STARTING SYSTEM - V8 S/C 5.0L PETROL

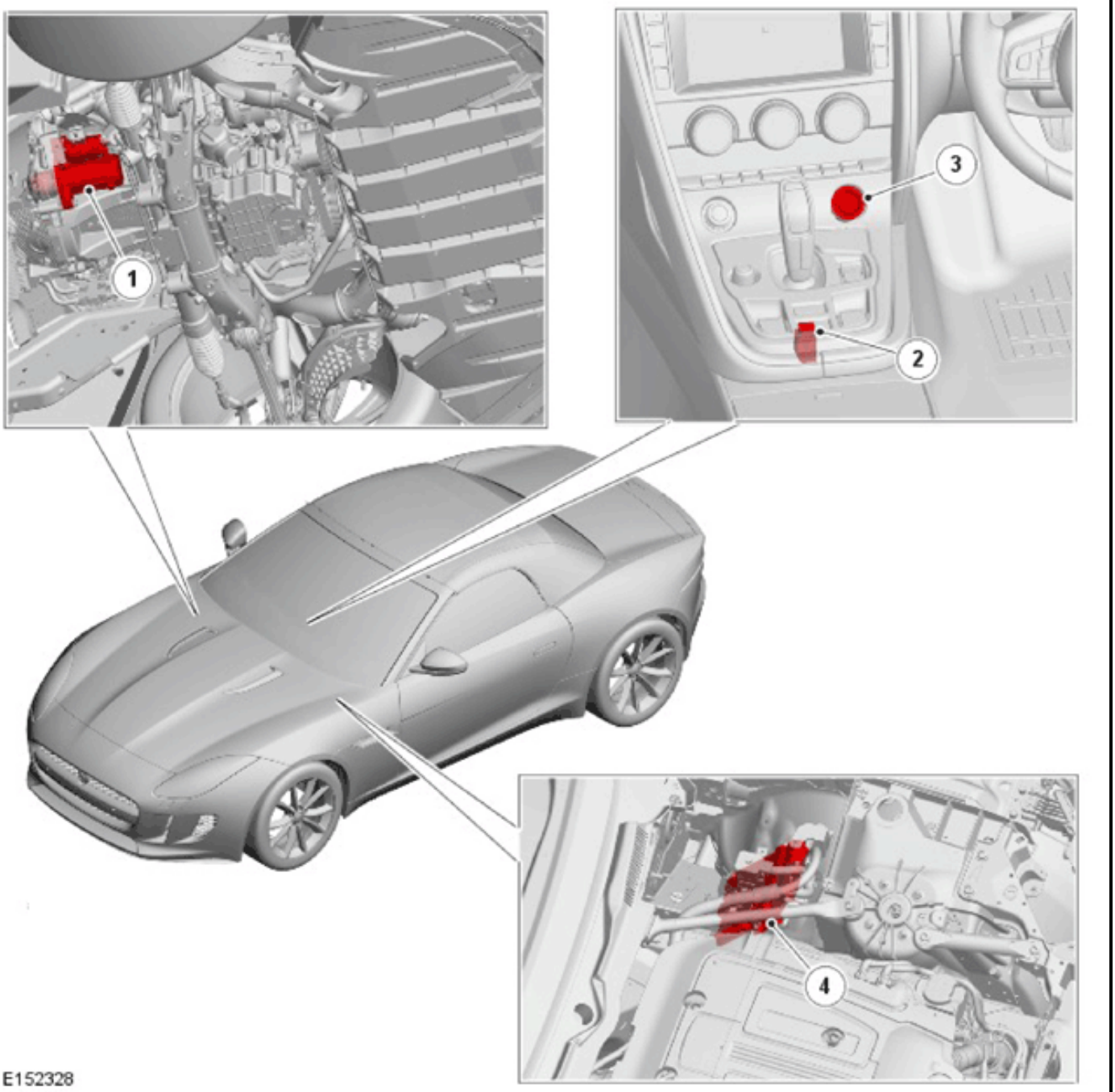
SPECIFICATIONS

DESCRIPTION	NM	LB-FT	LB-IN
Starter motor retaining bolts	47	-	416
Battery positive terminal connector retaining nuts	10	-	89
Heat shield retaining bolts	4	-	35
Solenoid terminal connector retaining nut	4	-	35
Starter motor mounting bracket bolts	47	Â	416

DESCRIPTION AND OPERATION

COMPONENT LOCATION

NOTE: **Convertible shown, coupe is similar.**



ITEM	DESCRIPTION
1	Starter motor
2	Auto stop/start/Deployable spoiler switchpack
3	Stop/start switch
4	Engine Control Module (ECM)

OVERVIEW

The starter motor is manufactured by Denso and is rated at 2.0 kW. The motor is geared directly to the pinion. The motor is a series wound motor with an overrunning clutch. The interior of the motor is ventilated through a breather tube attached to the underside of the motor housing.

The V8 5.0L S/C Petrol engine features Auto stop/start technology in some markets. The auto stop/start system automatically stops and restarts the engine when appropriate conditions are met. This reduces the amount of time the

engine is running at idle speed which improves economy and reduces engine emissions. This provides advantages for vehicles which spend time in congested environments, for example waiting at traffic lights or frequent stopping and starting in traffic queues.

The advantages of the Auto stop/start system are:

- Carbon Dioxide (CO2) emissions significantly reduced
- Fuel consumption improved.

NOTE: **Fuel economy and emissions reduction will vary depending on driving style and traffic conditions.**

The Auto stop/start system is automatically activated each time an ignition cycle occurs and is operational in 'DRIVE' and 'SPORT' transmission positions. The driver can disable the system by pressing the Auto stop/start switch in the floor console.

The Auto stop/start system stops the engine when it is not needed, this is known as auto stop. The engine will restart automatically when vehicle parameters are met and the driver removes their foot from the brake pedal, this is known as auto start. The engine will be at full operating speed before the driver's foot reaches the accelerator pedal.

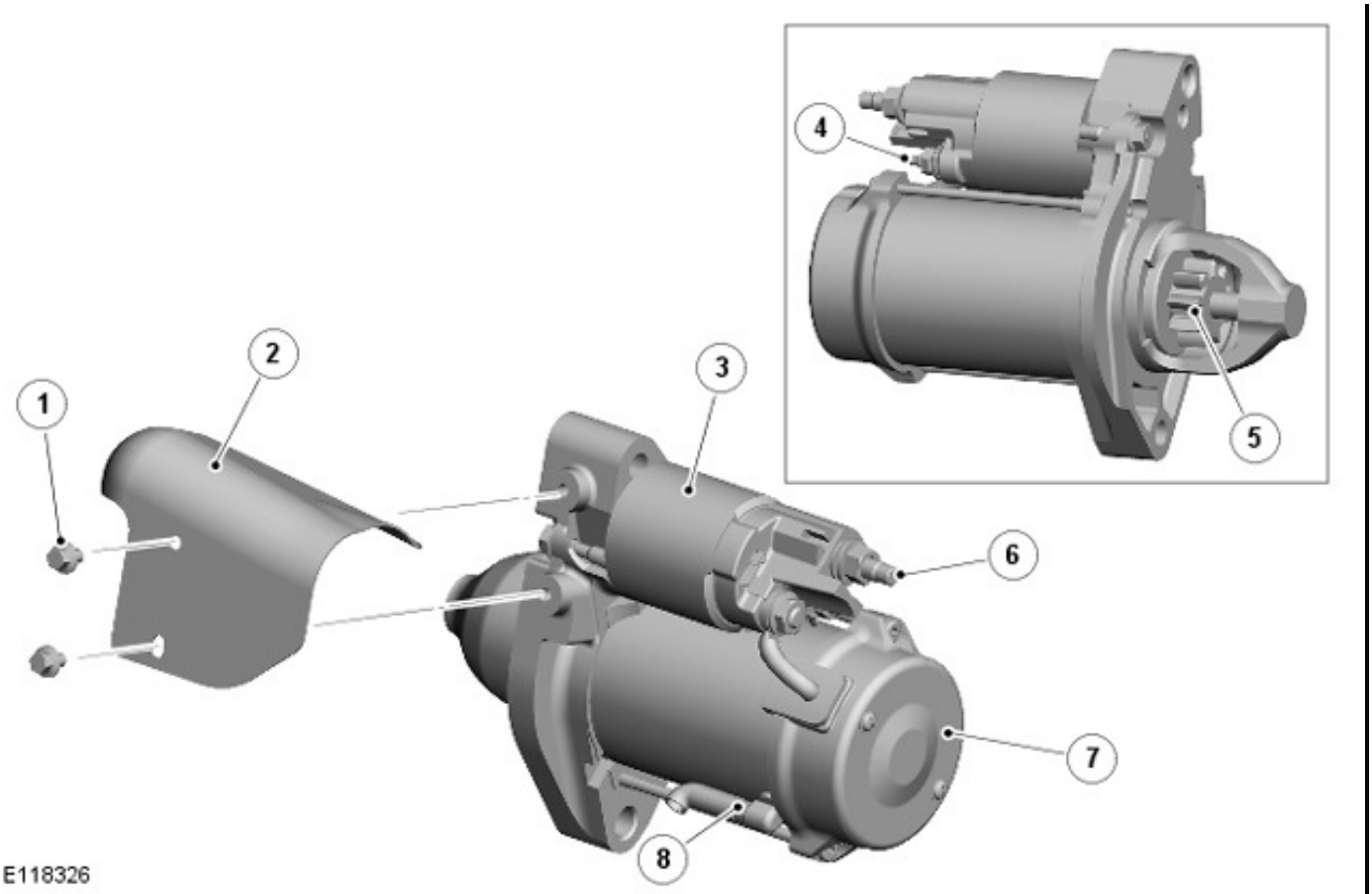
The Auto stop/start system is fully integrated into the vehicle electrical systems and other system modules communicate to determine if an auto stop or start is viable.

The Auto stop/start system uses a VQM (Voltage Quality Module), to ensure sufficient battery power is available for repeated engine starts without affecting the operation of the vehicle systems. For additional information, refer to: **Battery and Cables** (Battery, Mounting and Cables, Description and Operation).

DESCRIPTION

STARTER MOTOR

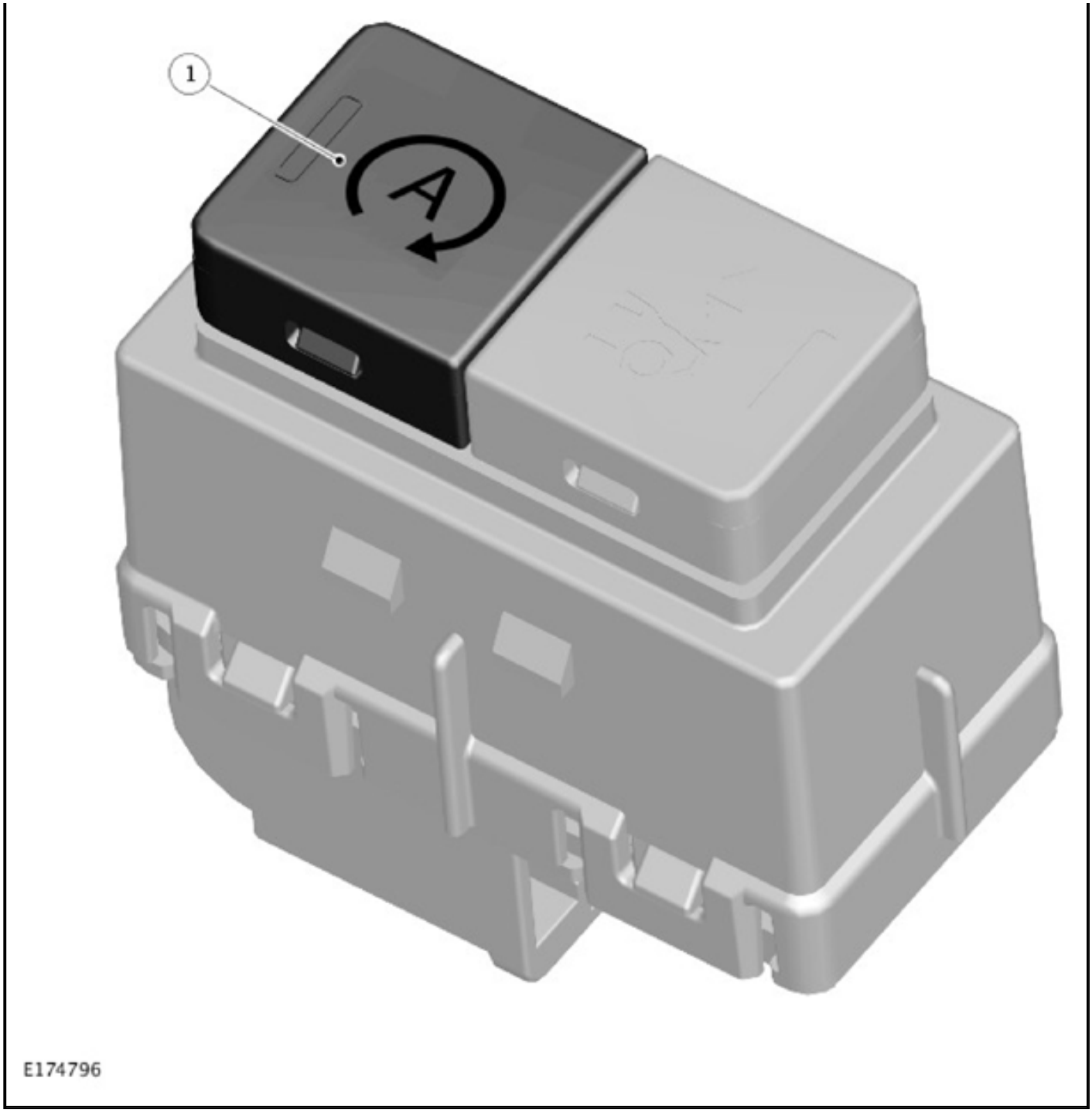
NOTE: **Some variation in the illustrations may occur, but the essential information is always correct.**



ITEM	DESCRIPTION
1	Bolt (2 of)
2	Heatshield
3	Starter motor solenoid
4	Starter solenoid electrical connection
5	Pinion gear
6	Battery electrical connection
7	Starter motor
8	Breather tube

The starter motor is located on the rear right side of the cylinder block and protrudes through an aperture to drive the drive plate via a ring gear. The motor is secured to the cylinder block by 2 bolts. Power to operate the motor is supplied from BJB (Battery Junction Box). Power to operate the solenoid is supplied from the starter motor relay in the left EJB (Engine Junction Box).

AUTO STOP/START SWITCH



ITEM	DESCRIPTION
1	Auto stop/start switch

On vehicles with Auto stop/start system, the Auto stop/start switch is located in the floor console. An amber LED (Light Emitting Diode) in the Auto stop/start switch remains illuminated while the auto stop/start system is active. Selection of the Auto stop/start switch is transmitted from the JDS (JaguarDrive Switchpack) to the GWM (Gateway Module) via the HS (High Speed) CAN (Controller Area Network) chassis systems bus. The GWM then transmits this message to the ECM on the HS CAN powertrain systems bus.

AUTO STOP/START WARNING INDICATOR

E168805

On vehicles with Auto stop/start system, an Auto Stop/start warning indicator is located in the IC (Instrument Cluster). The warning indicator illuminates green when the engine stops during a stop/start cycle, then goes off when the engine restarts. The warning indicator illuminates amber when the Auto stop/start system is disabled. The warning indicator is controlled by a HS CAN powertrain systems bus message from the ECM.

OPERATION

OPERATION - VEHICLES WITHOUT STOP/START SYSTEM

When the Auto stop/start switch is pressed, if the KVM (Keyless Vehicle Module) detects a valid smart key in the vehicle the CJB (Central Junction Box) transmits a hardwired crank request to the ECM.

For additional information, refer to: Anti-Theft - Passive **Description And Operation** (Description and Operation).

The ECM energizes the starter motor relay, when:

- it receives a crank request from the CJB
- the brake pedal is pressed
- the TCS (Transmission Control Switch) is in 'P' (Park) or 'N' (Neutral).

The energized starter relay supplies battery power to the starter solenoid, which energizes and causes the pinion gear to engage with the ring gear. When the starter solenoid is energized it also closes high-current contacts, which connects battery power from the BJB to the motor to turn the engine.

OPERATION - VEHICLES WITH STOP/START SYSTEM

At the beginning of a drive cycle, when the Stop/start switch is operated, the Auto stop/start system operates in the same way as on vehicles without stop/start.

The Auto stop/start system is controlled by the ECM and the GWM (Gateway Module) via HS CAN powertrain systems bus messages and signals from other system components and modules to determine the correct conditions for system operation. The Auto stop/start system detects when it is appropriate to stop and start the engine.

Before the engine is stopped the following parameters must be detected:

- The vehicle must be stopped from a speed greater than 4 km/h (2.5 mph)
- Sufficient brake pressure must be applied to the brake pedal to ensure the vehicle is stationary
    - OR
- The vehicle must be stationary and 'P' or 'N' selected on the TCS.

Before the engine is restarted, the following parameters must be detected:

- The accelerator pedal is pressed (ECM detects a signal from the APP (Accelerator Pedal Position) sensor)
- The vehicle speed exceeds approximately 1 km/h (0.5 mph)
- Climate control system demand increases (signal from the ATCM (Automatic Temperature Control Module))
- Brake vacuum has been reduced from repeated use of brake pedal with engine not running (detected by ECM from the brake vacuum sensor)
- Battery charge becomes low
- Auto stop/start is deactivated using the Auto stop/start switch in the floor console
- A steering wheel paddle switch is operated to select a gear
- 'D' (Drive) or 'S' (Sport) selected on the TCS and the brake pedal is released
- 'R' (Reverse) is selected on the TCS.

The following conditions will prevent an Auto stop:

- The external ambient temperature is less than 0Â°C (32Â°F) (detected by the ECM via the AAT (Ambient Air Temperature) sensor)
- The external ambient temperature is more than 40Â°C (104Â°F) (detected by the ECM via the AAT sensor)
- The engine has not reached its optimum operating temperature (detected by the ECM via the ECT (Engine Coolant Temperature) sensor)
- The driver door is opened (detected by the CJB from the door ajar switch)
- The driver safety belt is not fastened (detected by the RCM (Restraints Control Module) from the driver seatbelt buckle switch)
- The climate control system requires the engine to be running, for example; windshield demist selected
- The battery charge is low (signal from the GWM)
- The hood is open (detected by the CJB from the hood ajar switch)
- Auto stop/start is deactivated using the Auto stop/start switch in the floor console
- A steering wheel paddle switch has been used to select a gear.

STOP/START STRATEGY

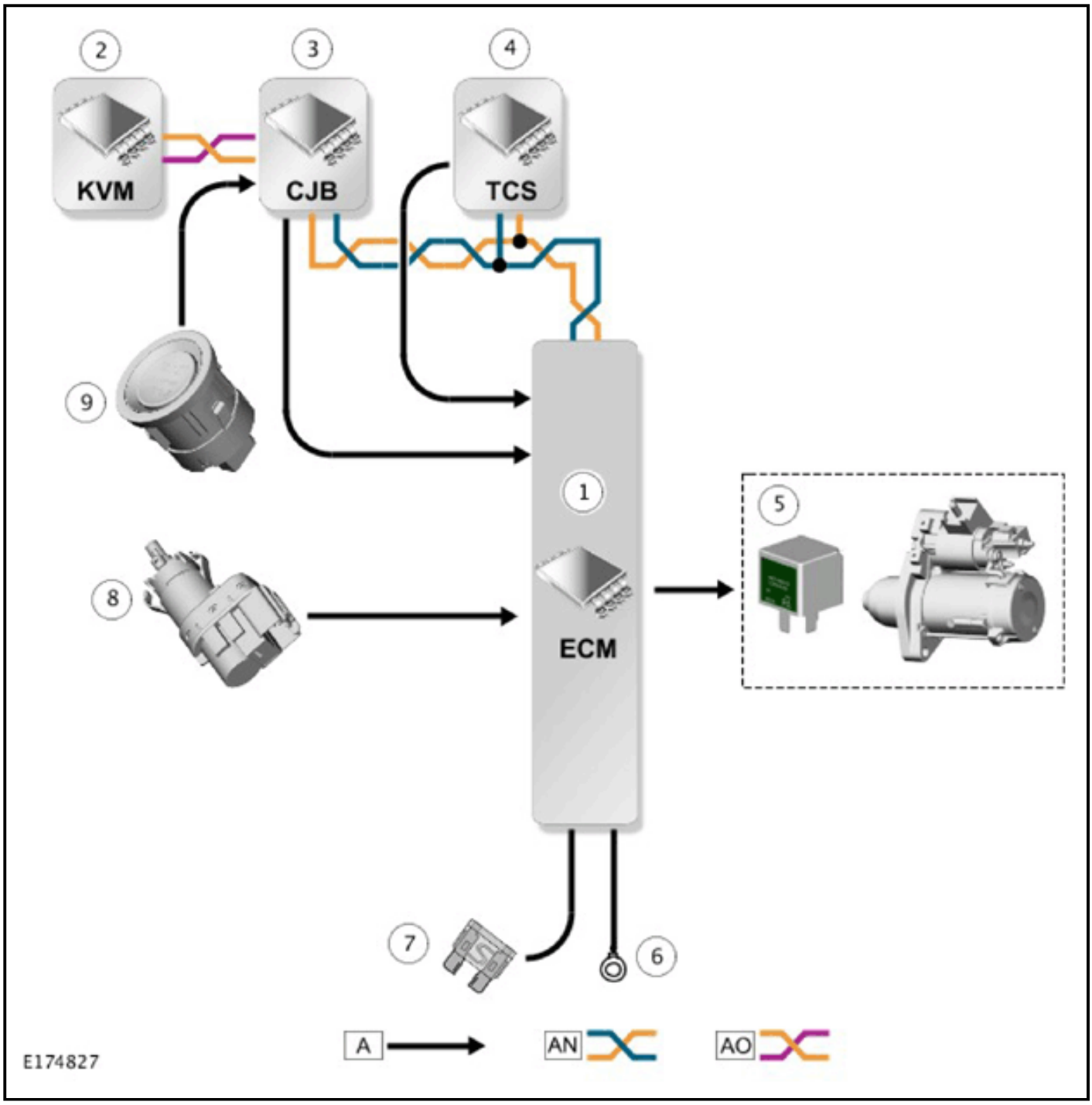
Engine Speed above 330 RPM:

When the engine speed is above 330 RPM, and an ECO stop is initiated, the restarting of the engine is controlled by the ECM. The ECM activates the fuelling and engine systems only.

Engine Speed below 330 RPM:

When the engine speed is below 330 RPM, and an ECO stop is initiated, the restarting of the engine is controlled via the starter motor. The starter motor has the capability of engaging with the transmission ring gear whilst still rotating. When the starter motor rotates the engine speed up to 330 RPM, the ECM then activates the fuelling and engine systems to restart the engine.

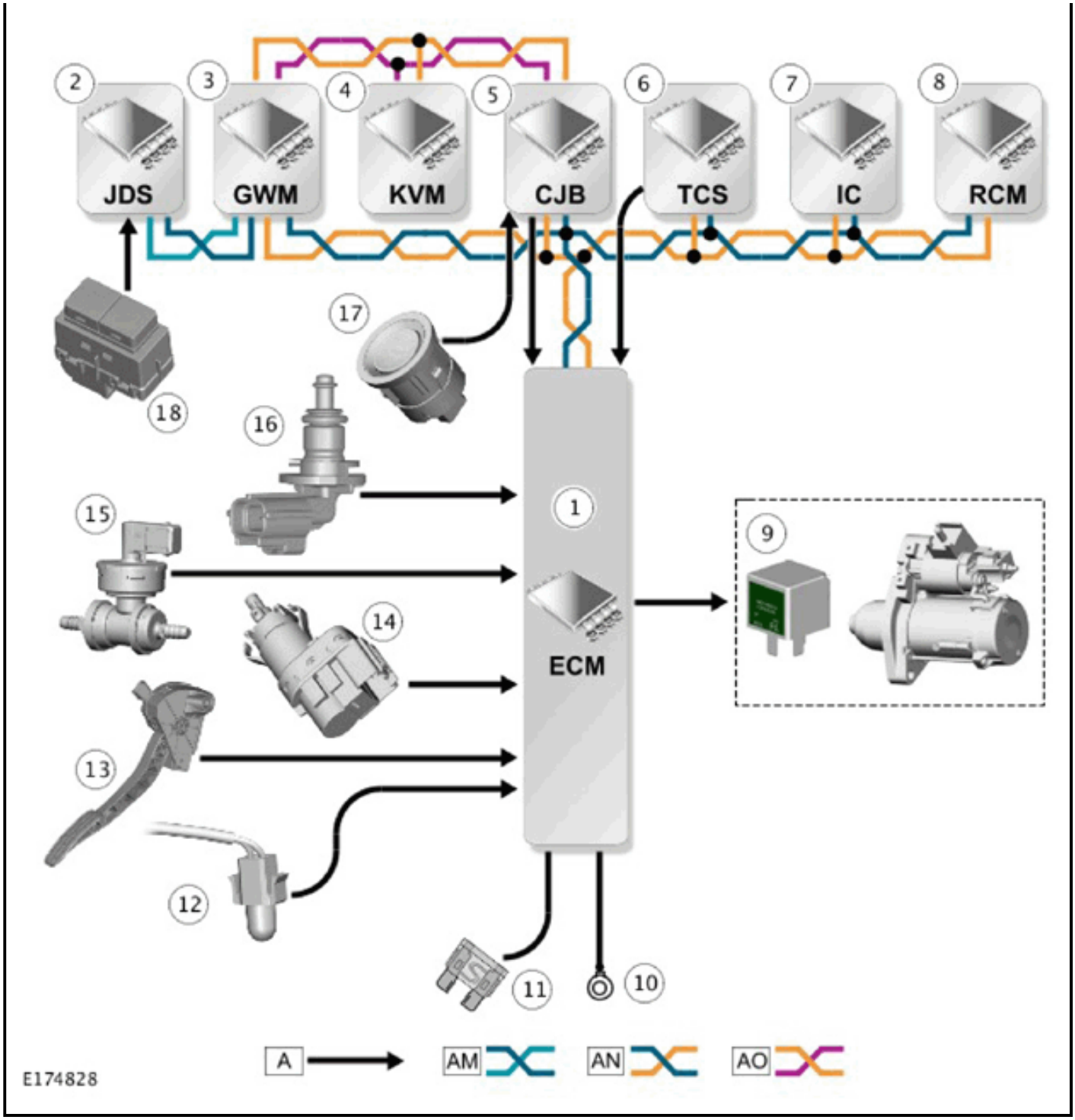
INPUT/OUTPUT DIAGRAM - SHEET 1 OF 2 - VEHICLES WITHOUT STOP/START



A = HARDWIRED; AN = HS (HIGH SPEED) CAN (CONTROLLER AREA NETWORK) POWERTRAIN SYSTEMS BUS; AO = MS (MEDIUM SPEED) CAN BODY SYSTEMS BUS.

ITEM	DESCRIPTION
1	Engine Control Module (ECM)
2	Keyless Vehicle Module (KVM)
3	Central Junction Box (CJB)
4	Park/Neutral signal - Transmission Control Switch (TCS)
5	Starter motor
6	Ground
7	Power supply - left Engine Junction Box (EJB)
8	Brake pedal switch
9	Stop/start switch

INPUT/OUTPUT DIAGRAM - SHEET 2 OF 2 - VEHICLES WITH STOP/START



A = HARDWIRED; AM = HS (HIGH SPEED) CAN (CONTROLLER AREA NETWORK) CHASSIS SYSTEMS BUS; AN = HS CAN POWERTRAIN SYSTEMS BUS; AO = MS (MEDIUM SPEED) CAN BODY SYSTEMS BUS.

ITEM	DESCRIPTION
1	Engine Control Module (ECM)
2	JaguarDrive Switchpack (JDS)
3	Gateway Module (GWM)
4	Keyless Vehicle Module (KVM)
5	Central Junction Box (CJB)
6	Park/Neutral signal - Transmission Control Switch (TCS)
7	Instrument Cluster (IC)

ITEM	DESCRIPTION
8	Restraints Control Module (RCM)
9	Starter motor
10	Ground
11	Power supply - left Engine Junction Box (EJB)
12	Ambient Air Temperature (AAT) sensor
13	Accelerator Pedal Position (APP) sensor
14	Brake pedal switch
15	Brake vacuum sensor
16	Engine Coolant Temperature (ECT) sensor
17	Stop/start switch
18	Auto stop/start/Deployable spoiler switchpack

DIAGNOSIS AND TESTING

PRINCIPLES OF OPERATION

For a detailed description of the Starting System, refer to the relevant Description and Operation section in the service information. Refer to: **Starting System** (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.**

NOTE:

- **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.**

Visual Inspection

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

MECHANICAL	ELECTRICAL

MECHANICAL	ELECTRICAL
• Starter motor • Engine (turns freely)	• Battery • Battery terminal clamps • Fuses • Wiring harnesses and connectors • Powertrain control module • Smart key • Ignition switch • ECO switch • Starter 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
The engine does not crank (starter motor does not turn)	• Battery/charging system fault • Engine system fault • Transmission fault • Transmission control switch not set to Park or Neutral • Smart key not present/recognised • Starter relay fault • Starter motor ground circuit open circuit, high resistance • Starter motor solenoid power circuit short circuit to ground, open circuit, high resistance • Starter motor power circuit short circuit to ground, open circuit, high resistance • Engine seized	• Refer to the relevant section of the service information and check the battery and charging system. Rectify as necessary • Using the Jaguar Land Rover approved diagnostic equipment, check the powertrain control module for related DTCs and refer to the relevant DTC index • Using the Jaguar Land Rover approved diagnostic equipment, check the transmission control module for related DTCs and refer to the relevant DTC index • Set the transmission control switch to Park or Neutral and retest • Check that the smart key is present and recognised • Check the operation of the starter relay. Rectify as necessary • Refer to the applicable SYSTEM WIRING DIAGRAM(S) and check the starter motor ground circuit for open circuit, high resistance. Repair the wiring harness as necessary • Refer to the applicable SYSTEM WIRING DIAGRAM(S) and check the starter motor solenoid power circuit for short circuit to ground, open circuit, high resistance. Repair the wiring harness or install a new starter motor solenoid as necessary • Refer to the applicable SYSTEM WIRING DIAGRAM(S) and check the starter motor power circuit for short circuit to ground, open circuit, high resistance. Repair the wiring harness or install a new starter motor as necessary • Check that the engine turns freely. Rectify as necessary

SYMPTOM	POSSIBLE CAUSES	ACTION
The engine does not crank (starter motor does turn)	• Starter motor incorrectly installed • Starter motor internal failure • Flywheel/drive plate ring gear damaged	• Check the installation of the starter motor. Rectify as necessary • Check the operation of the starter motor. Rectify as necessary • Check the flywheel/drive plate ring gear teeth for damage, foreign objects, etc. Rectify as necessary
Engine cranks too slowly	• Battery/charging system fault • Starter motor ground circuit open circuit, high resistance • Starter motor power circuit open circuit, high resistance • Starter motor internal failure • Engine oil grade incorrect	• Refer to the relevant section of the serice information and check the battery and charging system. Rectify as necessary • Refer to the applicable SYSTEM WIRING DIAGRAM(S) and check the starter motor ground circuit for open circuit, high resistance. Repair the wiring harness as necessary • Refer to the applicable SYSTEM WIRING DIAGRAM(S) and check the starter motor power circuit for open circuit, high resistance. Repair the wiring harness as necessary • Check the operation of the starter motor. Rectify as necessary • Check the engine oil grade. Rectify as necessary
Engine cranks too fast	• Timing chain failure • Engine cylinder compressions too low	• Check the integrity of the timing chain. Rectify as necessary • Refer to the relevant section of the service information and check the engine cylinder compressions. Rectify as necessary
Starter motor excessively noisy	• Starter motor incorrectly installed • Starter motor internal failure • Flywheel/drive plate ring gear damaged	• Check the installation of the starter motor. Rectify as necessary • Check the operation of the starter motor. Rectify as necessary • Check the flywheel/drive plate ring gear teeth for damage, foreign objects, etc. Rectify as necessary

SYMPTOM	POSSIBLE CAUSES	ACTION

Auto stop/start system inoperative	• Auto stop/start system inhibited
	  • Driver error/expectation
	  • Recent DTC clear
	  • System fault
	• Auto stop/start system fault
		NOTE:
		'AUTO STOP/START FAULT' will be displayed in the instrument cluster message centre when the system is inoperative due to a fault.
		• Refer to the Auto Stop/Start System Inhibits table for possible inhibit conditions
		  • Auto stop/start system inhibited due to driver error/expectation: Explain/demonstrate the auto stop/start system to the driver
		  • Auto stop/start system inhibited due to a recent DTC clear (and a drive cycle not completed): Road test the vehicle at a speed of 48 to 80 km/h (30 to 50 mph) for 2 to 3 minutes, allow the engine to idle, auto stop/start will now activate
		  • Auto stop/start system inhibited due to battery condition: Using the Jaguar Land Rover approved diagnostic equipment, perform routine - Power Supply Service Mode Diagnostic Routine
		• Using the Jaguar Land Rover approved diagnostic equipment, check the powertrain control module for related DTCs and refer to the relevant DTC index

AUTO STOP/START SYSTEM INHIBITS

The inhibit conditions listed below will not set Diagnostic Trouble Codes (DTCs) but will set flags which can be viewed using the Jaguar Land Rover approved diagnostic equipment - Datalogger/Powertrain Control Module (PCM). Normal auto stop/start system operation will resume when an inhibit condition is no longer present, but the battery related inhibits may persist for some time.

NOTE:

- **Performing a DTC clear on a petrol (gasoline) engine vehicle will inhibit the auto stop/start system.**
- **Do not reset the Battery Monitoring System (BMS) to rectify battery condition inhibits. This may temporarily restore auto stop/start system operation but will lead to a recurrence of the fault.**

INHIBITS

INHIBITS
• Auto stop/start off switch has been operated by driver • DTC clear performed • Transmission not in neutral • Accelerator pedal not released • Hood open detected • Driver door detected open • Driver seatbelt not fastened • All terrain progress control special programme selected • Climate control demand exceeds calibrated threshold • Heated windshield operating • Trailer connected • Brake booster vacuum below threshold • Engine coolant temperature below threshold • Engine oil temperature below threshold • Catalytic converter outside either pre or post calibration range • Battery state of charge low • Battery cold cranking capability below threshold • Ambient temperature above 40Â°C • Ambient temperature below 0Â°C

DTC INDEX

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to: **Diagnostic Trouble Code (DTC) Index - V8 S/C 5.0L Petrol, DTC: Engine Control Module (ECM)** (General Information, Description and Operation).

REMOVAL AND INSTALLATION

STARTER MOTOR (G1821723)

REMOVAL

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

NOTE:

- **Removal steps in this procedure may contain installation details.**
- **Some components shown removed for clarity.**

All vehicles

1. Disconnect the startup battery ground cable.

   Refer to: **Battery Disconnect and Connect** (Battery, Mounting and Cables, General Procedures).

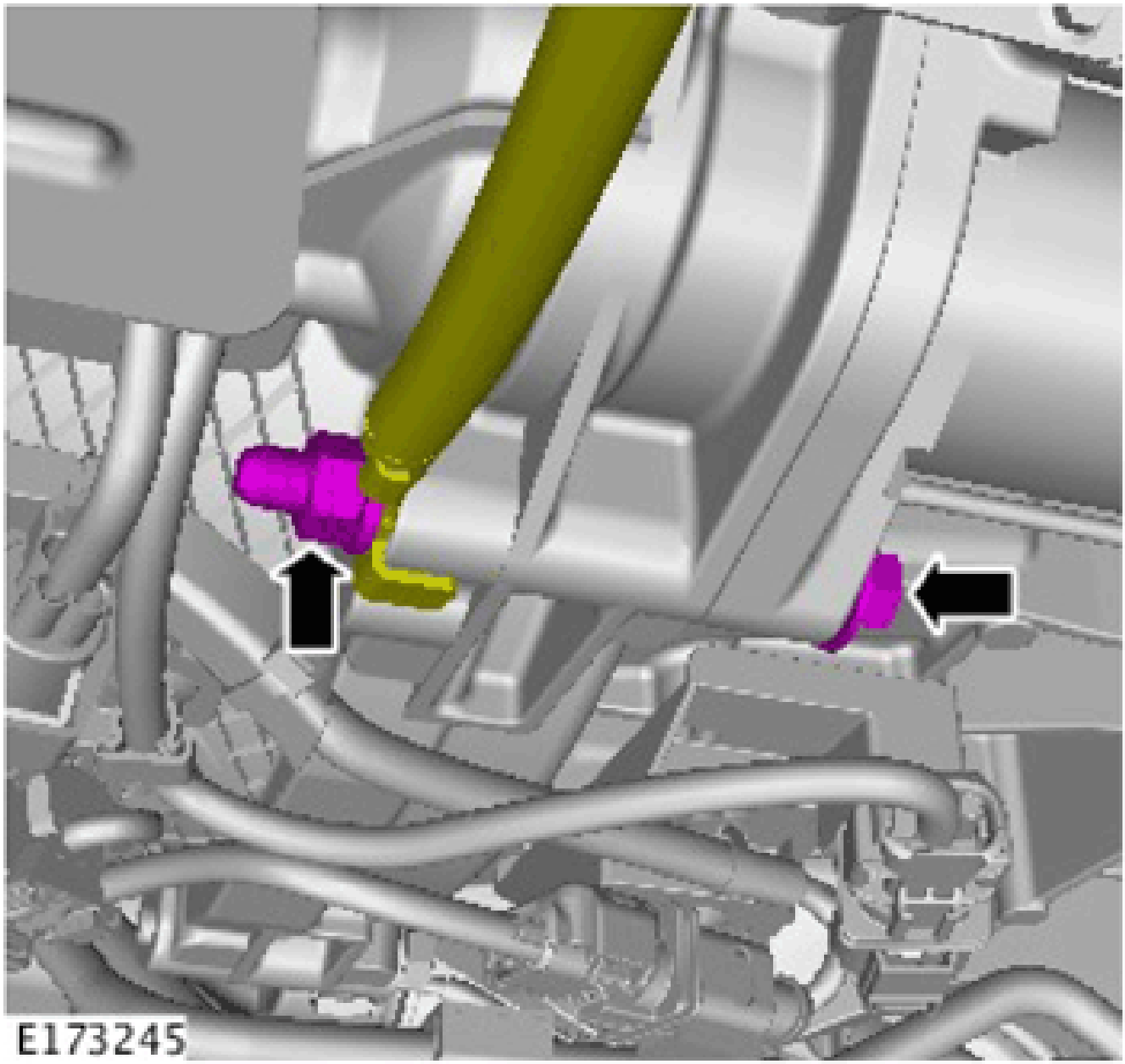
2. Raise and support the vehicle.

   Refer to: **Lifting** (Jacking and Lifting, Description and Operation).

3. Remove the catalytic converter for access only.

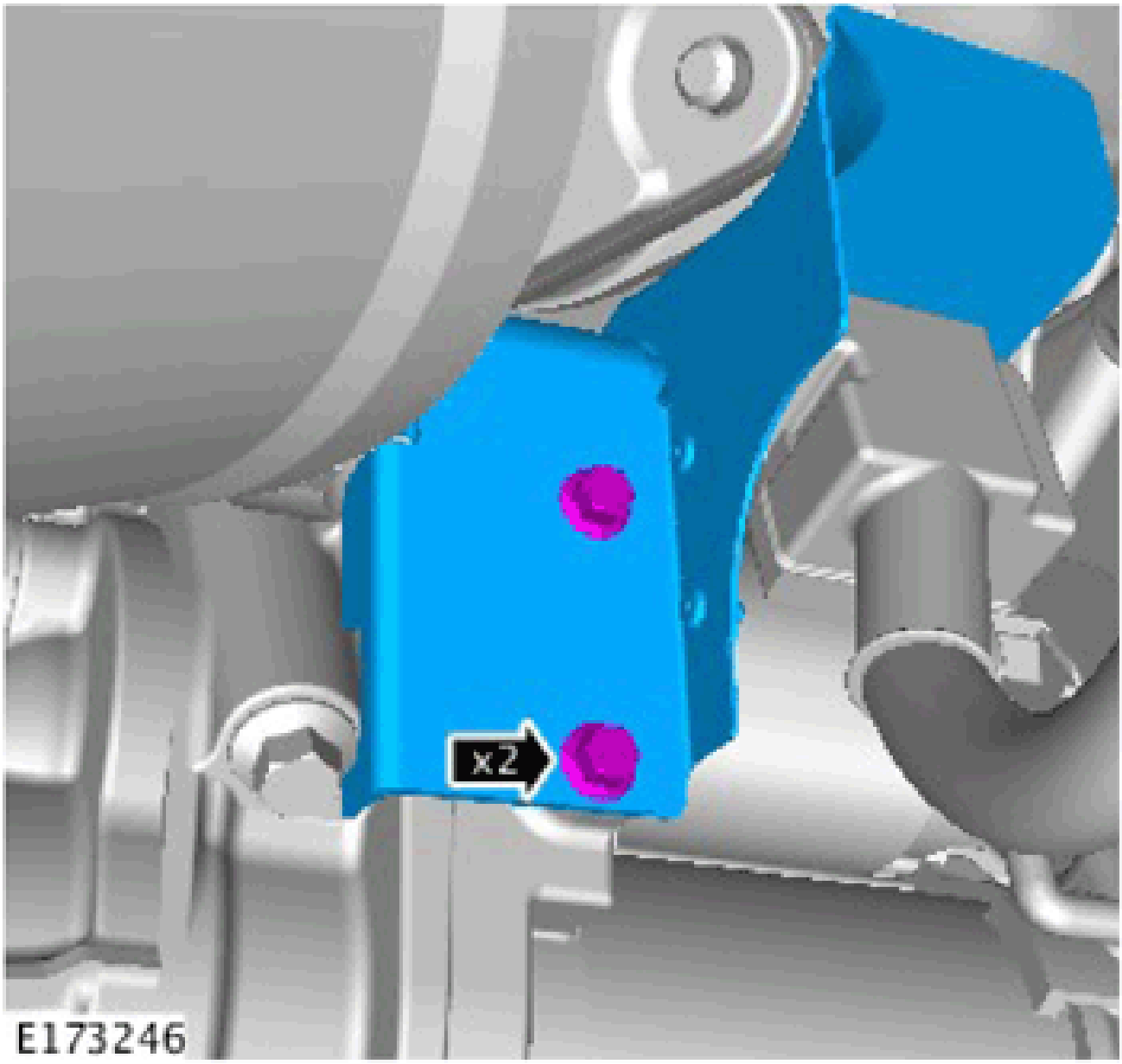
   Refer to: **CATALYTIC CONVERTER RH (G1842488)** (Removal and Installation).

   Refer to: **CATALYTIC CONVERTER LH (G1842487)** (Removal and Installation).

4. 

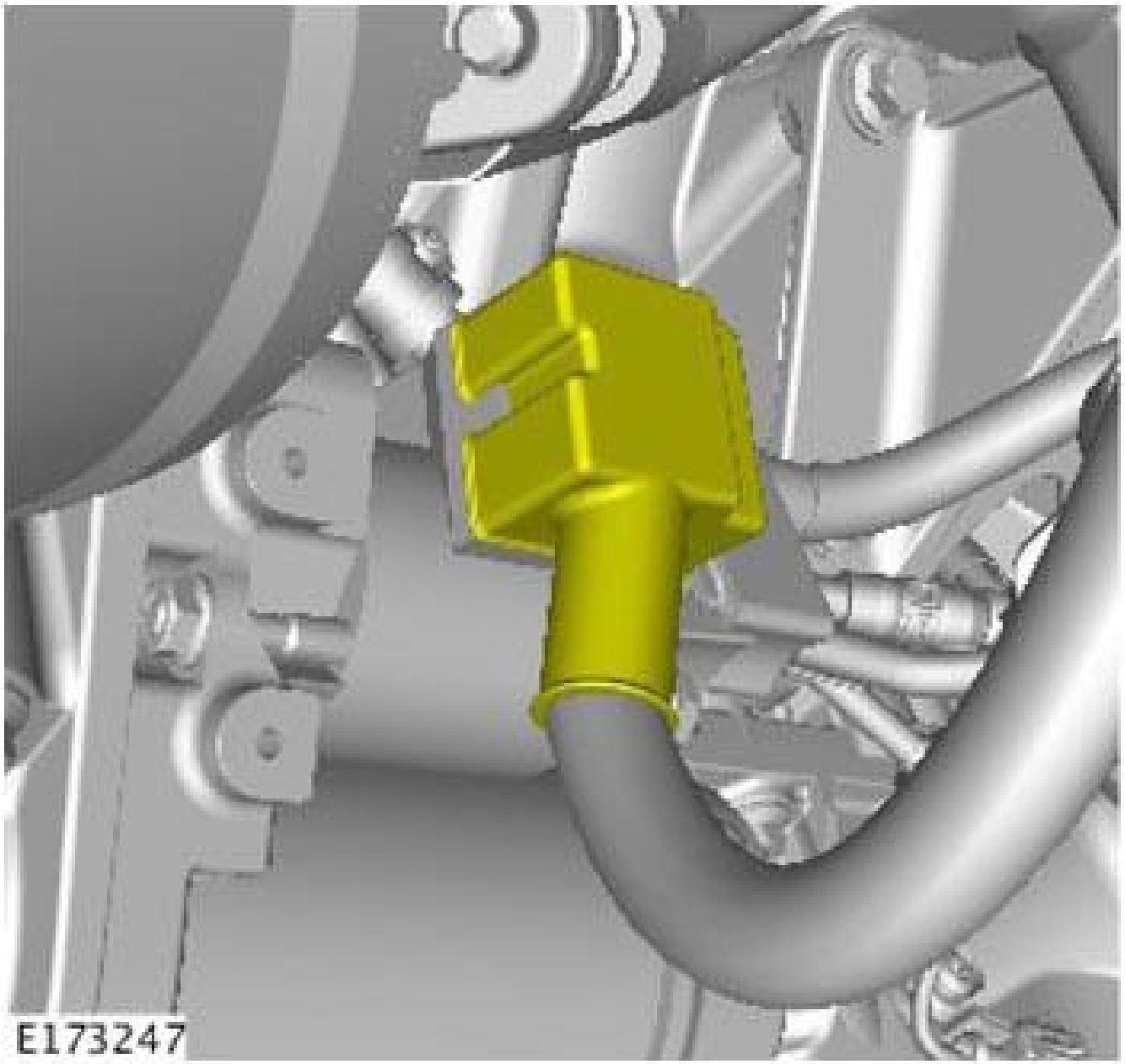
   Torque Specification: **48 Nm**

5.

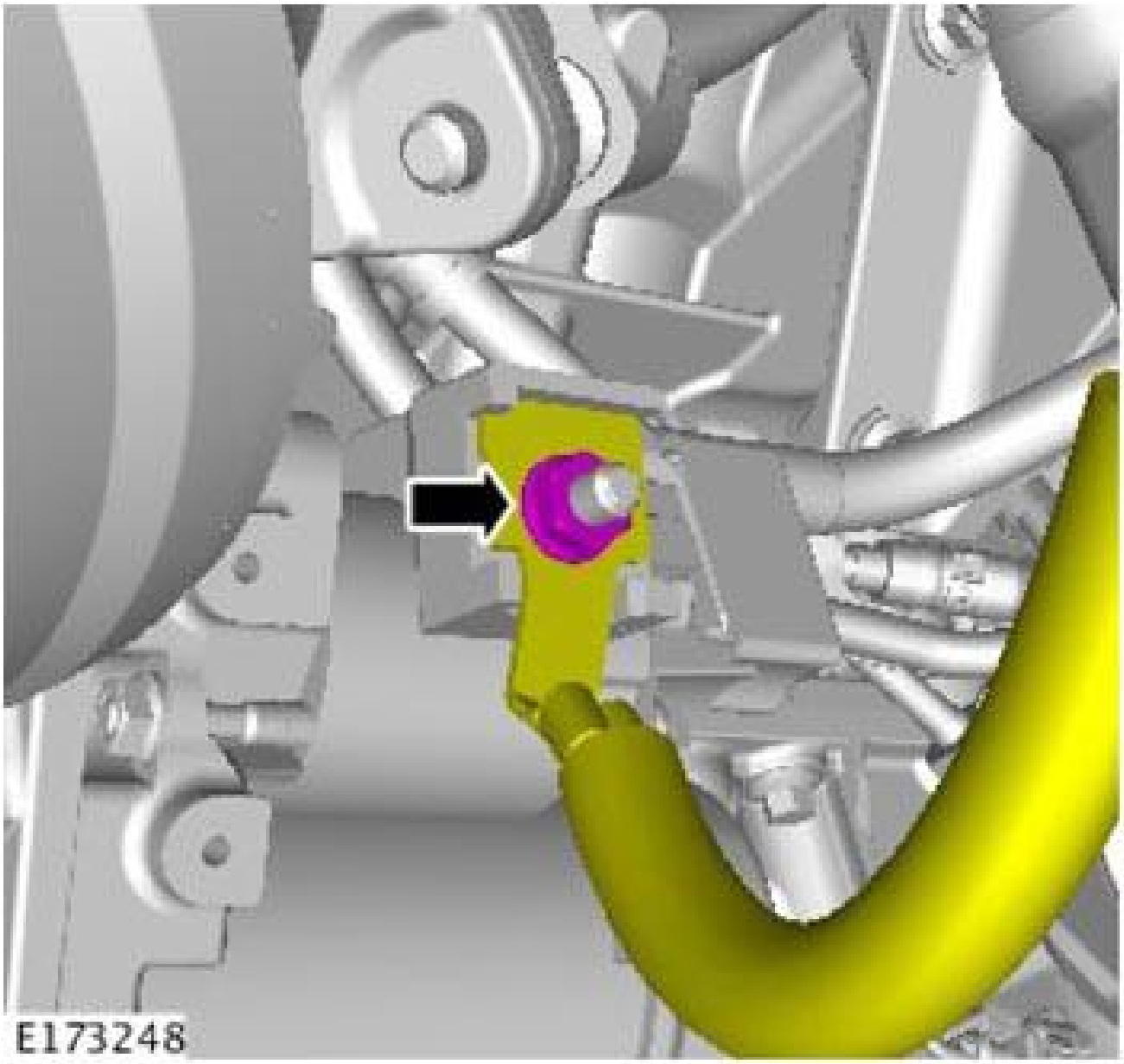


Torque Specification: **6 Nm**

6. **CAUTION:** **Make sure that the protective cover is correctly installed over the electrical connector.**

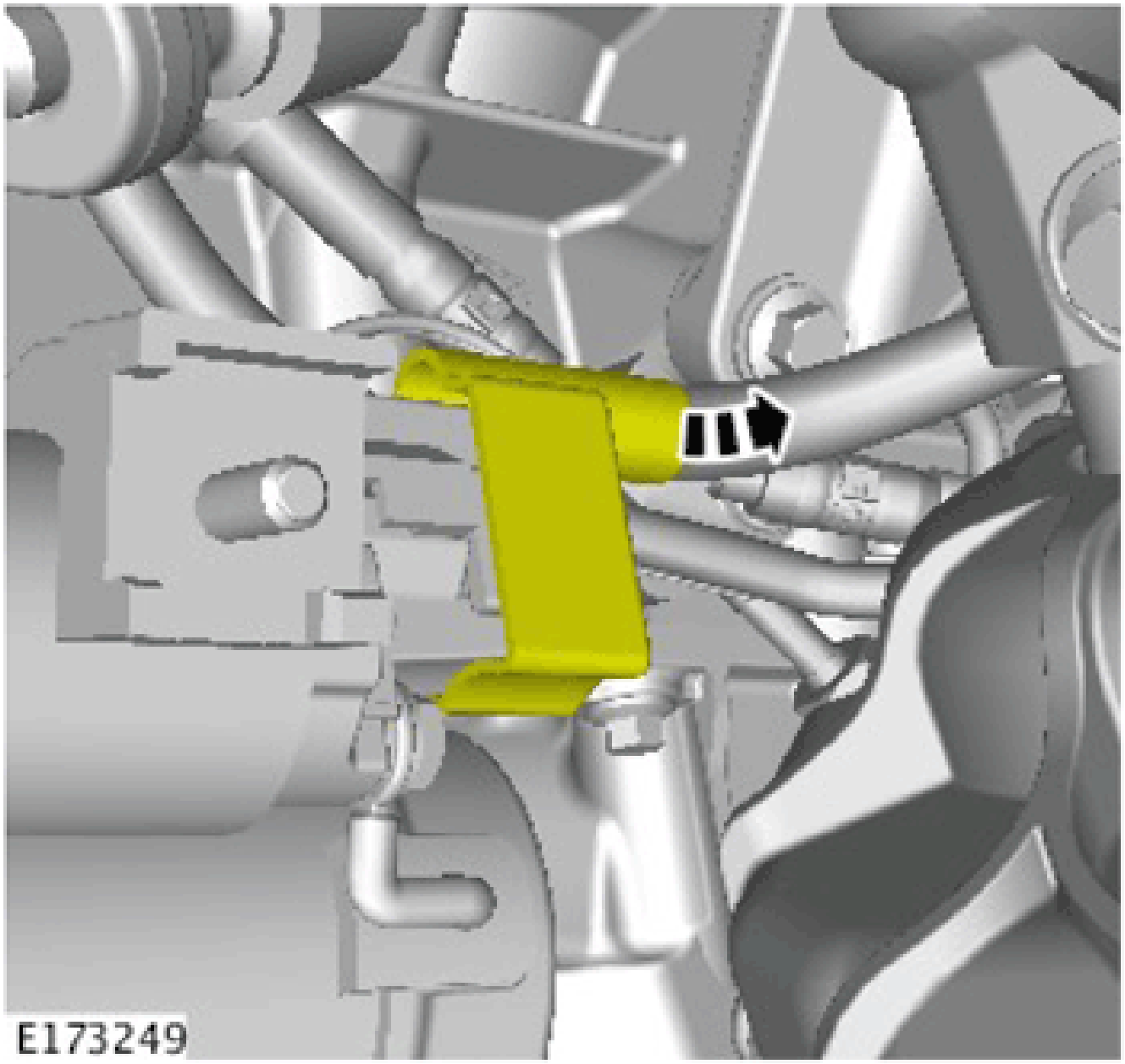


7. **NOTE:** **Protective cover shown removed for clarity.**

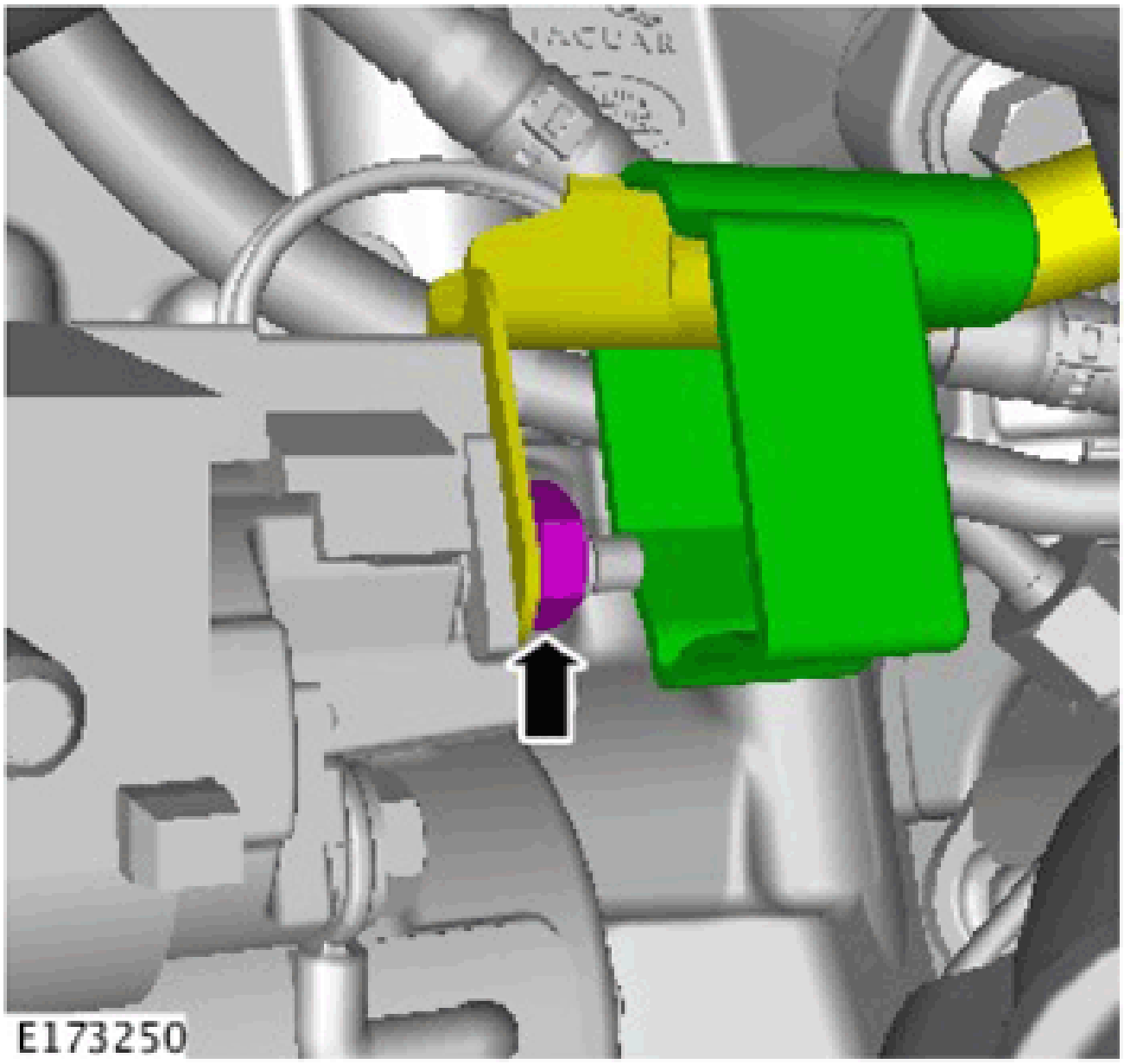


Torque Specification: **9 Nm**

8. **CAUTION: Make sure that the protective cover is correctly installed over the electrical connector.**



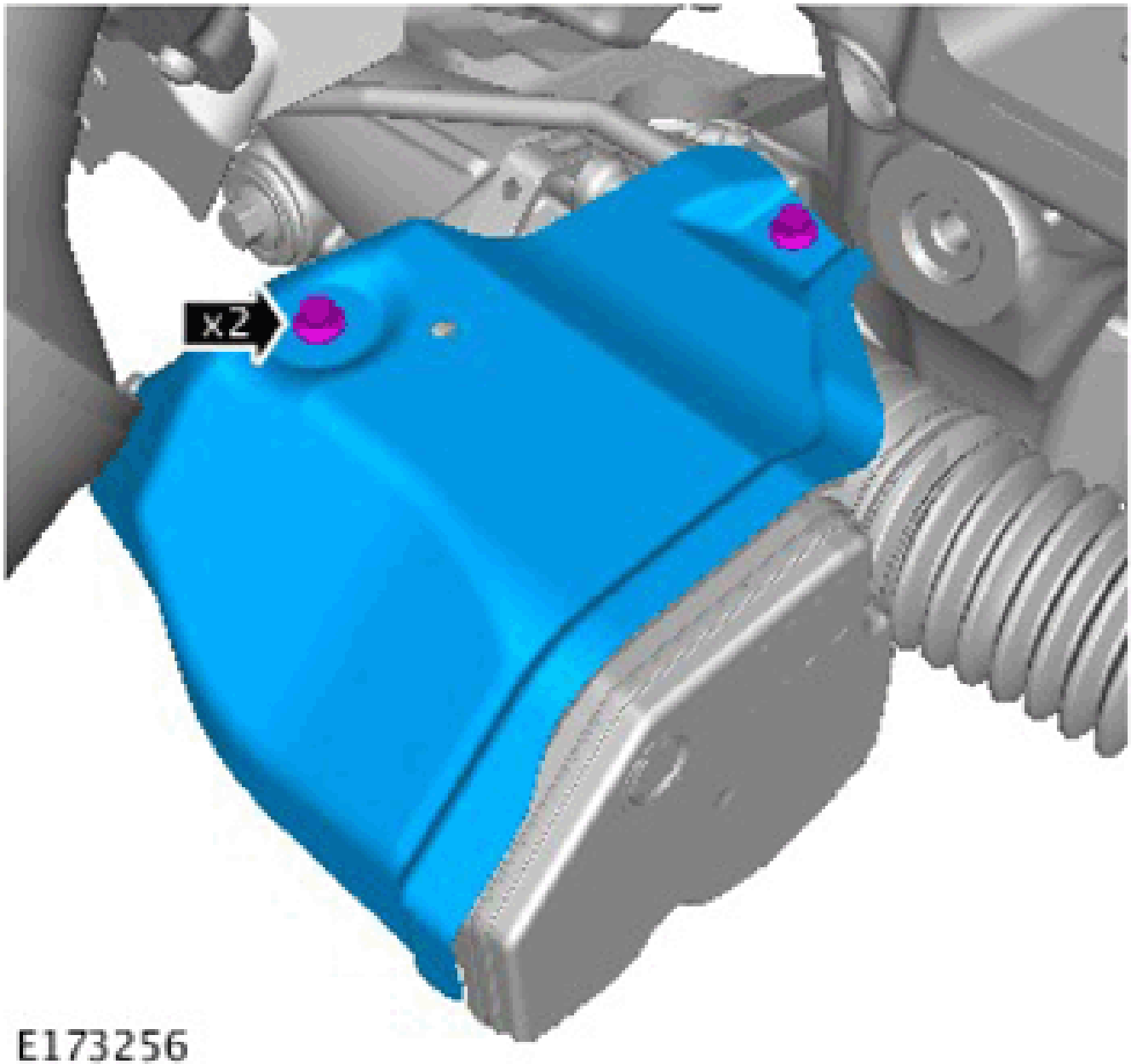
9.



Torque Specification: **9 Nm**

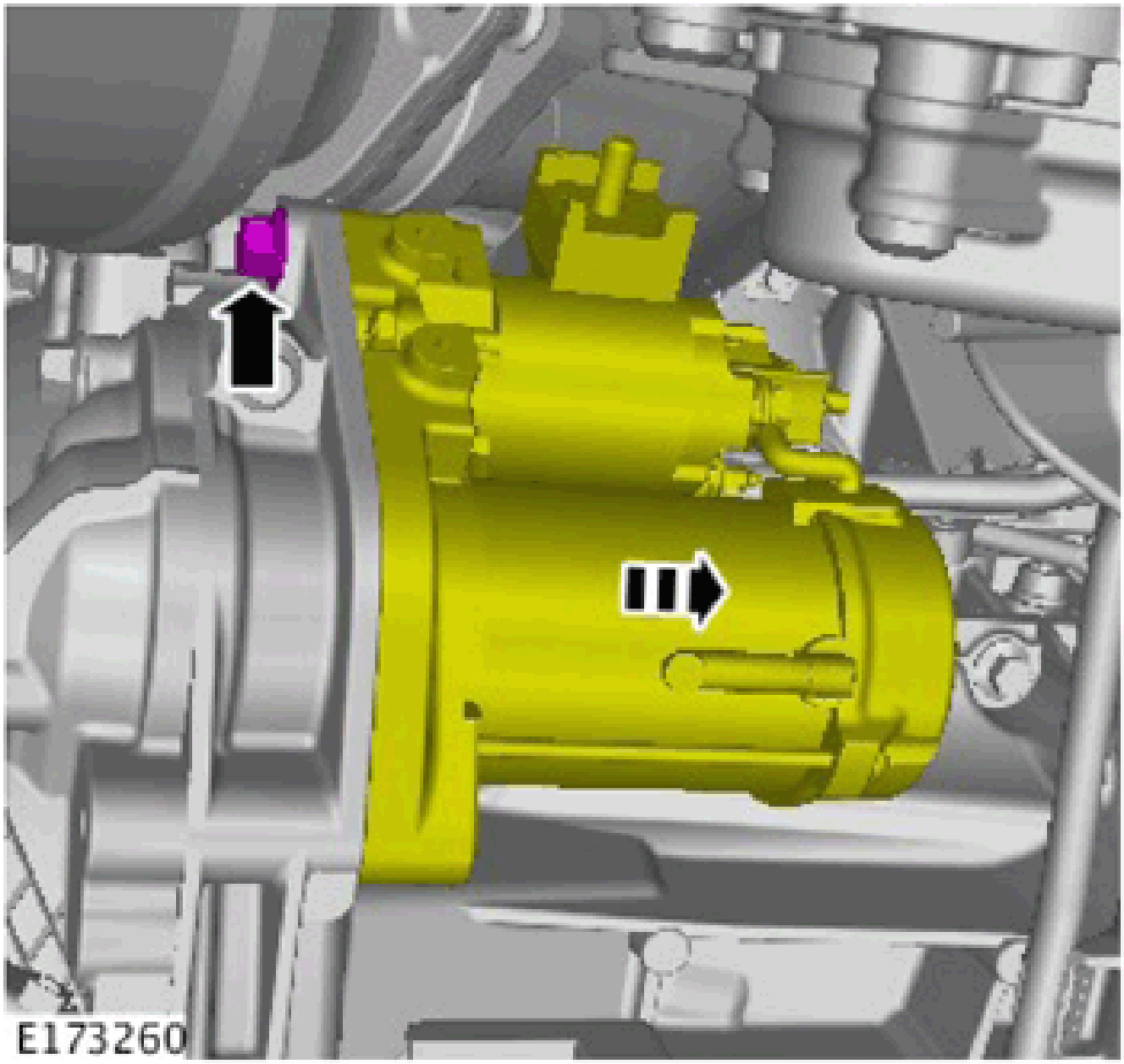
Left-hand drive vehicles

1.



Torque Specification: **10 Nm**

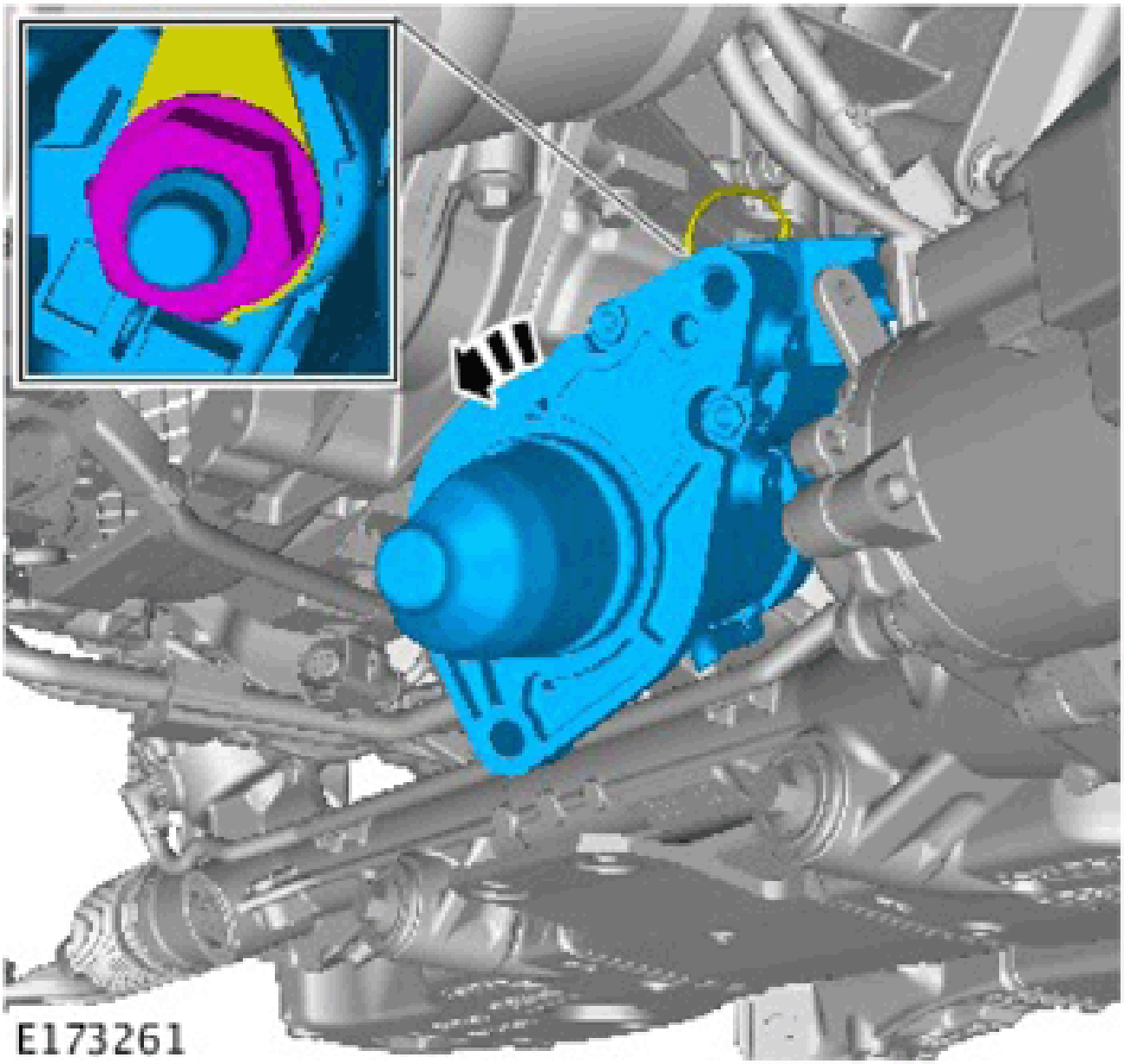
2.



Remove the upper bolt.

Torque Specification: **48 Nm**

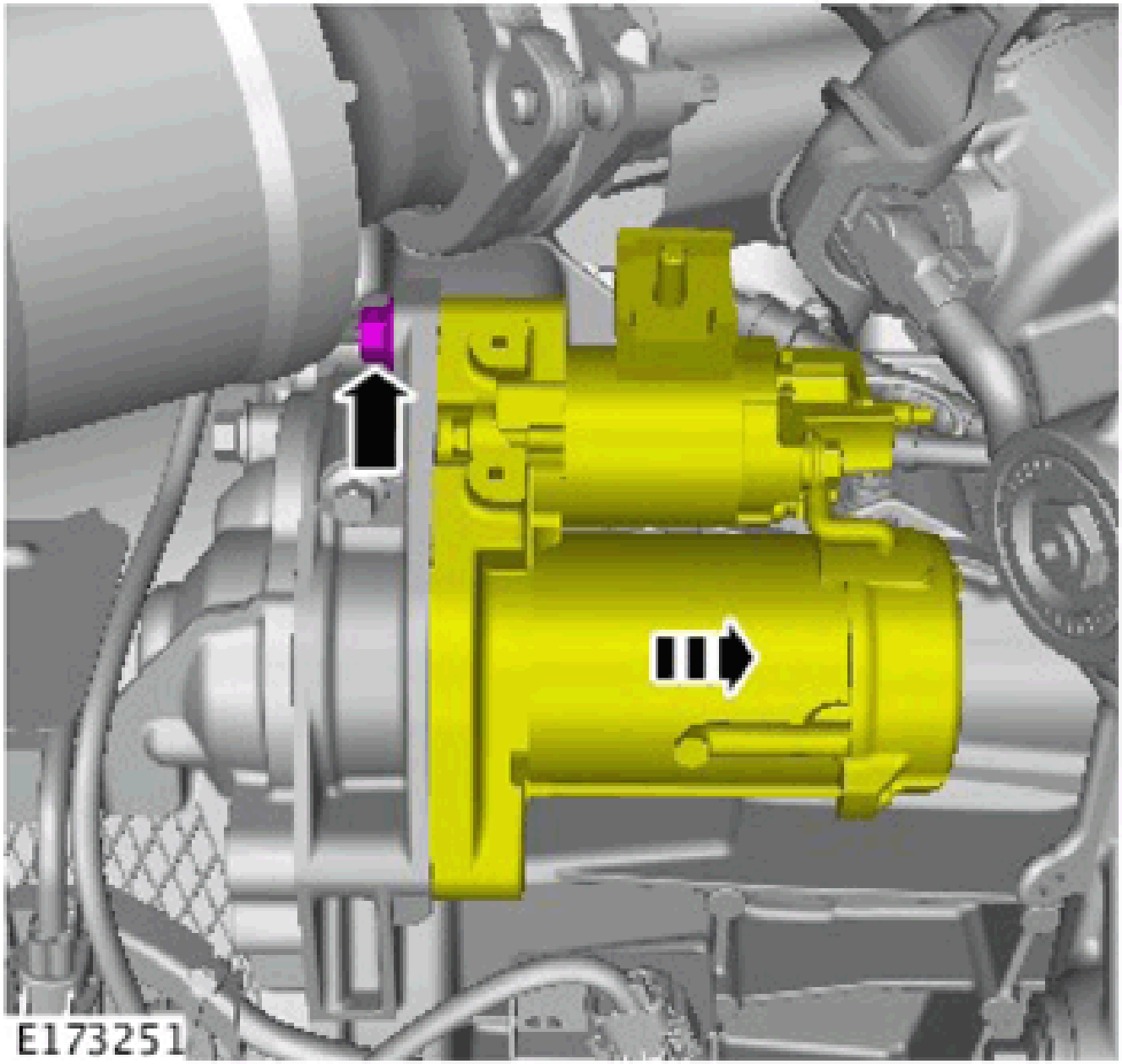
3. **CAUTION:**
   - **Make sure that the starter motor is supported when removing the nut.**
   - **Make sure the wiring harness and electrical connector are not damaged during this operation.**



Torque Specification: **6 Nm**

Right-hand drive vehicles

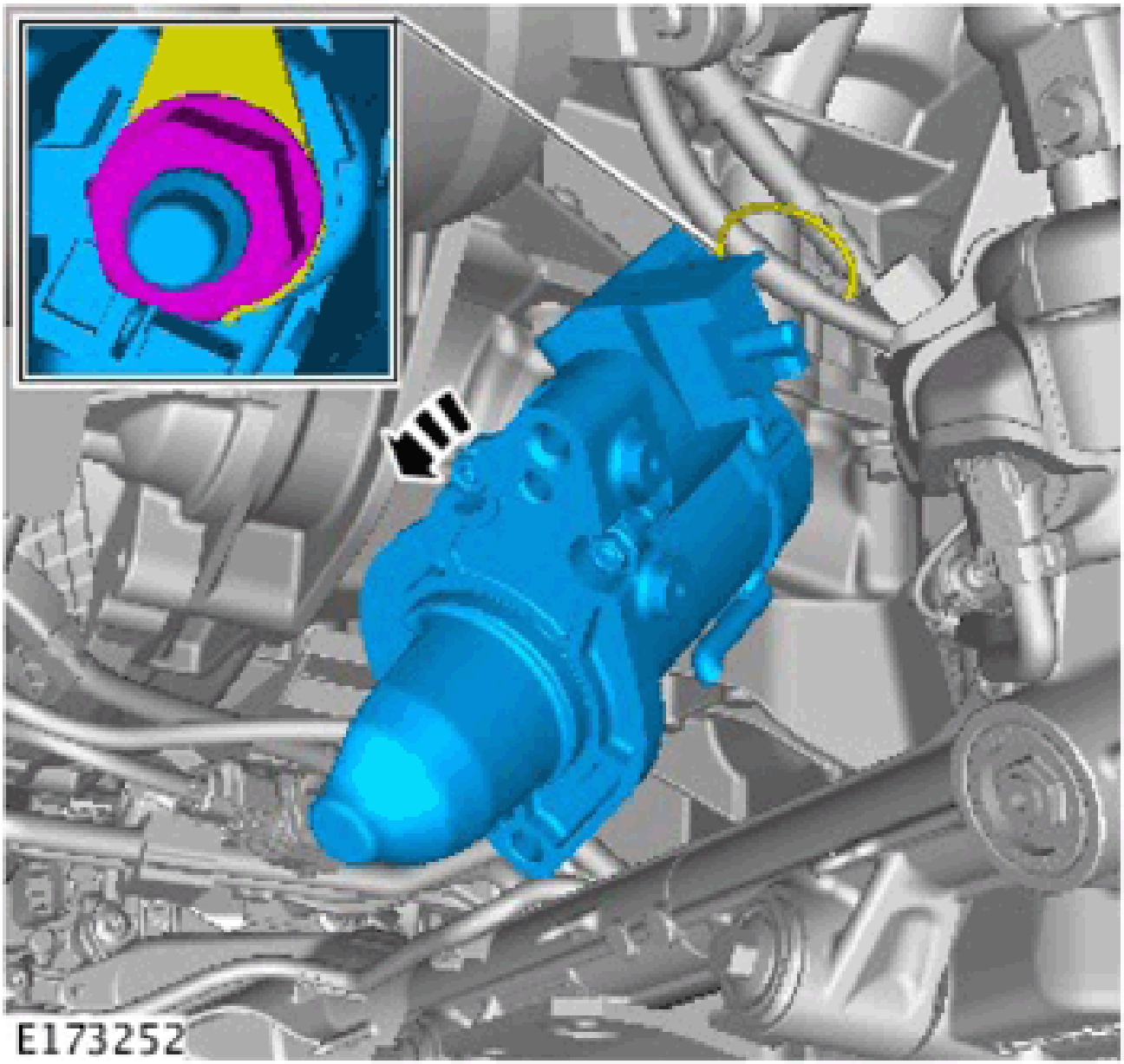
1.



Remove the upper bolt.

Torque Specification: **48 Nm**

2. **CAUTION:**
   - **Make sure that the starter motor is supported when removing the nut.**
   - **Make sure the wiring harness and electrical connector are not damaged during this operation.**



Torque Specification: **6 Nm**

INSTALLATION

1. To install, reverse the removal procedure.