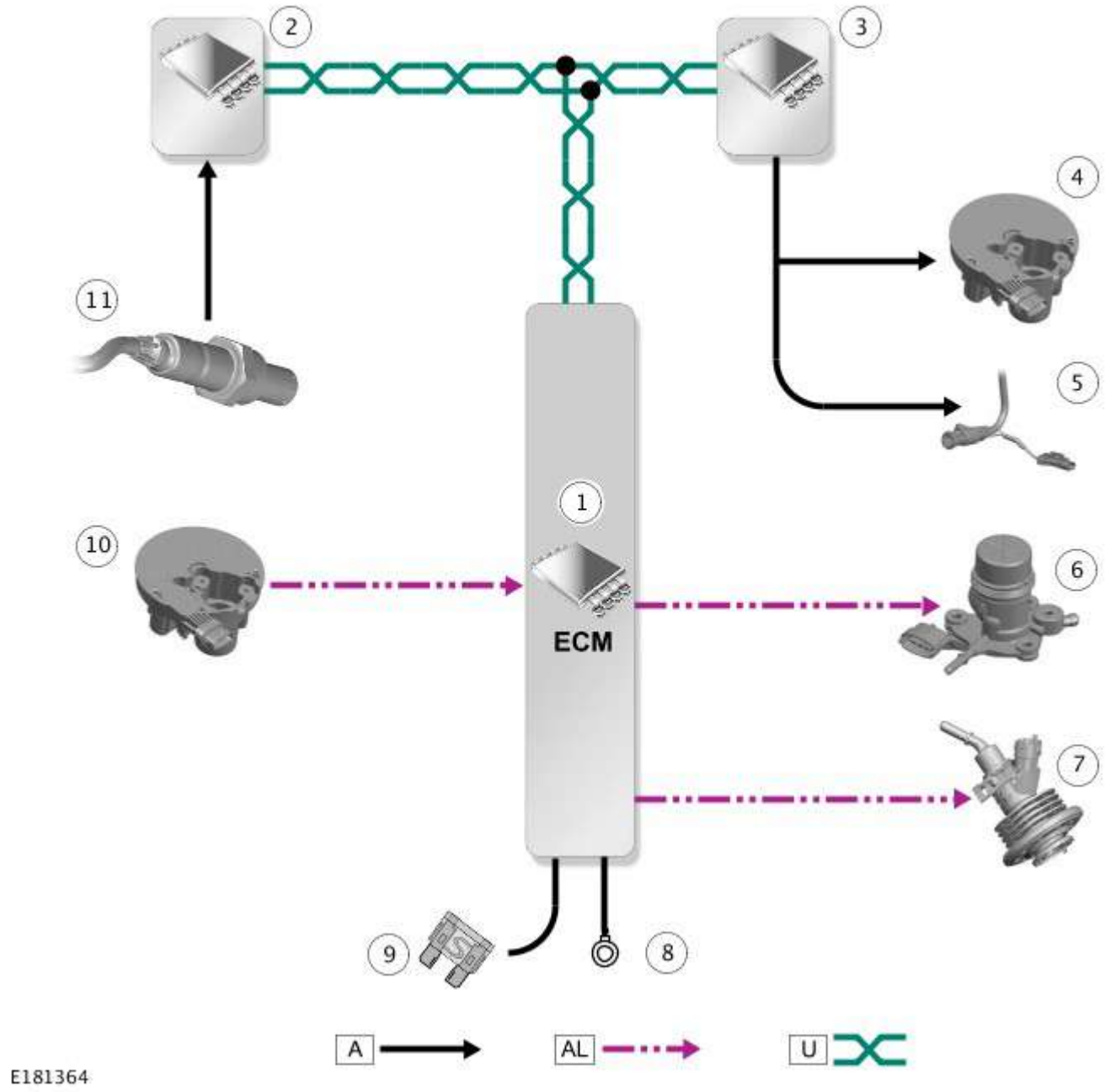
Warning Messages

It is a legal requirement for the driver to be informed of SCR system faults. If the performance of the SCR system is reduced a message will be displayed in the Instrument Cluster (IC) message center. There are three possible routes to receive a fault message on the IC:

- Low DEF volume in the tank
- Incorrect DEF quality supplied to the SCR System
- Efficiency of the SCR System is reduced in the event of a system fault.

In case of low DEF level, a warning is given 800km (497 miles) ahead of any vehicle restriction in order to allow time to visit an authorized Land Rover dealer to refill the DEF tank. If the DEF fluid is not replenished within this distance, and the engine is turned off, the vehicle will fail to start. In this event customers can use two standard size refill bottles as a short term solution to restart the vehicle, a complete refill of the DEF tank will still be required by an authorized Land Rover dealer.

INPUT/OUTPUT DIAGRAM



A = Hardwired; AL = Pulse Width Modulation (PWM); U = Private Controller Area Network (CAN) bus.

Item	Description
1	Engine Control Module (ECM)
2	Post-Selective Catalyst Reduction (SCR) nitrogen oxide (NOx) sensor control module
3	Diesel Exhaust Fluid (DEF) heater control unit
4	Diesel Exhaust Fluid (DEF) tank module heater element
5	Diesel Exhaust Fluid (DEF) line heater
6	Diesel Exhaust Fluid (DEF) injection pump
7	Diesel Exhaust Fluid (DEF) injector
8	Ground
9	Power supply
10	Diesel Exhaust Fluid (DEF) level sensor
11	Post Selective Catalyst Reduction (SCR) NOx sensor

Published: 07-Sep-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Catalytic Converter and Diesel Particulate Filter (DPF) Assembly

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

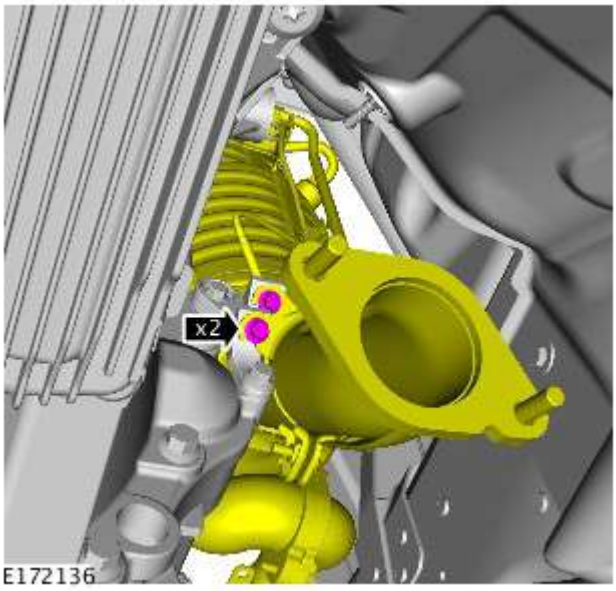
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05, Removal and Installation).

2. WARNING: Make sure to support the vehicle with axle stands.

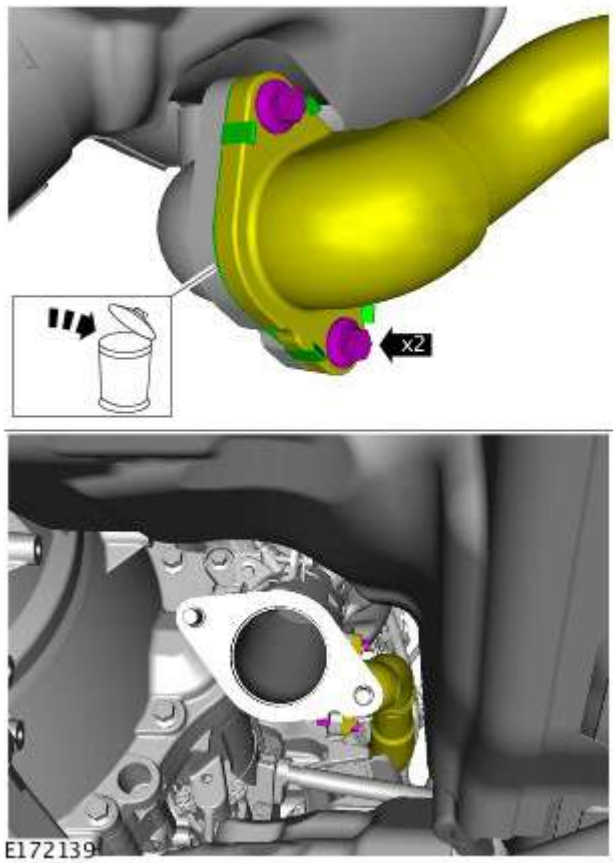
   Raise and support the vehicle.

3. Refer to: Exhaust System (309-00, Removal and Installation).



4. *Torque:* 25 Nm

5. *Torque:* 9 Nm



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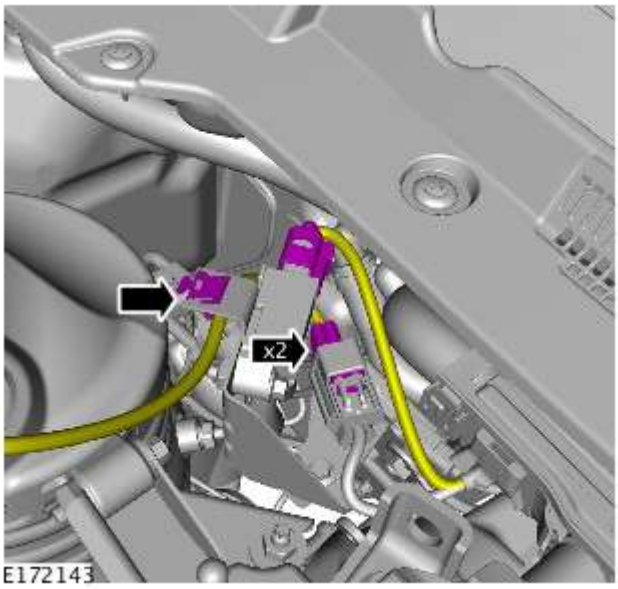

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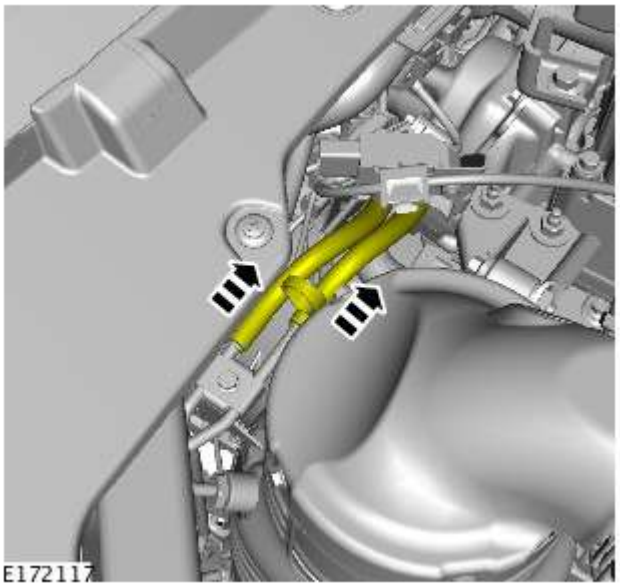

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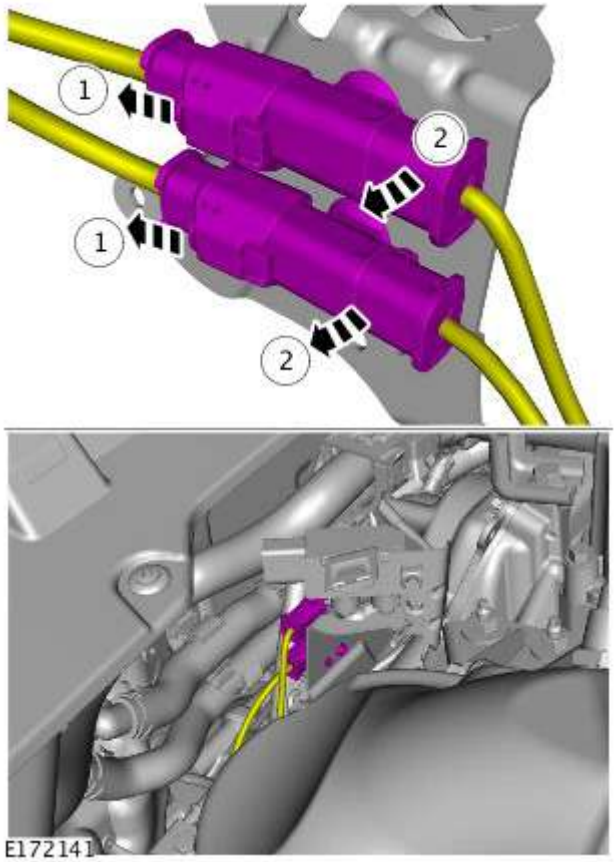
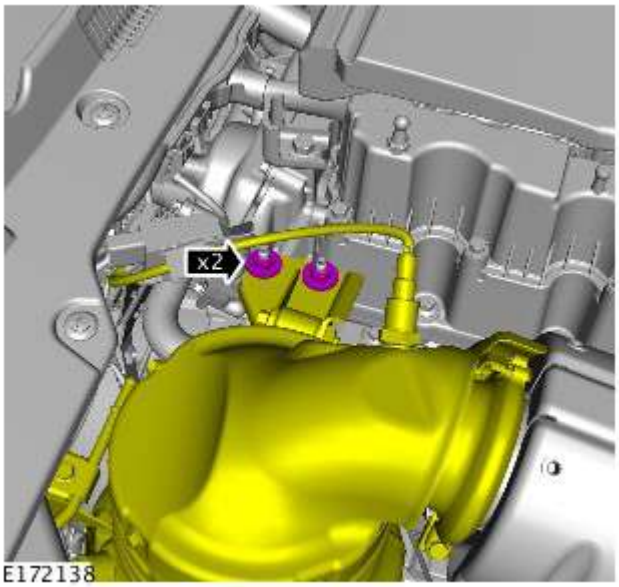
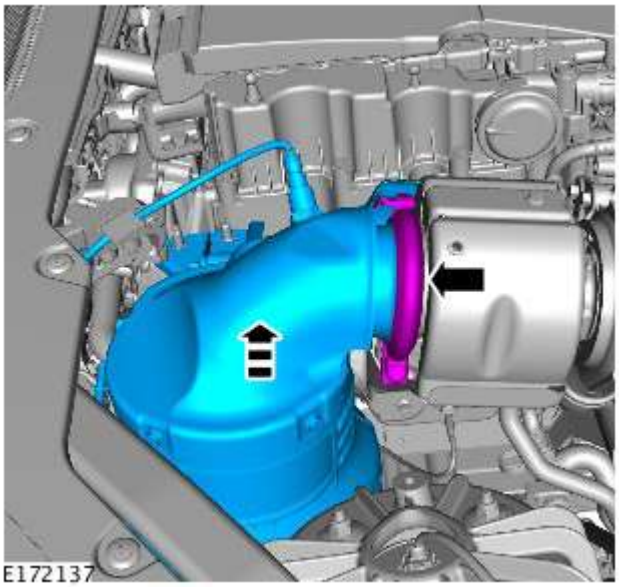


9. *Torque:* 25 Nm

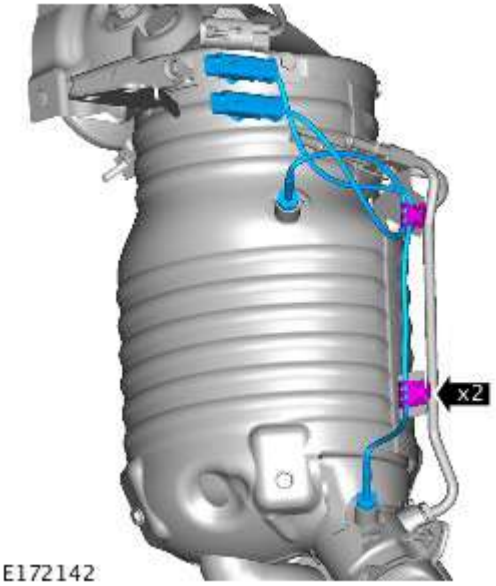


10. *Torque:* 10 Nm

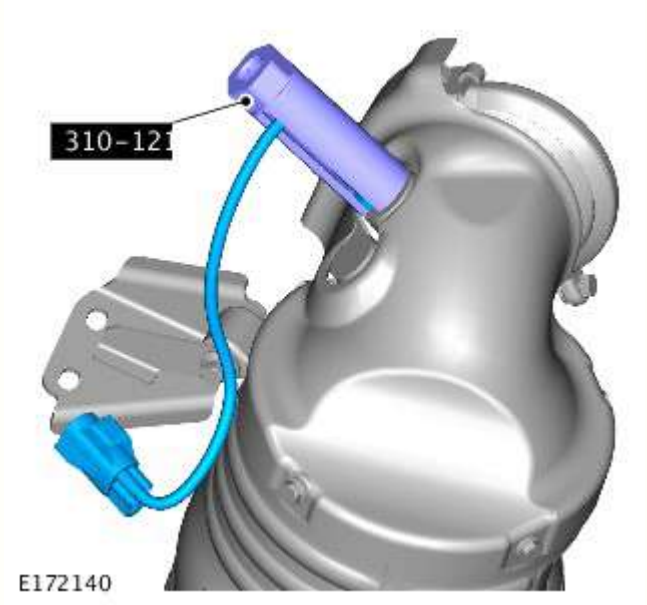


11. NOTE: Do not disassemble further if the component is removed for access only.

Torque: 35 Nm



12. *Torque:* 48 Nm



Installation

1. To install, reverse the removal procedure.

2. If a new unit is installed, configure using the approved diagnostic tool.

Published: 13-Oct-2016

Exhaust System - INGENIUM I4 2.0L Diesel - Catalytic Converter

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

WARNING: Observe due care when working near a hot exhaust system.

NOTES:

Some variation in the illustrations may occur, but the essential information is always correct.

Removal steps in this procedure may contain installation details.

1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Remove the engine acoustic cover.

   Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the right front fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

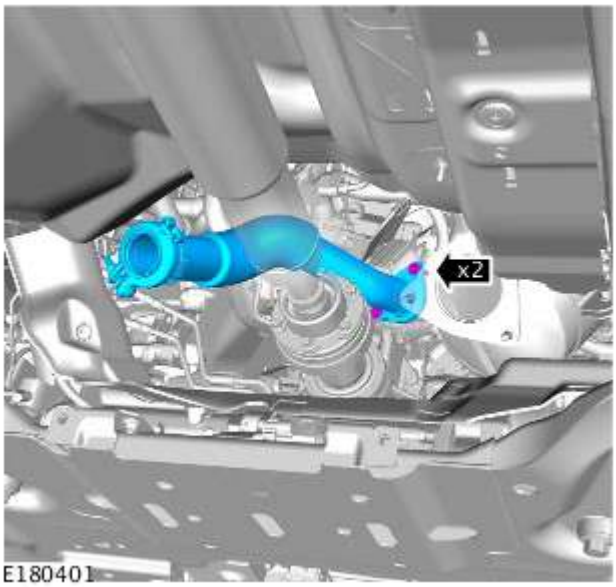
4. Remove the front subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

5. Remove the Diesel Particulate Filter (DPF).

   Refer to: Catalytic Converter and Diesel Particulate Filter (DPF) Assembly (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).
   Refer to: Catalytic Converter (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).

6. NOTE: Remove and discard the gasket.



E180401

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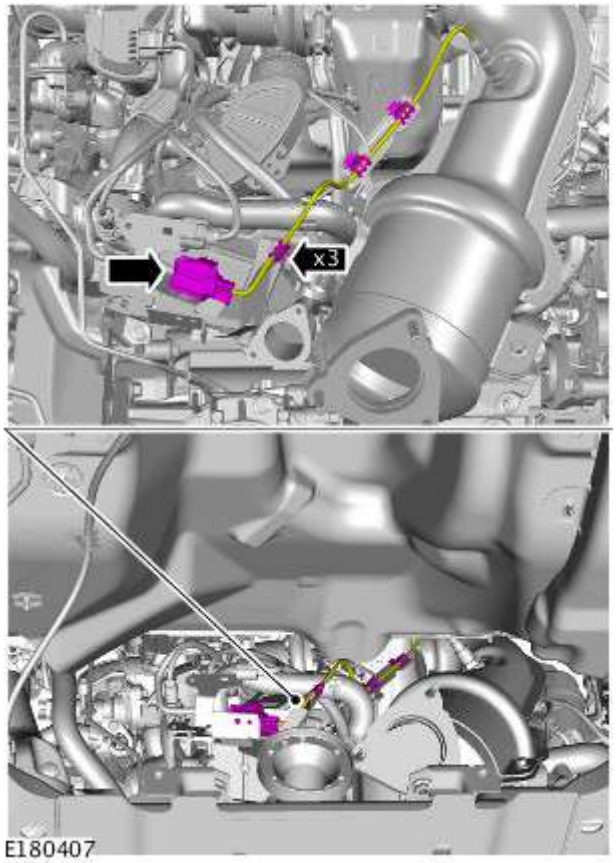

E180407

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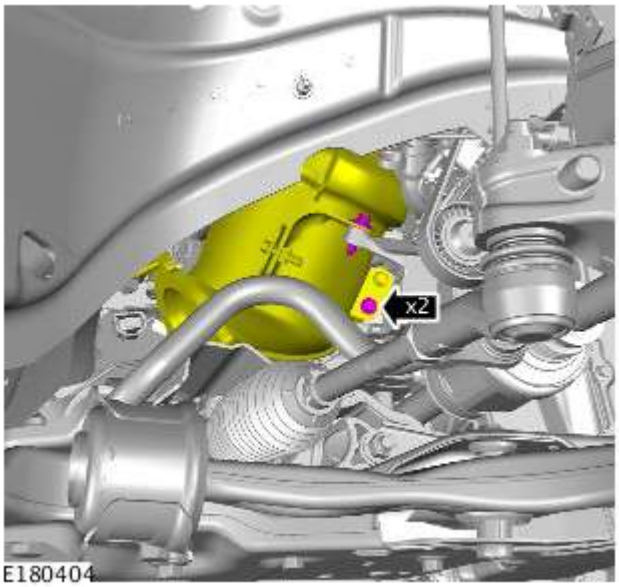

E180404

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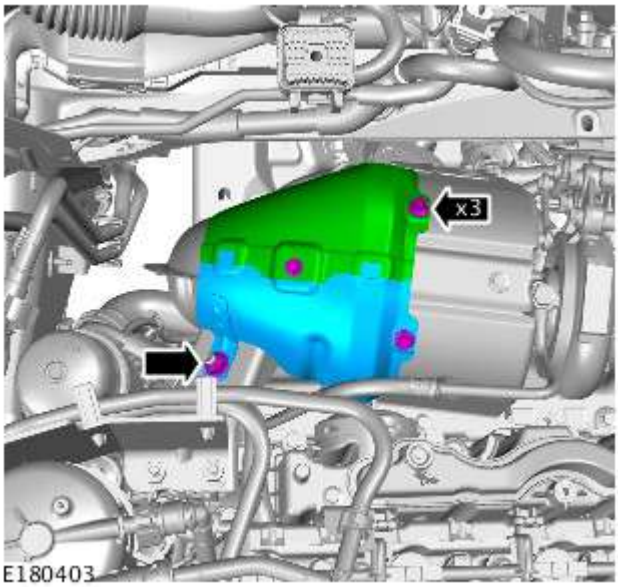

E180403

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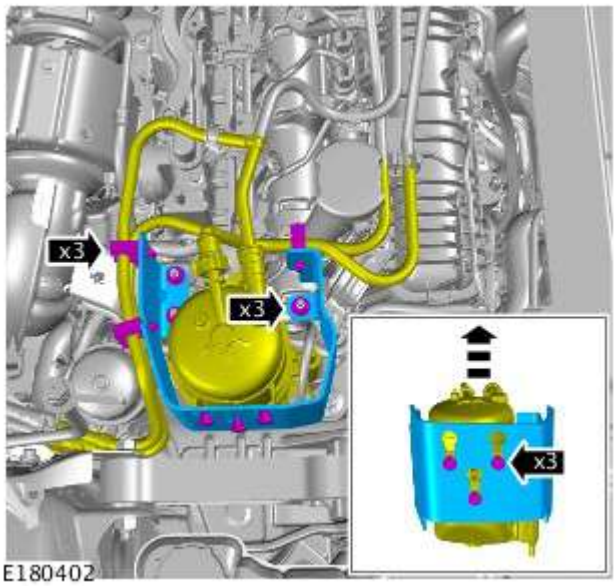
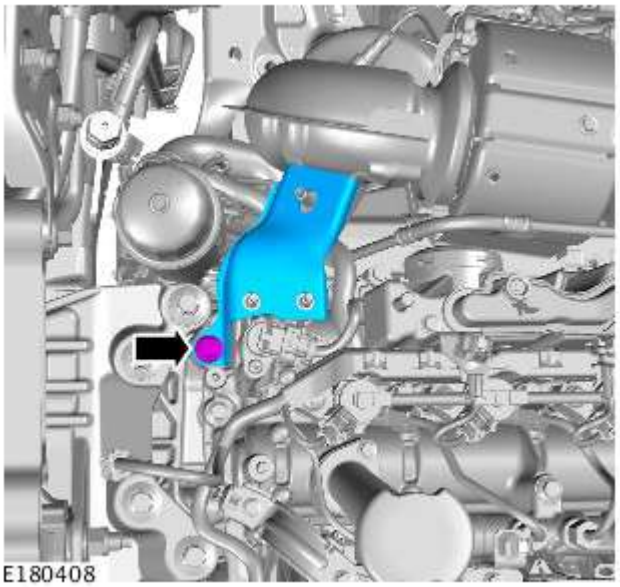
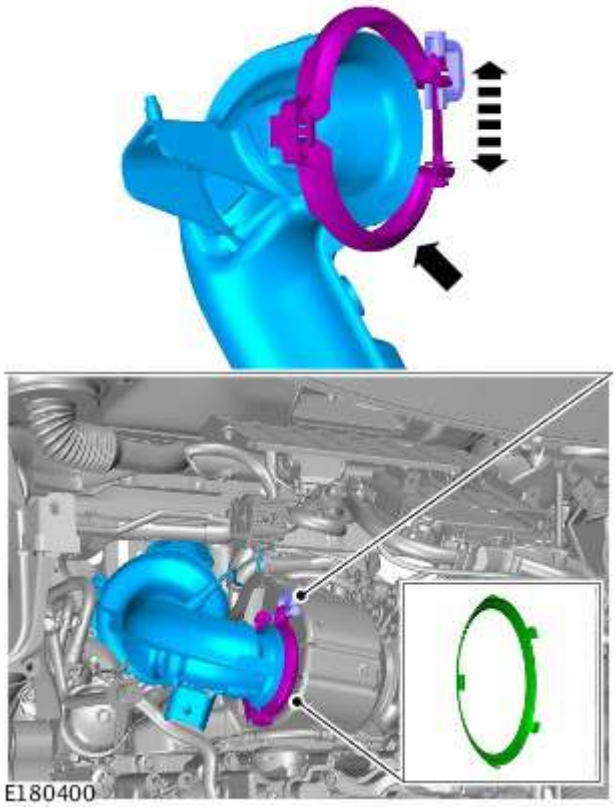


E180402

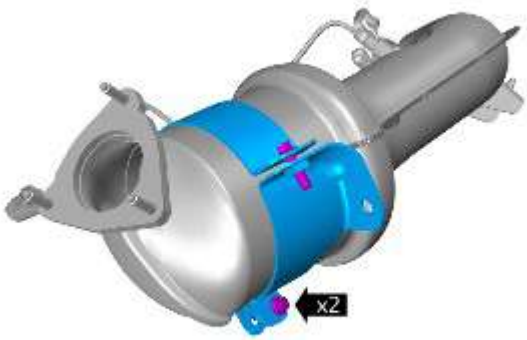
11.



12. NOTE: Remove and discard the gasket.

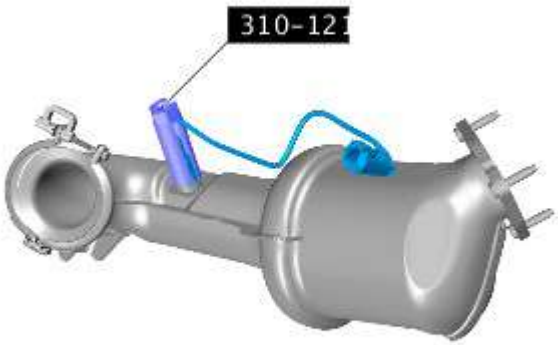


13. NOTE: Do not disassemble further if the component is removed for access only.



E180405

14. *Special Tool(s):* 310-121



E180406

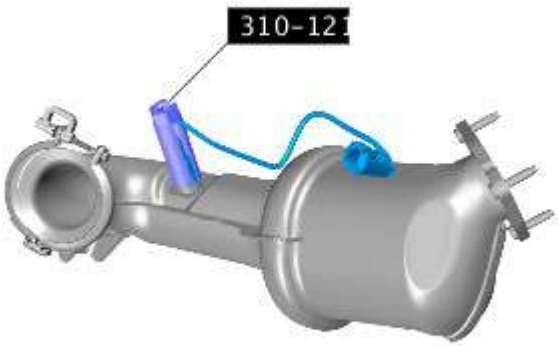
Installation

1. CAUTIONS:

⚠ Make sure the anti-seize compound does not contact the catalyst monitor sensor tip.

⚠ If accidentally dropped or knocked install a new sensor.

Special Tool(s): 310-121
Torque: 48 Nm



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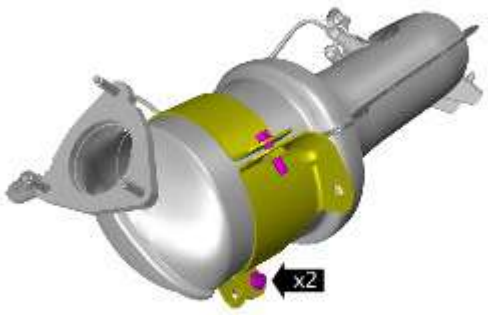
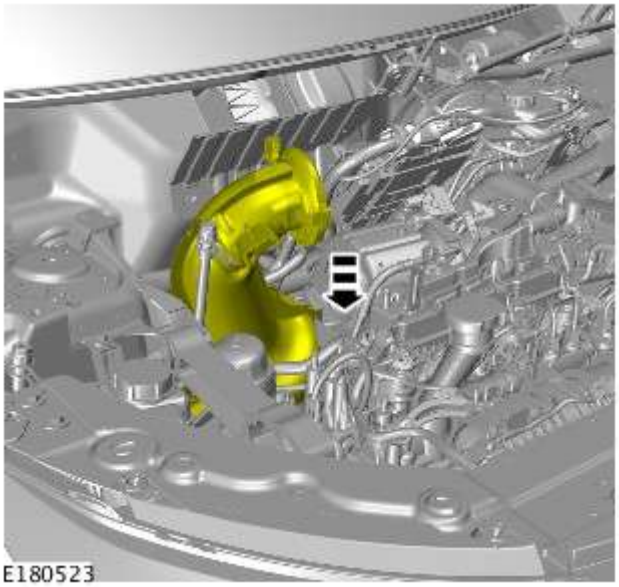


E180522

2. CAUTION: Only tighten the bolts finger tight at this stage

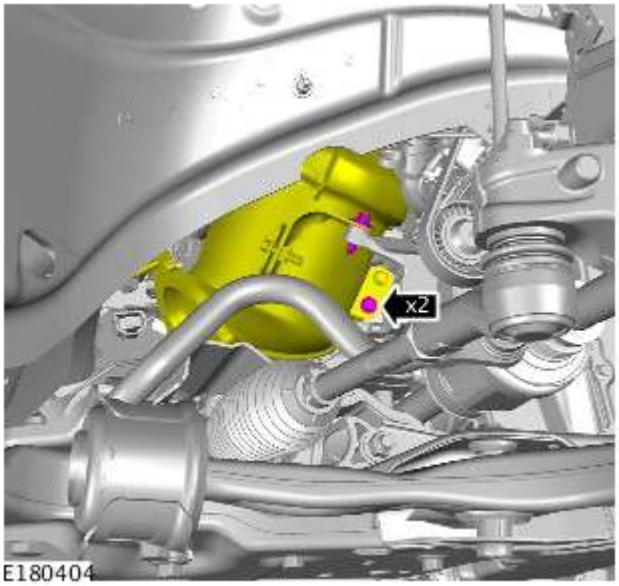


E180523

3. CAUTIONS:

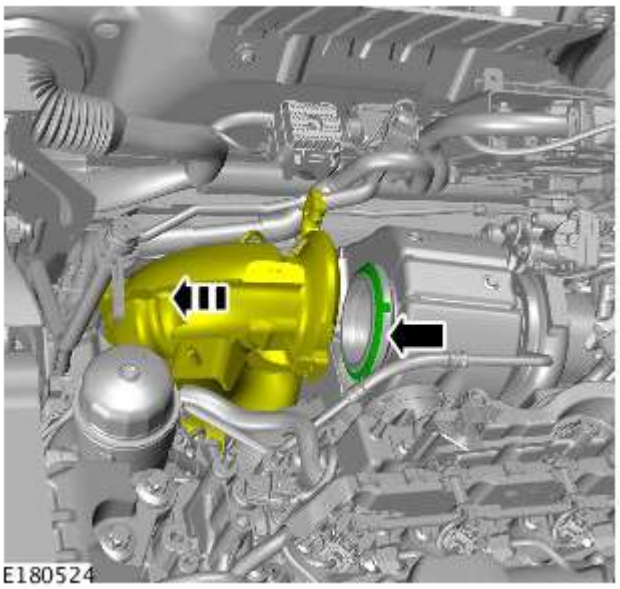
Take extra care not to damage the component.

Take extra care not to damage the surrounding components.



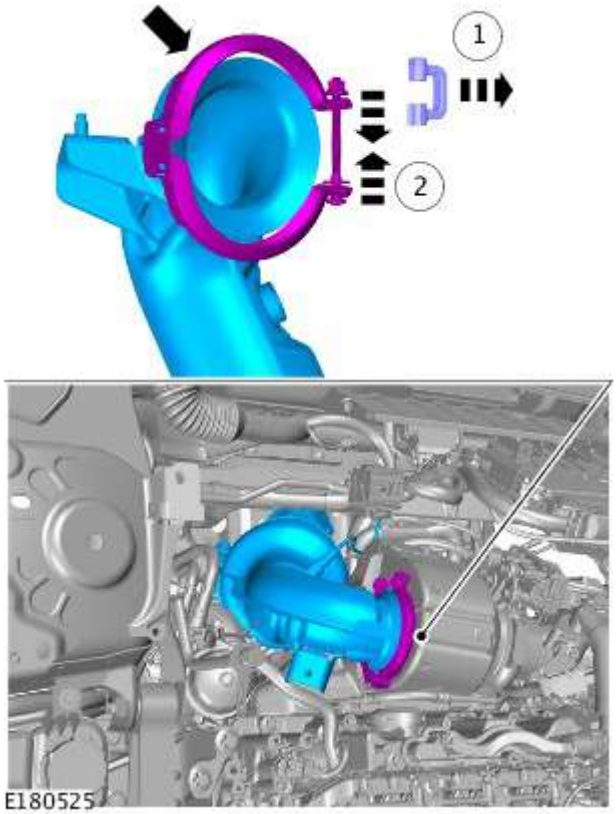
E180404

4. CAUTION: Only tighten the bolts finger tight at this stage

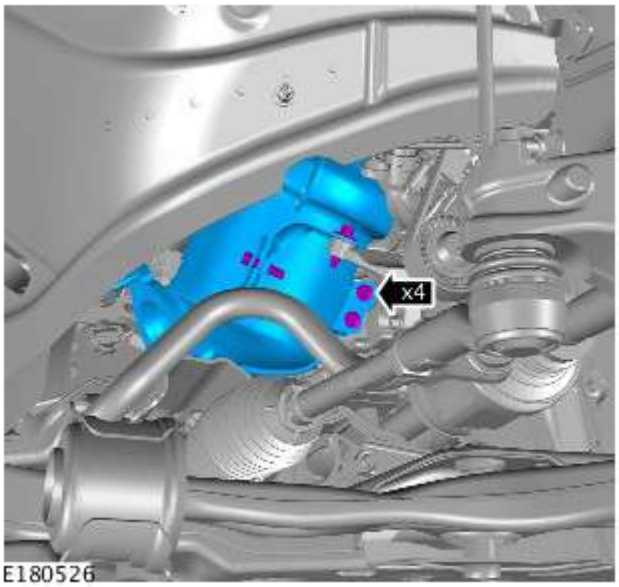


5. NOTE: Install a new gasket.

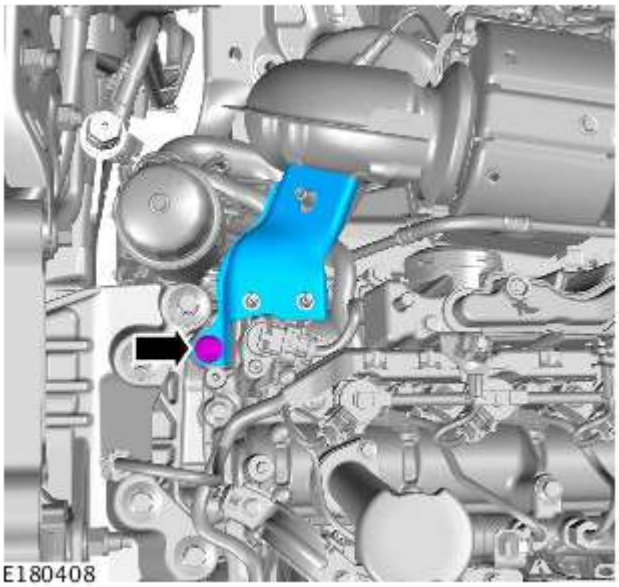
6. *Torque:* 10 Nm



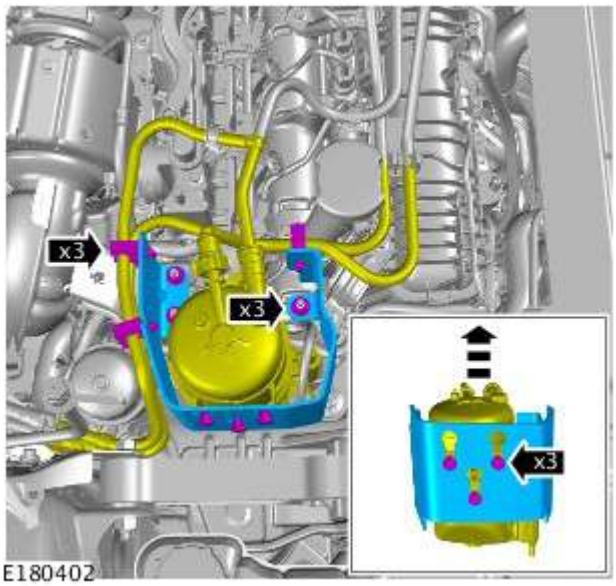
7. *Torque:* 24 Nm



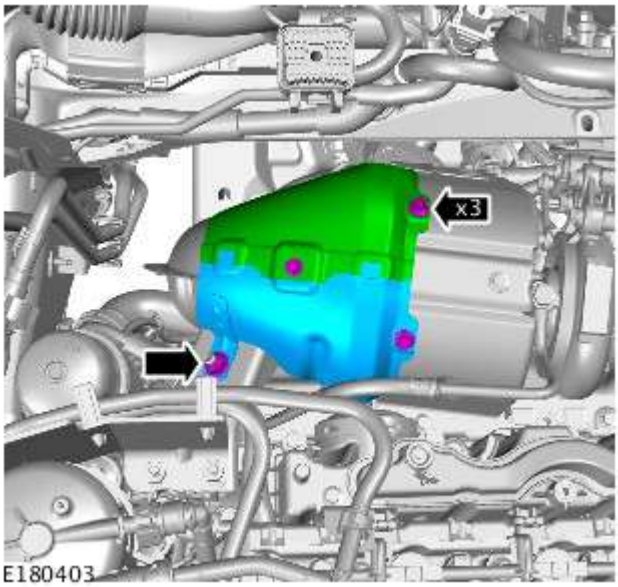
8. *Torque:* 24 Nm



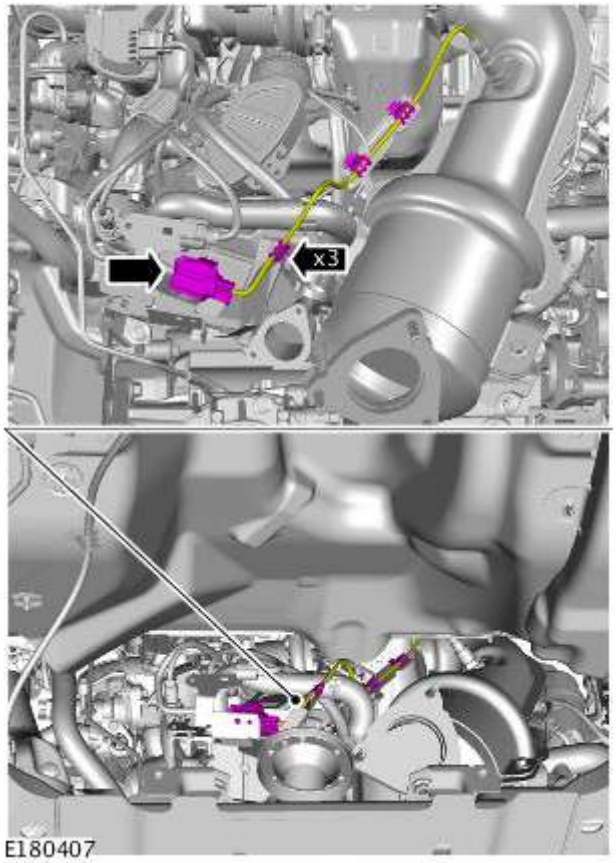
9. *Torque:* 24 Nm



10. *Torque:* 24 Nm

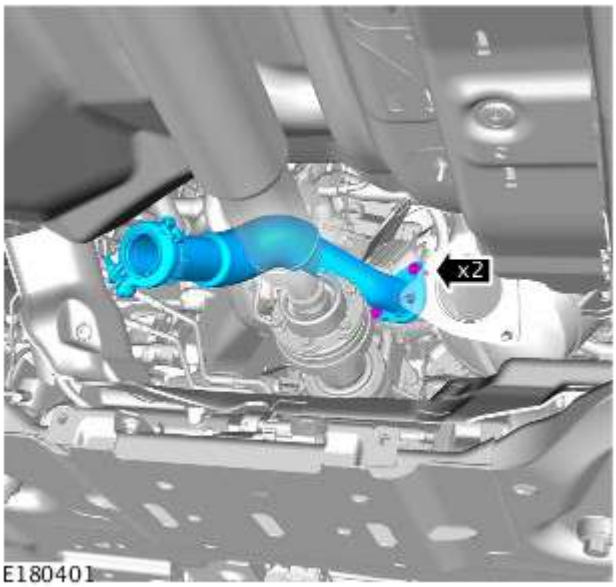


11.



12. NOTE: Install a new gasket.

Torque: 24 Nm



13. Install the Diesel Particulate Filter (DPF).

Refer to: Catalytic Converter and Diesel Particulate Filter (DPF) Assembly (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).
Refer to: Catalytic Converter (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).

14. Install the front subframe.

Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

15. Install the engine acoustic cover.

Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

16. Install the right front fender splash shield.

Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

Published: 30-Jun-2015

Interior Trim and Ornamentation - Engine Cover INGENIUM I4 2.0L Diesel

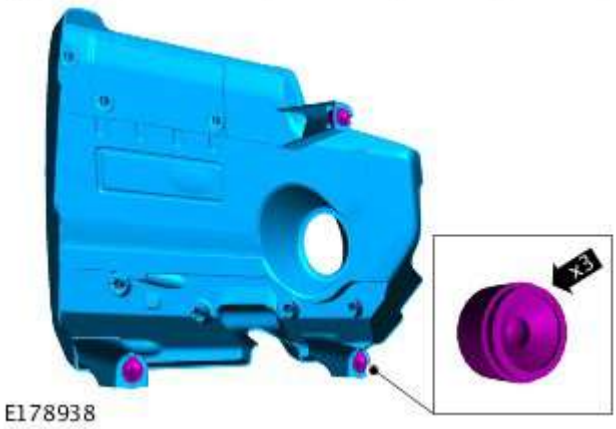
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1.

2.



Installation

1. To install, reverse the removal procedure

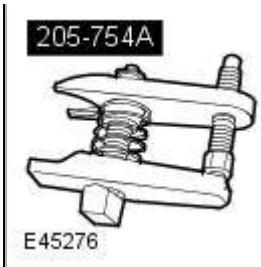
Published: 18-Oct-2016

Uni-Body, Subframe and Mounting System - Front Subframe

Removal and Installation

Special Tool(s)

	205-754A Splitter, Ball Joints

	
	502-012 Alignment Pins, Subframe

General Equipment

Transmission jack

Removal

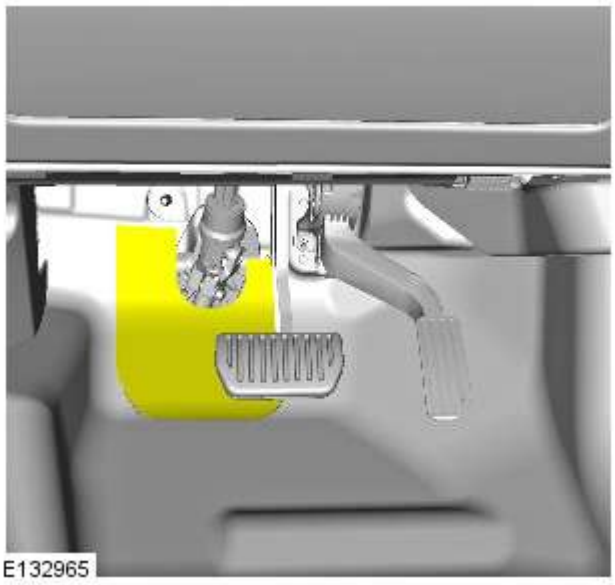
CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

NOTES:

Removal steps in this procedure may contain installation details.

LHD illustration shown, RHD is similar.

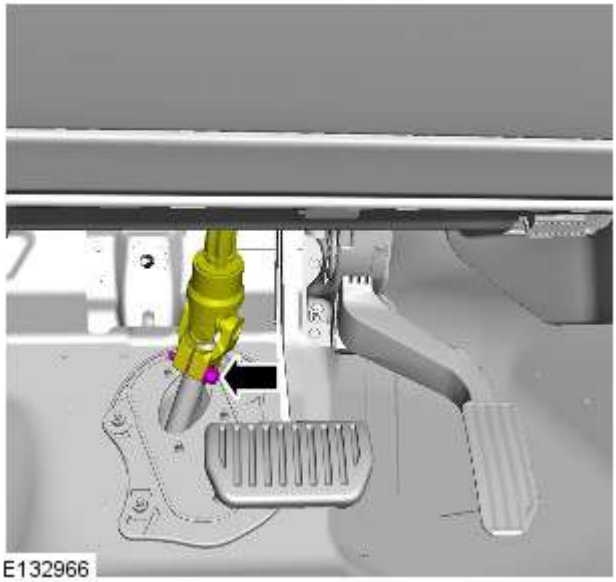
All vehicles

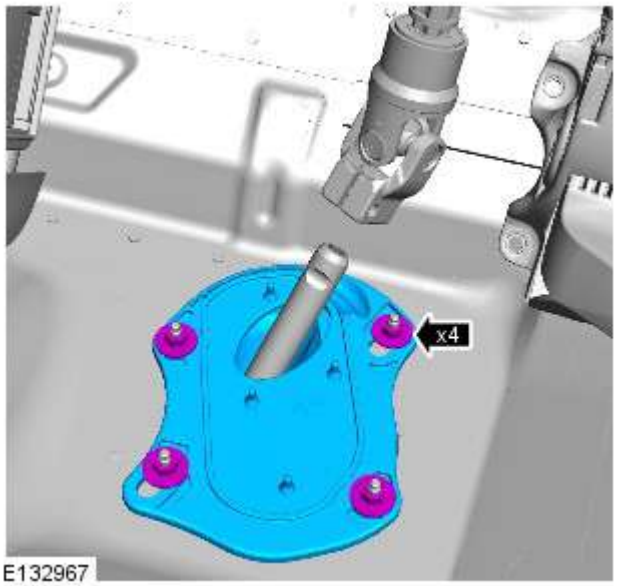


1.

2. WARNING: Make sure that a new steering column flexible coupling bolt is installed.

Torque: 25 Nm





3. WARNING: Make sure that new nuts are installed.

CAUTION: Make sure that the specified torque is not exceeded, or the retaining studs may shear and damage the body panel.

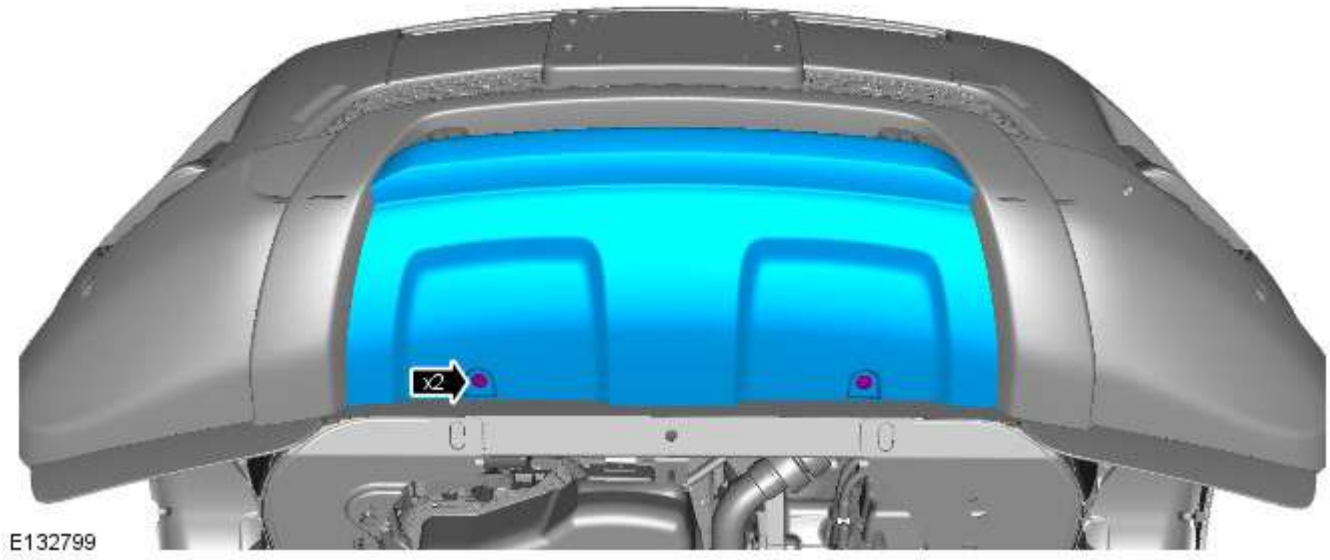
Torque: 2.2 Nm

4. WARNING: Make sure to support the vehicle with axle stands.

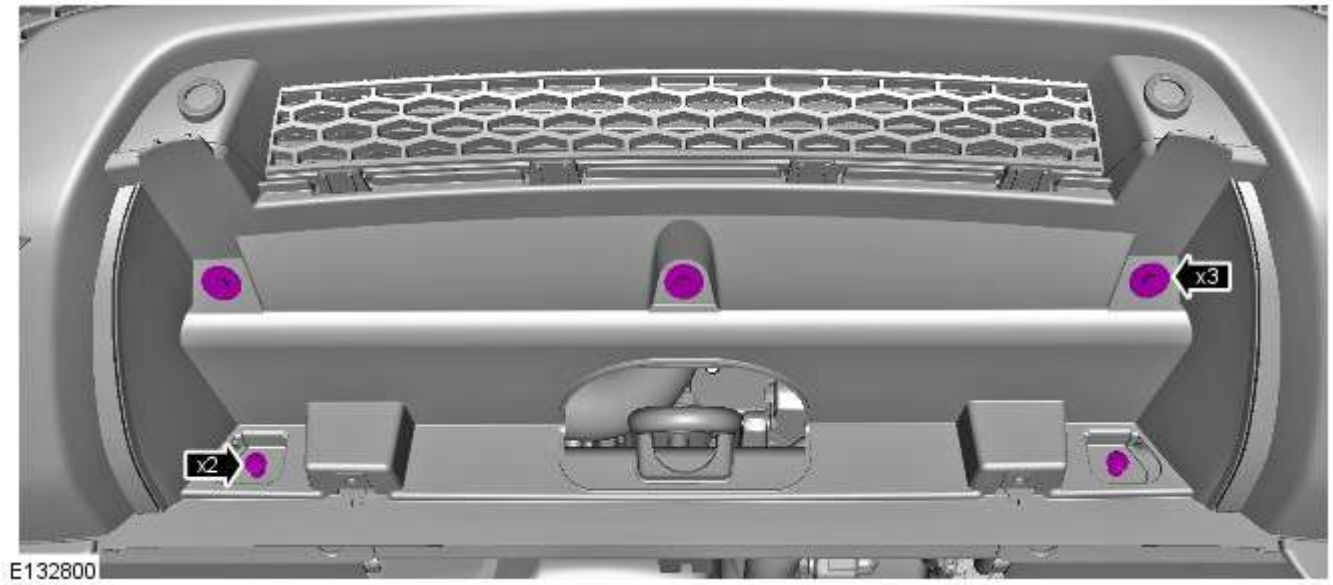
Raise and support the vehicle.

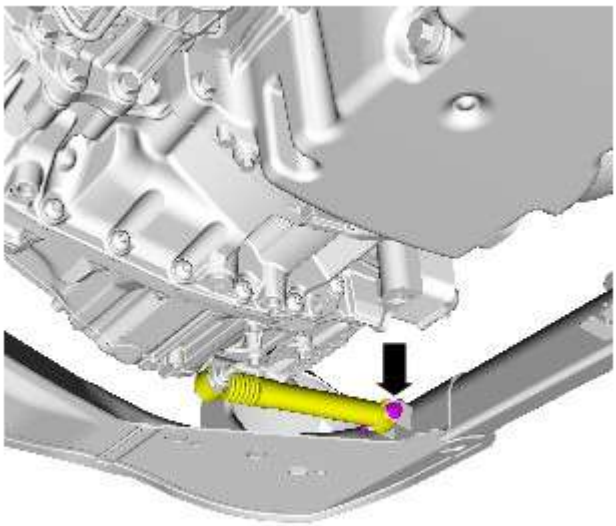
5. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

6. *Torque:* 10 Nm



7. *Torque:* 10 Nm



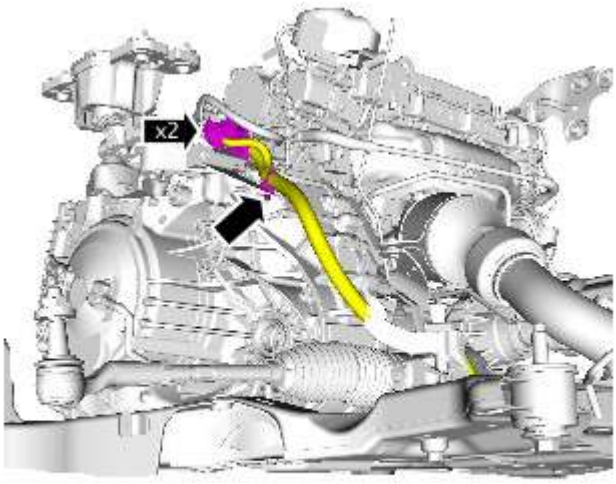


8. NOTE: If equipped.

9. Repeat the above step for the other side.

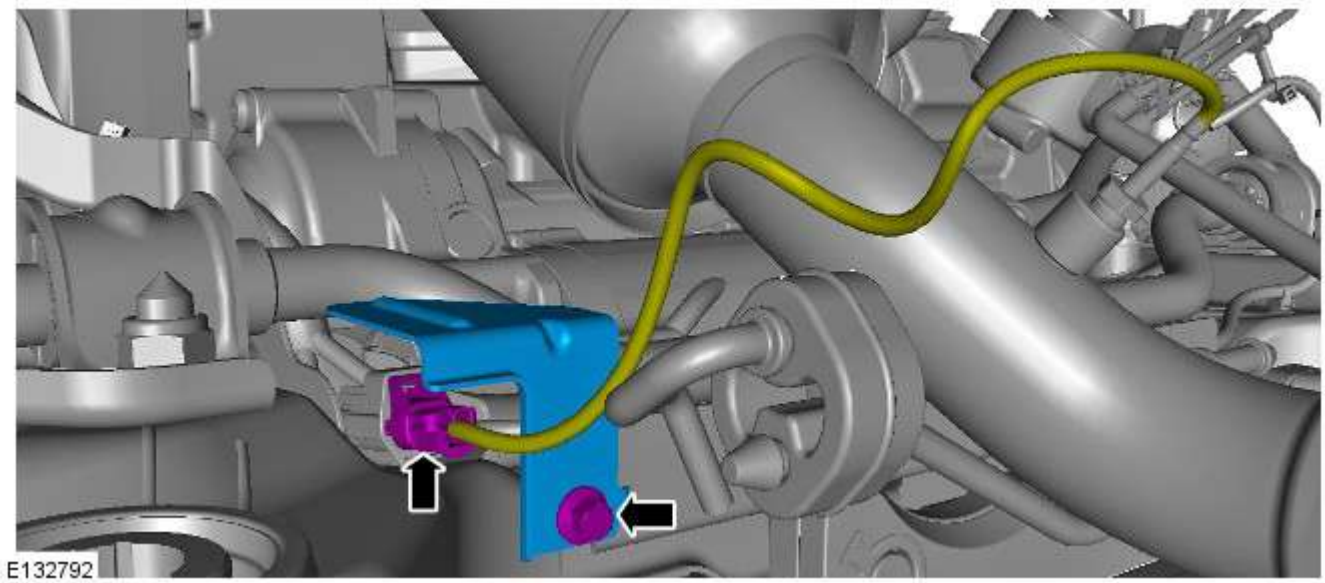
Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

10.



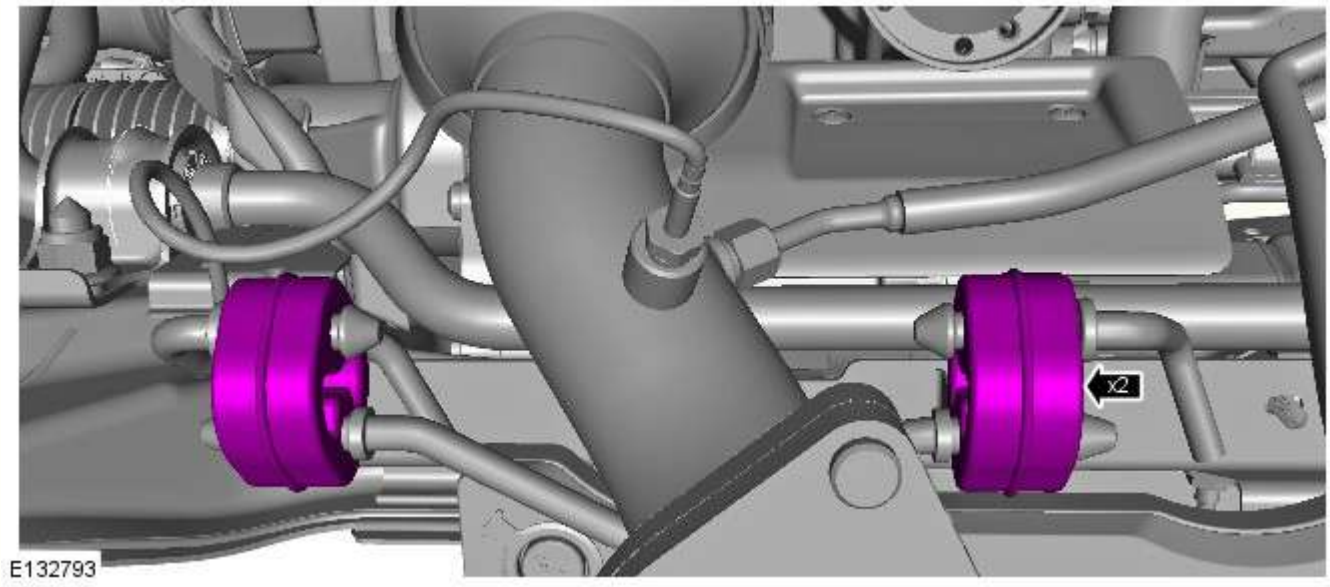
E132791

11. *Torque:* 12 Nm



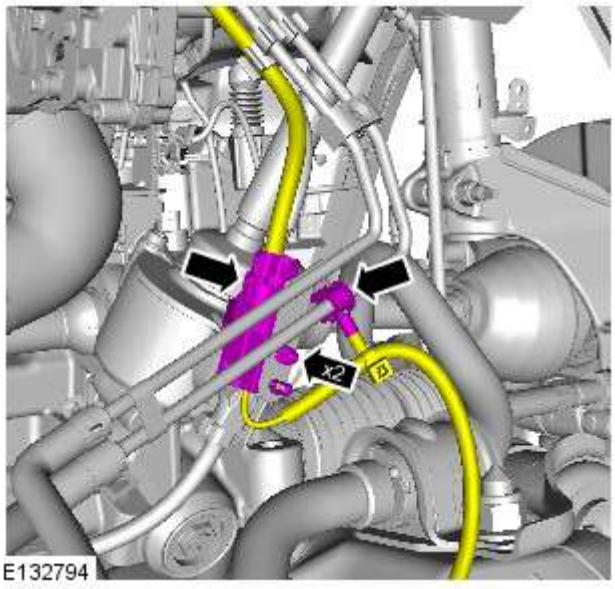
E132792

12.



Vehicles with diesel particulate filter (DPF)

13.

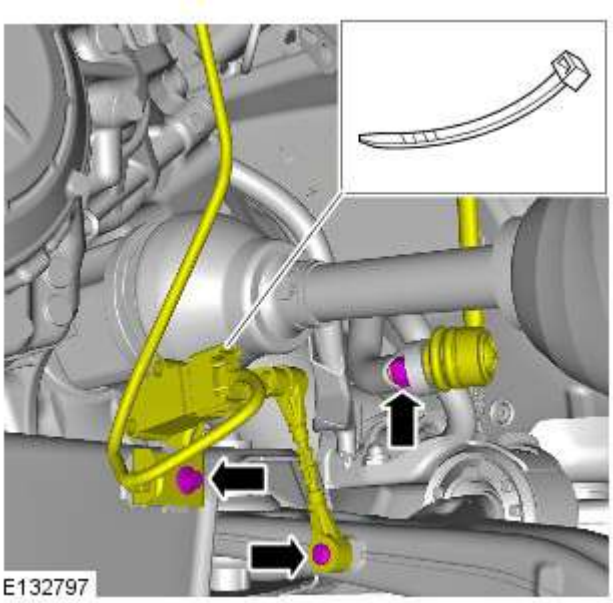


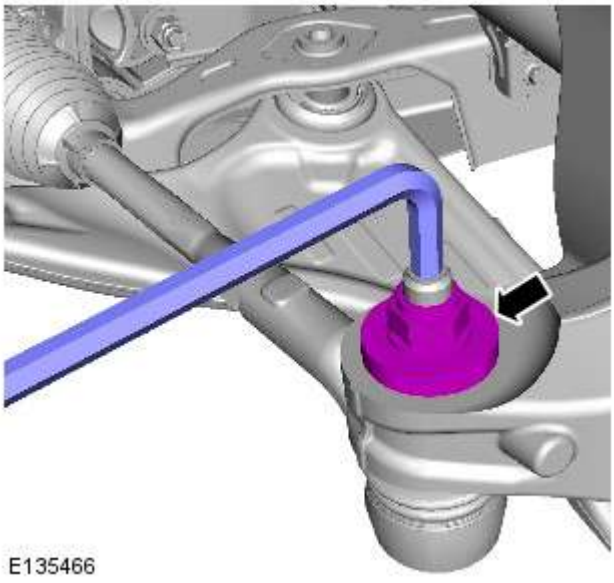
All vehicles

14. WARNING: Make sure that a new nut is installed.

CAUTION: Make sure that the ball joint ball does not rotate.

- Tie aside.
- *Torque:*
  Bolt 10 Nm
  nut 55 Nm
- Repeat the above step for the other side.

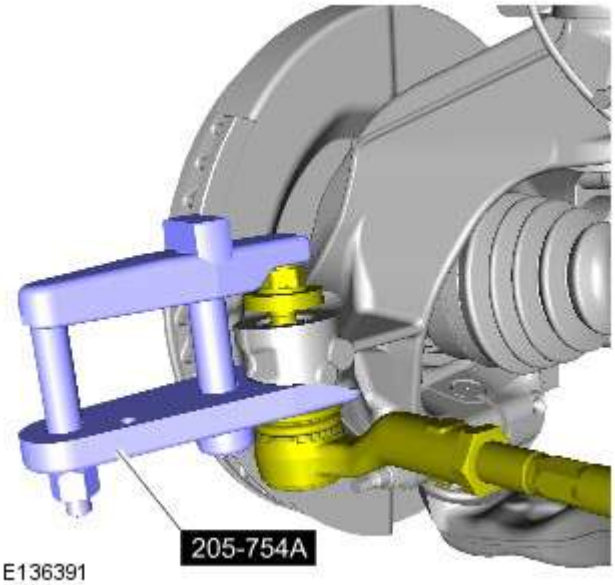




15. WARNING: Make sure that a new nut is installed.

CAUTION: Make sure that the ball joint ball does not rotate.

Torque: 133 Nm



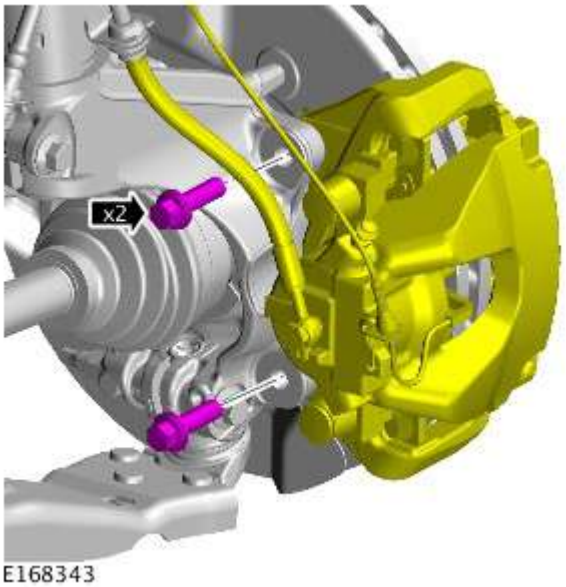
16. CAUTION: Make sure that the ball joint seal is not damaged.

NOTES:

Some variation in the illustrations may occur, but the essential information is always correct.

Repeat the step for the other side.

- *Special Tool(s):* 205-754A



E168343

17. CAUTION: Make sure that new bolts are installed.

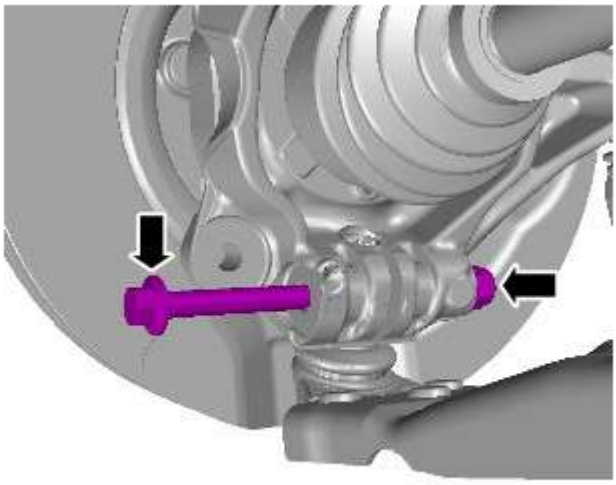
NOTE: Repeat the step for the other side.

Torque:

Vehicles fitted with 18'' brakes.
- Stage 1:110 Nm
- Stage 2:120°

M14 bolts 200 Nm

M12 bolts
- Stage 1:90 Nm
- Stage 2:120°

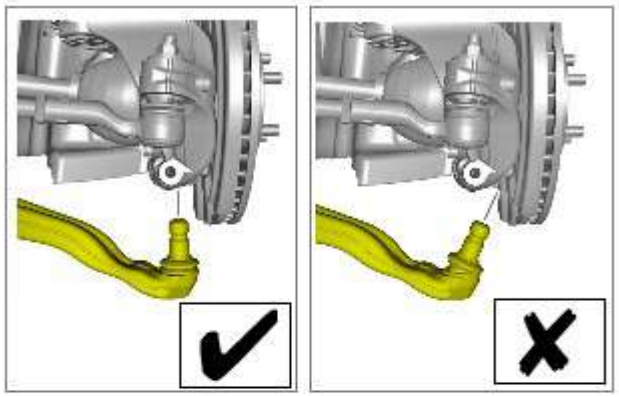

E185125

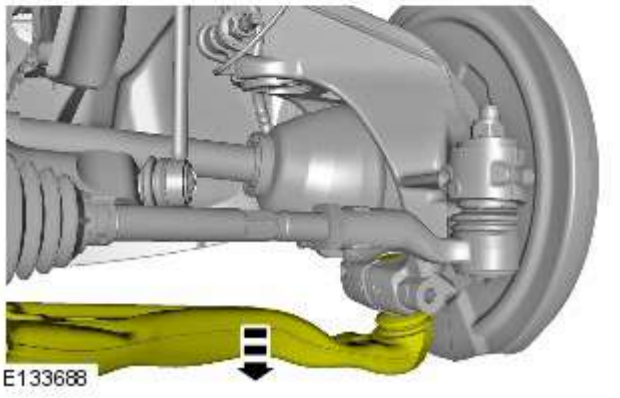
18. CAUTION: Make sure that new bolts are installed.

NOTE: Repeat the step for the other side.

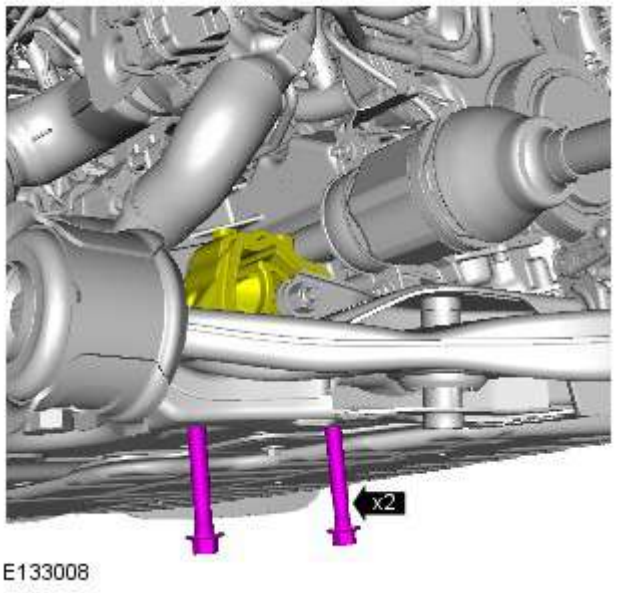
Torque:
- Stage 1:80 Nm
- Stage 2:180°

19.

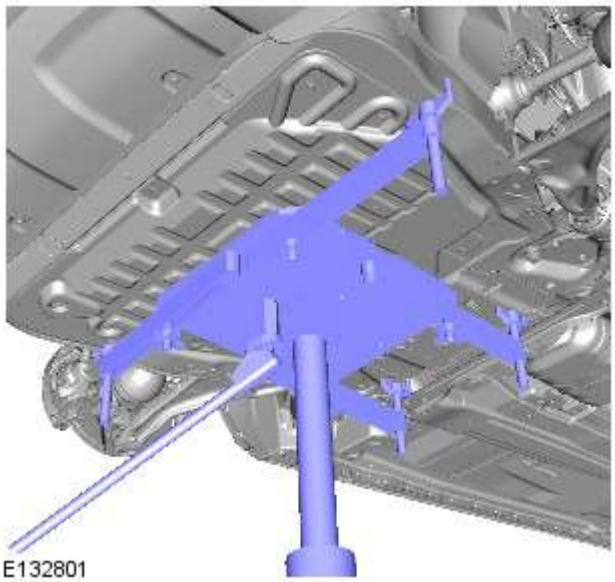




20. *Torque:* 110 Nm



21. *General Equipment:* Transmission jack

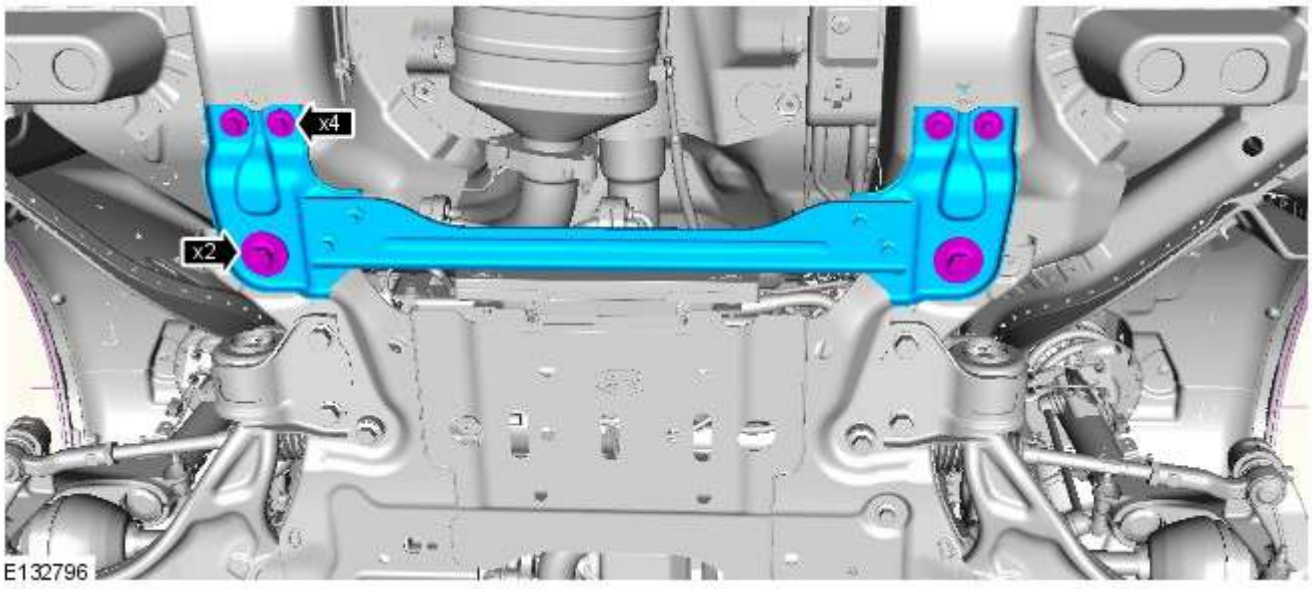


22. CAUTIONS:

Remove and discard the M16 subframe retaining bolts.

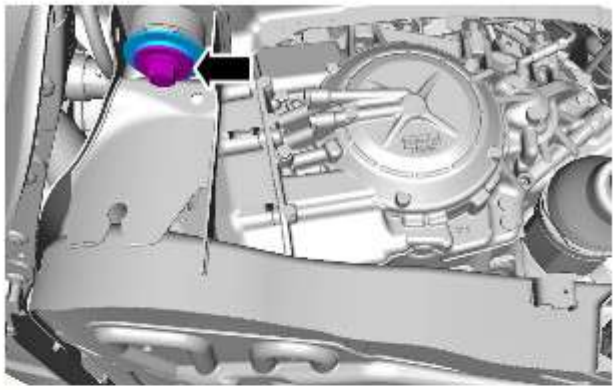
Do not discard the M10 retaining bolts.

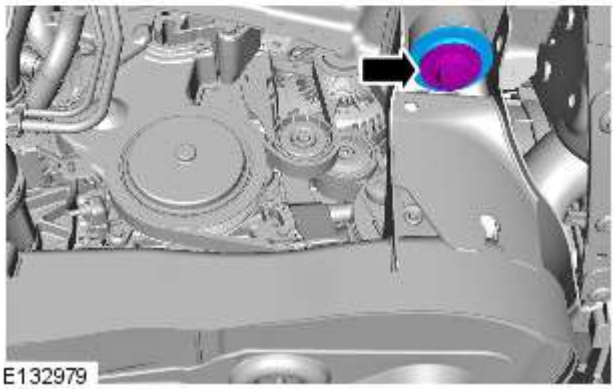
- *Torque:* 45 Nm
- *Torque:*
  Stage 1:140 Nm
  Stage 2:240°



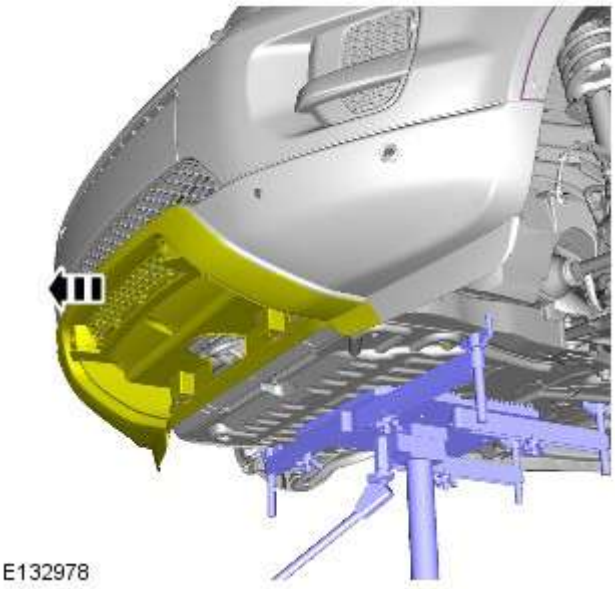
23. CAUTION: Remove and discard the M16 subframe retaining bolts.

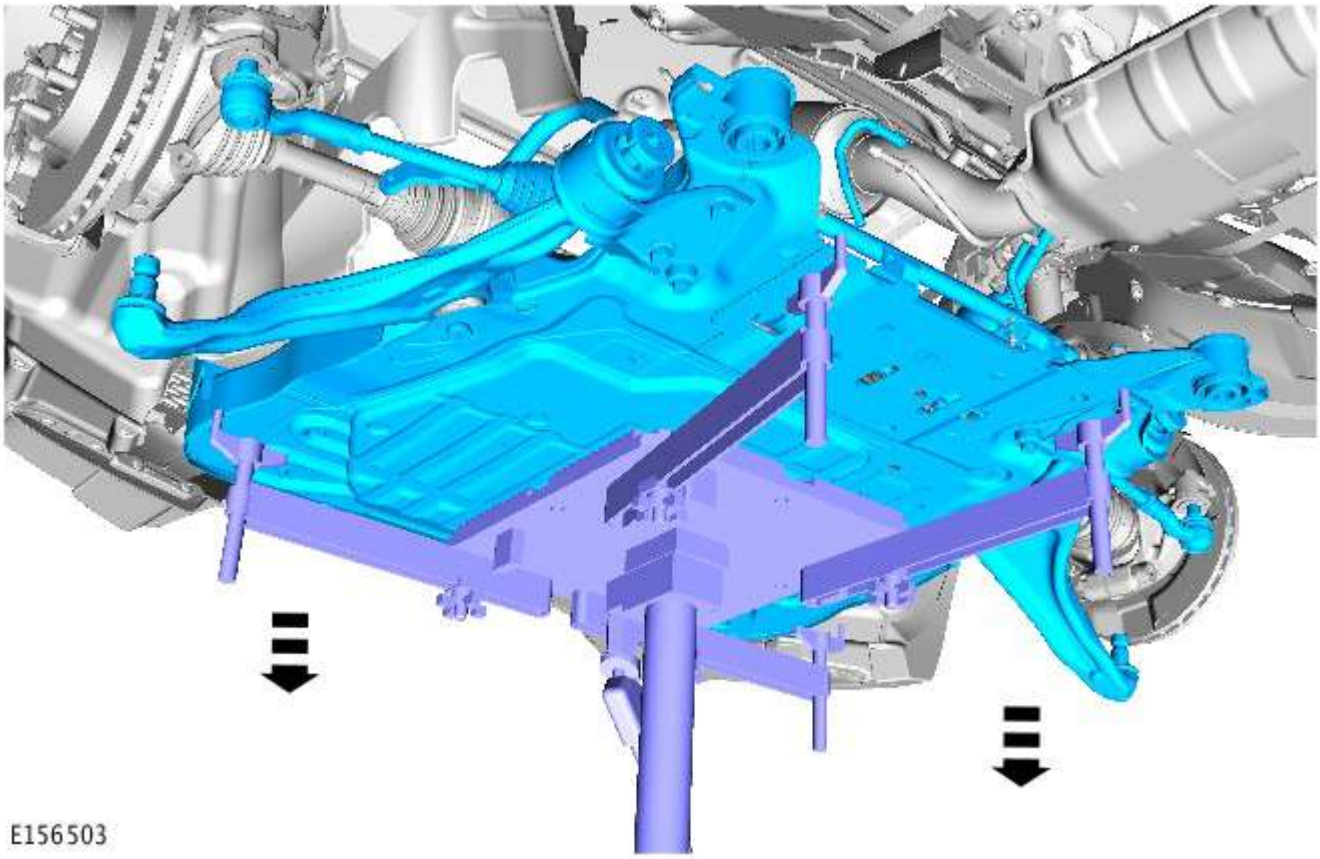
Torque:
Stage 1:140 Nm
Stage 2:240°

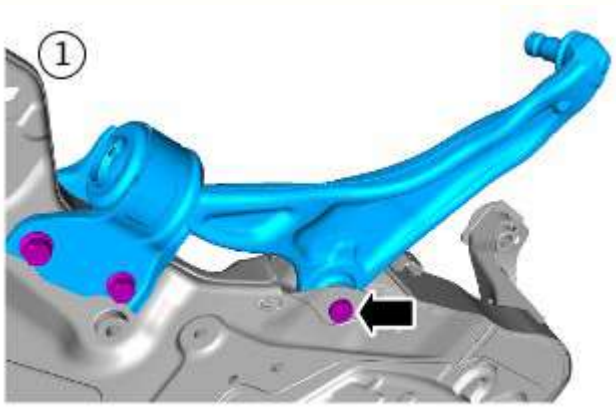


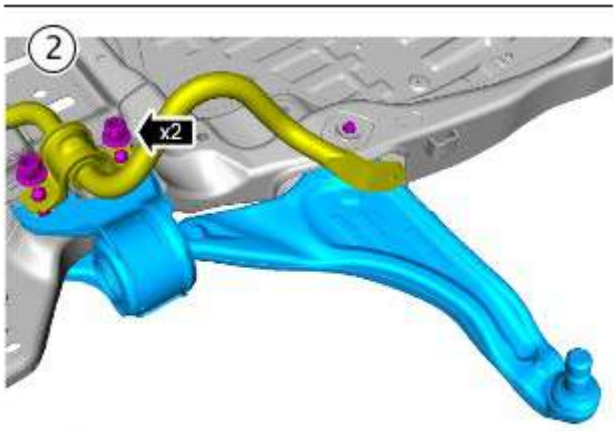


24.









E198932

26. CAUTION: Make sure that new nuts and bolts are installed.

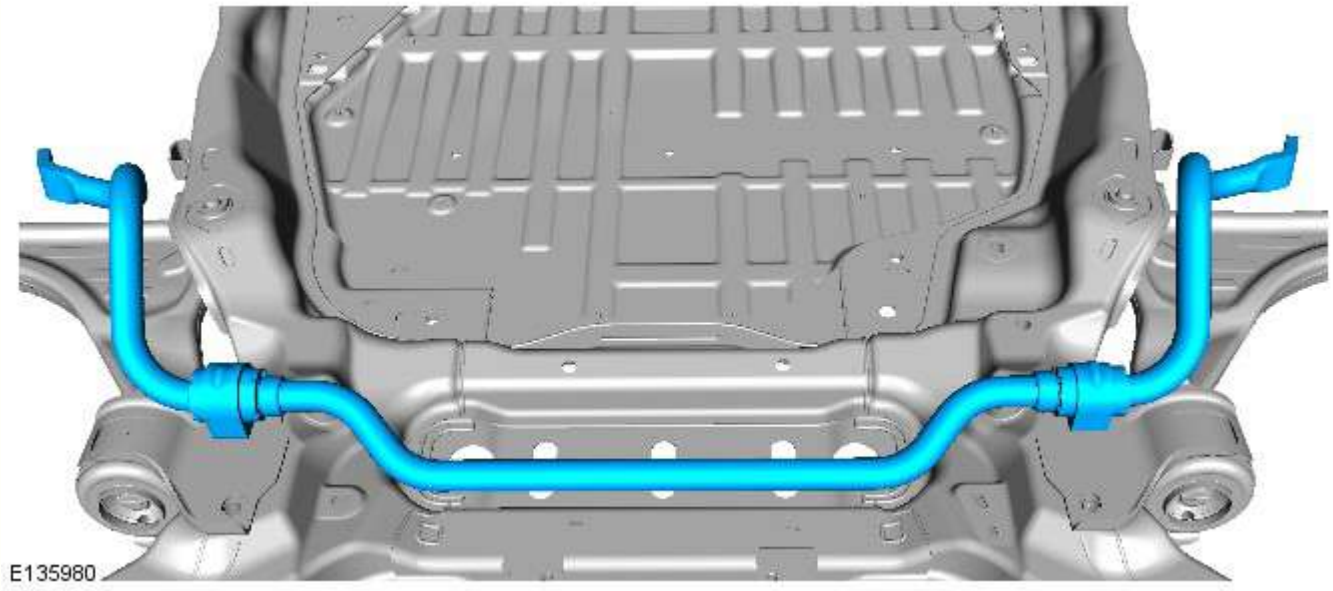
- Repeat for the other side.
- **(1)** Lower control arm front bolt.

  Torque:
  Stage 1:140 Nm
  Stage 2:45°
- **(2)** Lower control arm rear nuts and bolts for vehicles fitted with 18" brakes.

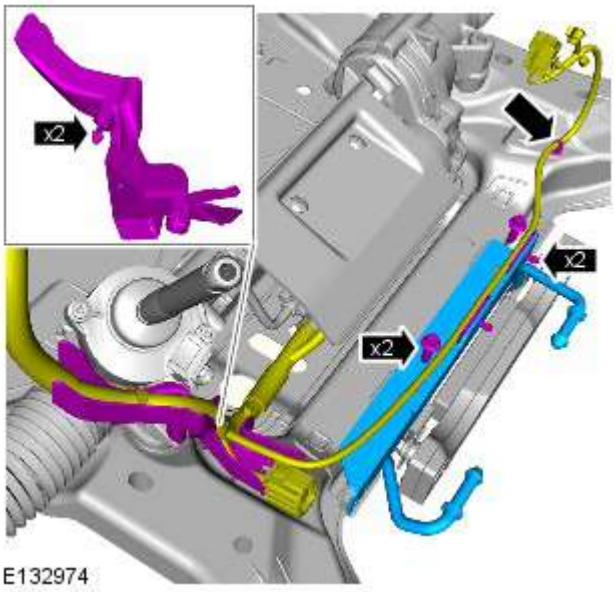
  Torque:
  Stage 1:115 Nm
  Stage 2:240°
- **(2)** Lower control arm rear nuts and bolts for vehicles fitted with 17" brakes.

  Torque: 175 Nm

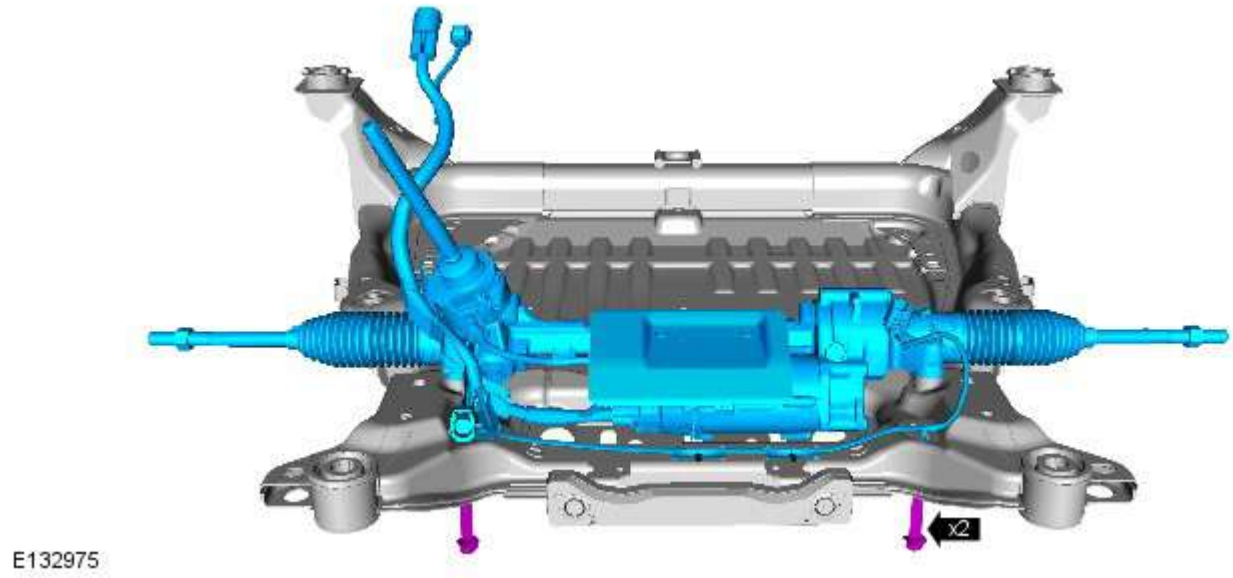
27. NOTE: Some components shown removed for clarity.



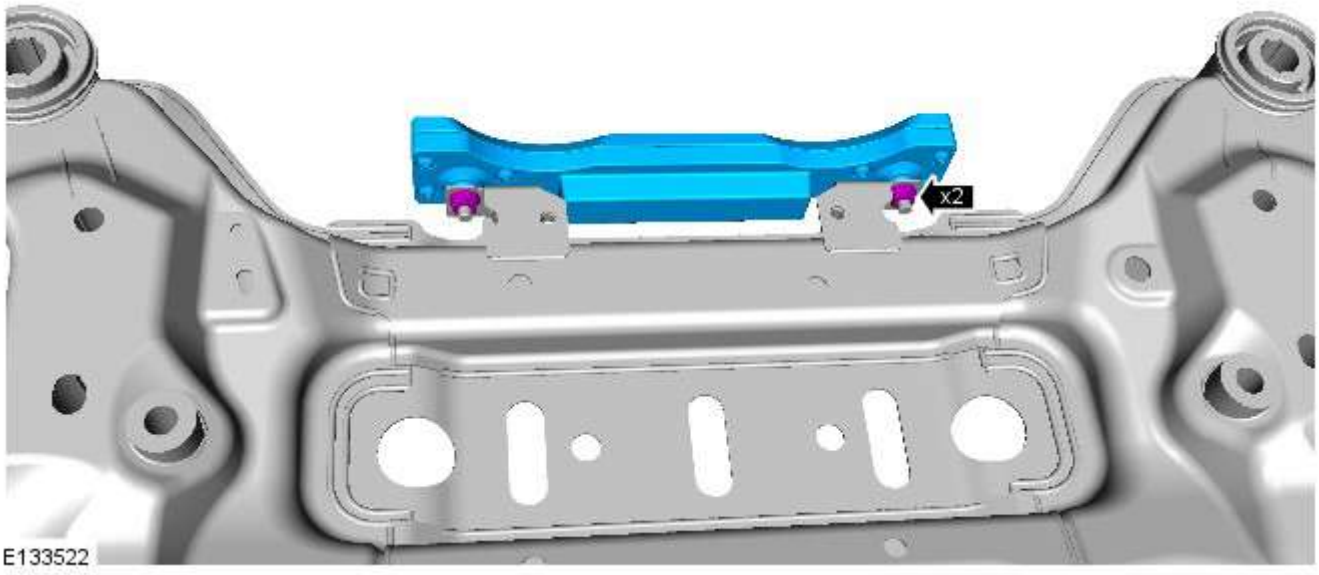
28. *Torque:* 20 Nm



29. *Torque:* 189 Nm



30. *Torque:* 24 Nm



31. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

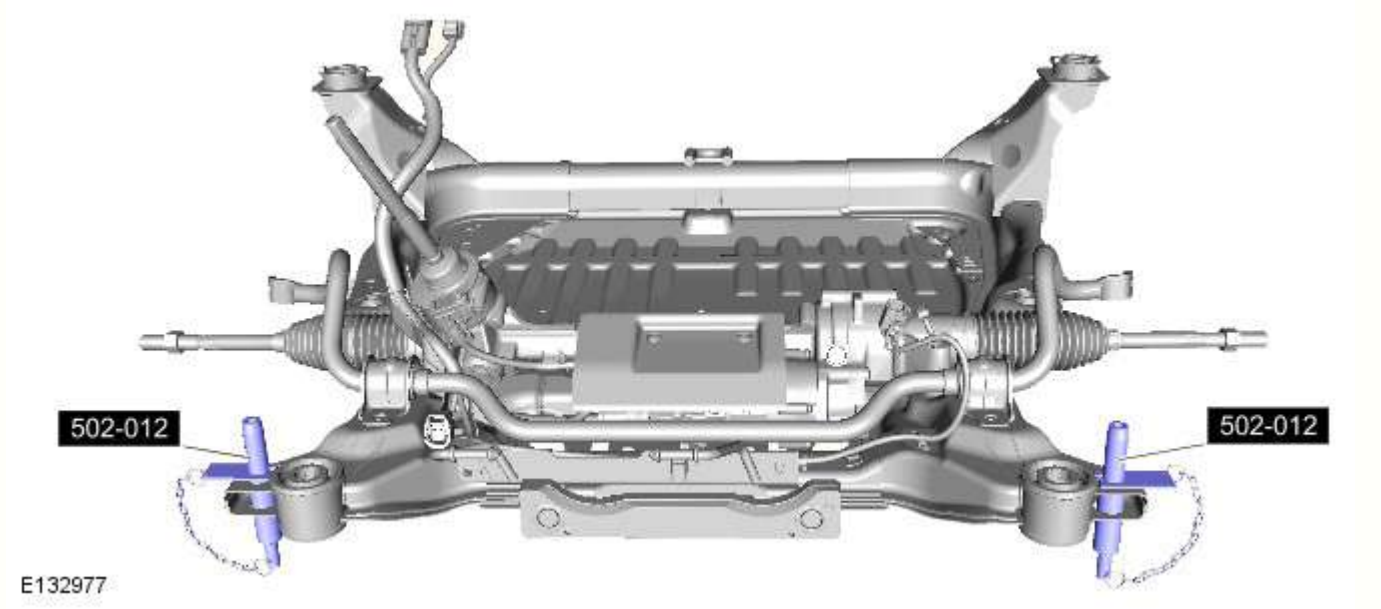
Refer to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures).

Installation

All vehicles

1. CAUTION: Use the special tool to align the components.

- To install, reverse the removal procedure.
- *Special Tool(s):* 502-012
- *Special Tool(s):* 502-012



Vehicles with dynamic suspension

2. Check the suspension system ride height.

Published: 07-Sep-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Catalytic Converter and Diesel Particulate Filter (DPF) Assembly

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

Some variation in the illustrations may occur, but the essential information is always correct.

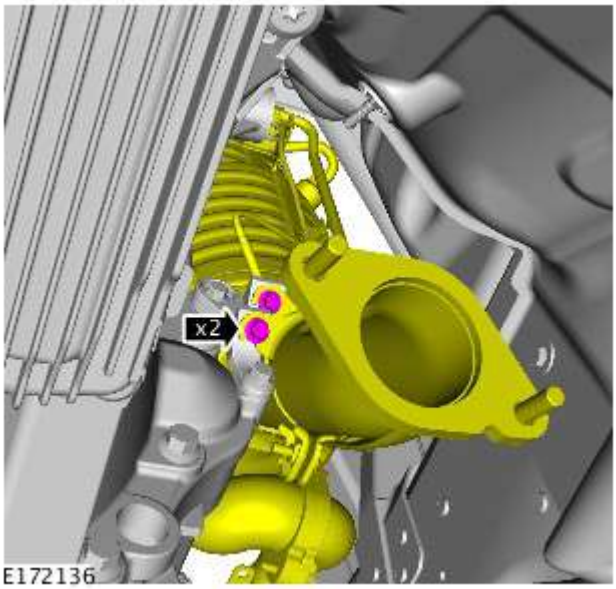
1. Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05, Removal and Installation).

2. WARNING: Make sure to support the vehicle with axle stands.

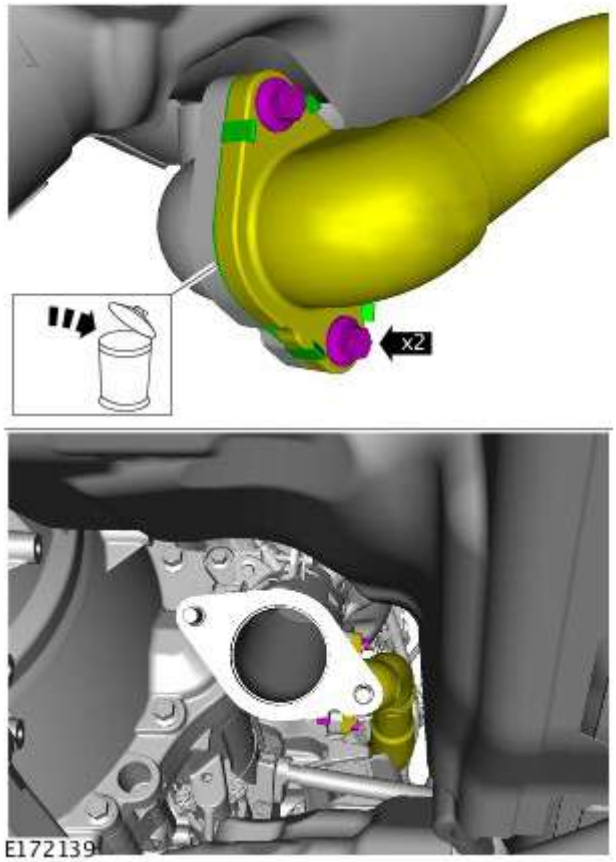
Raise and support the vehicle.

3. Refer to: Exhaust System (309-00, Removal and Installation).

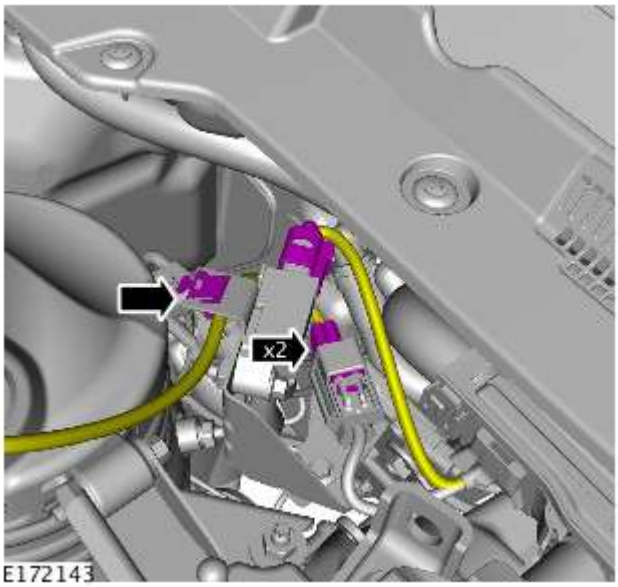
4. *Torque:* 25 Nm



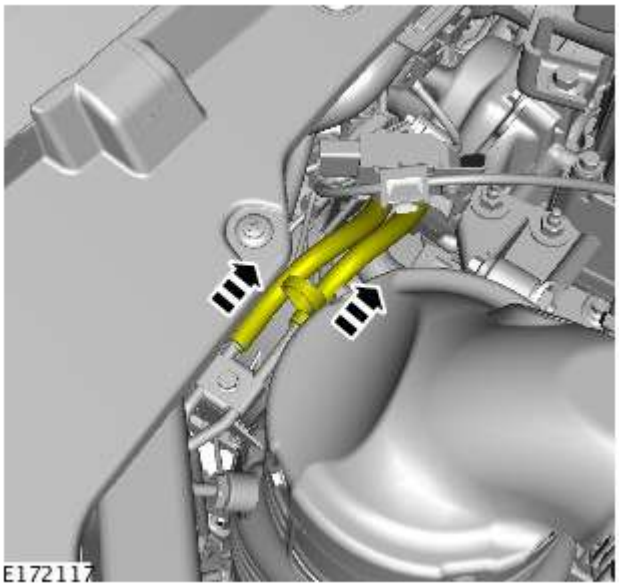
5. *Torque:* 9 Nm



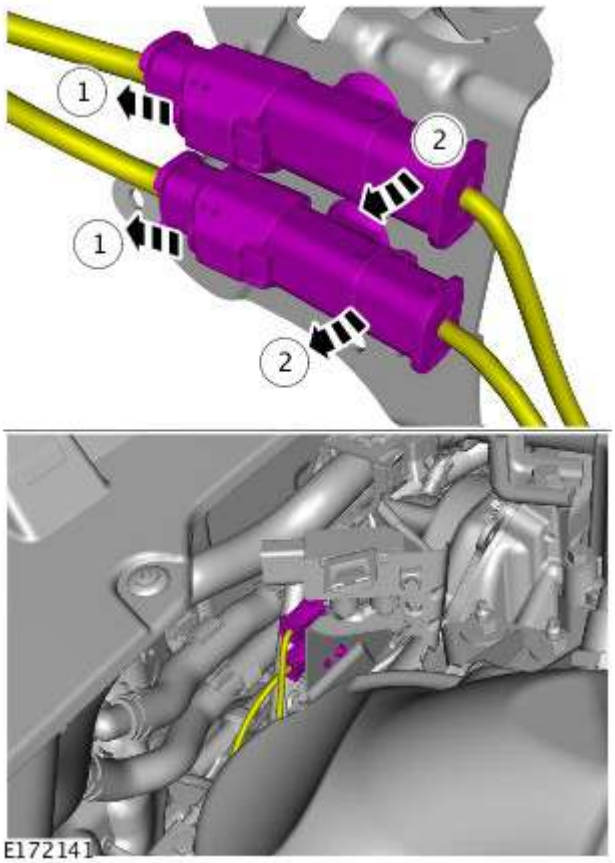
6.



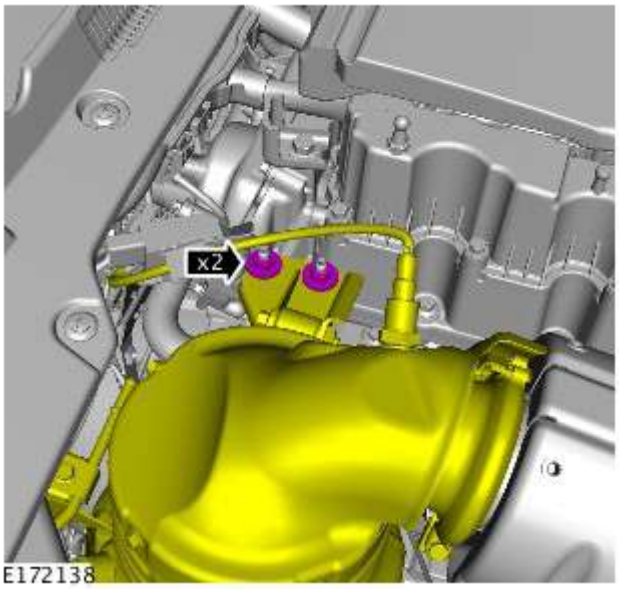
7.



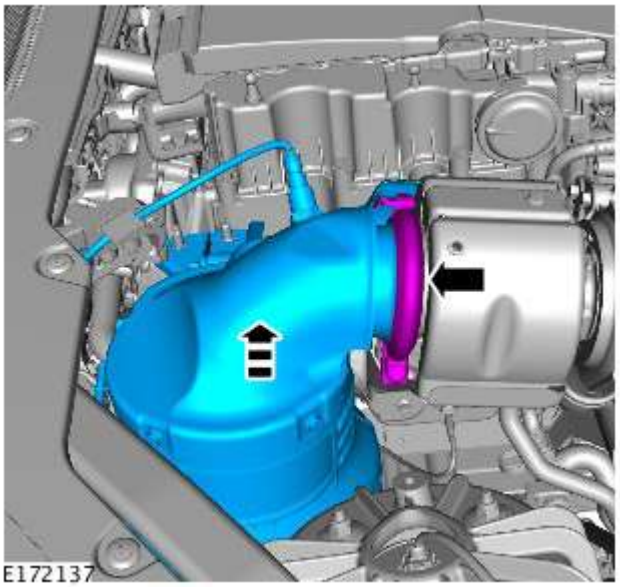
8.

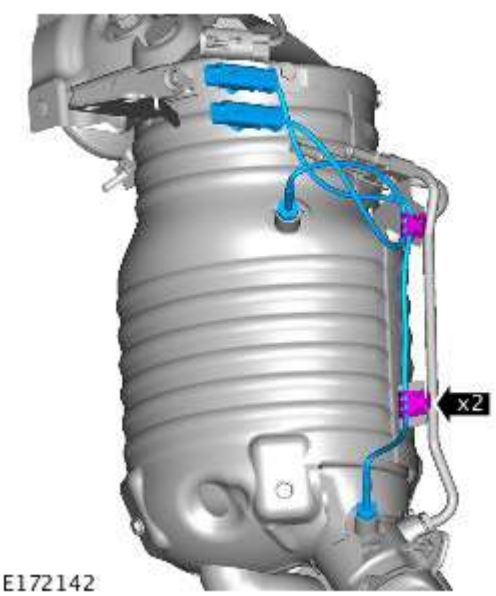


9. *Torque:* 25 Nm



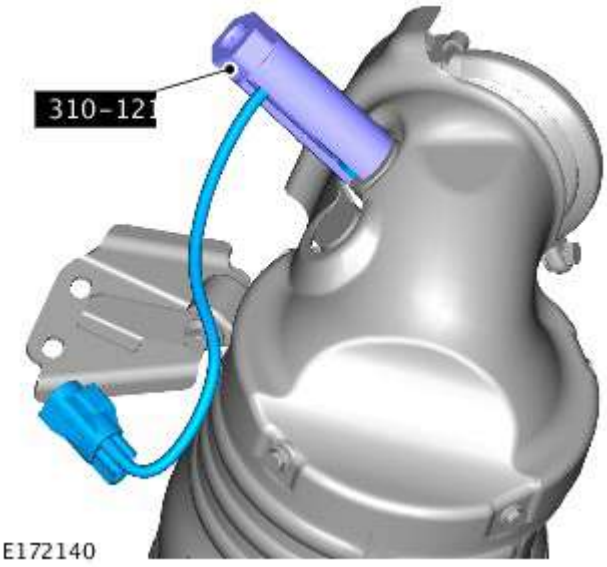
10. *Torque:* 10 Nm





11. NOTE: Do not disassemble further if the component is removed for access only.

Torque: 35 Nm



12. *Torque:* 48 Nm

Installation

1. To install, reverse the removal procedure.

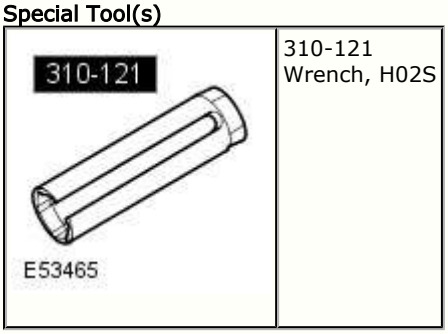
2. If a new unit is installed, configure using the approved diagnostic tool.

Published: 13-Oct-2016

Exhaust System - INGENIUM I4 2.0L Diesel - Catalytic Converter

Removal and Installation

Special Tool(s)

	310-121 Wrench, H02S

Removal

WARNING: Observe due care when working near a hot exhaust system.

NOTES:

Some variation in the illustrations may occur, but the essential information is always correct.

Removal steps in this procedure may contain installation details.

1. WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the engine acoustic cover.

Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the right front fender splash shield.

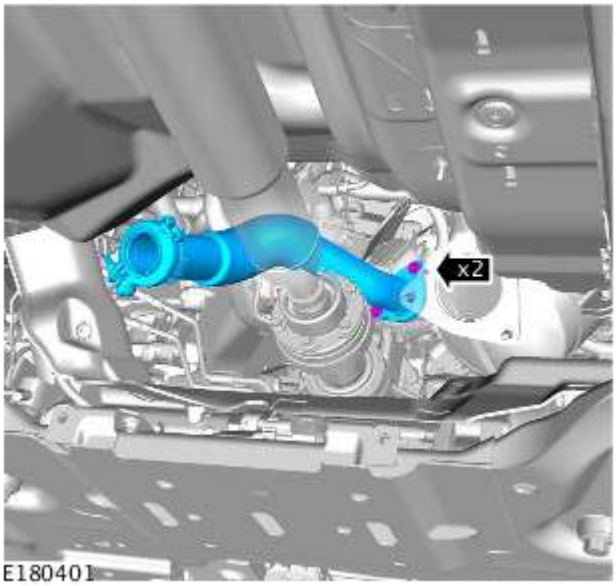
Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

4. Remove the front subframe.

Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

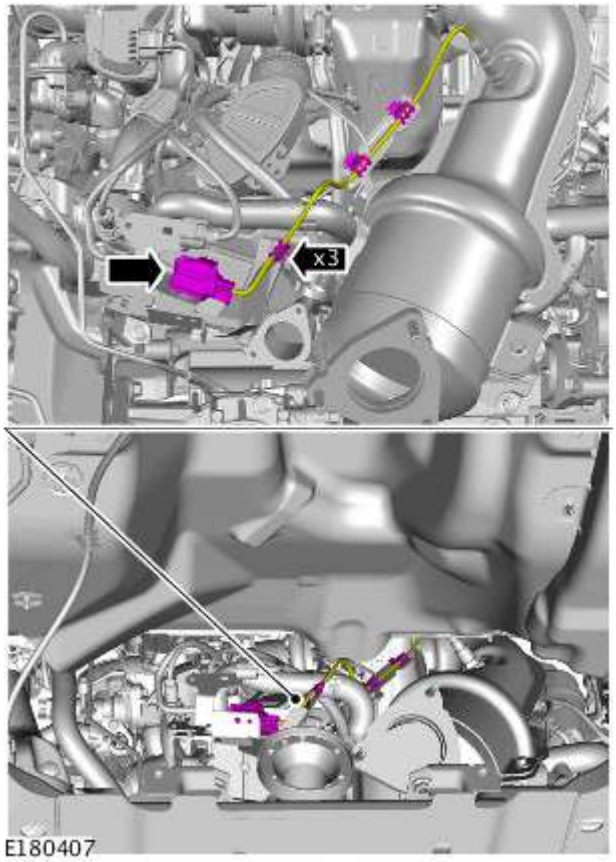
5. Remove the Diesel Particulate Filter (DPF).

Refer to: Catalytic Converter and Diesel Particulate Filter (DPF) Assembly (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).
Refer to: Catalytic Converter (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).



E180401

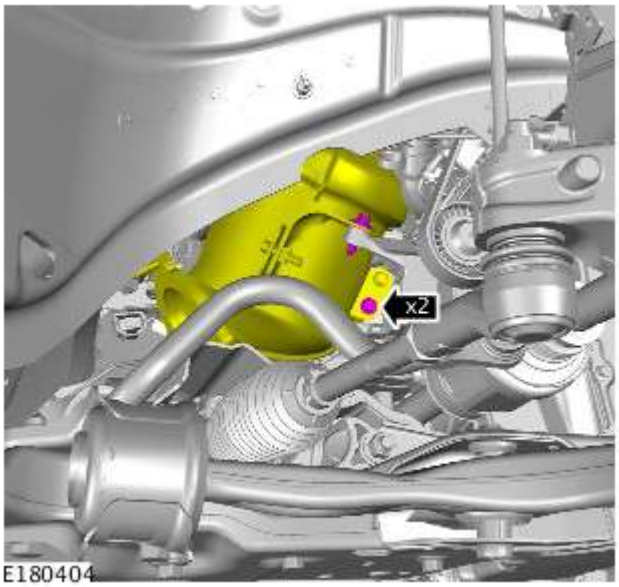
6. NOTE: Remove and discard the gasket.



E180407

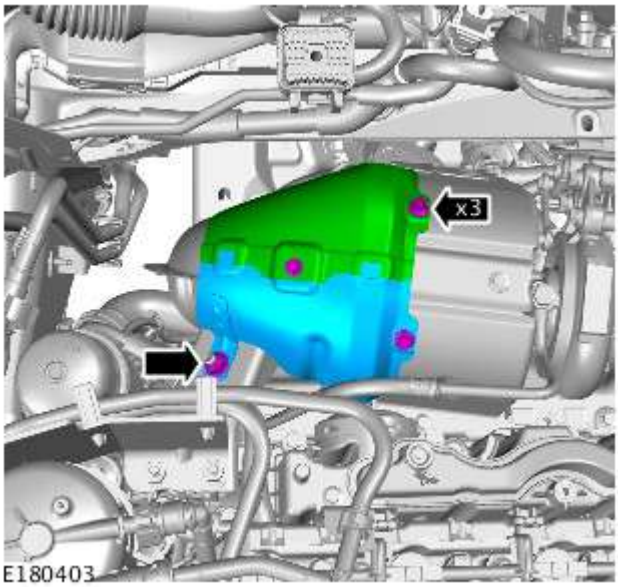
7.

8.



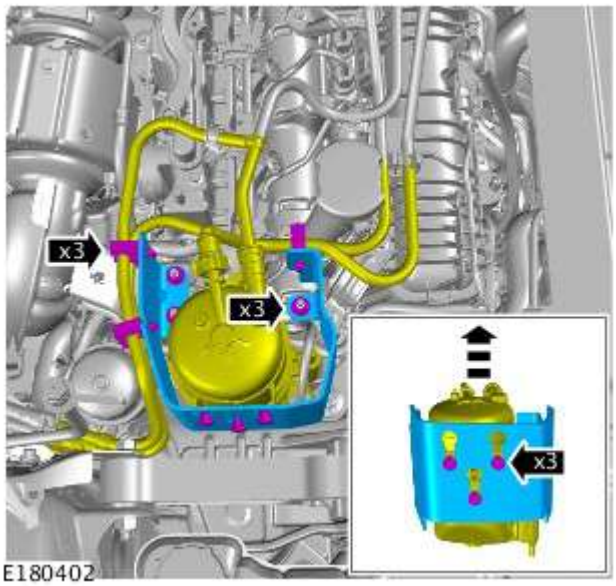
E180404

9.



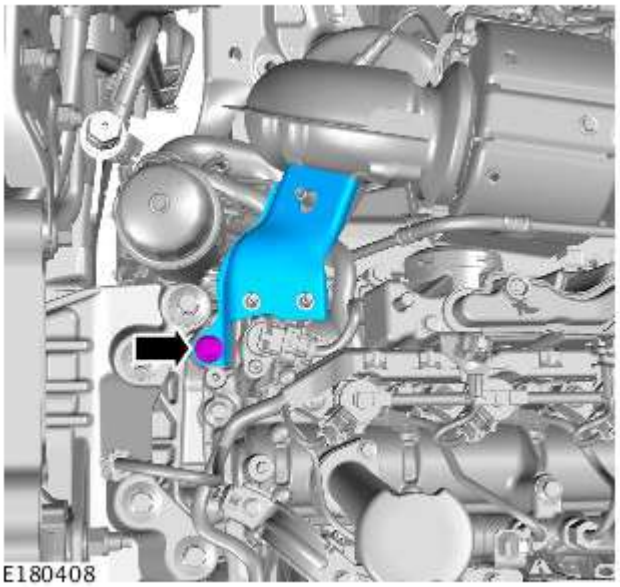
E180403

10.

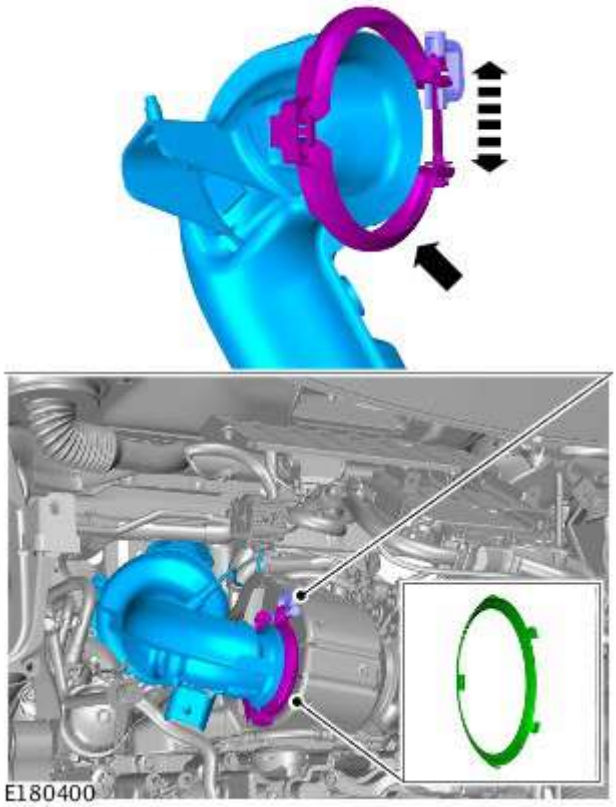


E180402

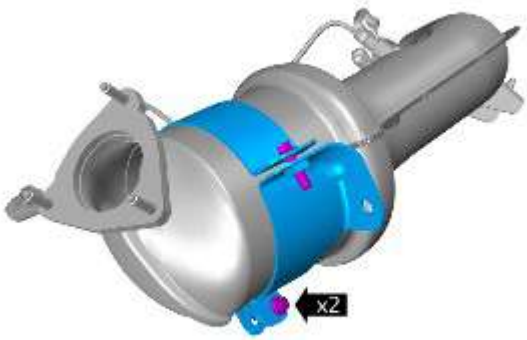
11.



12. NOTE: Remove and discard the gasket.

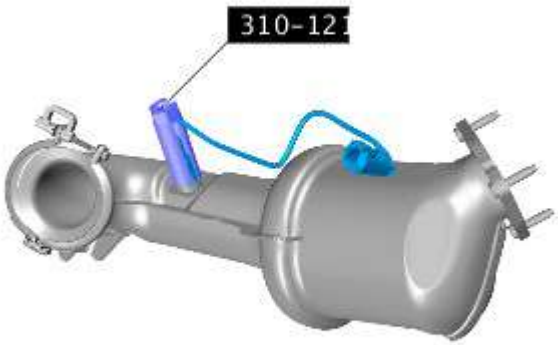


13. NOTE: Do not disassemble further if the component is removed for access only.



E180405

14. *Special Tool(s):* 310-121



E180406

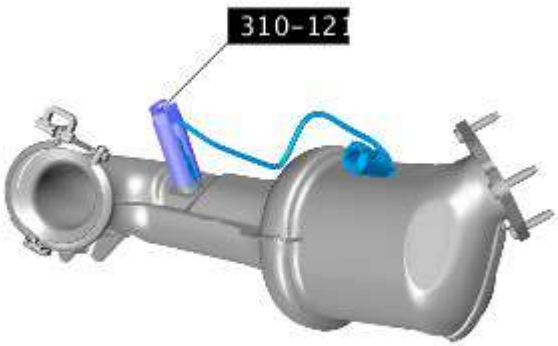
Installation

1. CAUTIONS:

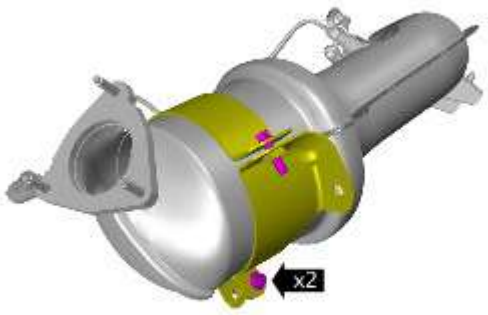
⚠ Make sure the anti-seize compound does not contact the catalyst monitor sensor tip.

⚠ If accidentally dropped or knocked install a new sensor.

Special Tool(s): 310-121
Torque: 48 Nm

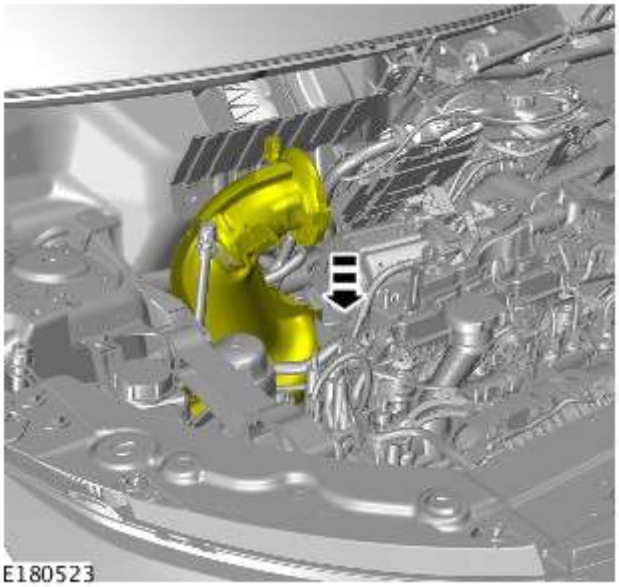


E180406



E180522

2. CAUTION: Only tighten the bolts finger tight at this stage

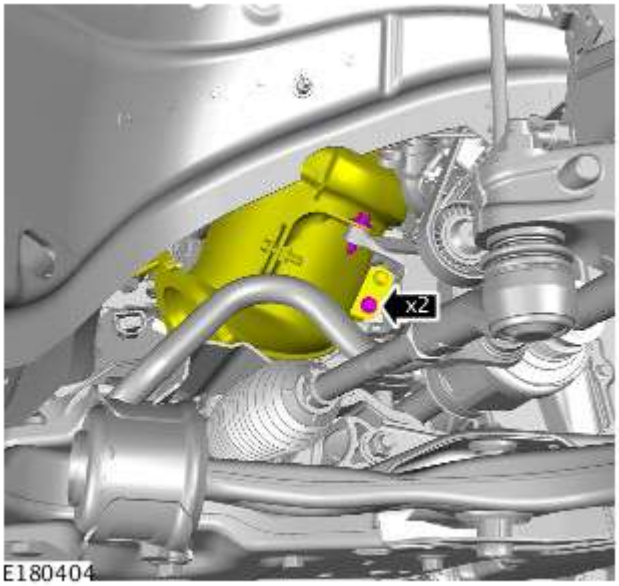


E180523

3. CAUTIONS:

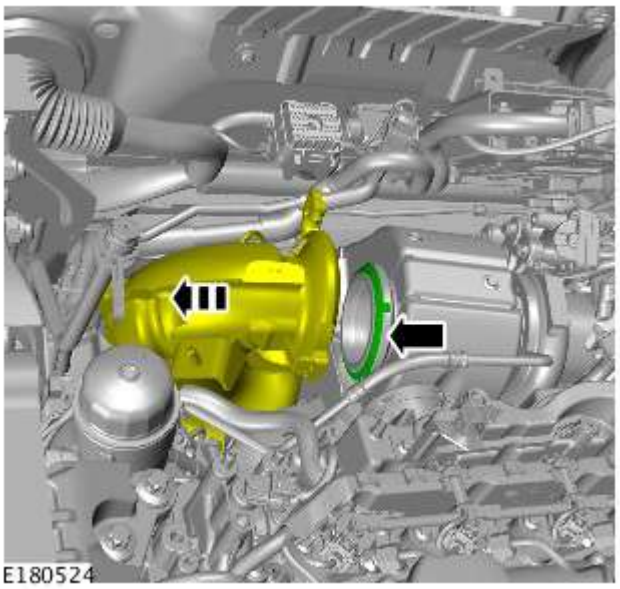
Take extra care not to damage the component.

Take extra care not to damage the surrounding components.



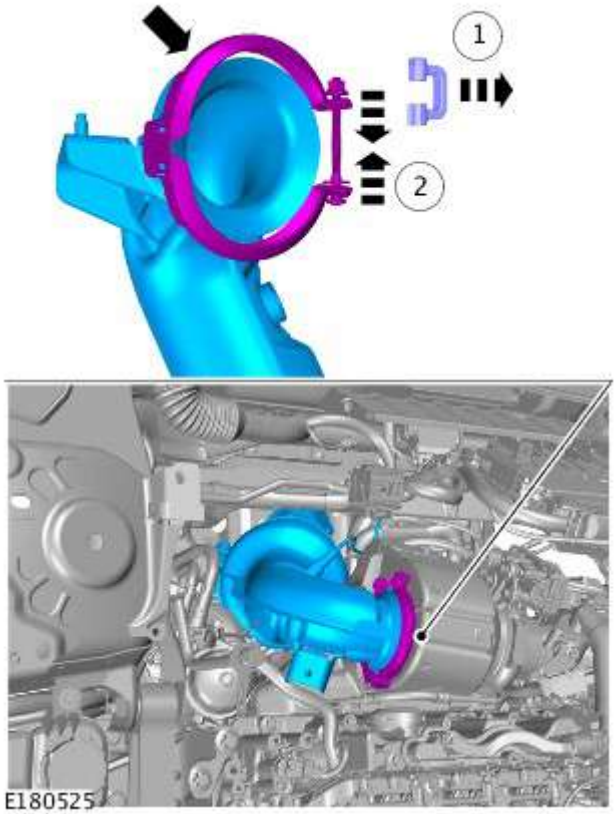
E180404

4. CAUTION: Only tighten the bolts finger tight at this stage

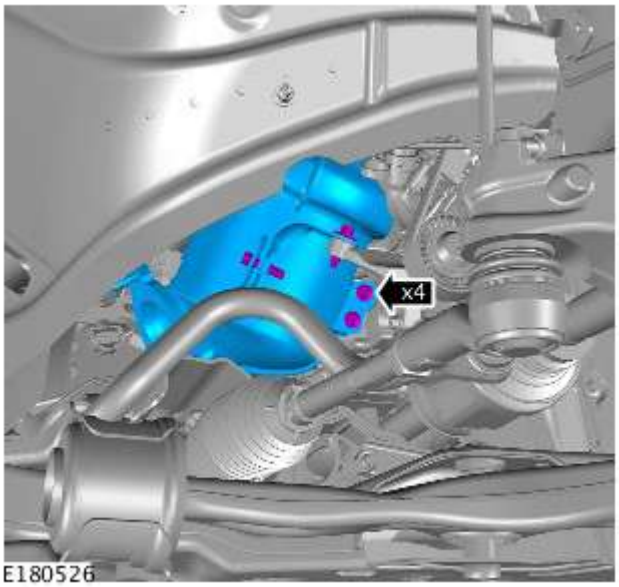


5. NOTE: Install a new gasket.

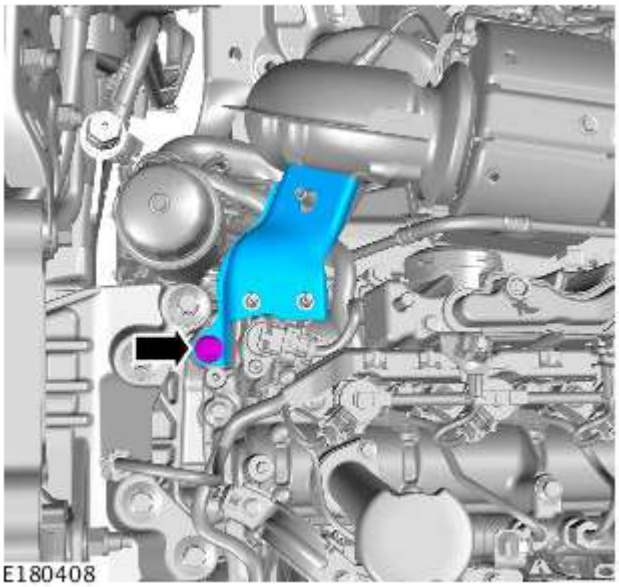
6. *Torque:* 10 Nm



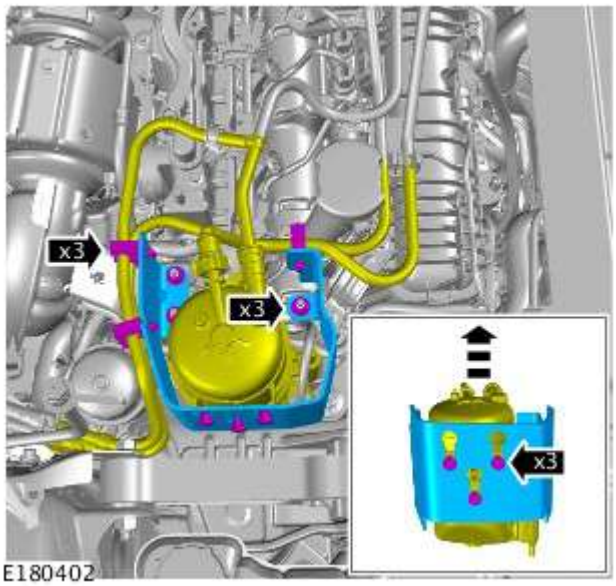
7. *Torque:* 24 Nm



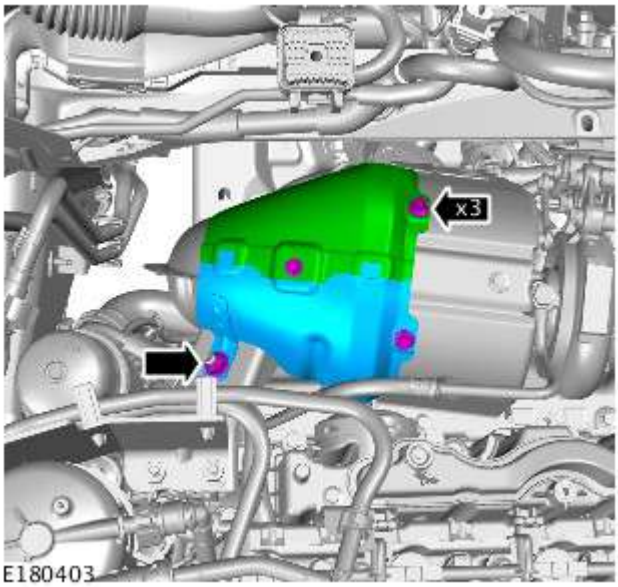
8. *Torque:* 24 Nm



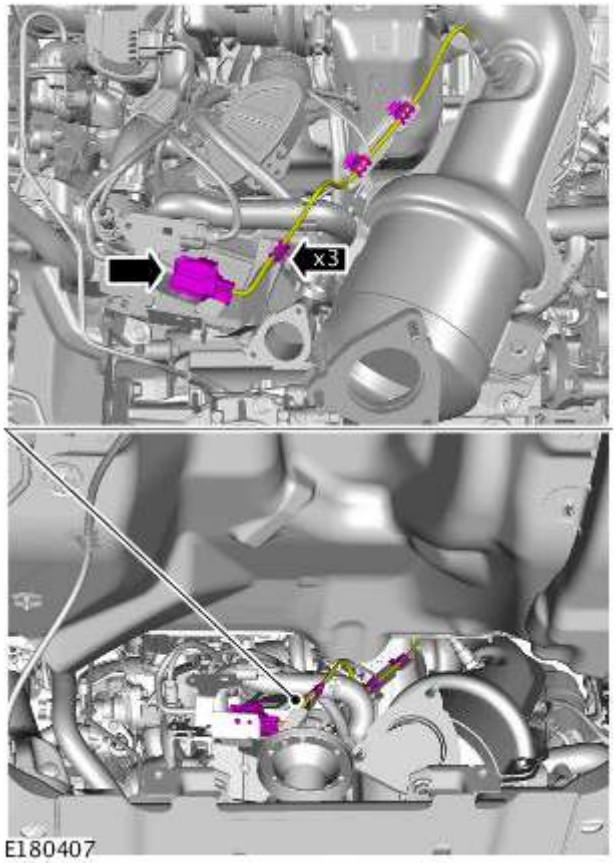
9. *Torque:* 24 Nm



10. *Torque:* 24 Nm

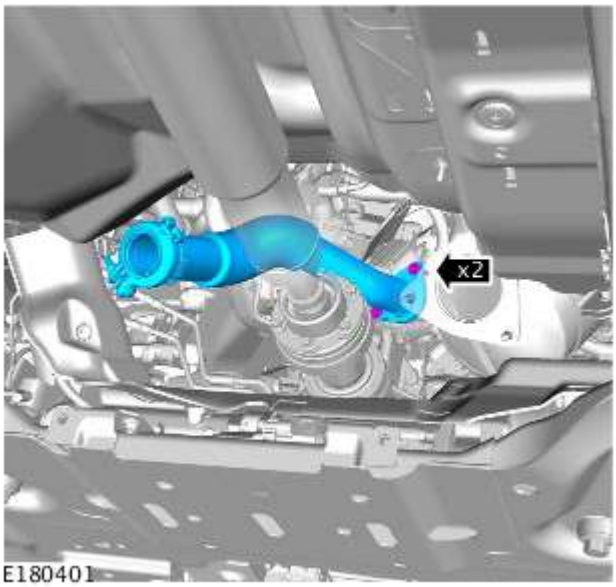


11.



12. NOTE: Install a new gasket.

Torque: 24 Nm



13. Install the Diesel Particulate Filter (DPF).

Refer to: Catalytic Converter and Diesel Particulate Filter (DPF) Assembly (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).
Refer to: Catalytic Converter (309-00B Exhaust System - INGENIUM I4 2.0L Diesel, Removal and Installation).

14. Install the front subframe.

Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

15. Install the engine acoustic cover.

Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

16. Install the right front fender splash shield.

Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

Published: 30-Sep-2014

Front End Body Panels - Fender Splash Shield

Removal and Installation

Removal

NOTES:

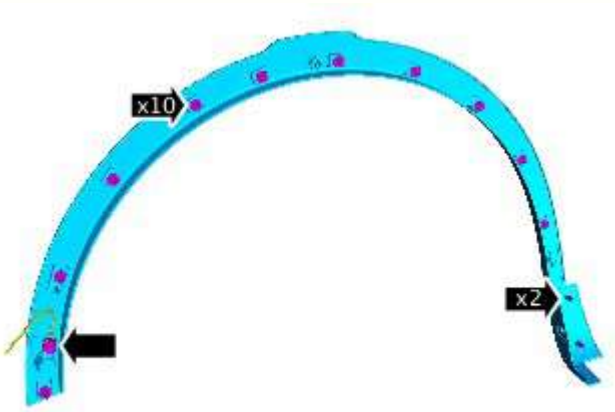
Removal steps in this procedure may contain installation details.

RH illustration shown, LH is similar.

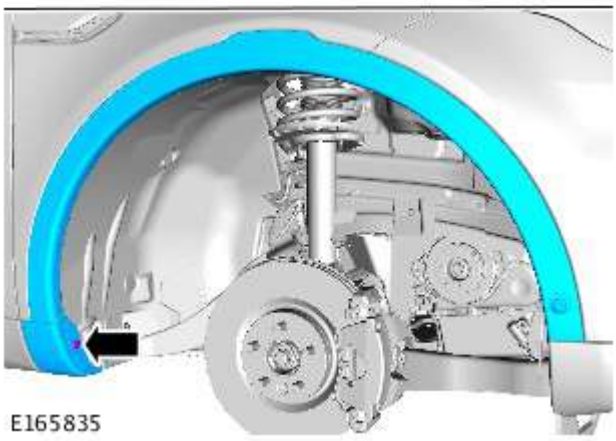
1. WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

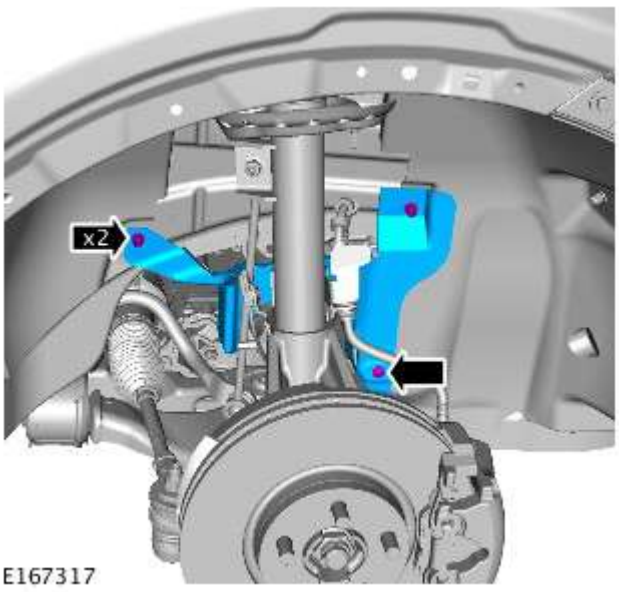
2. Refer to: Wheel and Tire (204-04, Removal and Installation).



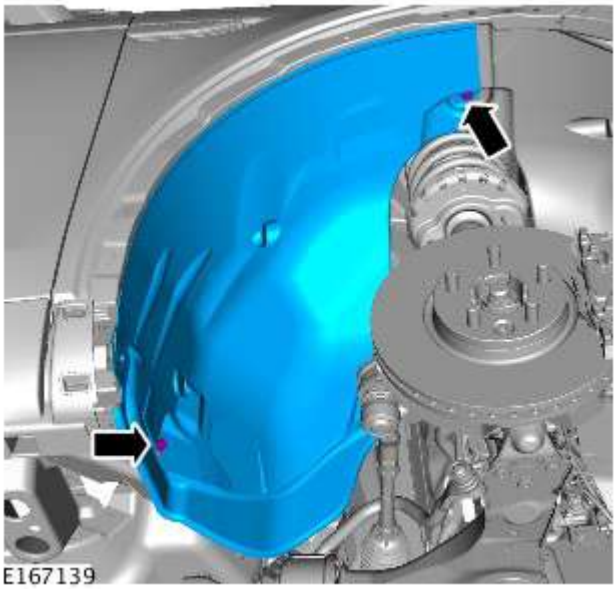
3. CAUTION: Take extra care not to damage the component.



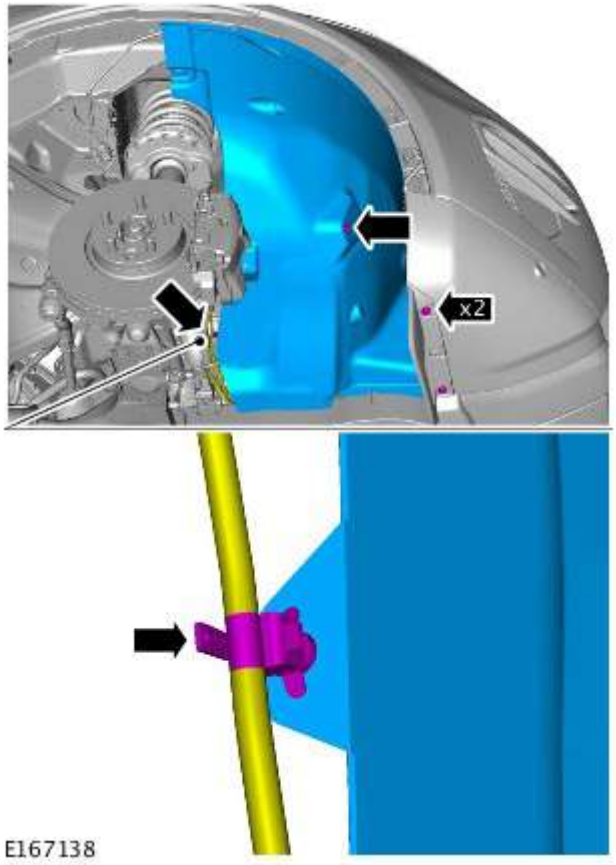
4.



5.



6.



Installation

1. To install, reverse the removal procedure.

Published: 28-Sep-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Diesel Particulate Filter (DPF) Differential Pressure Sensor

Removal and Installation

Removal

NOTES:

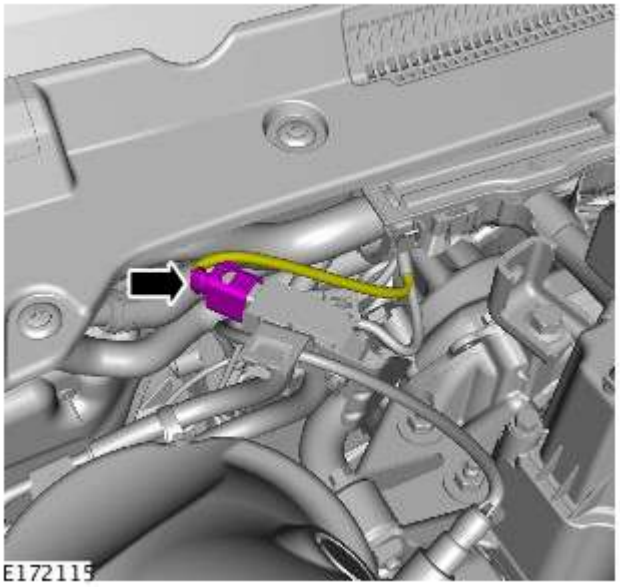
Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

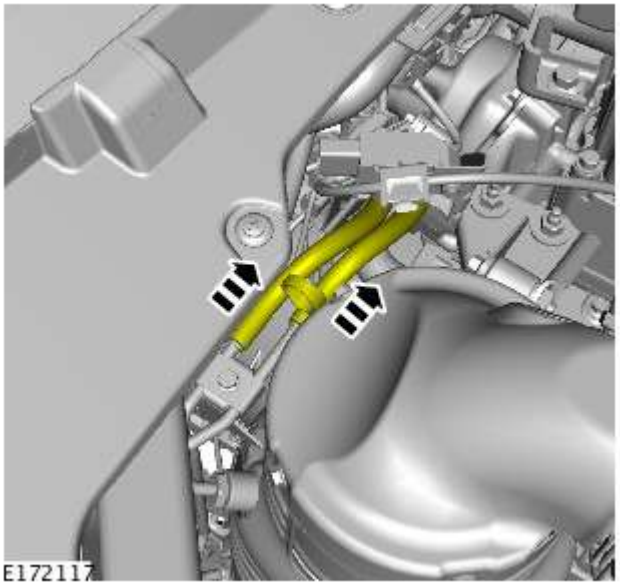
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

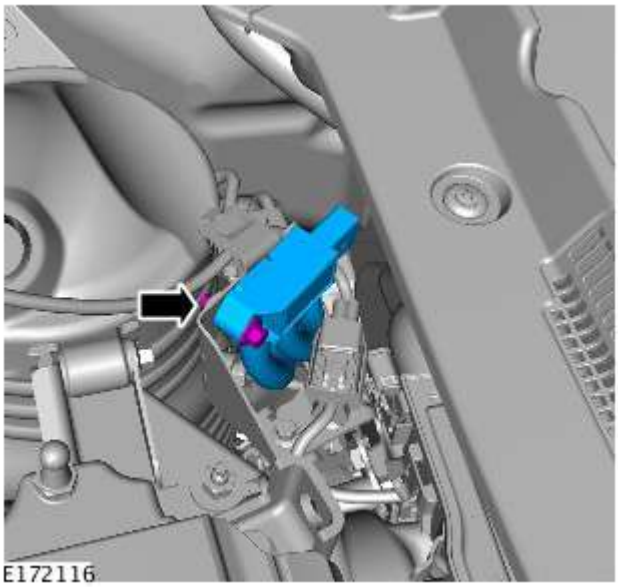
2.



3.



4. *Torque:* 6 Nm



Installation

1. To install, reverse the removal procedure.

2. NOTE: This step is only necessary when installing a new component.

- Using the diagnostic tool, clear diagnostic trouble codes (DTCs) from the engine control module (ECM).
- Using the data logger, check the engine oil temperature.
- Make sure the selector lever is in the 'P' position.
- Start and run the engine.
- Make sure that the engine oil is at a minimum temperature of 50 degrees C.
- Allow the engine to idle for 2 minutes and 30 seconds.
- Make sure that the engine cooling fan is not running.
- Turn off the ignition.
- Wait for 30 seconds.
- Repeat steps 4 to 9, a further 5 times.
- Disconnect the Jaguar approved diagnostic system.

Published: 30-Jun-2015

Interior Trim and Ornamentation - Engine Cover INGENIUM I4 2.0L Diesel

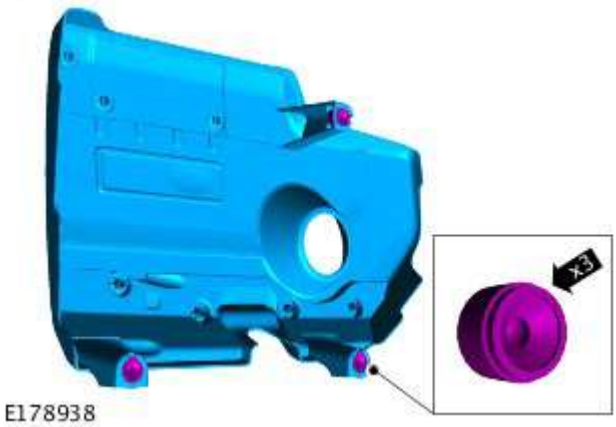
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1.

2.



Installation

1. To install, reverse the removal procedure

Published: 13-Mar-2015

Exhaust System - INGENIUM I4 2.0L Diesel - Rear Silencer

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

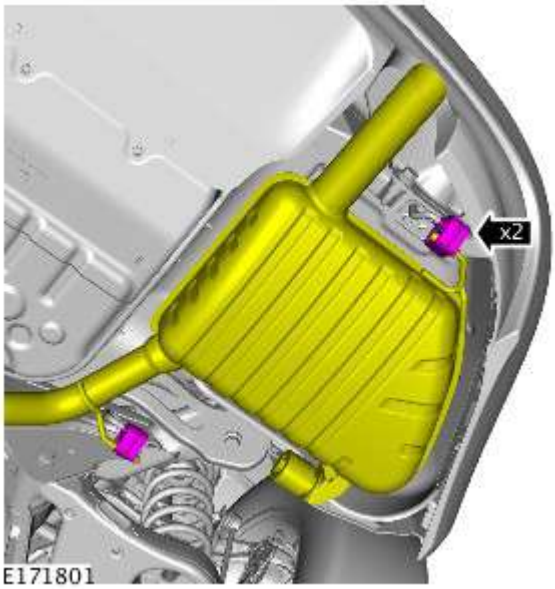
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

Vehicles with petrol engine

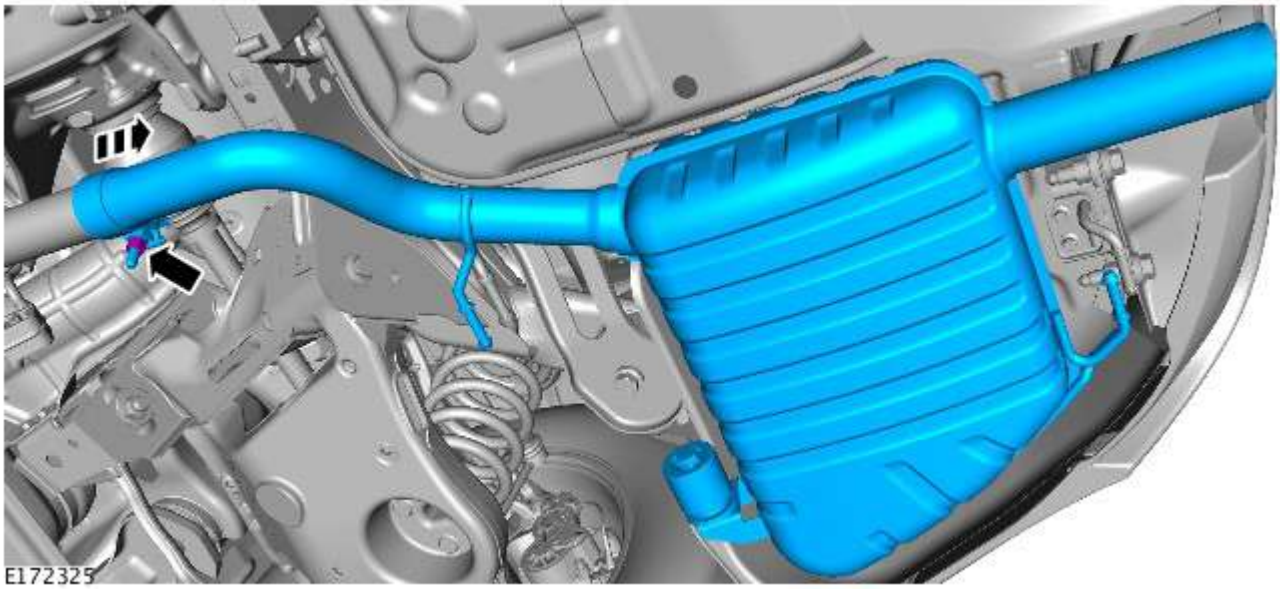


2. CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.

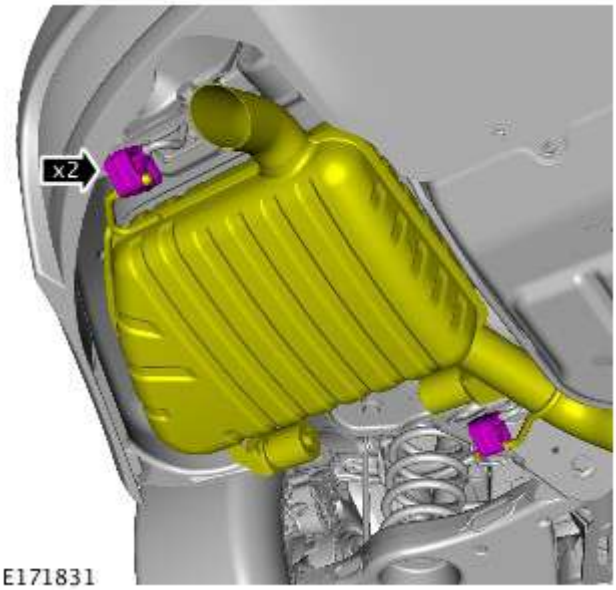
   NOTE: Right illustration shown, Left is similar

3. NOTE: Right illustration shown, Left is similar

   Torque: 55 Nm

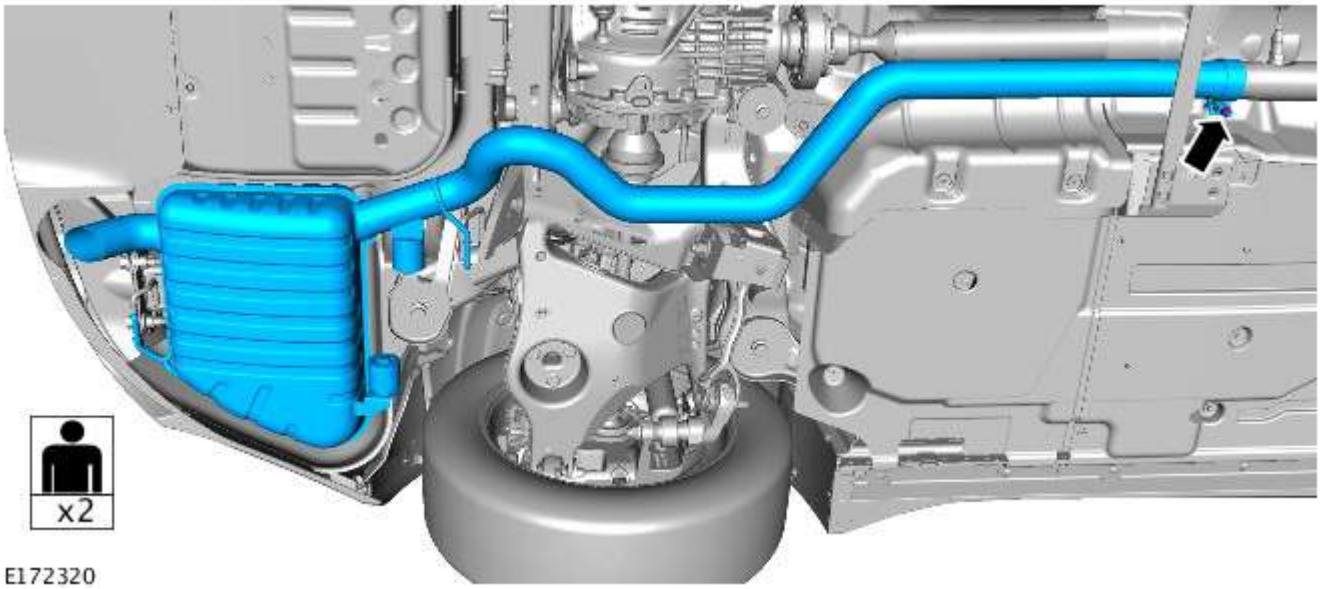


Vehicles with diesel engine

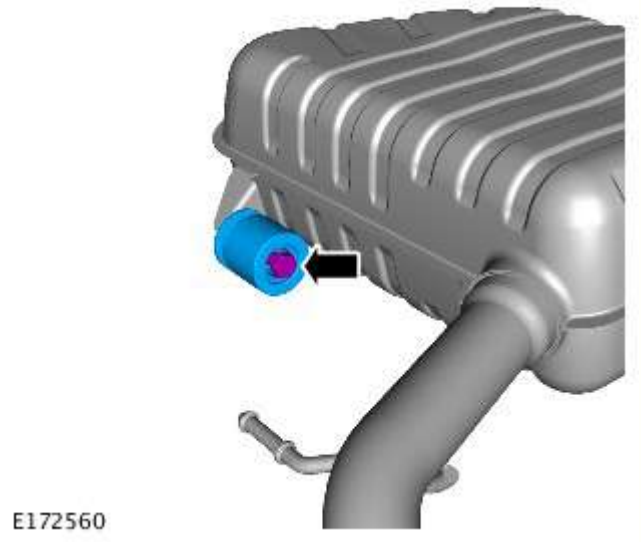


4. CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.

5. *Torque:* 55 Nm



Vehicles with petrol engine



6. CAUTION: Make sure that a new bolt is installed.

NOTES:

Right illustration shown, Left is similar

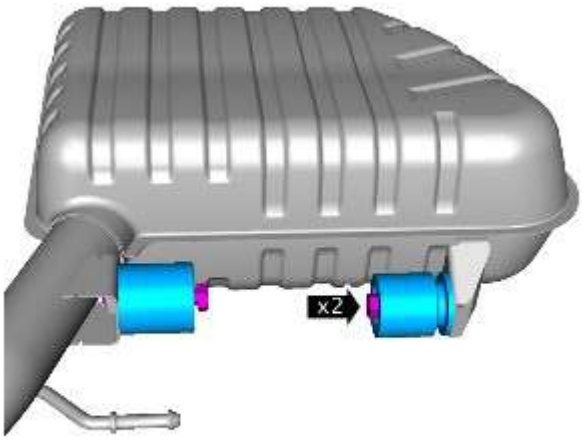
Do not disassemble further if the component is removed for access only.

Torque: 22 Nm

Vehicles with diesel engine

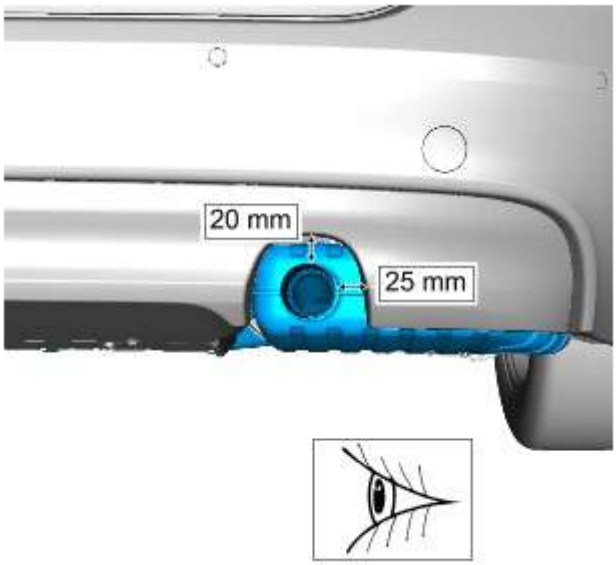
7. CAUTION: Make sure that new bolts are installed.

Torque: 22 Nm



E172319

Installation



E172326

1. To install reverse the removal procedure.

Published: 26-May-2016

Exhaust System - INGENIUM I4 2.0L Diesel - Exhaust System Vehicles Without: Diesel Exhaust Fluid

Removal and Installation

Removal

WARNING: Observe due care when working near a hot exhaust system.

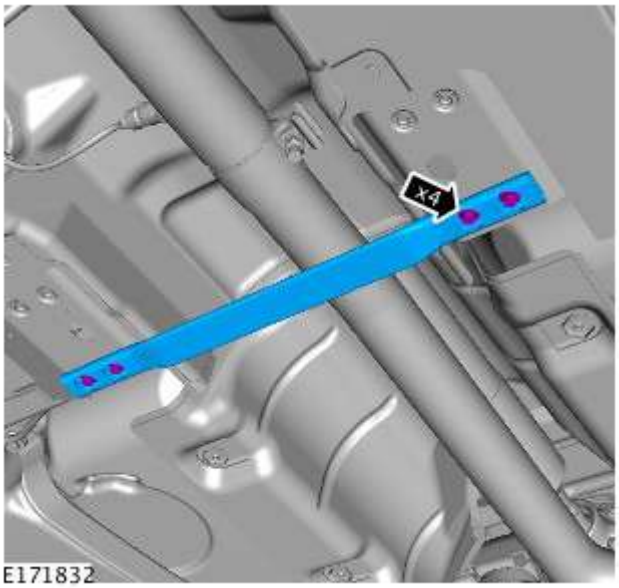
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

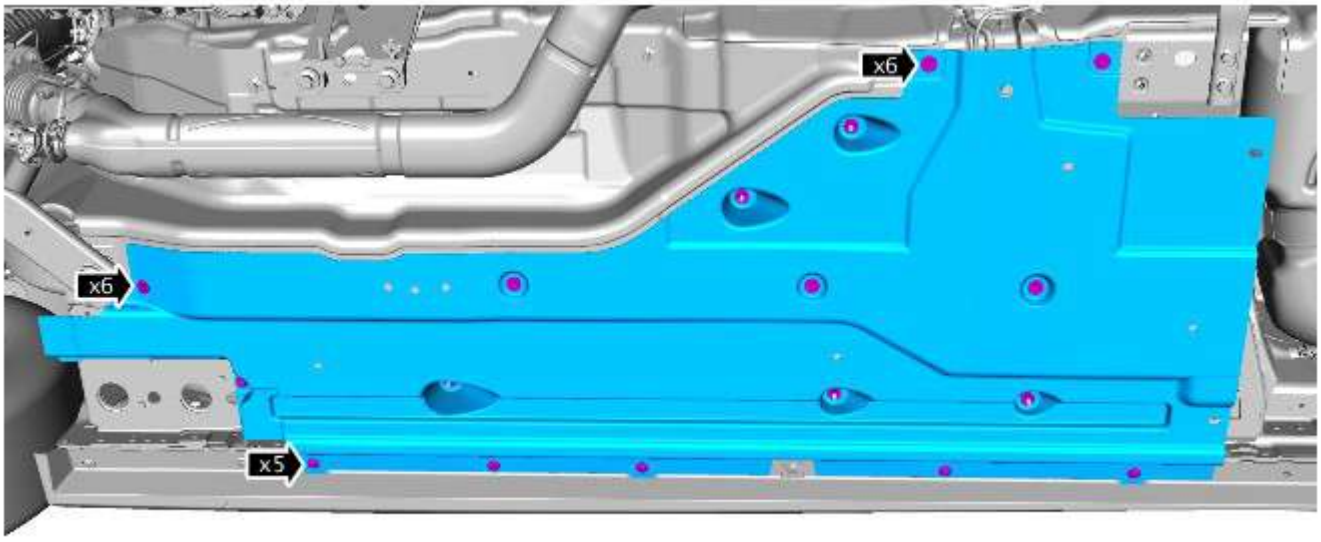
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



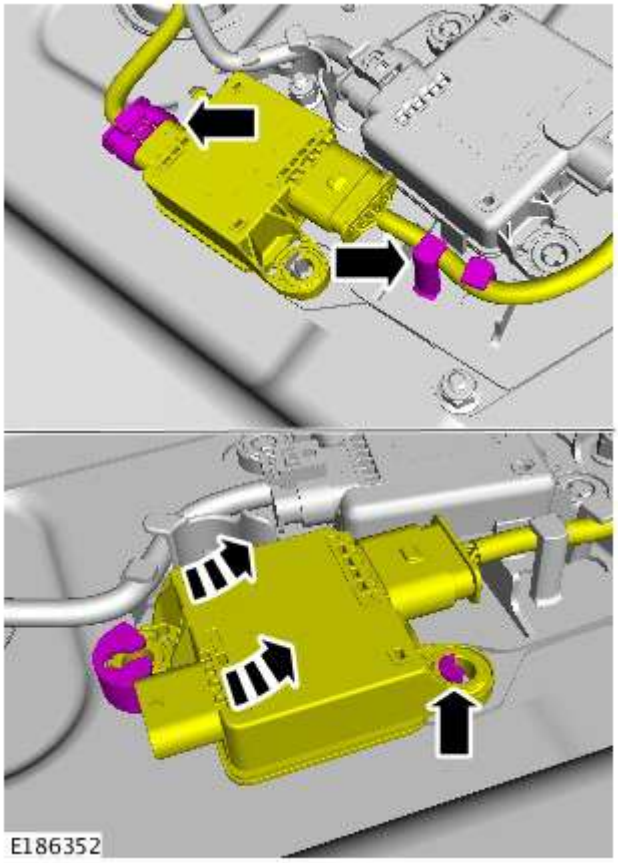
3. *Torque:* 30 Nm



E171834

NAS vehicles

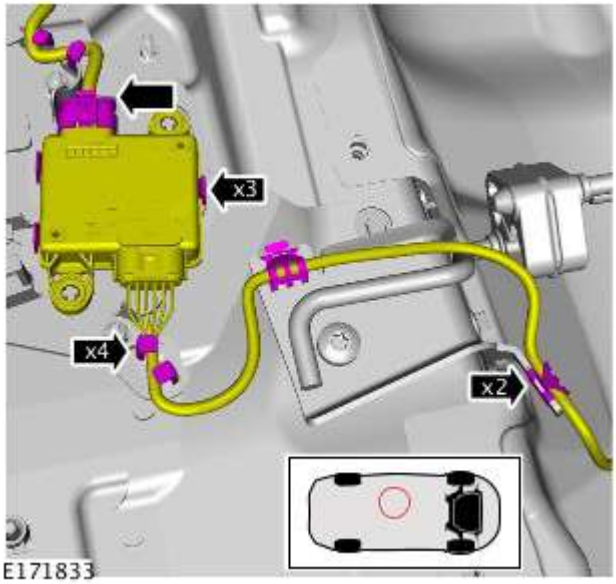
5.

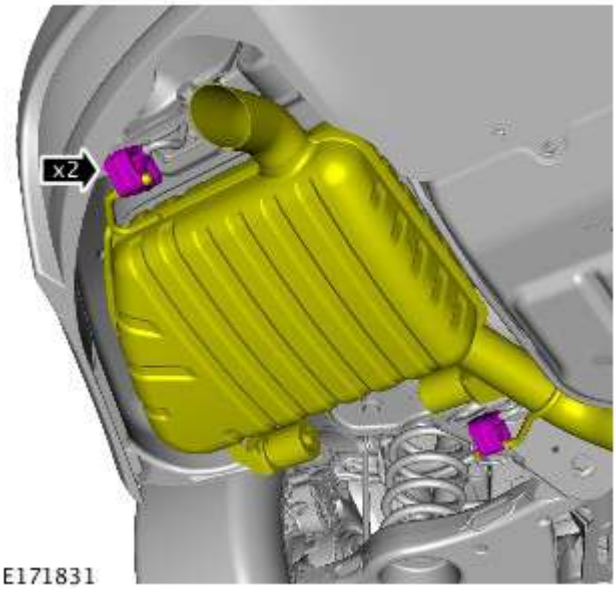


E186352

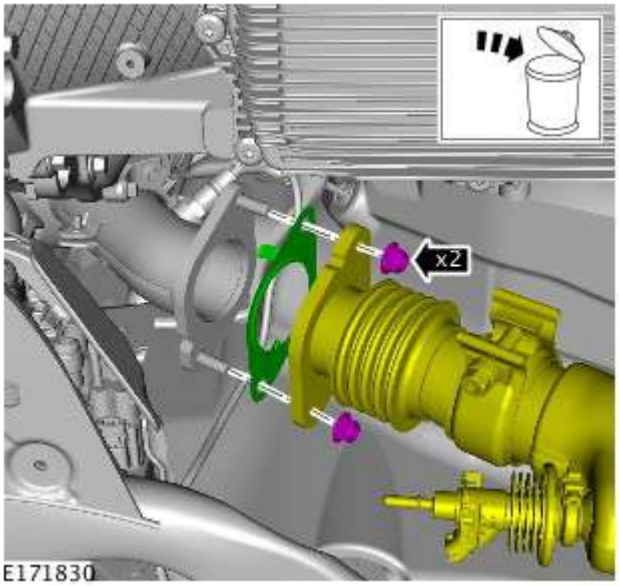
All vehicles

6.





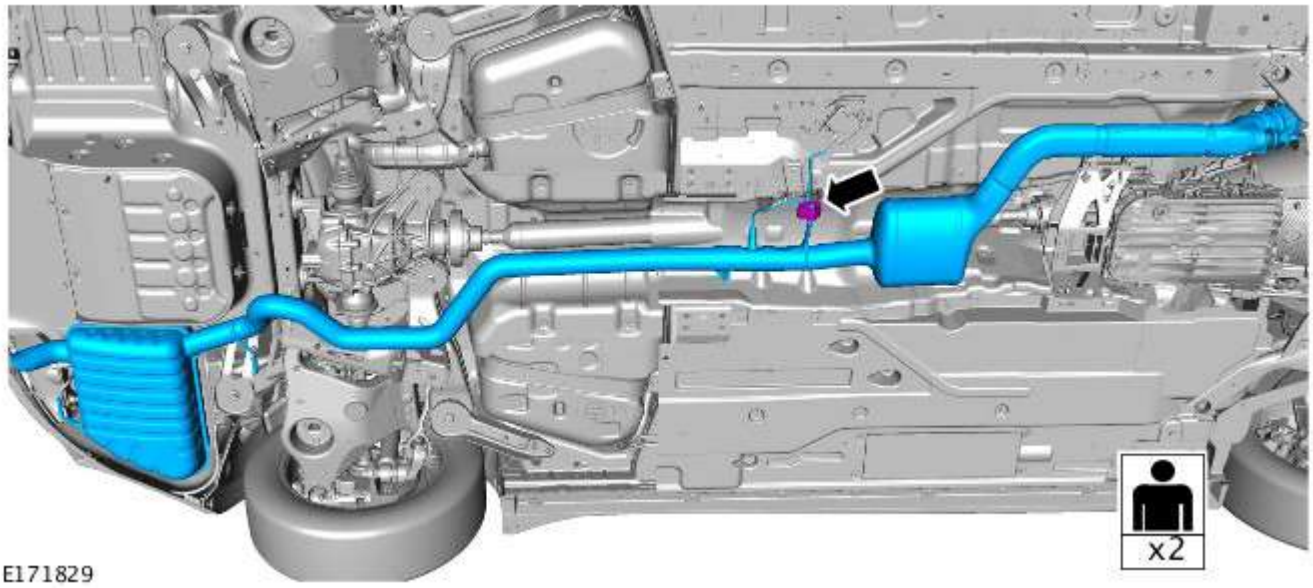
7. CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.



8. CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.

Torque: 40 Nm

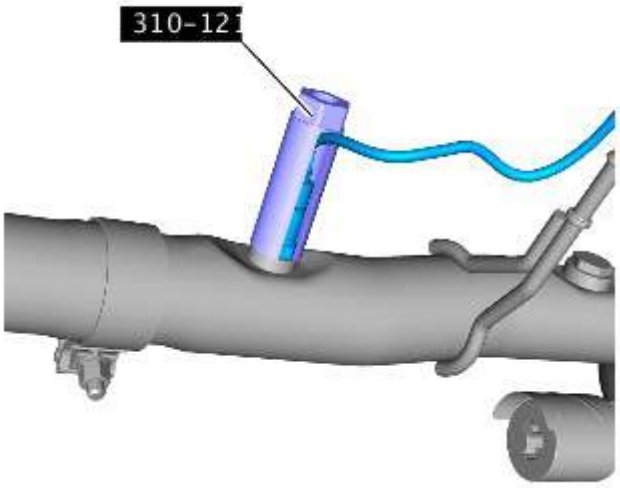
9.



E171829

10. NOTE: Do not disassemble further if the component is removed for access only.

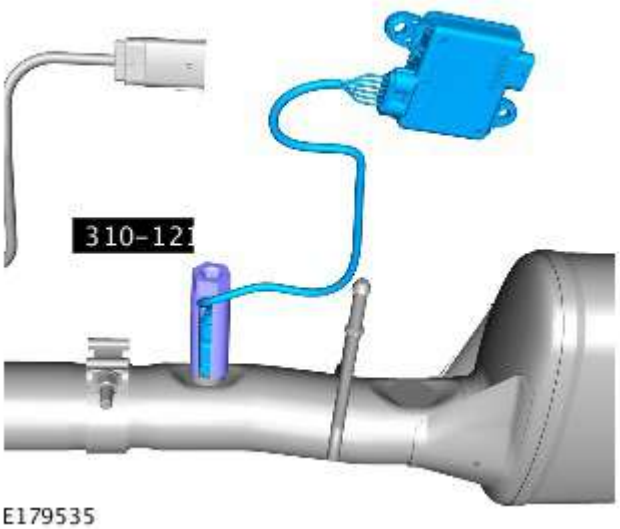
Torque: 48 Nm



E172595

NAS vehicles

11. *Torque:* 48 Nm



E179535

Installation

1. To install, reverse the removal procedure.

Published: 01-Oct-2013

Front End Body Panels - Engine Undershield

Removal and Installation

Removal

NOTES:

Some variation in the illustrations may occur, but the essential information is always correct.

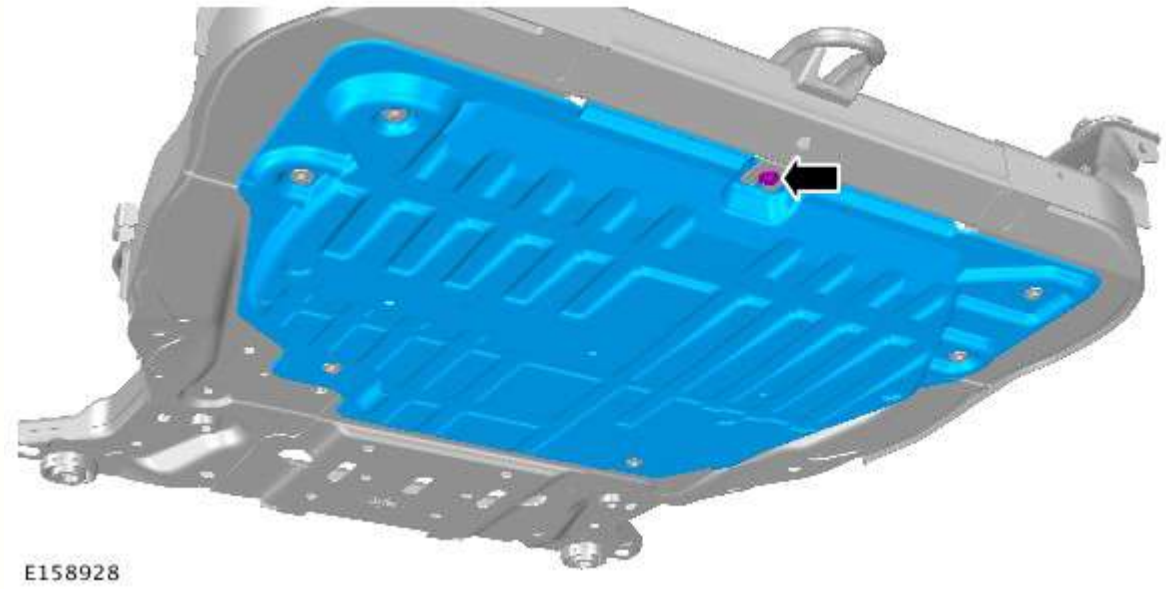
Removal steps in this procedure may contain installation details.

1. WARNING: Make sure to support the vehicle with axle stands.

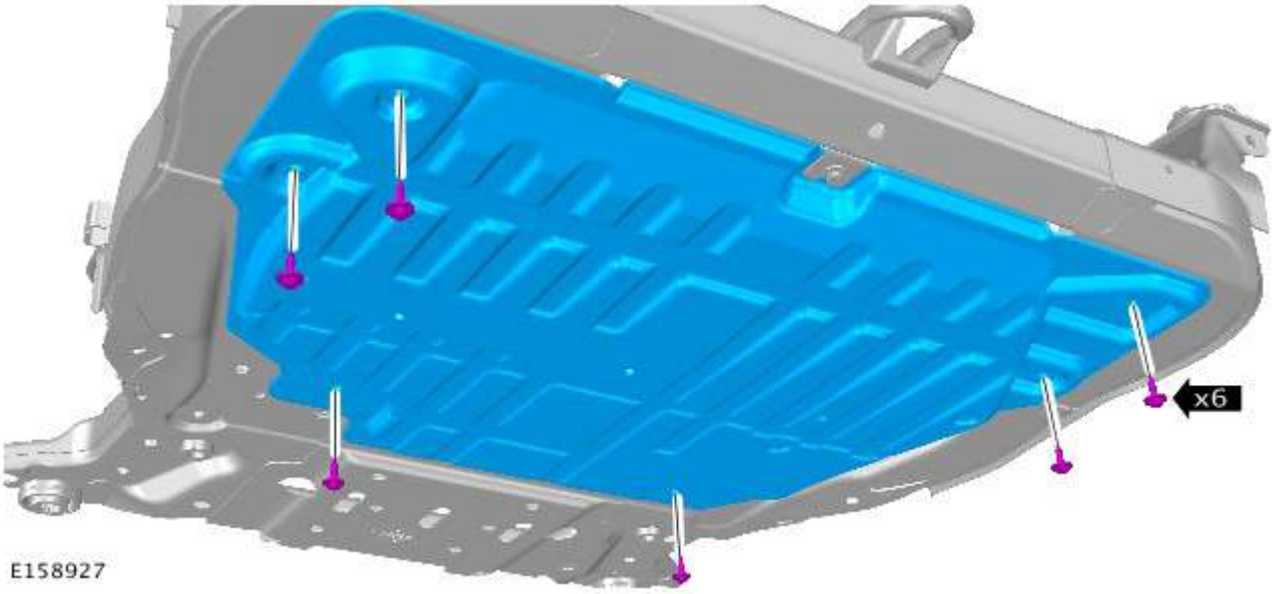
   Raise and support the vehicle.

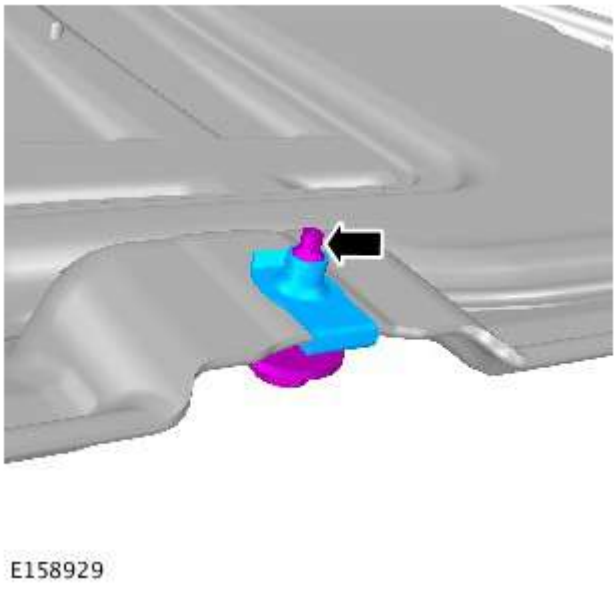
2. NOTE: Loosen the bolt, but do not fully remove.

   Torque: 10 Nm



3. *Torque:* 10 Nm





4. NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

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Bumpers - Rear Armature

Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

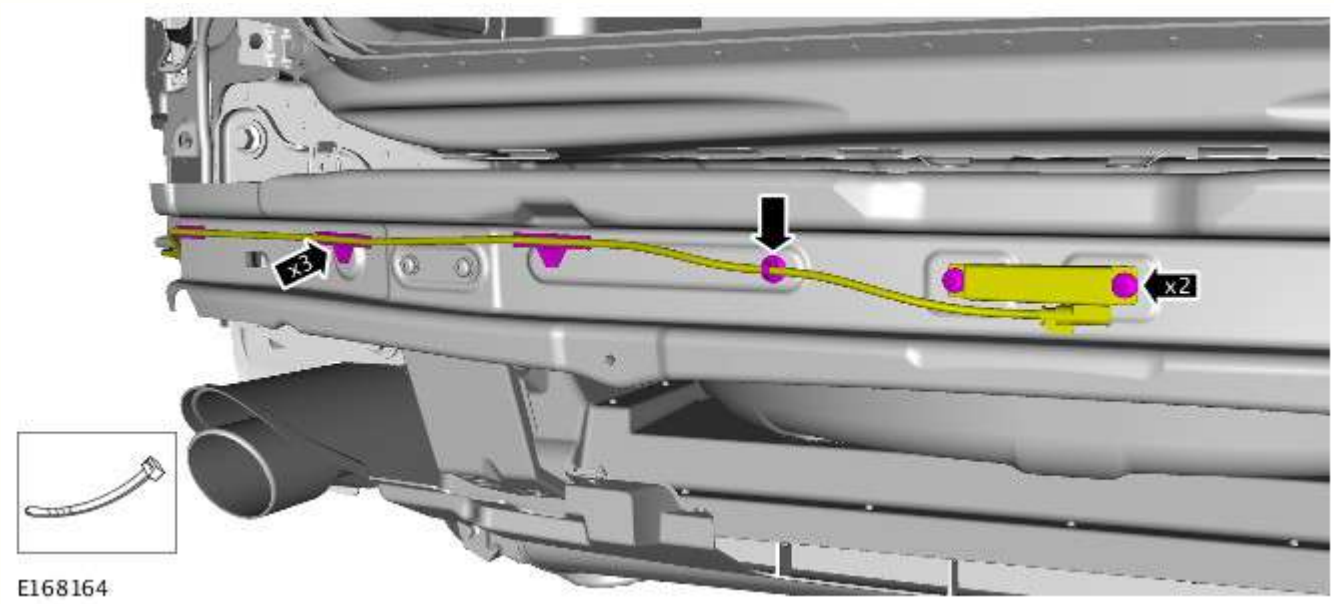
All vehicles

1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

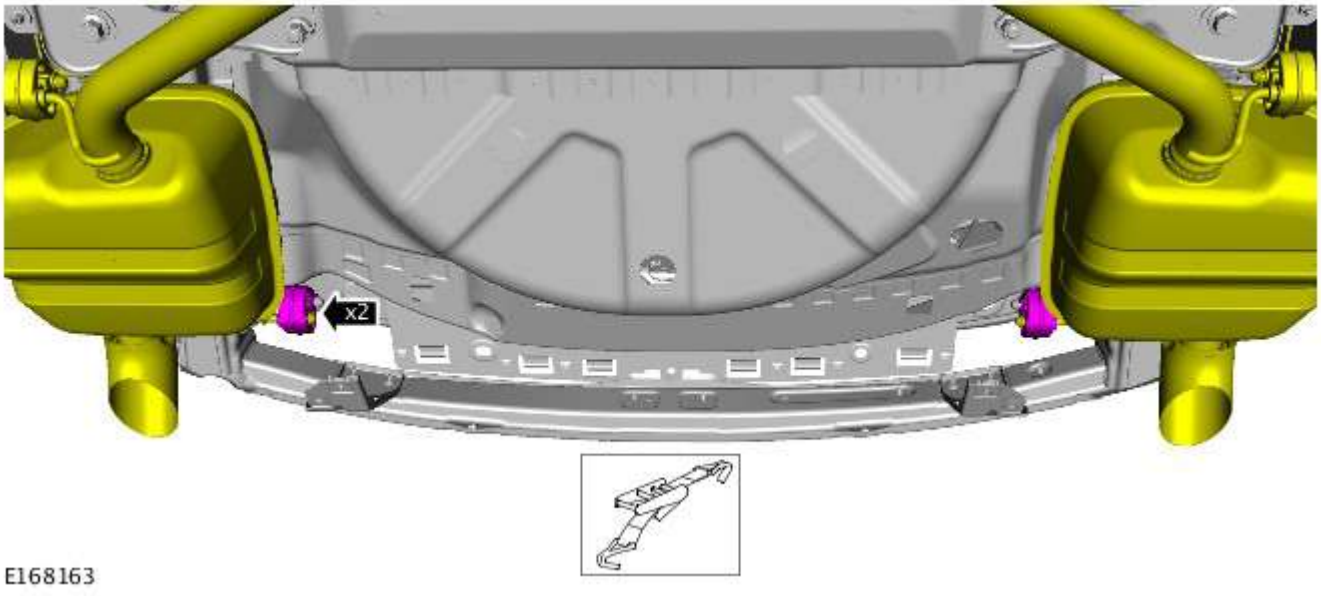
2. Refer to: Rear Bumper Cover (501-19, Removal and Installation).

3.



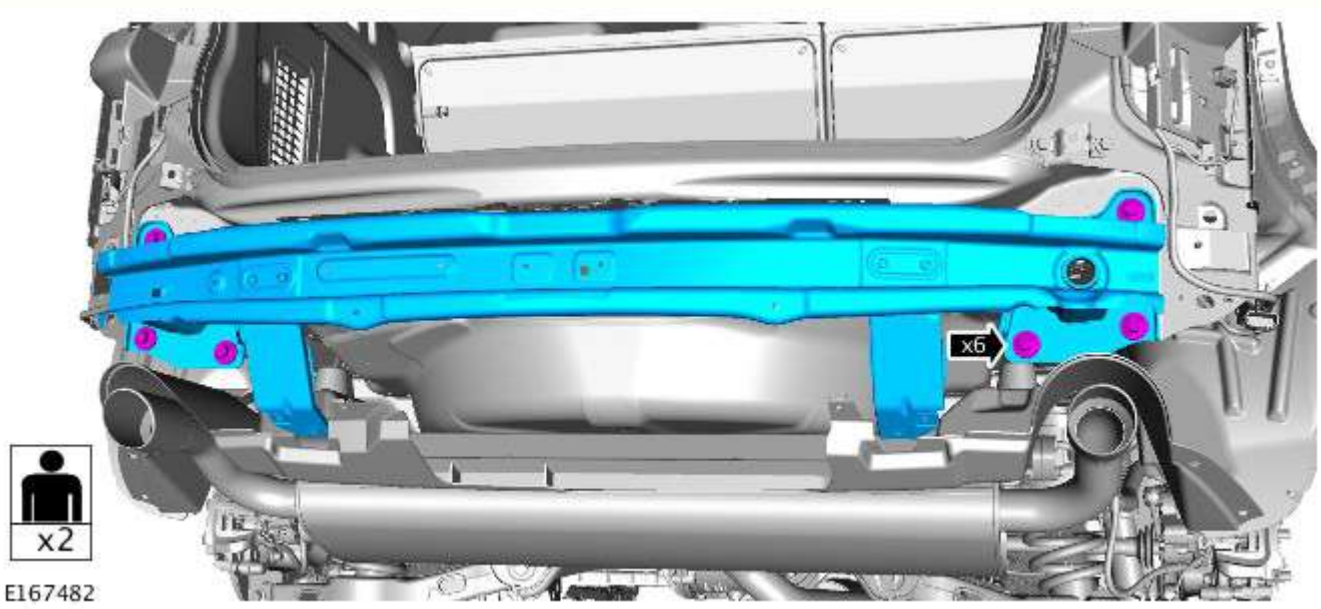
Vehicles with occasional rear seats

4. WARNING: Observe due care when working near a hot exhaust system.



All vehicles

5. *Torque:* 30 Nm



Installation

1. To install, reverse the removal procedure.