

## SECTION 303-01C Engine — 3.2L Duratorq-TDCi (148kW/200PS) - Puma

### VEHICLE APPLICATION: 2011.50 Ranger

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**DISASSEMBLY**

Engine.....	(21 134 8)	303-01C-86
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**ASSEMBLY**

Engine.....	(21 134 8)	303-01C-93
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Engine Accessories.....	(21 139 4)	303-01C-126

## SPECIFICATIONS

### Engine Data

Description	
Code	SAFA
Firing order	1-2-4-5-3
Bore diameter	89.9 mm
Stroke	100.76 mm
Displacement	3198 cc
Compression ratio	15.7:1
Power output at 3000 rpm	147 kW (200 PS)
Torque between 2000 to 2500 rpm	470 Nm
Idle speed	770 rpm
Maximum oil consumption	0.1L / 1000 Km

### Engine Oil Capacity

Description	Liters
Initial fill including oil filter	10.1
Service fill including oil filter	9.8
Service fill without oil filter	9.4

### Cylinder Block Dimensions

Description	mm
Cylinder bore diameter — Class 1	89.900 - 89.910
Cylinder bore diameter — Class 2	89.910 - 89.920
Cylinder bore diameter — Class 3	89.920 - 89.930
Main bearing shells 1 to 5 inner diameter — bearings installed	64.994 - 65.022
Main bearing shell 6 inner diameter — bearings installed	69.994- 70.022
Main bearings 1 to 5 radial clearance	0.024 - 0.072
Main bearing 6 radial clearance	0.024 - 0.072
Main bearings 1 to 5 parent bore diameter — vertical measurement	69.504 - 64.520
Main bearing 6 parent bore diameter — vertical measurement	74.504 - 74.520
Main bearings 1 to 5 parent bore diameter — horizontal measurement	69.502 - 69.525
Main bearing 6 parent bore diameter — horizontal measurement	74.502 - 74.525

### Piston Dimensions

Description	mm
Piston diameter — Class 1	89.84 - 89.85
Piston diameter — Class 2	89.85 - 89.86
Piston diameter — Class 3	89.86 - 89.87
Piston clearance in cylinder	0.05 - 0.07
Piston ring end gaps	

**SPECIFICATIONS**

Description	mm
— upper compression ring	0.25 - 0.40
— lower compression ring	0.50 - 0.75
— oil control ring	0.25 - 0.50
Piston ring gap position: The piston ring end gaps must be distributed evenly around the circumference of the piston. This also applies to the oil control ring elements. Align the piston ring end gaps at 120 degrees to each other.	

**Crankshaft Dimensions**

Description	mm
Main bearing journal end float	0.090 - 0.305
Main bearing journals 1 to 5 diameter	64.950 - 64.970
Main bearing journal 6 diameter	69.950 - 69.970
Connecting rod bearing journal diameter	52.980 - 53.000

**Connecting Rod Dimensions**

Description	mm
Large end bore diameter	55.996 - 56.016
Small end bore diameter	32.010 - 32.018
Connecting rod bearing shell inner diameter — bearings installed	53.016 - 53.046
Connecting rod bearing radial clearance	0.026 - 0.084
Connecting rod bearing axial clearance	0.100 - 0.320

**Piston Pin Dimensions**

Description	mm
Piston pin length	73.95
Piston pin diameter	31.998 - 32.002
Piston pin slide clearance	0.008 - 0.018

**Camshaft Dimensions**

Description	mm
Camshaft end float	0.014 - 0.200
Camshaft bearing journal diameter	26.440 - 26.465
Camshaft bearing clearance — radial measurement	0.04 - 0.09

**Valve Dimensions**

Description	mm
Valve stem to valve guide clearance — intake valve	0.0625 - 0.0275
Valve stem to valve guide clearance — exhaust valve	0.0725 - 0.0375

**Cylinder Head Dimensions**

Description	mm
Maximum distortion — measured longitudinally and diagonally	0.10

**SPECIFICATIONS**

Description	mm
Peak to valley height of mating surface	0.02
Cylinder head gasket thickness	
Piston protrusion of 0.310 - 0.400 mm	1.1 (one hole/tooth)
Piston protrusion of 0.401 - 0.450 mm	1.15 (two holes/teeth)
Piston protrusion of 0.451 - 0.500 mm	1.2 (three holes/teeth)

**Oil Pressure Specifications**

Description	bar
Minimum oil pressure at idle speed	1.25
Minimum oil pressure at 2000 rpm	2.5

**Lubricants, Fluids, Sealers and Adhesives**

Item	Specification
Ford Formula E SAE 5W-30 engine oil (for markets with low sulphur content less than 350 ppm)	WSS-M2C-913-C
Ford Formula E SAE 10W-30 engine oil (for markets with high sulphur content greater than 350 ppm)	WSS-M2C-921-A
Sealer — oil pan, camshaft carrier and engine front cover	WSE-M4G323-A4

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## DESCRIPTION AND OPERATION

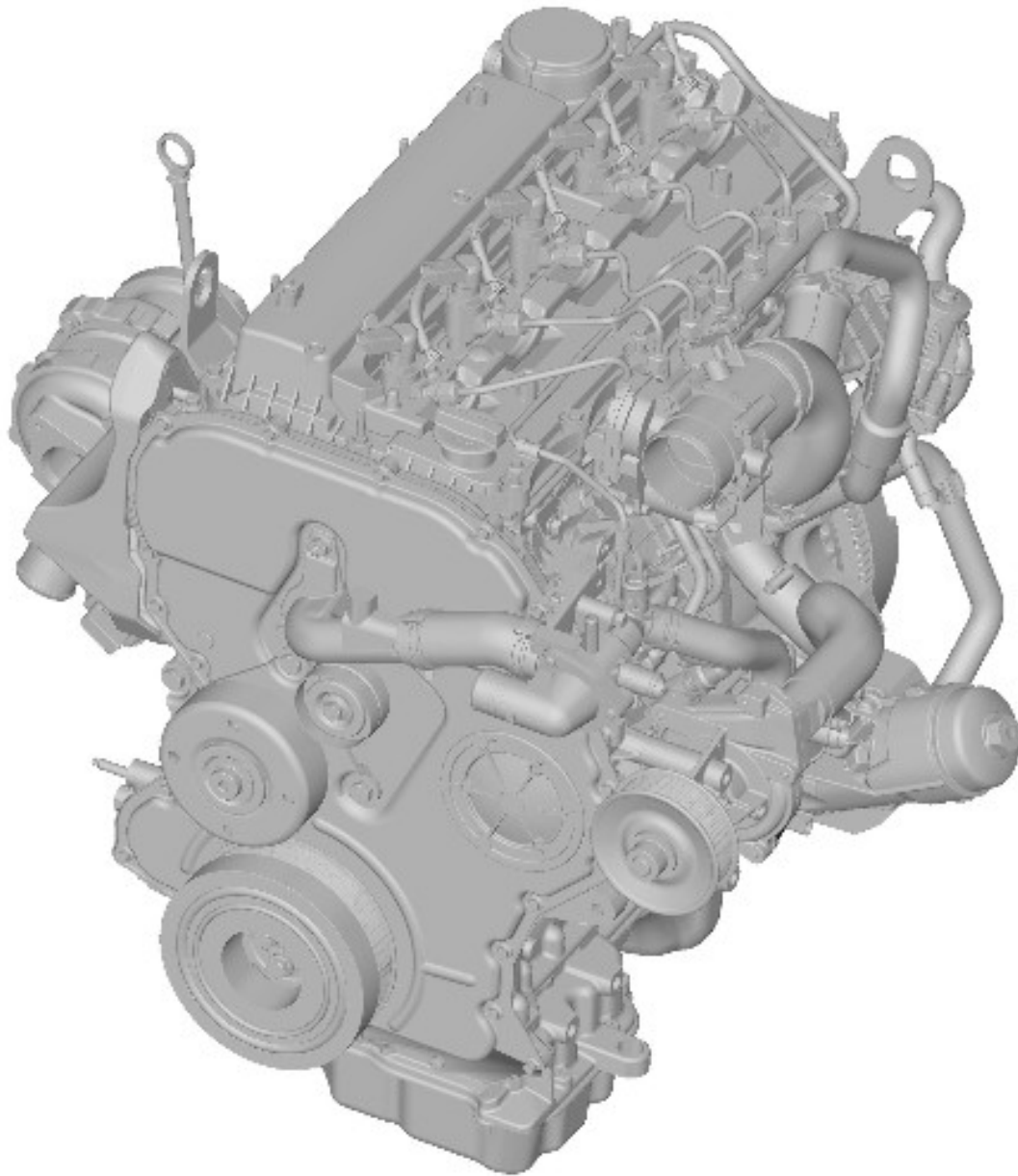
### Engine – Overview

#### General View

- The 3.2L Duratorq-TDCi (Puma) diesel engine is a five-cylinder inline engine which delivers a power of 147kW (200 PS).
- The engine is additionally equipped with an oil level/oil temperature sensor .
- The cylinder head consists of two parts and is made of aluminum. Both parts are bolted to each other.
- The lower part contains four valves for each combustion chamber and the two camshafts.

- The upper part houses the rocker arm frame with the roller rocker arms. The hydraulic valve clearance adjustment is integrated in the roller rocker arms.
- The camshafts and the fuel injection pump are driven by the crankshaft via the timing chain.
- The oil pump is located inside the oil pan and is driven by the crankshaft via a chain.

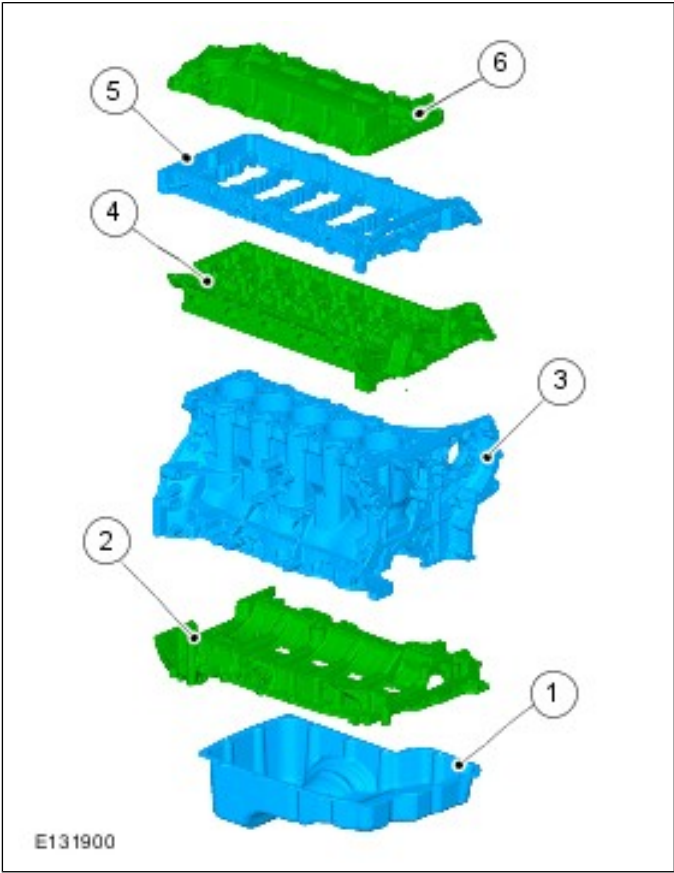
**NOTE:** Cylinder 1 is located on the timing chain end.

**DESCRIPTION AND OPERATION**

E131231

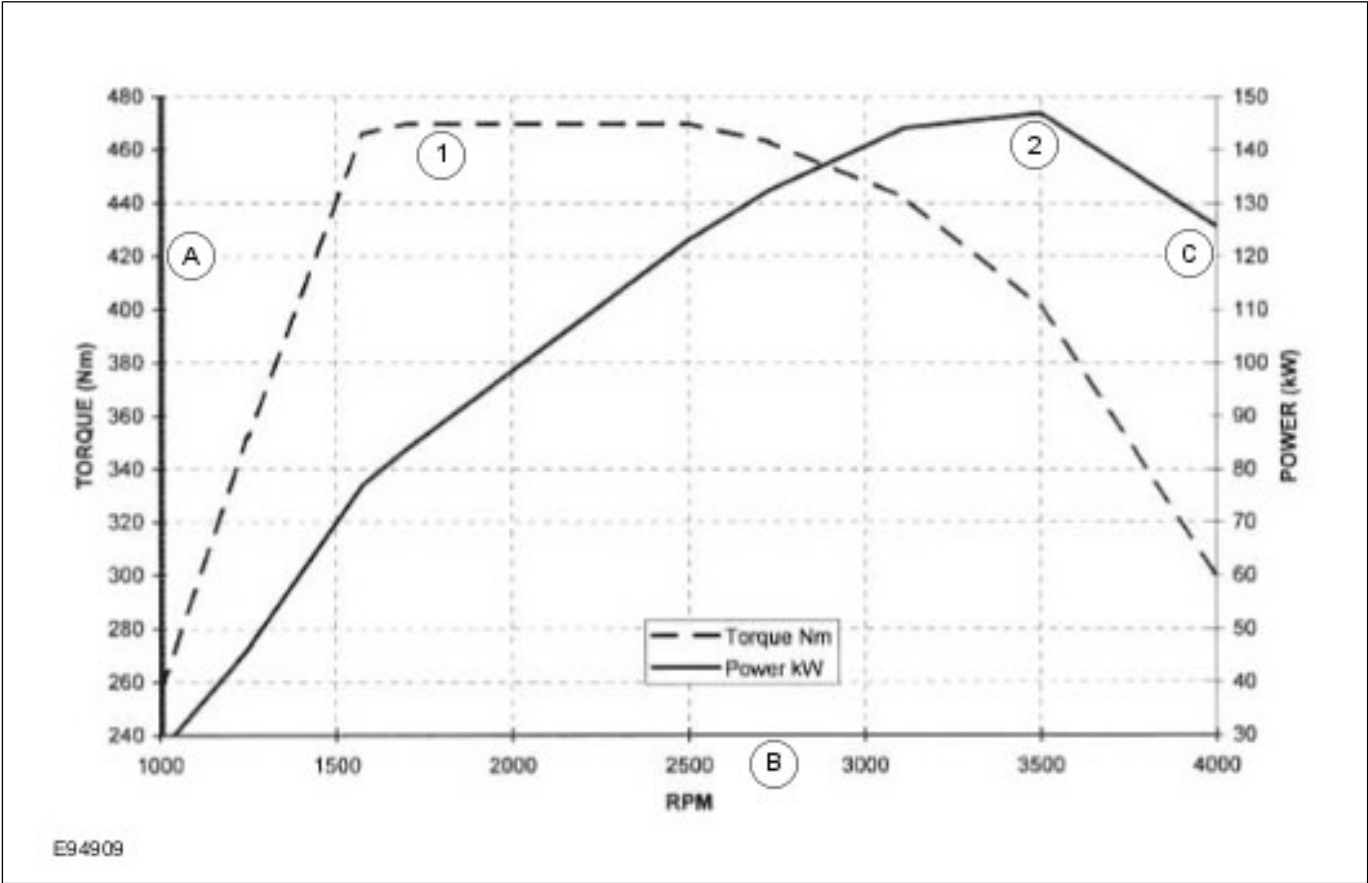
DESCRIPTION AND OPERATION

Engine overview



Item	Description
1	Oil pan
2	Oil pan extension
3	Cylinder block
4	Cylinder head lower part
5	Cylinder head upper part
6	Valve cover

Power and torque curves

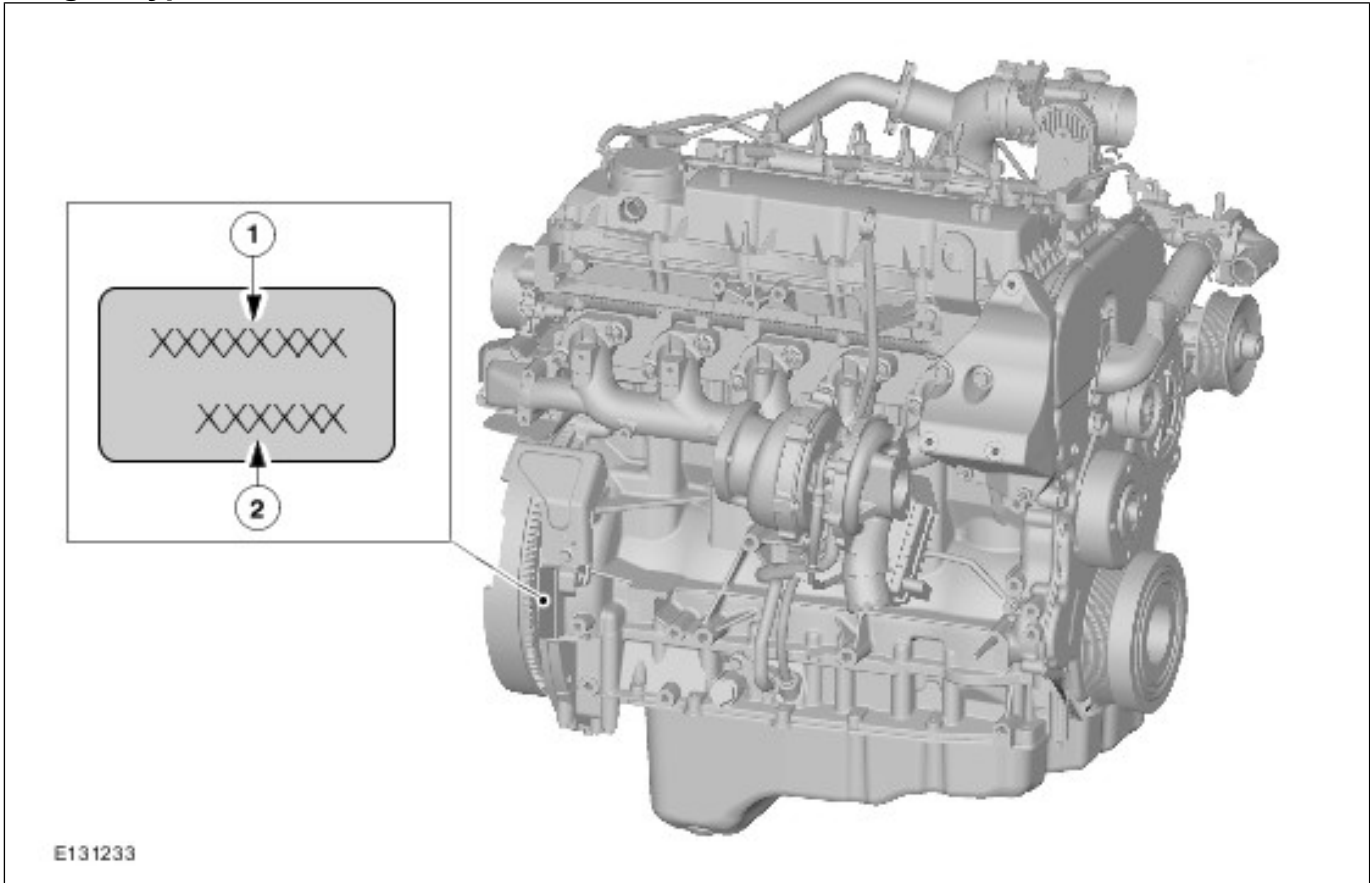




DESCRIPTION AND OPERATION

Item	Description	Item	Description
A	Torque (Nm)	1	Torque curve for the 147 kW engine (200 PS)
B	Engine speed (rpm)	2	Power curve for the 147 kW engine (200 PS)
C	Power (kW)		

Engine type identification



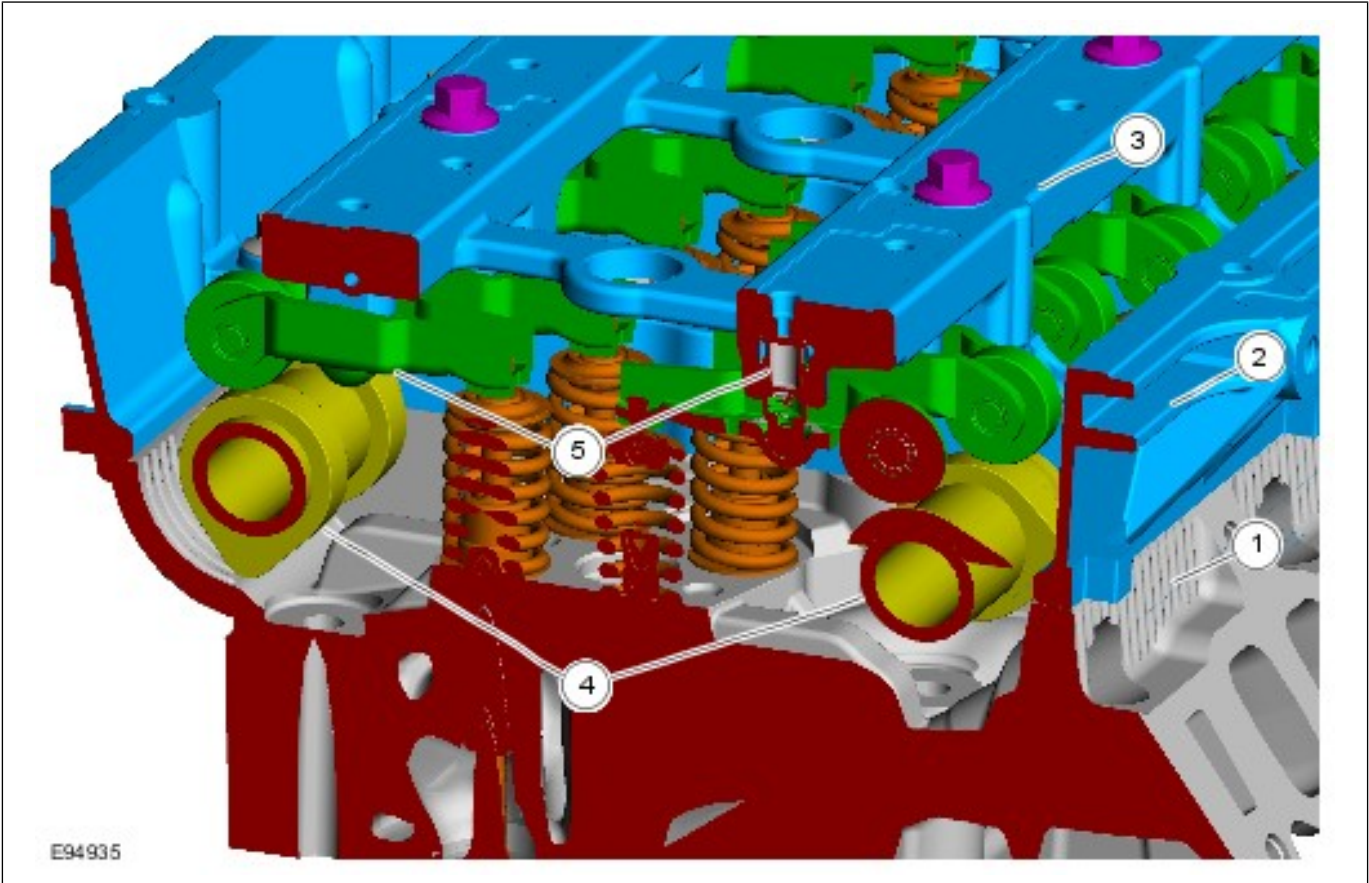
Item	Description
1	Engine code
2	Engine serial number

On the 3.2L engine the engine code (4 digits) and the engine serial number (2 letters for the year and month and 5 figures for the serial number) are stamped in the cylinder block on the exhaust side (in line with cylinder no. 5).

If the engine or cylinder block is changed, the vehicle identification number must be stamped in the indicated location.

Cylinder head

DESCRIPTION AND OPERATION

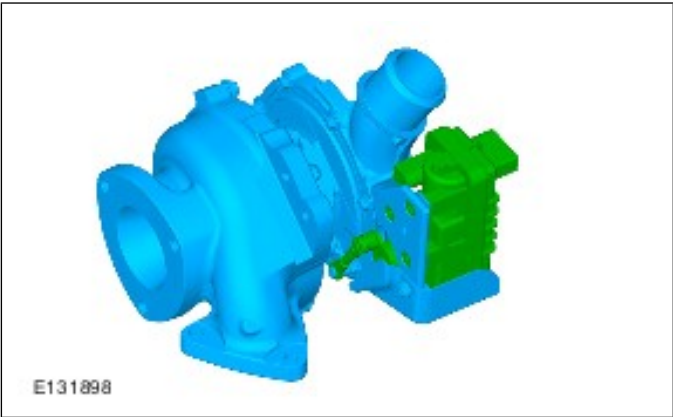


Item	Description
1	Cylinder head lower part
2	Cylinder head upper part
3	Rocker arm frame

Item	Description
4	Camshafts
5	Roller rocker arms with hydraulic valve clearance adjustment

DESCRIPTION AND OPERATION

Electronic turbocharger guide vane adjustment



Item	Description
1	Electric actuator for turbocharger guide vane adjustment

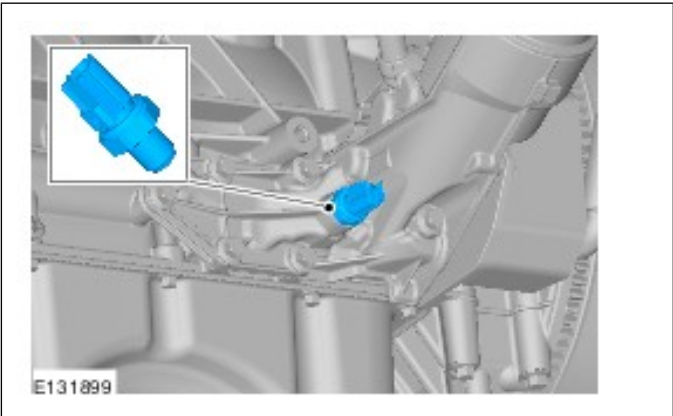
operating conditions) and displays it in the instrument panel.

In addition, a separate indicator in conjunction with a corresponding message in the instrument cluster display warns the driver when the oil quantity falls below the minimum level.

Service instruction

The interval indicator must be reset after an oil change on all vehicles with a diesel engine.  
It must be ensured that the vehicle is standing on level ground.

Oil level/temperature sensor



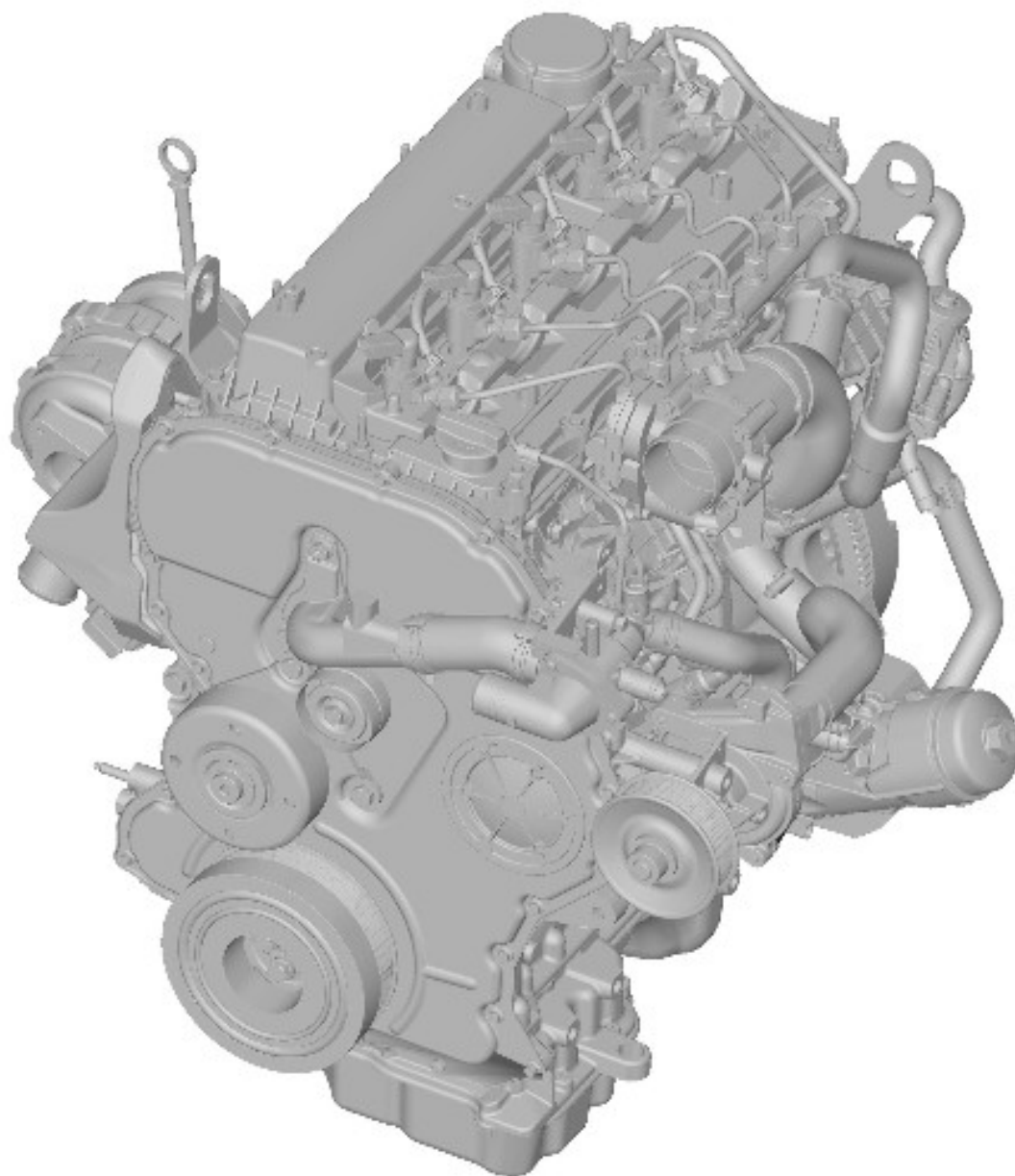
An oil level/temperature sensor located on the front of the engine directly beside the engine oil dipstick is provided for the service interval indicator.

A wire coil that is fitted inside the sensor and continuously supplied with current is used to measure the oil level.

The resistance of the wire coil changes according to how deeply the sensor is immersed in the oil. The measurement values are registered by the Powertrain Control Module (PCM).

The change in the voltage drop serves as an input variable for calculating the oil level. The oil temperature is sensed simultaneously via the integrated temperature sensor. The temperature is used as a corrective factor in the calculation.

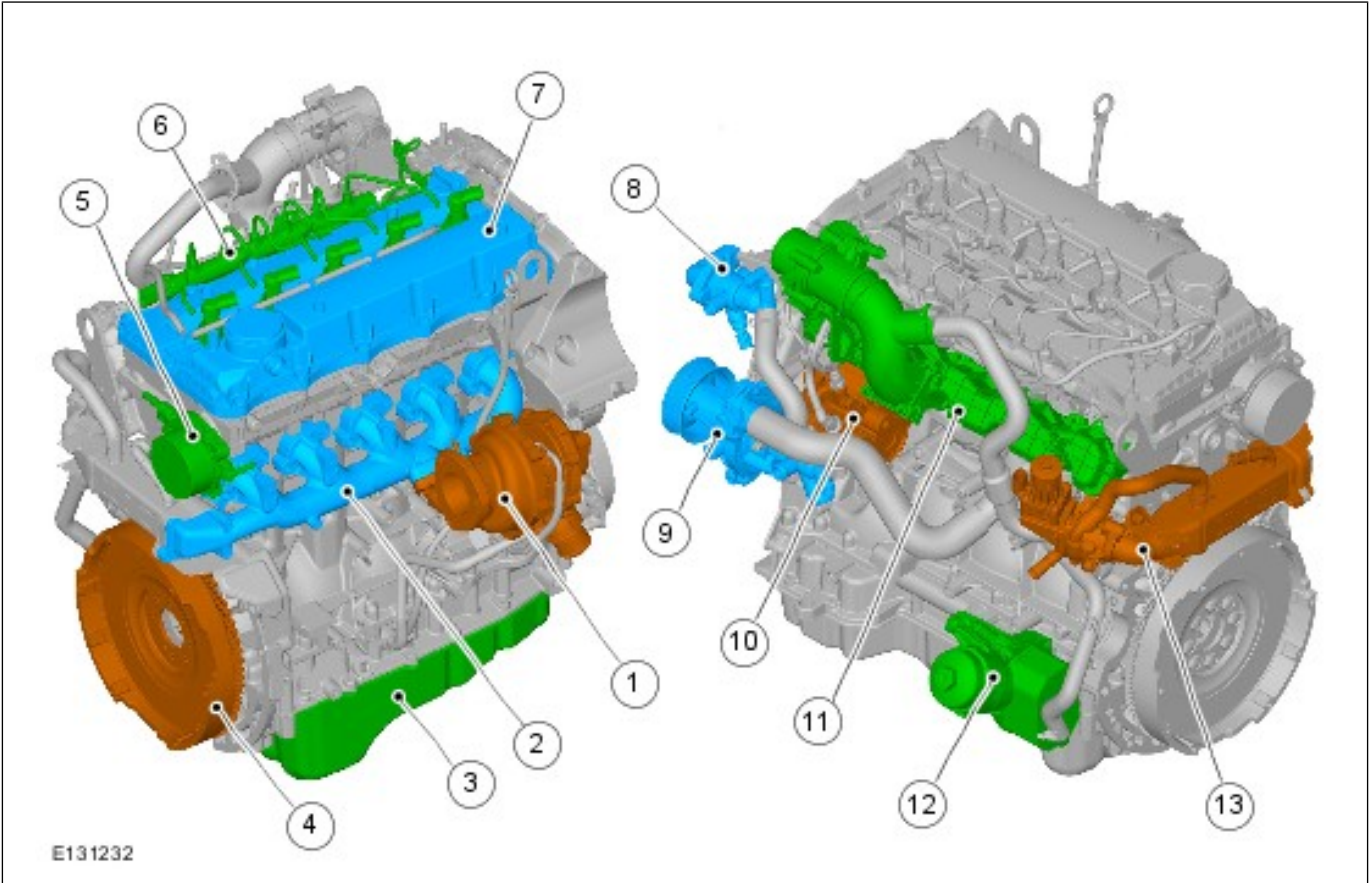
The PCM calculates the next oil change on the basis of an integrated strategy (which also takes into consideration the mileage and engine

**DESCRIPTION AND OPERATION****Engine – Component Location**

E131231



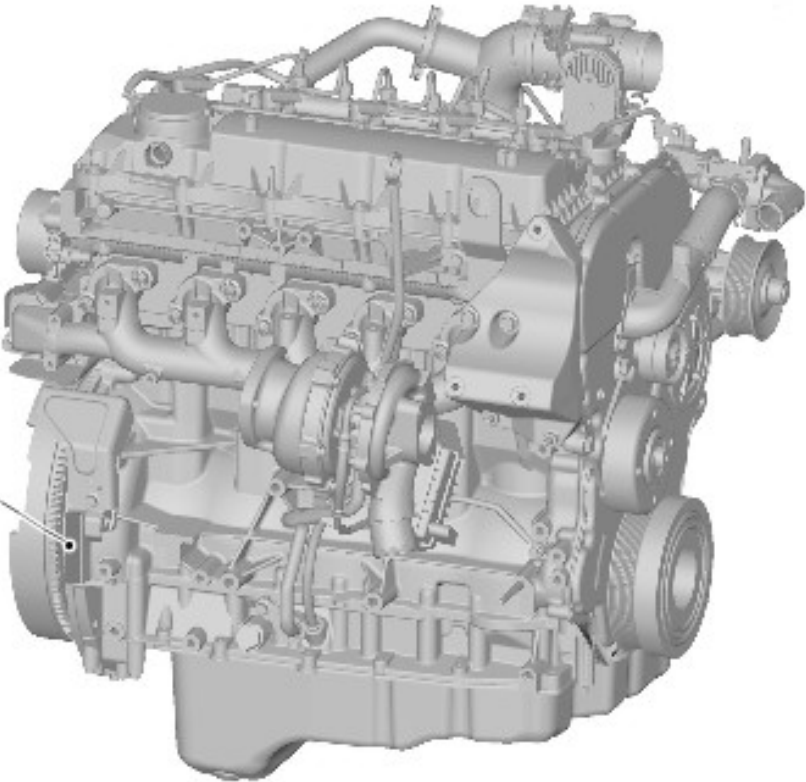
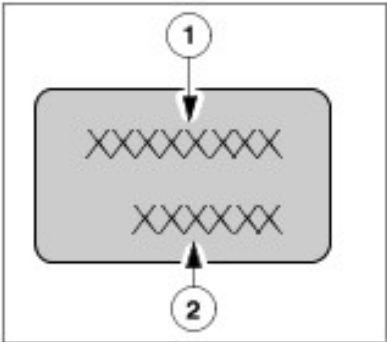
DESCRIPTION AND OPERATION



Item	Description
1	Turbocharger
2	Exhaust manifold
3	Oil pan
4	Flywheel
5	Vacuum pump
6	Fuel rail

Item	Description
7	Valve cover
8	Thermostat
9	Coolant pump
10	Fuel pump
11	Intake manifold
12	Oil cooler
13	EGR valve



DESCRIPTION AND OPERATION



E131233

Item	Description
1	Engine code
2	Engine serial number

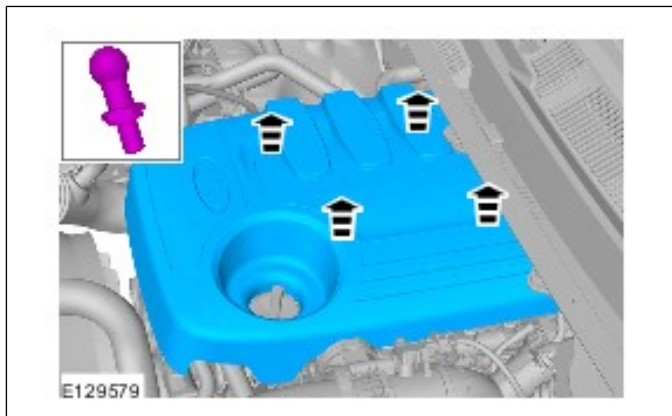
**REMOVAL AND INSTALLATION****Intake Manifold(21 183 0)****Removal****WARNINGS:**

-  **Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.**
-  **Wait at least one minute after the engine stops before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.**

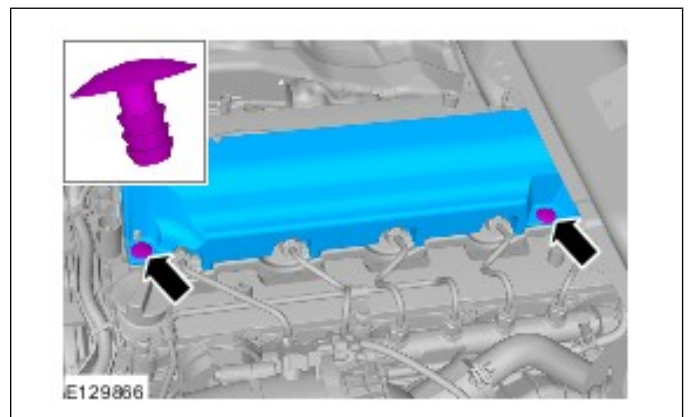
**NOTE:** Removal steps in this procedure may contain installation details.

1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

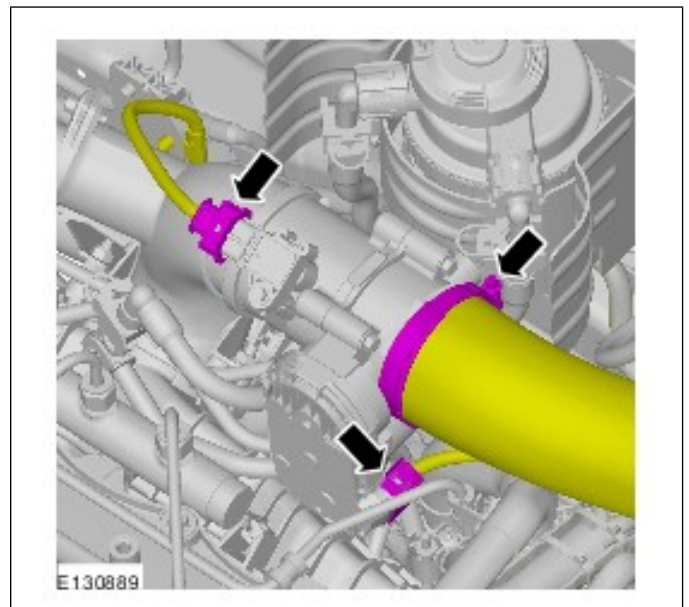
3.



4.



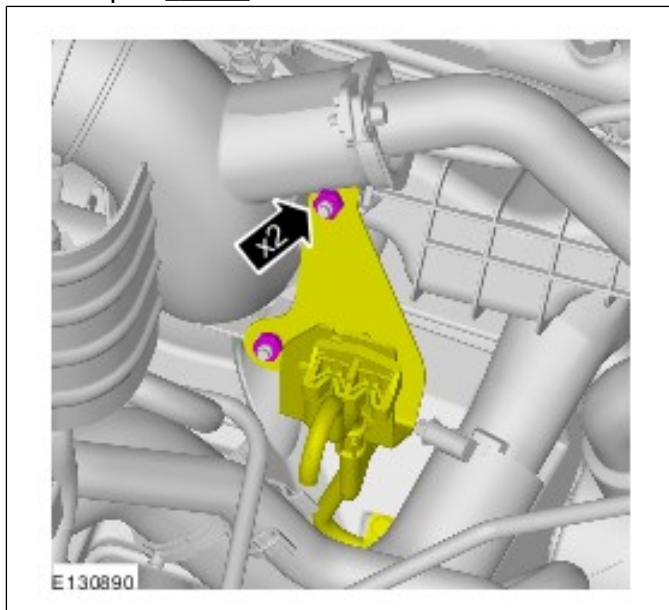
5.



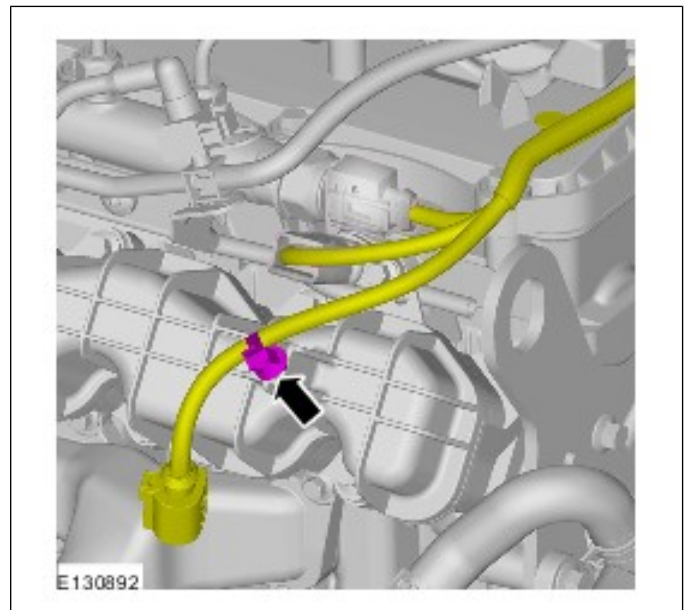


## REMOVAL AND INSTALLATION

6. Torque: 11 Nm



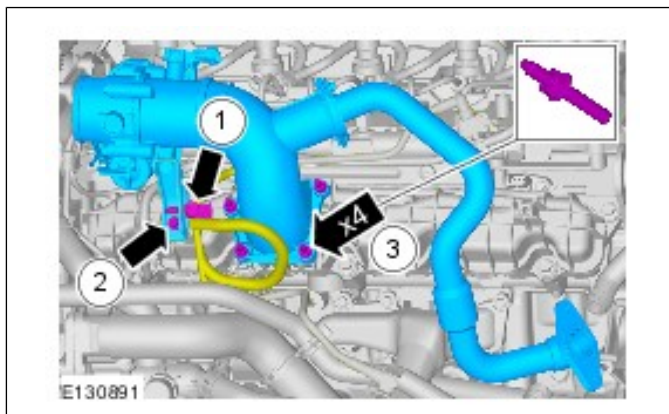
9.



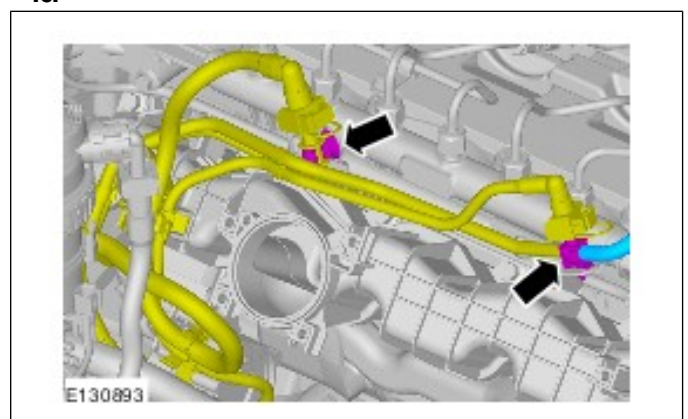
7. Refer to: [Exhaust Gas Recirculation \(EGR\) Valve - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-08 Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

8. 2. Torque: 10 Nm

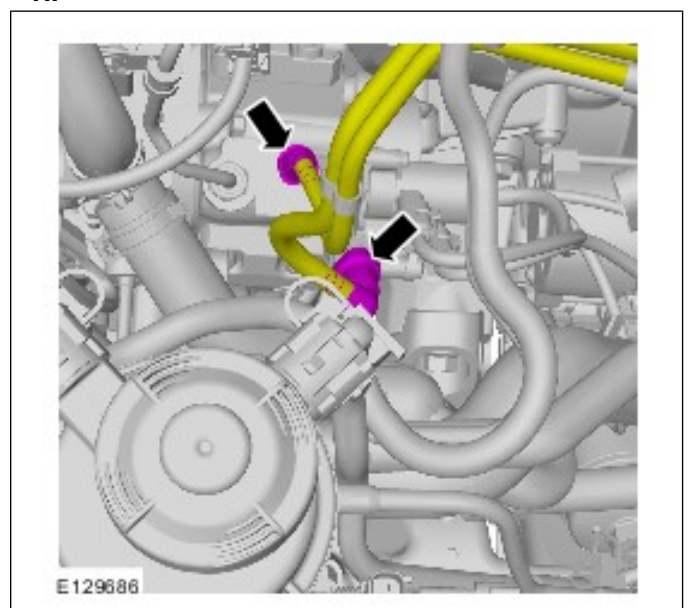
3. Torque: 15 Nm



10.



11.



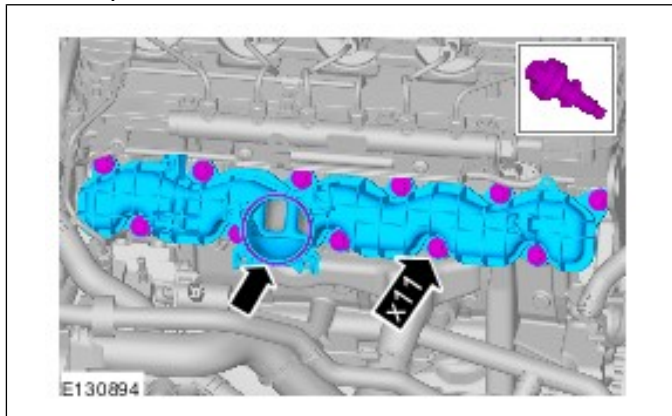


## REMOVAL AND INSTALLATION

**12 NOTE:** Replace the o-ring, if necessary.

**NOTE:** The gasket is to be reused unless damaged.

Torque: 15 Nm



### Installation

1. To install, reverse the removal procedure.

## REMOVAL AND INSTALLATION

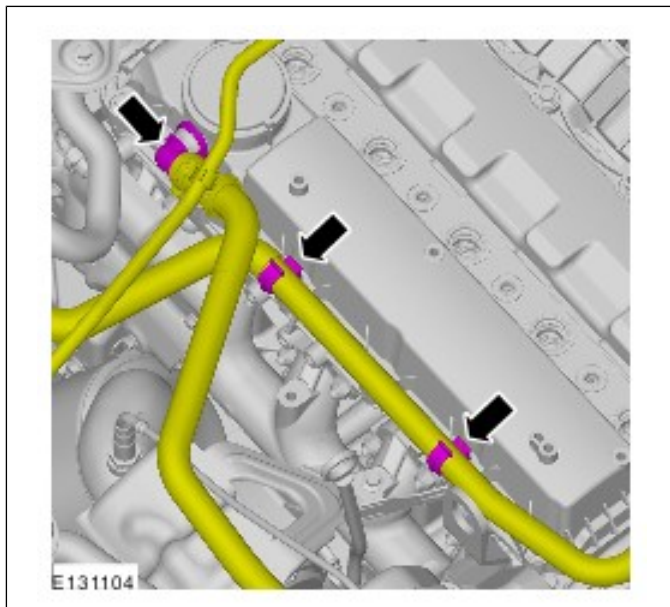
## Exhaust Manifold(21 187 0)

## Removal

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

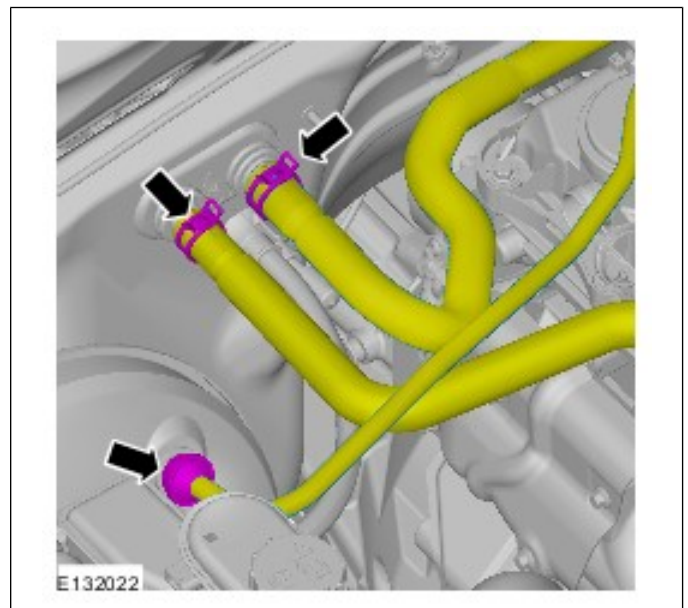
1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

3.

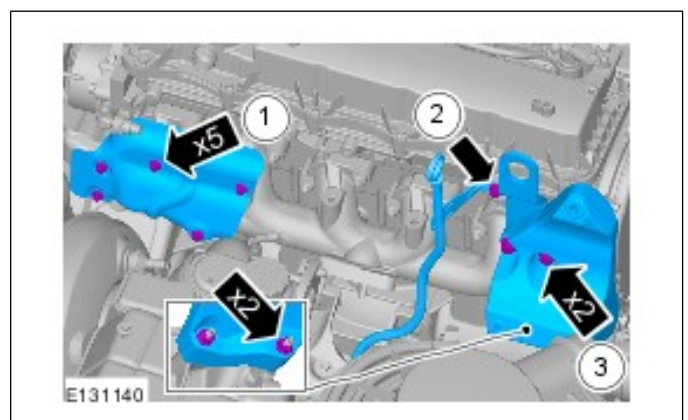


4. Refer to: [Turbocharger - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma, LHD 4WD/LHD RWD](#) (303-04 Fuel Charging and Controls - Turbocharger, Removal and Installation). Refer to: [Turbocharger - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma, RHD 4WD/RHD RWD](#) (303-04 Fuel Charging and Controls - Turbocharger, Removal and Installation). Refer to: [Generator - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (414-02 Generator and Regulator, Removal and Installation).

5.

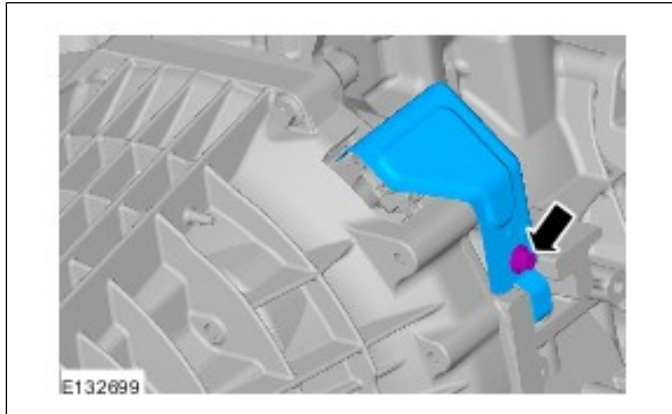


6. 1. Torque: 9 Nm  
2. Torque: 22 Nm  
3. Torque: 25 Nm

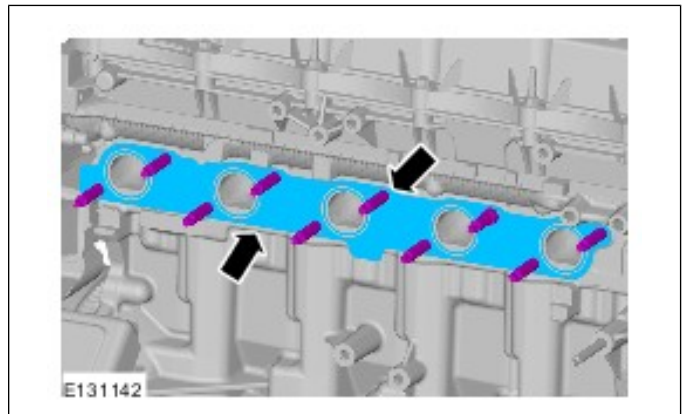


## REMOVAL AND INSTALLATION

7. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).
8. Remove front RH side wheel only.  
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).
9. Torque: 10 Nm



**NOTE:** The gasket is to be reused unless damaged.



### Installation

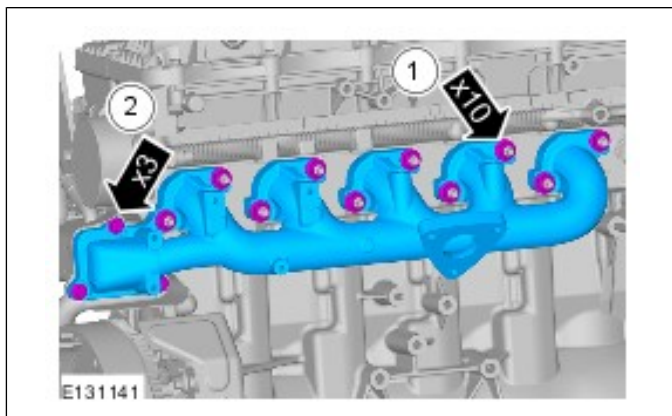
1. To install, reverse the removal procedure.

### 10. CAUTIONS:

**⚠ Make sure that new nuts are installed.**

**⚠ Make sure that new bolts are installed.**

1. Torque: 40 Nm
2. Torque: 23 Nm



11. **⚠ CAUTION:** Make sure that new studs are installed.

## REMOVAL AND INSTALLATION

## Valve Cover(21 141 0)

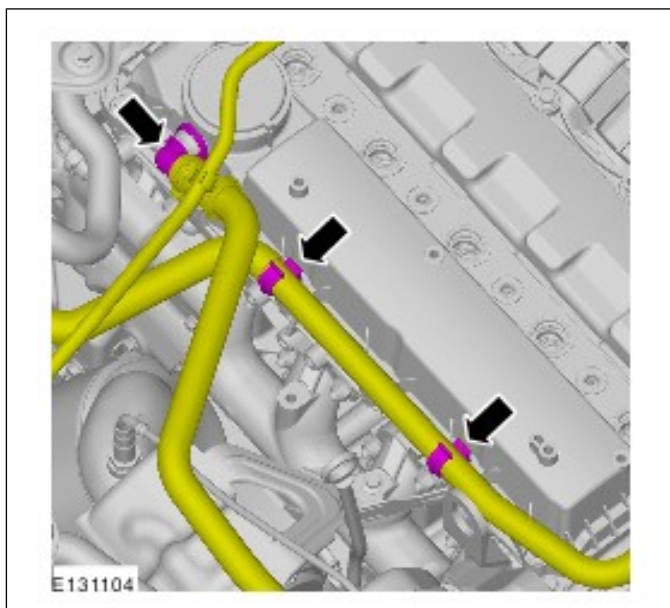
## Removal

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

1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

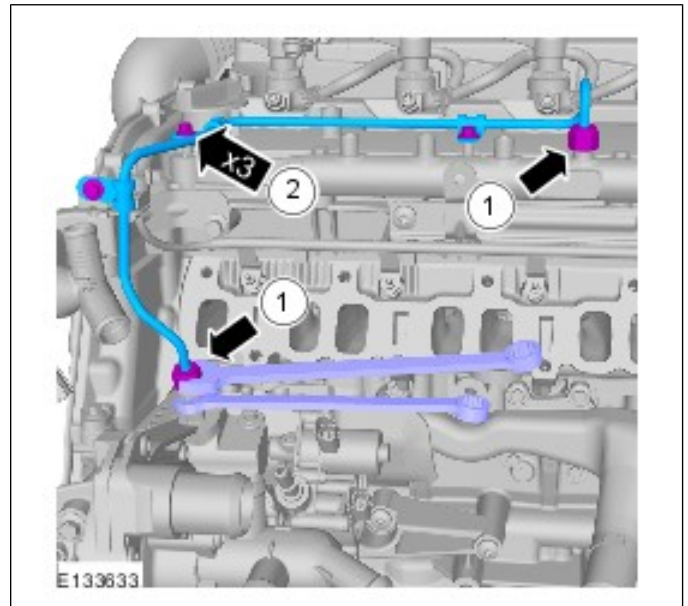
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

2.

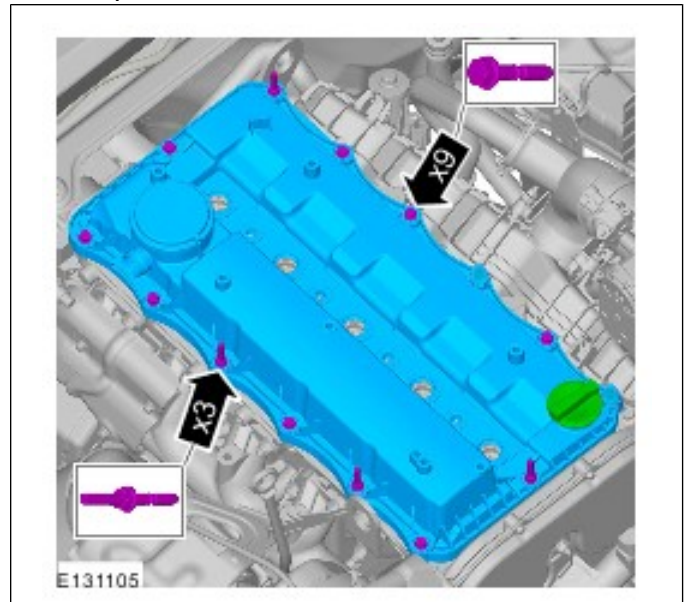


3. Refer to: [Fuel Injectors](#) (303-04 Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

4. 1. Torque:
  - Stage 1: 5 Nm
  - Stage 2: 35 Nm
2. Torque: 10 Nm

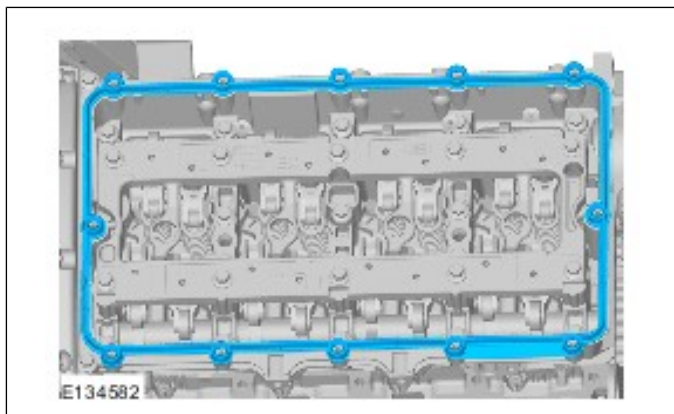


5. Torque: 10 Nm



## REMOVAL AND INSTALLATION

6. **NOTE:** The gasket is to be reused unless damaged.



### Installation



1. To install, reverse the removal procedure.



## REMOVAL AND INSTALLATION

## Camshafts(21 284 0)

## Special Tool(s) / General Equipment

	100-010 Remover, O-Ring Seal
	303-1587 Timing Tool, Crankshaft
2 mm Punch	
6 mm Drill Bit	

## Removal

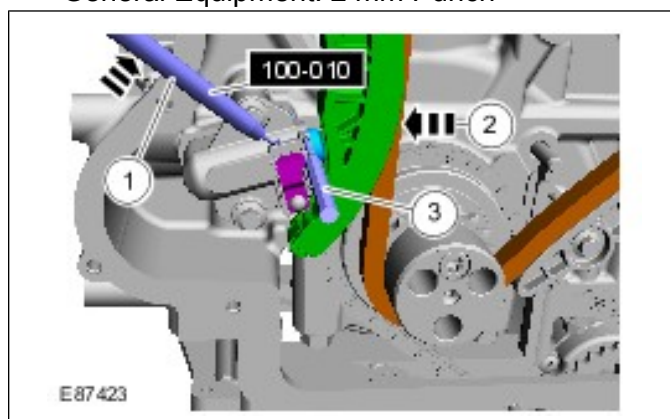
**WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

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

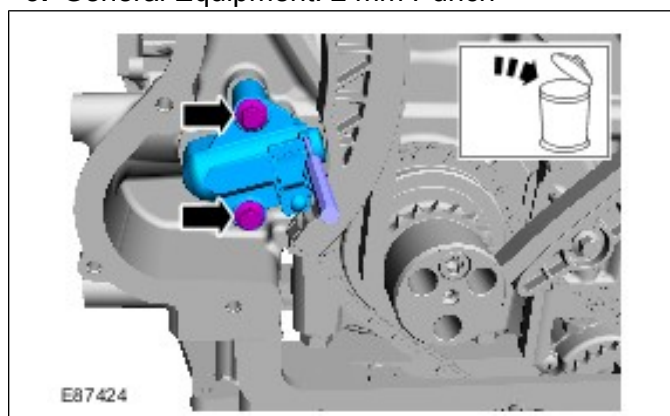
1. Refer to: [Fuel Rail](#) (303-04 Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).  
Refer to: [Valve Cover](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).  
Refer to: [Timing Cover](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).  
Refer to: [Brake Vacuum Pump - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (206-07 Power Brake Actuation, Removal and Installation).

2. Special Tool(s): 100-010

General Equipment: 2 mm Punch

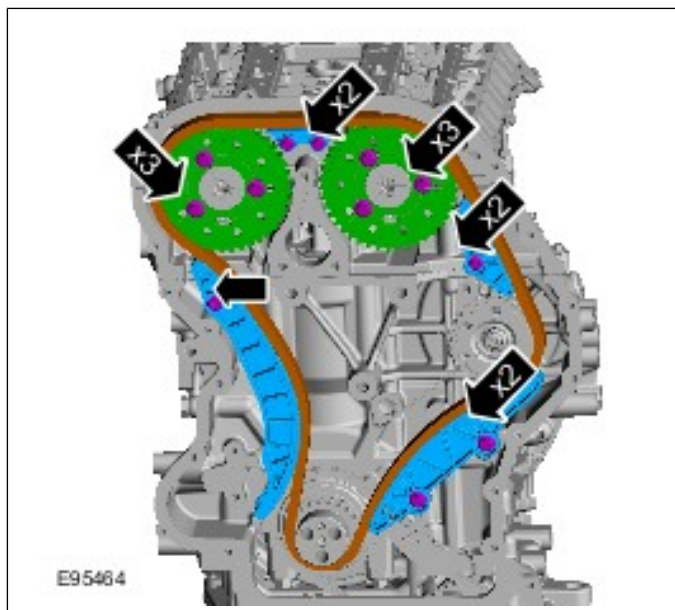


3. General Equipment: 2 mm Punch



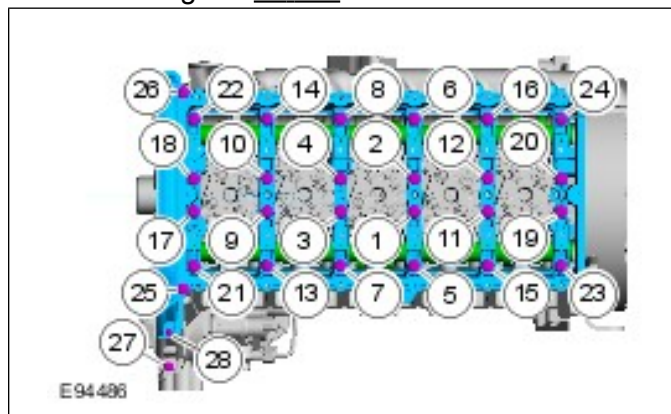
## REMOVAL AND INSTALLATION

4.

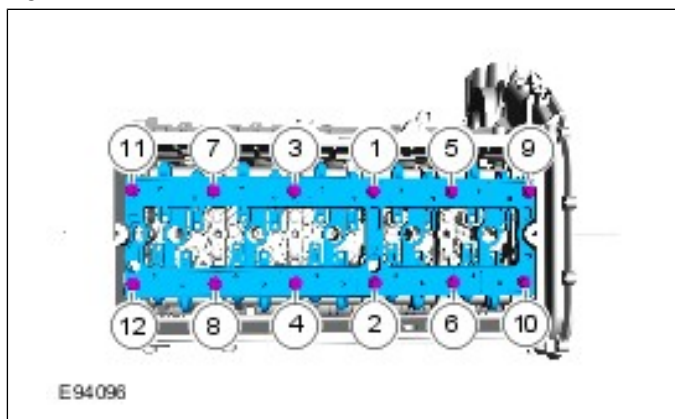


Torque:

- Bolts 1 to 26
  - Stage 1: 3,5 Nm
  - Stage 2: 15 Nm
  - Stage 3: 23 Nm
- Bolts 27 and 28
  - Stage 1: 3,5 Nm
  - Stage 2: 7,5 Nm
  - Stage 3: 10 Nm



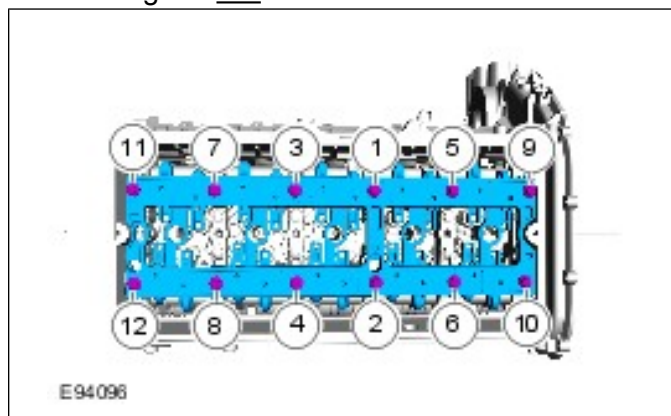
5.



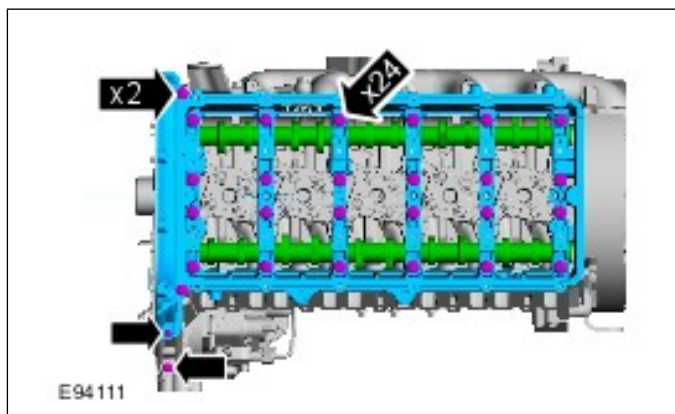
**2. NOTE:** Make sure that the rocker arms do not separate.

Torque:

- Stage 1: 10 Nm
- Stage 2: 30°

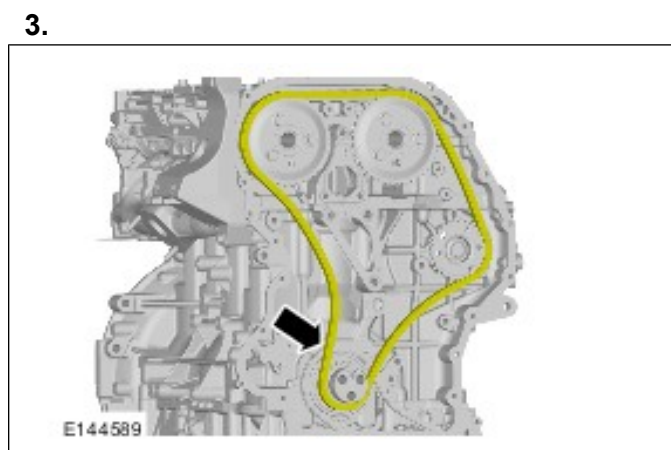


6.



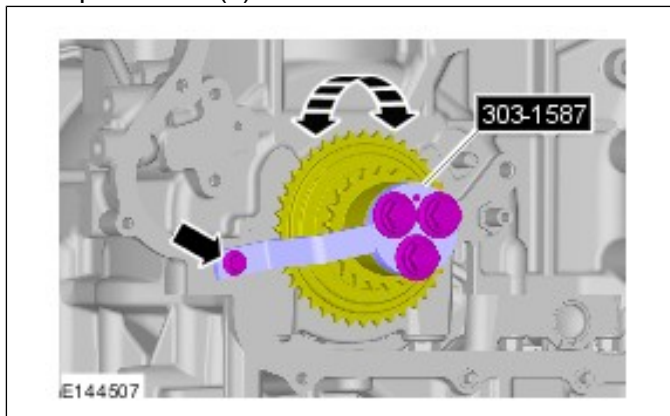
## Installation

- 1. NOTE:** Clean the mating faces of the camshaft carrier and the cylinder head.



## REMOVAL AND INSTALLATION

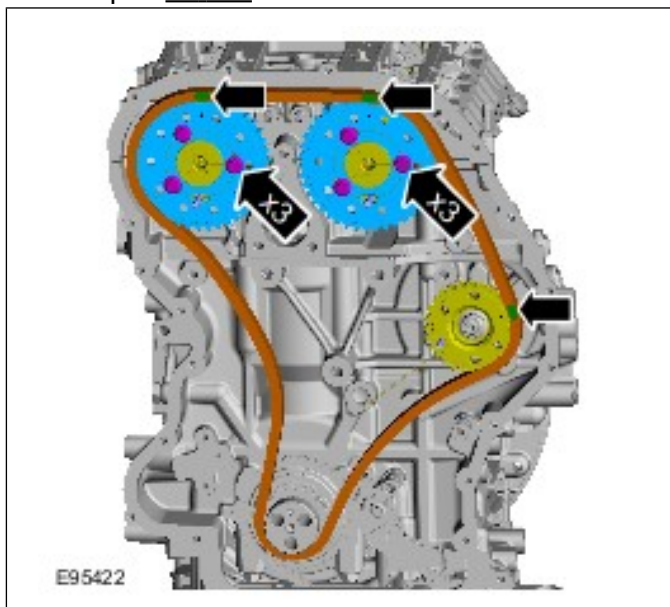
4. Special Tool(s): 303-1587



5. **NOTE:** Make sure that the installation marks are aligned.

General Equipment: 6 mm Drill Bit

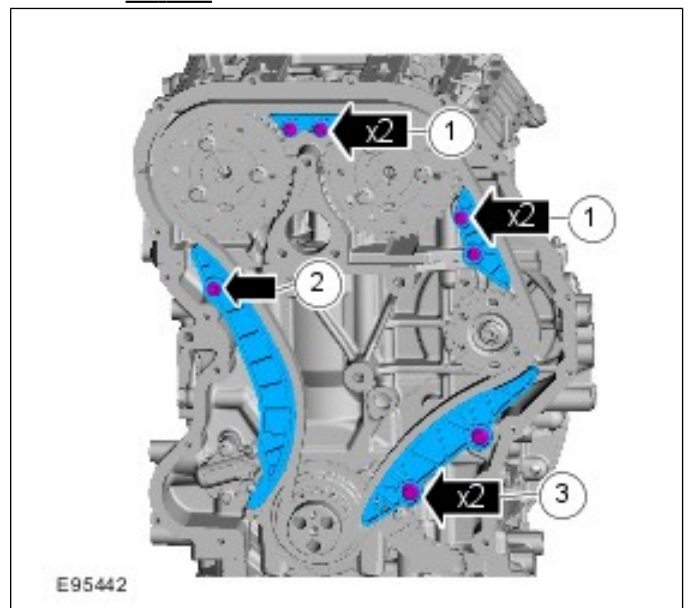
Torque: 33 Nm



6. Remove the 6 mm drill bit.

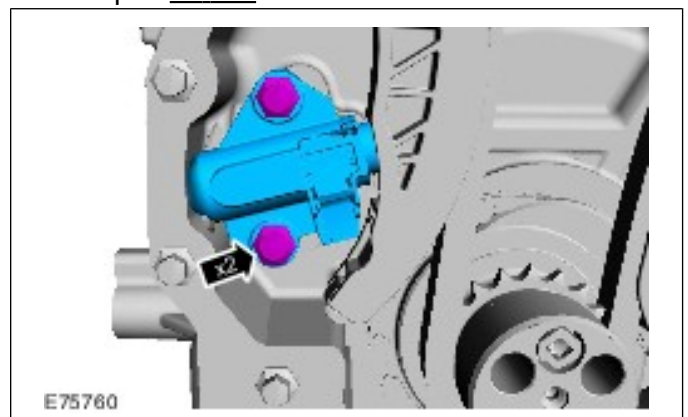
7. Torque:

- 1 15 Nm
- 2 40 Nm
- 3 40 Nm

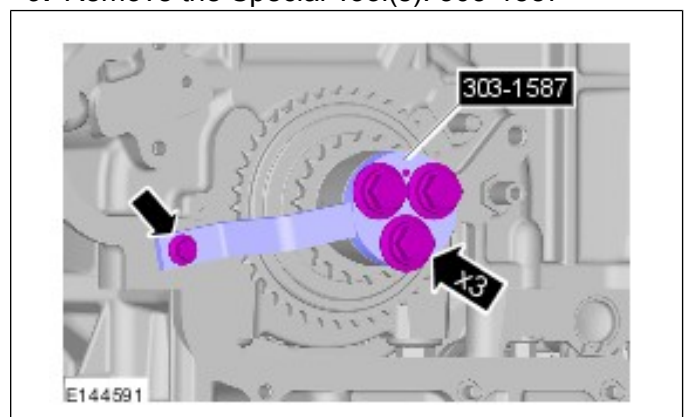


8. **NOTE:** Make sure that a new component is installed.

Torque: 15 Nm

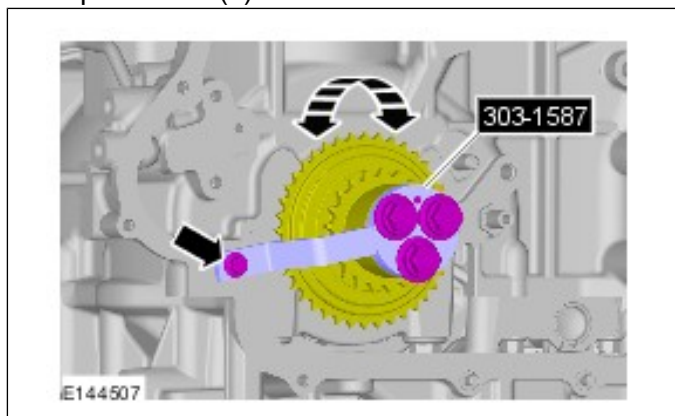


9. Remove the Special Tool(s): 303-1587



10. Rotate the engine two revolutions.



**REMOVAL AND INSTALLATION****11. Special Tool(s): 303-1587****15. Refer to: [Brake Vacuum Pump - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (206-07 Power Brake Actuation, Removal and Installation).**

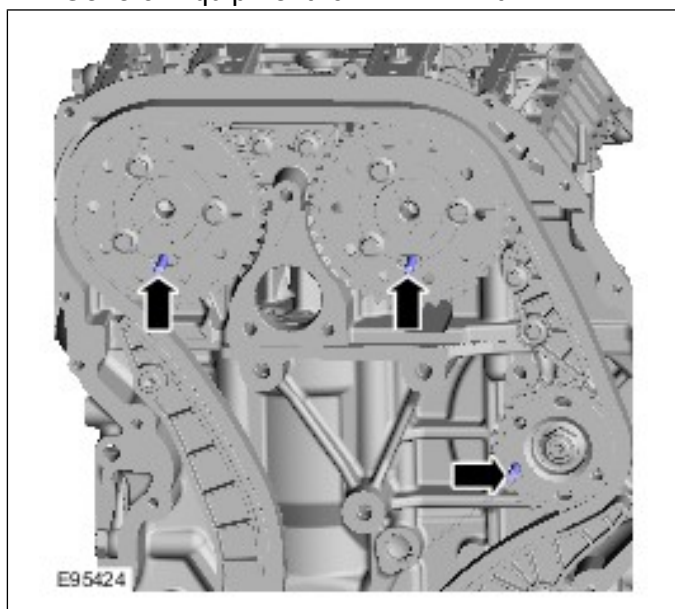
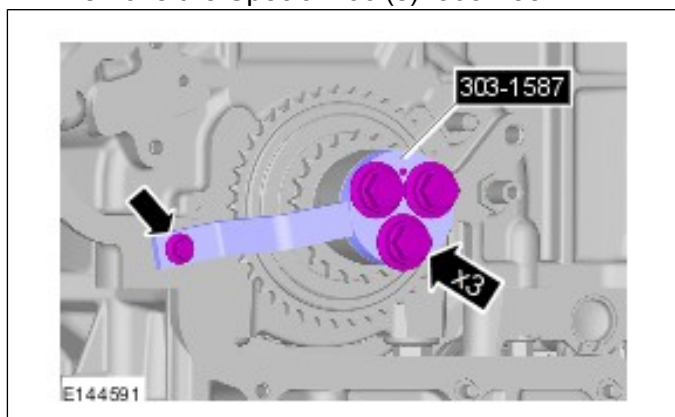
Refer to: [Timing Cover](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Valve Cover](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Fuel Rail](#) (303-04 Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

**12. Check the valve timing by inserting the drill bits.  
If the drill bits cannot be inserted repeat the timing steps.**

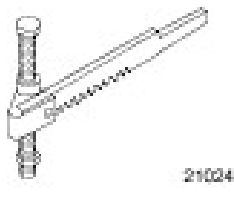

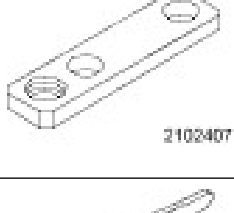

General Equipment: 6 mm Drill Bit

**13. Remove the 6 mm drill bits.****14. Remove the Special Tool(s): 303-1587**

REMOVAL AND INSTALLATION

Valves

Special Tool(s)

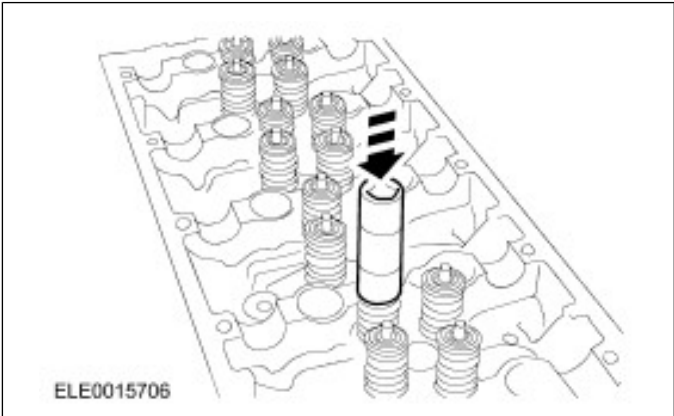
 21024	303-060 Compressor, Valve Spring
 2102405	303-060-05 Adapter for 303-060
 2102407	303-060-07 Adapter for 303-060
 21156	303-362 Installer, Valve Stem Collets

Removal

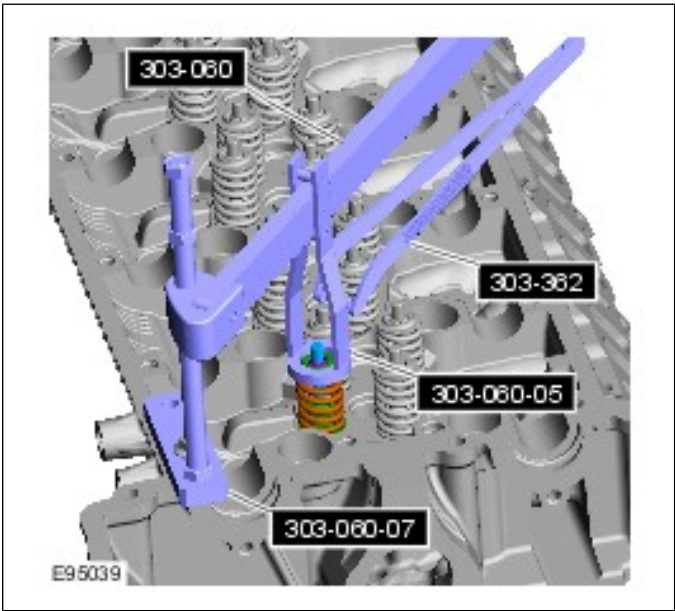
**NOTE:** Removal steps in this procedure may contain installation details.

1. Refer to: [Cylinder Head](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

2. **NOTE:** Position a socket on the valve spring seat and gently strike it with a hammer.

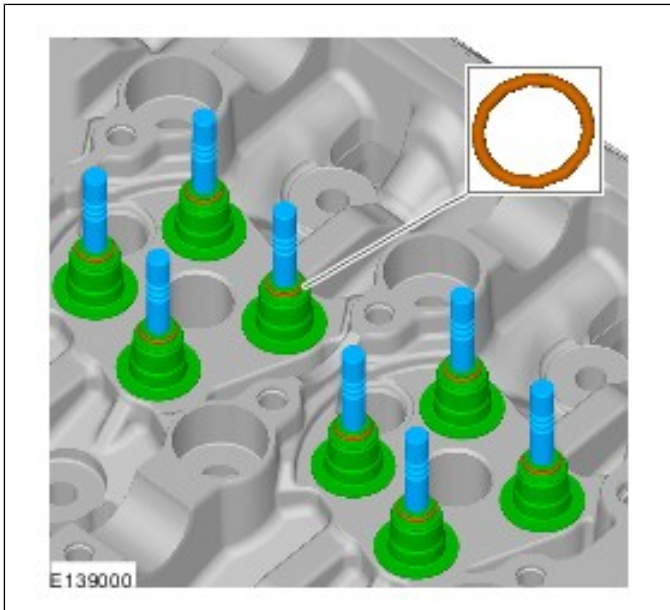


3. Special Tool(s): 303-060, 303-060-05, 303-060-07, 303-362



**REMOVAL AND INSTALLATION**

4.

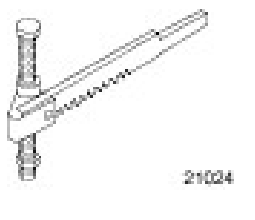
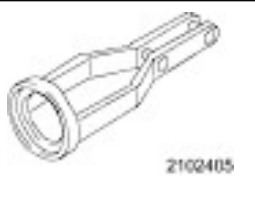
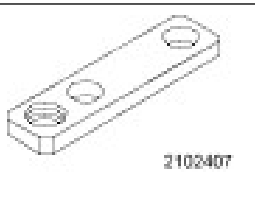
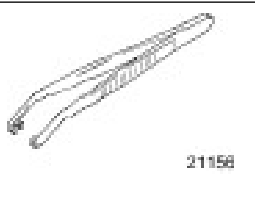
**Installation**

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Valve Springs

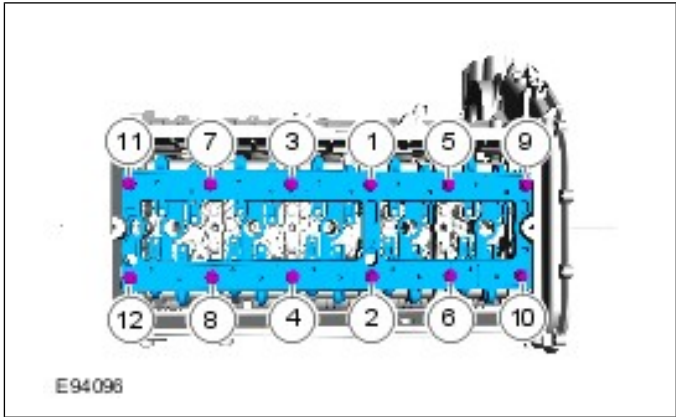
Special Tool(s)

 21024	303-060 Compressor, Valve Spring
 2102405	303-060-05 Adapter for 303-060
 2102407	303-060-07 Adapter for 303-060
 21156	303-362 Installer, Valve Stem Collets

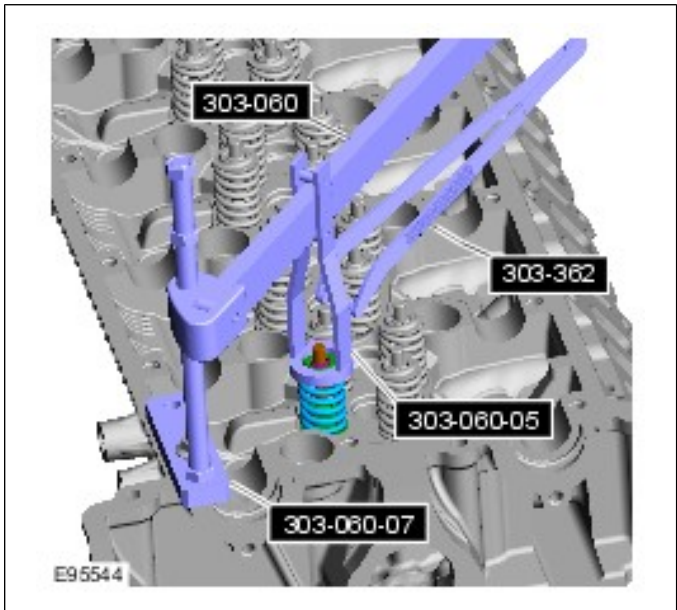
Removal

1. Refer to: [Valve Cover](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
4. Special Tool(s): 303-060, 303-060-05, 303-060-07, 303-362

2.



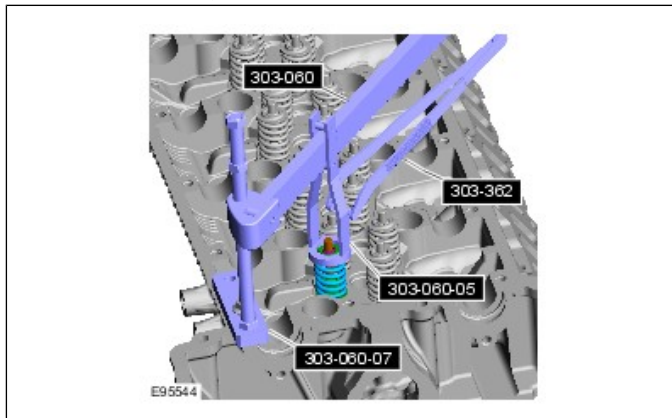
3. Position the appropriate piston at top dead center (TDC).



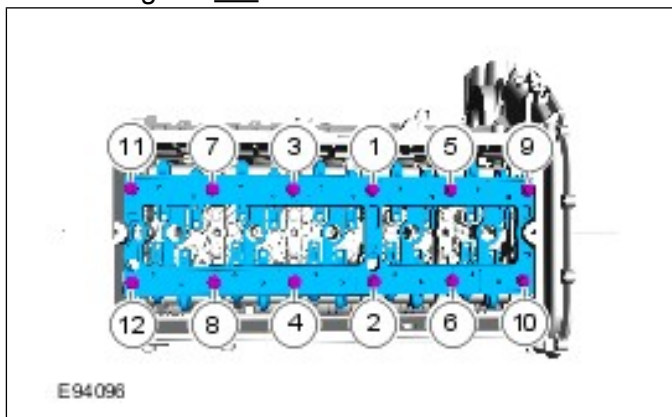
## REMOVAL AND INSTALLATION

### Installation

1. Special Tool(s): 303-060, 303-060-05, 303-060-07, 303-362



2. Torque:
  - Stage 1: 10 Nm
  - Stage 2: 30°




3. Refer to: [Valve Cover](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

## REMOVAL AND INSTALLATION

### Valve Stem Seals(21 238 0)

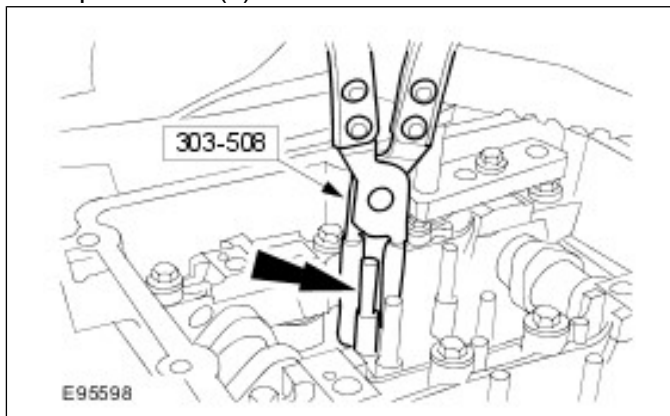
#### Special Tool(s)

	303-508 Pliers, Valve Stem Seal
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#### Removal

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

1. Refer to: [Valve Springs](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. Special Tool(s): 303-508



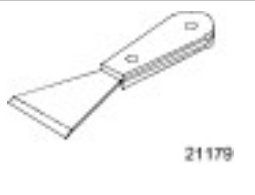
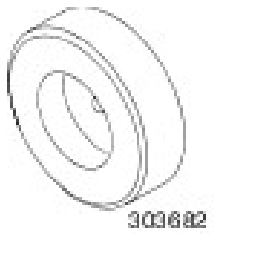
#### Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Timing Cover(21 146 0)

Special Tool(s)

 21179	303-428 Separator, Oil Pan
 303682	303-682 Aligner, Engine Front Cover

Materials

Name	Specification
Silicone Sealant LB 2U7J-M4G323-AA	WSE-M4G323-A4
Silicone Gasket and Sealant TA-30	

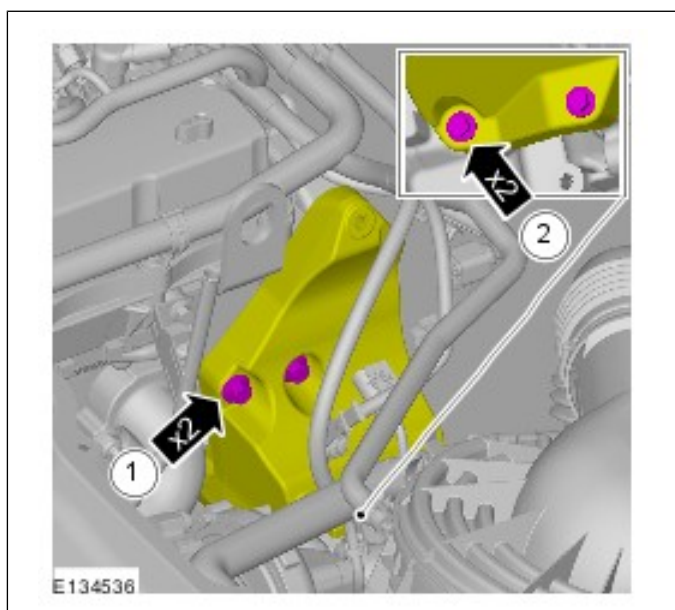
Removal

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

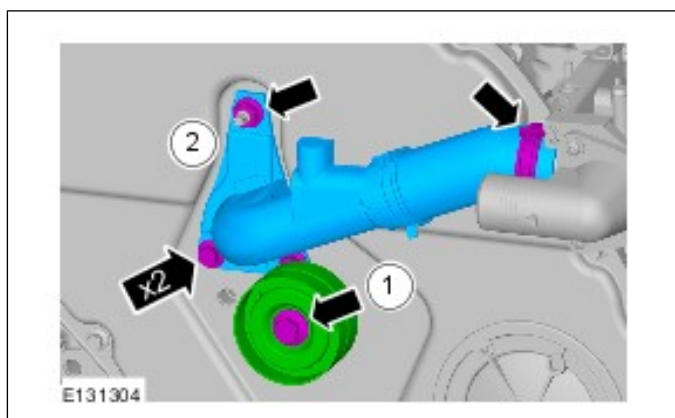


## REMOVAL AND INSTALLATION

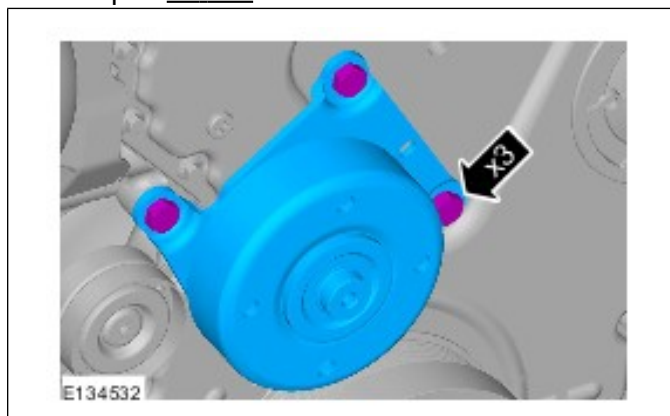
1. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Cooling Fan Motor and Shroud](#) (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
3. Refer to: [Generator - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (414-02 Generator and Regulator, Removal and Installation).
4. 1. Torque: 35 Nm  
2. Torque: 35 Nm



5. 1. Torque: 48 Nm  
2. Torque: 23 Nm

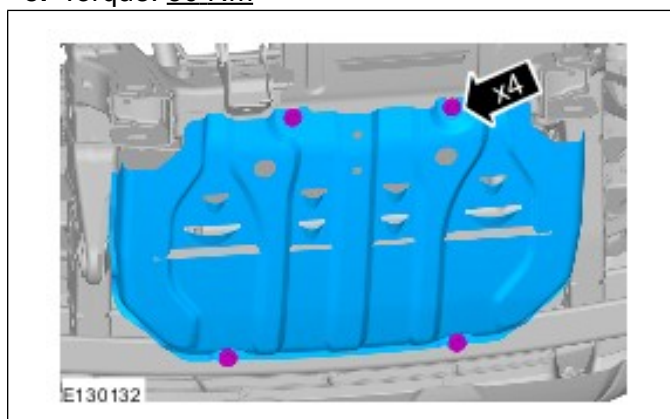


6. Torque: 48 Nm



7. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

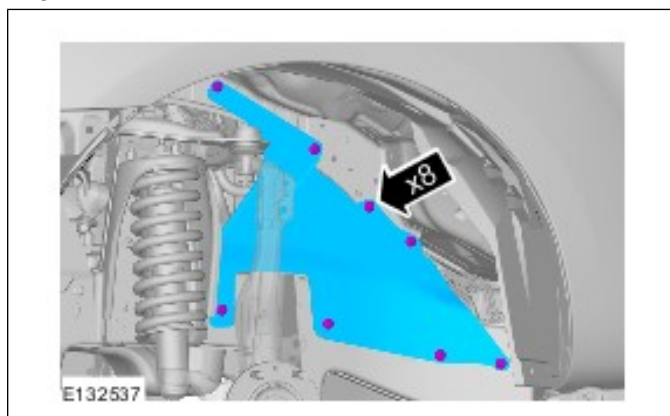
8. Torque: 30 Nm



9. **NOTE:** Remove front RH side wheel only.

Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

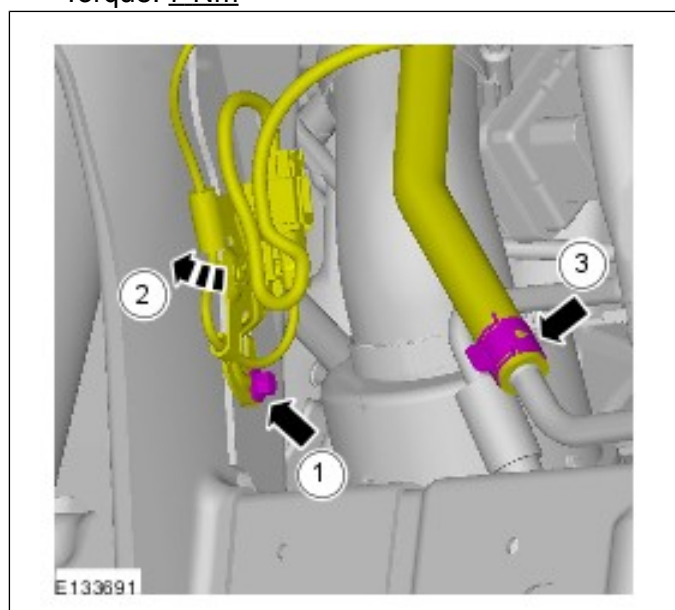
- 10.



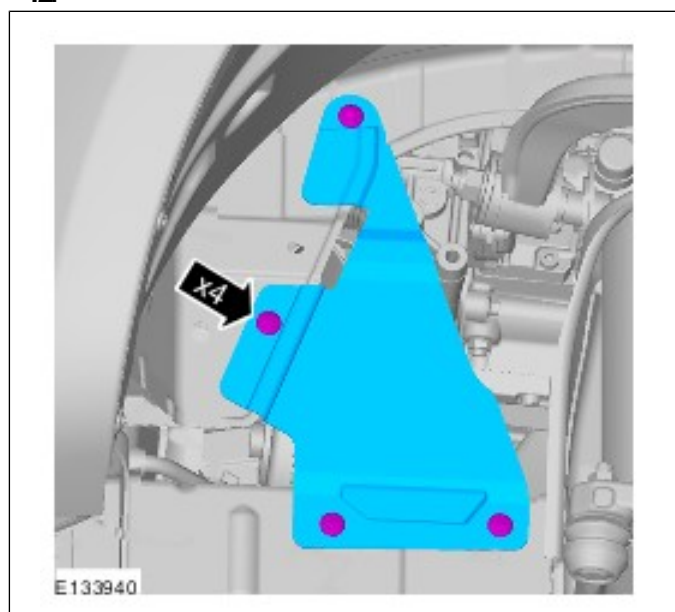
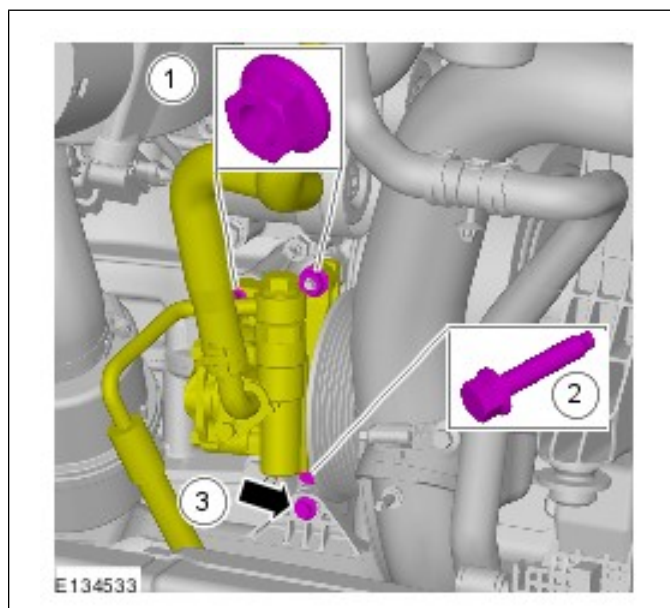
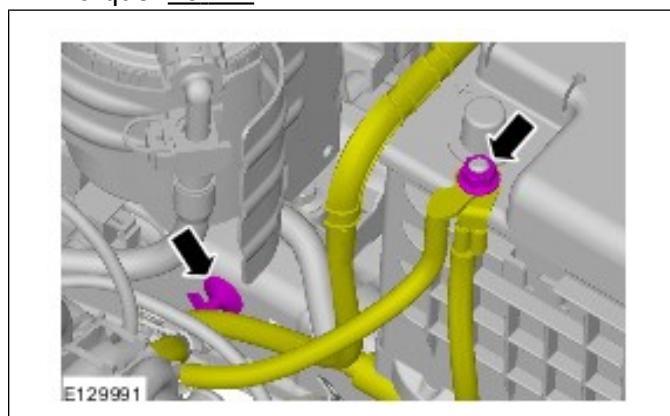
11. **CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.



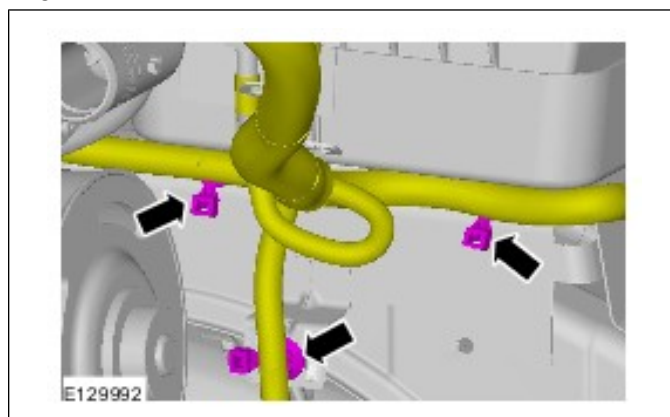
## REMOVAL AND INSTALLATION

Torque: 7 Nm

12

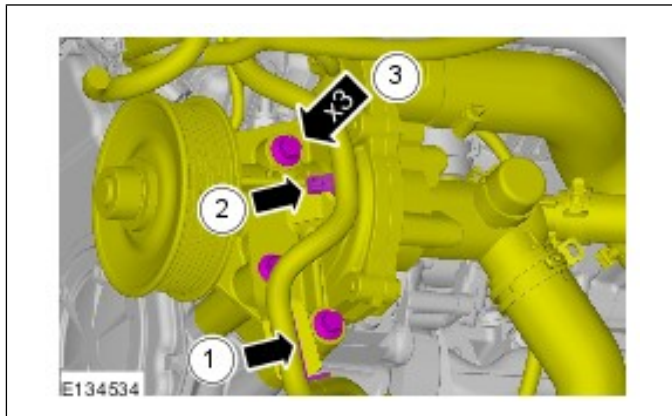
13. 1. Torque: 20 Nm2. Torque: 20 Nm3. Torque: 18 Nm14. Torque: 10 Nm

15.

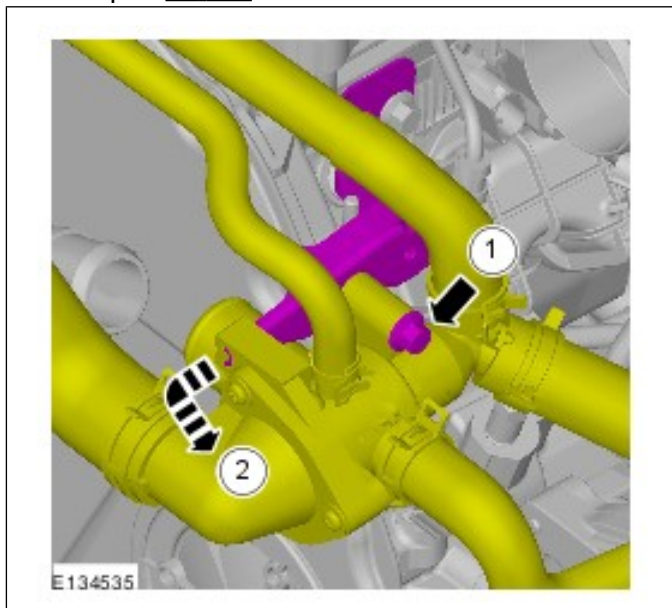


## REMOVAL AND INSTALLATION

16. 3. Torque: 23 Nm

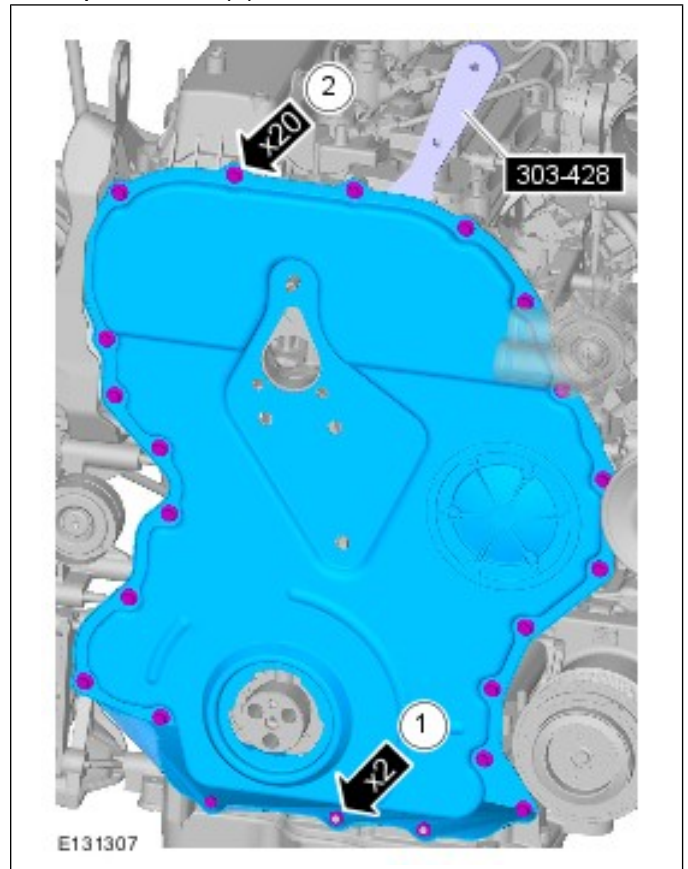


17. Torque: 23 Nm



18. Refer to: [Engine Front Seal](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

19. Special Tool(s): 303-428



## Installation

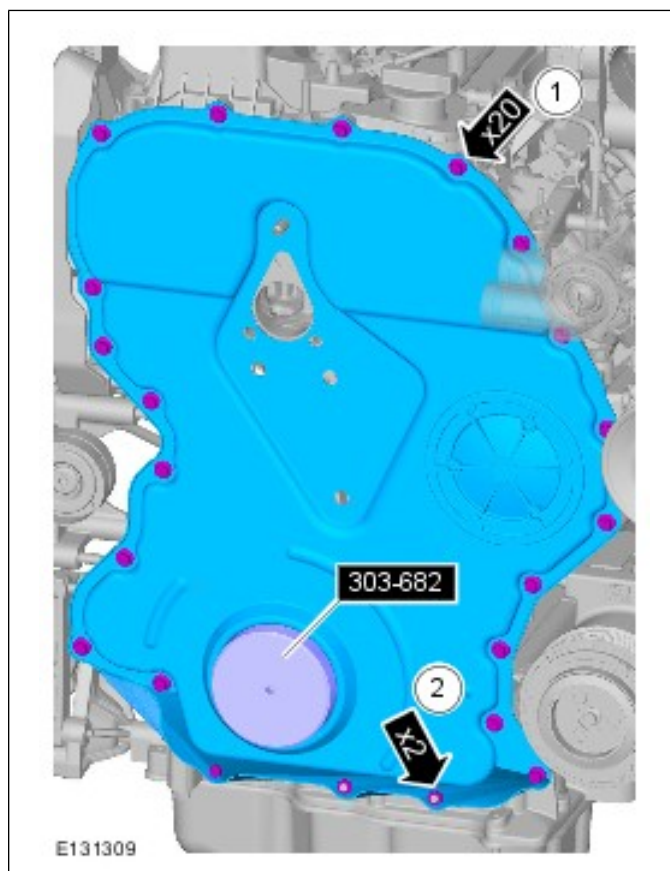
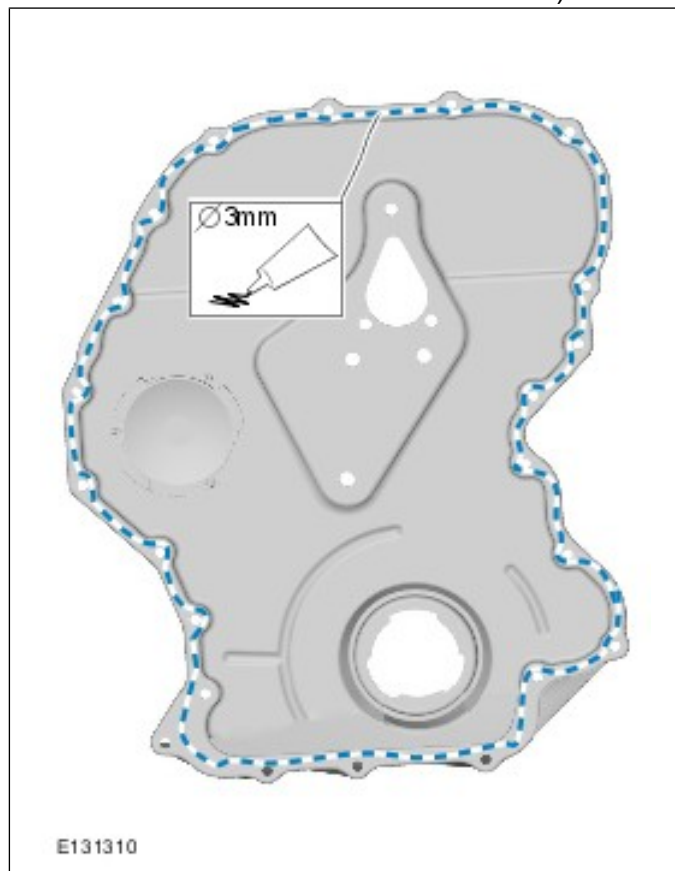
1. **CAUTION:** Install the timing cover within five minutes of applying the sealer.

**NOTE:** Do not damage the mating faces.

**REMOVAL AND INSTALLATION**

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)

2. 1. Special Tool(s): 303-682  
Torque: 10 Nm
2. Torque: 14 Nm

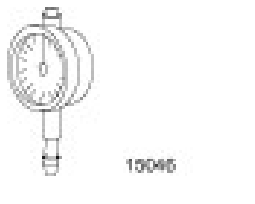
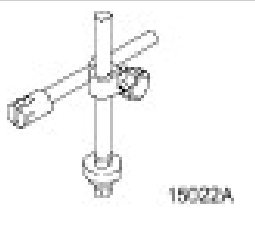



3. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Cylinder Head(21 163 0)

Special Tool(s)

	205-069 Dial Indicator Gauge (Metric)
	205-070 Holding Fixture, Dial Indicator Gauge
	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion)

Removal

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



## REMOVAL AND INSTALLATION

1. Refer to: [Intake Manifold](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

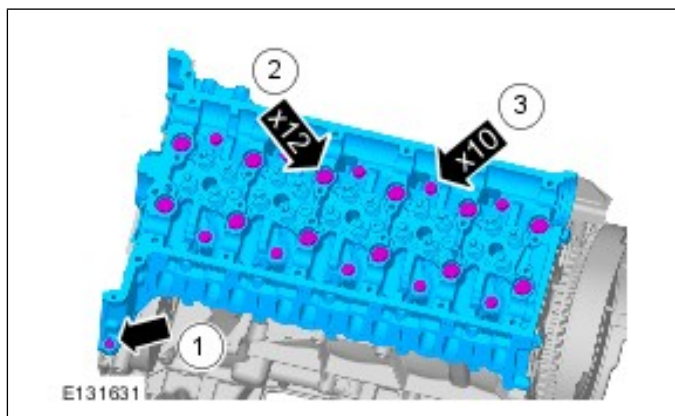
Refer to: [Brake Vacuum Pump - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (206-07 Power Brake Actuation, Removal and Installation).

Refer to: [Exhaust Gas Recirculation \(EGR\) Cooler - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-08 Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Exhaust Manifold](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Camshafts](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

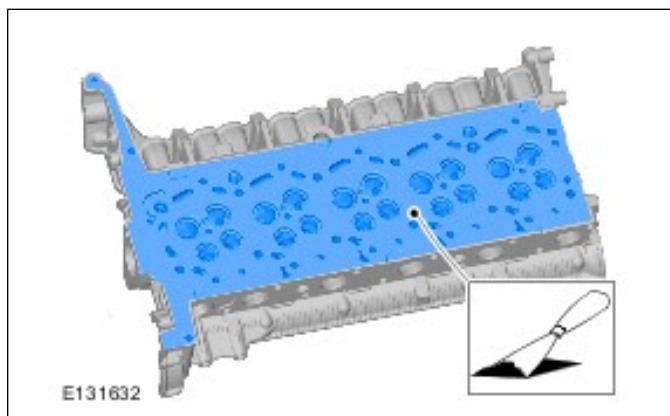
2.



### Installation

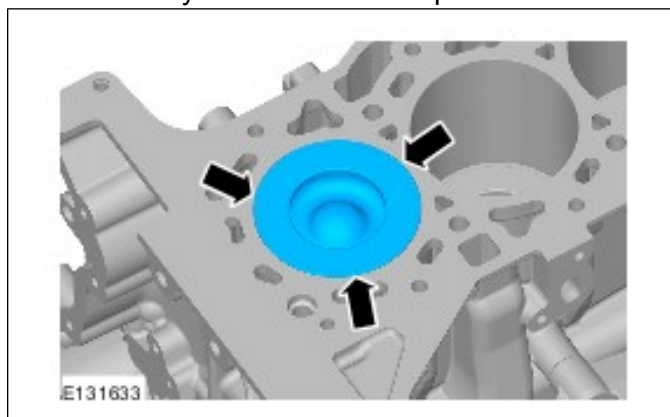
1. **WARNING:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak

paths. Use a plastic scraping tool to remove all traces of the head gasket.



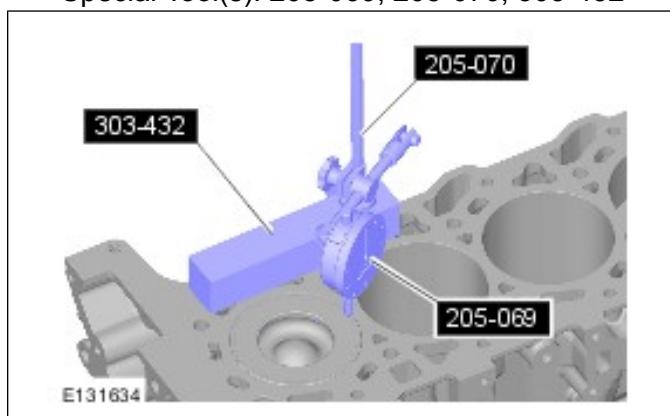
2. **NOTE:** Measure the piston protrusion of each cylinder at top dead center (TDC).

Measure the distance between the piston crown and the cylinder block at the points indicated.



3. **NOTE:** The largest measurement determines the choice of the cylinder head gasket.

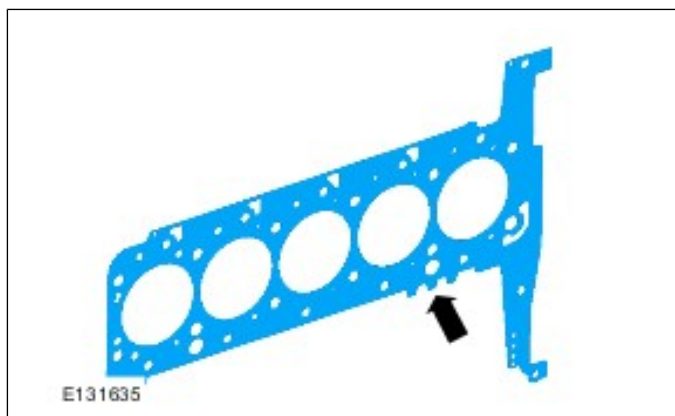
Special Tool(s): 205-069, 205-070, 303-432



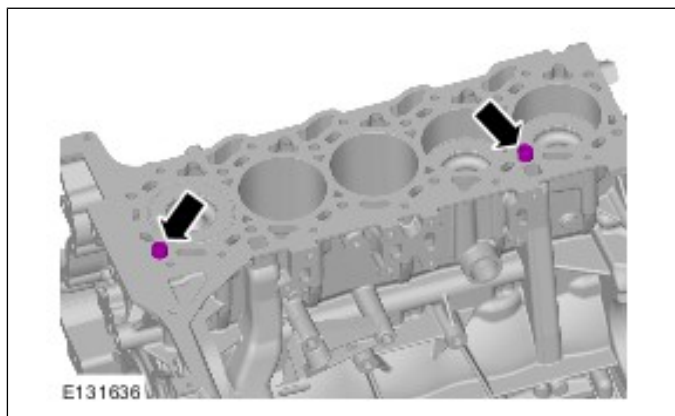
4. **NOTE:** Note the thickness of the gasket.

## REMOVAL AND INSTALLATION

**NOTE:** Make sure that a new component is installed.



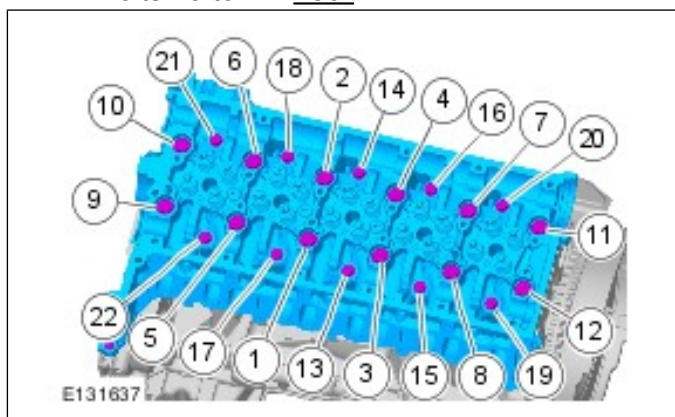
5.



6. **CAUTION:** Make sure that new cylinder head bolts are installed.

Torque:

- Bolts 1 to 12: 10 Nm
- Bolts 13 to 22: 5 Nm
- Bolts 1 to 12: 20 Nm
- Bolts 13 to 22: 10 Nm
- Bolts 1 to 12: 50 Nm
- Bolts 1 to 12: 180°
- Bolts 13 to 22: 25 Nm
- Bolts 13 to 22: 180°



7. Refer to: [Camshafts](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Exhaust Manifold](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Exhaust Gas Recirculation \(EGR\) Cooler - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-08 Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Refer to: [Brake Vacuum Pump - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (206-07 Power Brake Actuation, Removal and Installation).

Refer to: [Intake Manifold](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

REMOVAL AND INSTALLATION

Oil Pan(21 154 0)

Special Tool(s)

	303-428 Separator, Oil Pan
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Materials

Name	Specification
Silicone Sealant LB 2U7J-M4G323-AA	WSE-M4G323-A4
Silicone Gasket and Sealant TA-30	

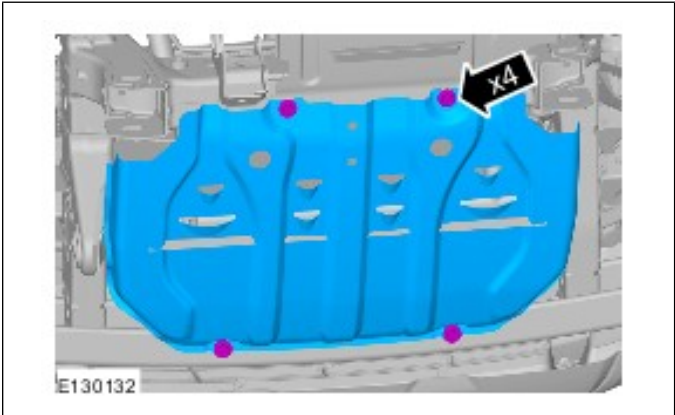
Removal

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

1. Refer to: [Engine Cooling System Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

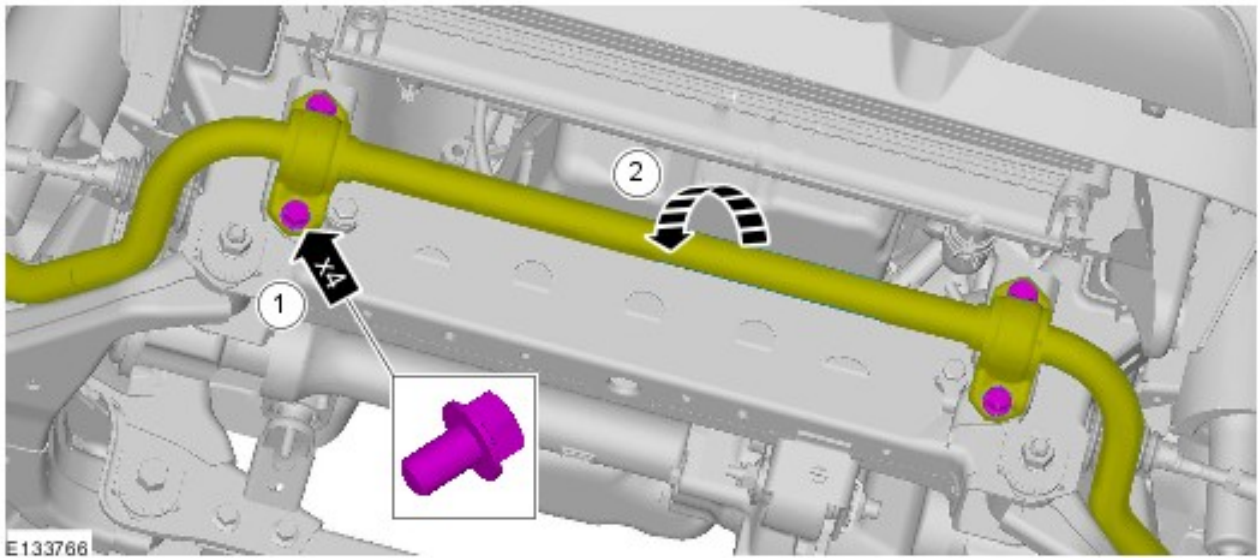
4x4

4. Torque: 30 Nm



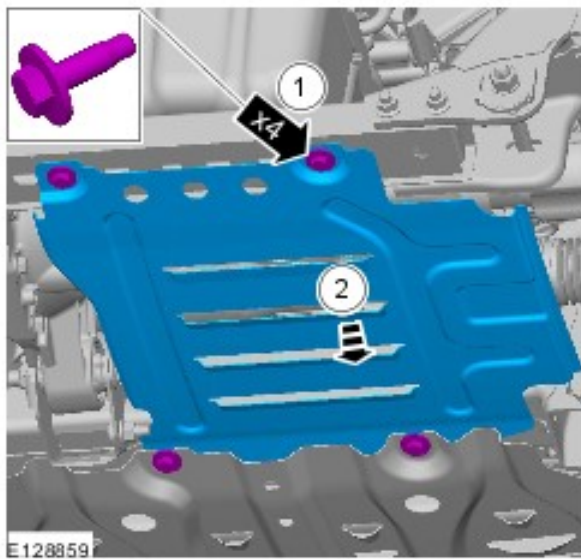
5. Torque: 30 Nm

## REMOVAL AND INSTALLATION

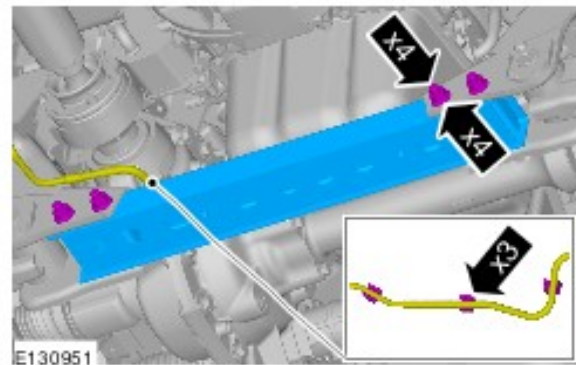


All vehicles

6. Torque: 30 Nm



7. Torque: 35 Nm

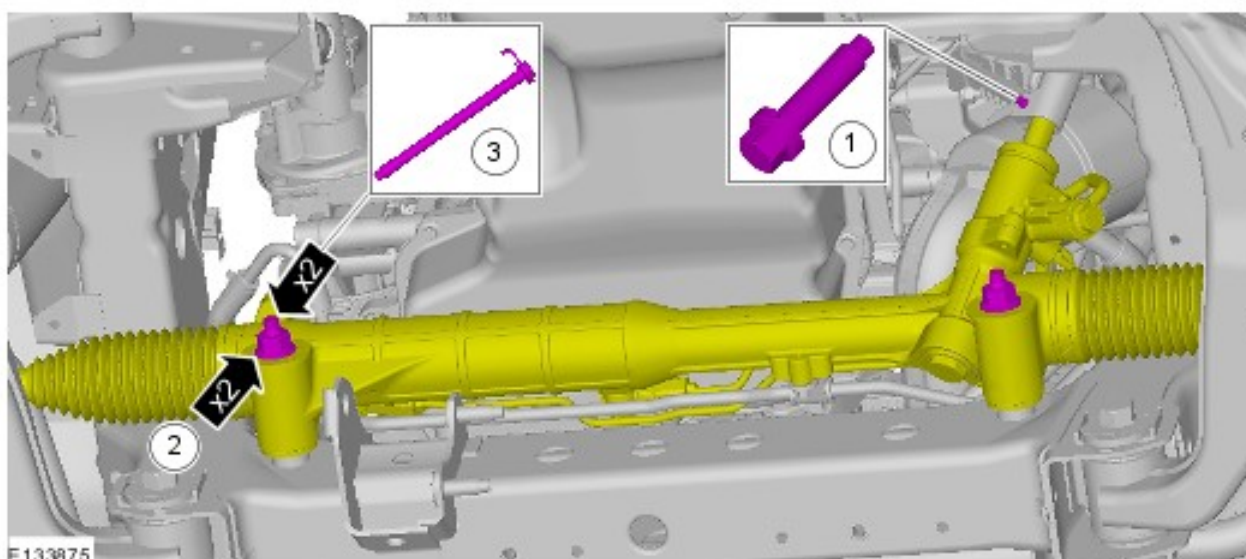


8. **⚠ CAUTION:** Take extra care when handling steering gear rack.

1. Torque: 23 Nm
2. Torque: 150 Nm

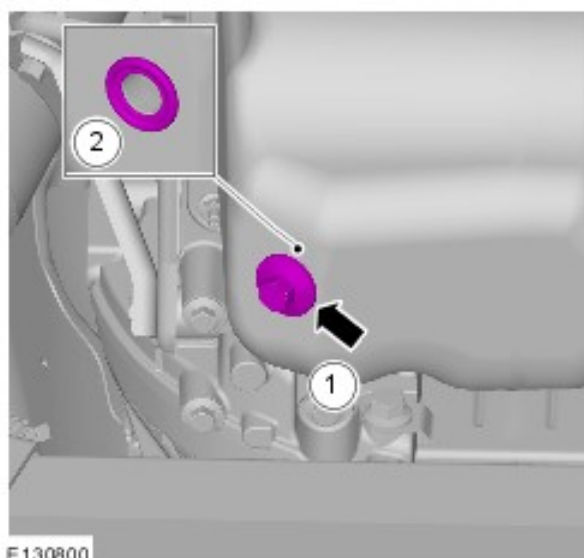


## REMOVAL AND INSTALLATION

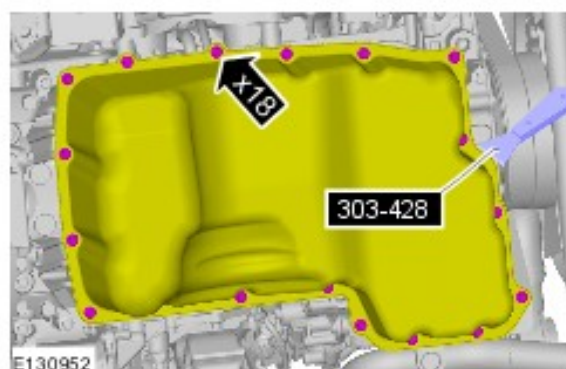


9. **⚠ WARNING: Be prepared to collect escaping fluids.**

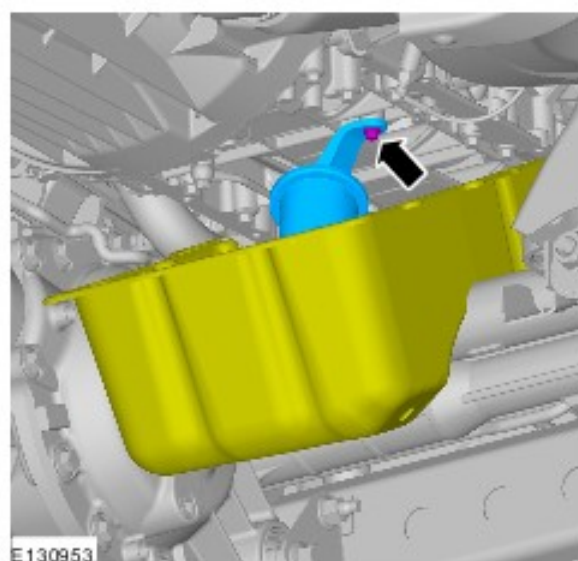
Drain the oil pan into a suitable container.  
Torque: 39 Nm



10. Special Tool(s): 303-428

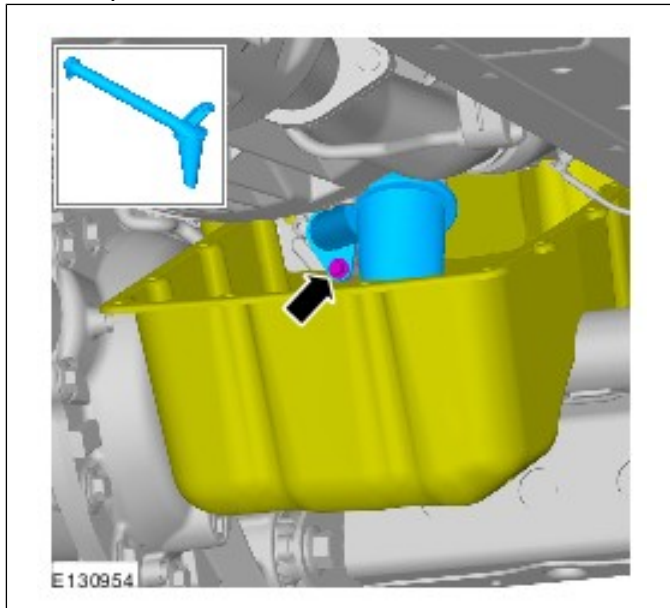


11. Torque: 10 Nm



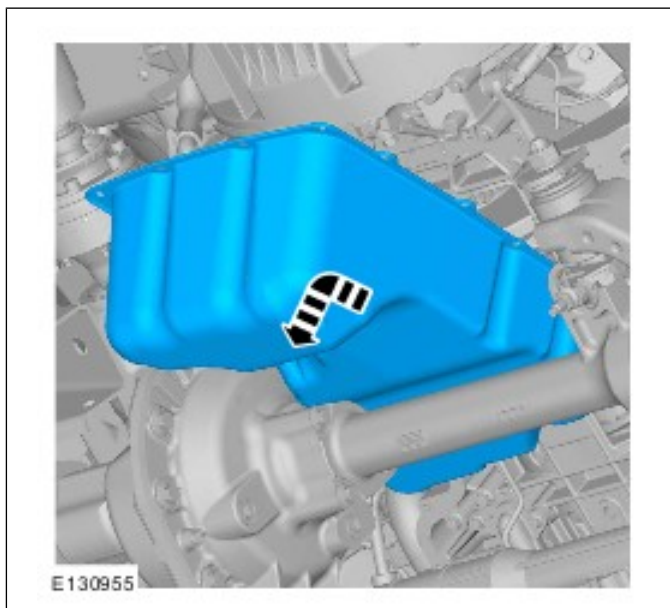
## REMOVAL AND INSTALLATION

12 Torque: 10 Nm



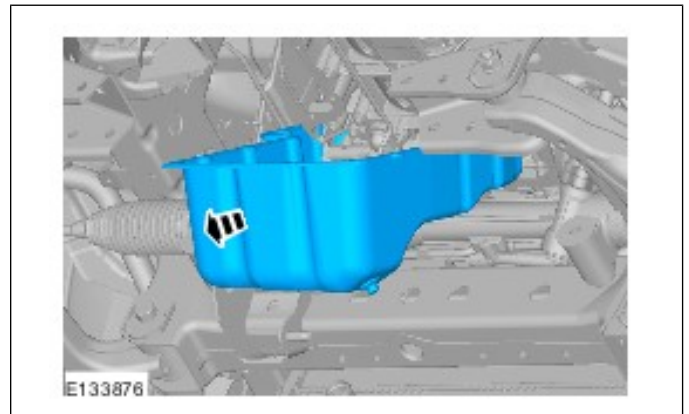
4x4

13.



4x2

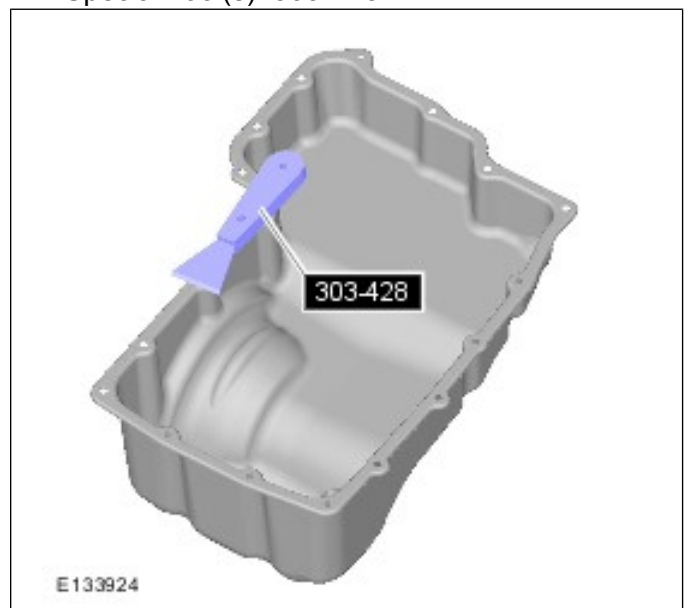
14.



## Installation

1. **NOTE:** Do not damage the mating faces.

Special Tool(s): 303-428

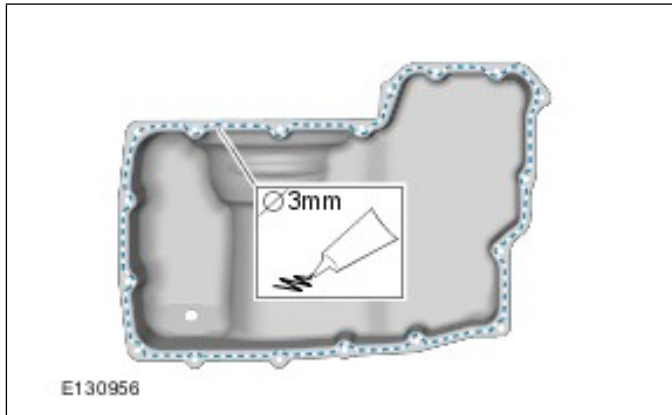


2. **CAUTION:** Install the oil pan within five minutes of applying the sealer.

**NOTE:** Do not damage the mating faces.

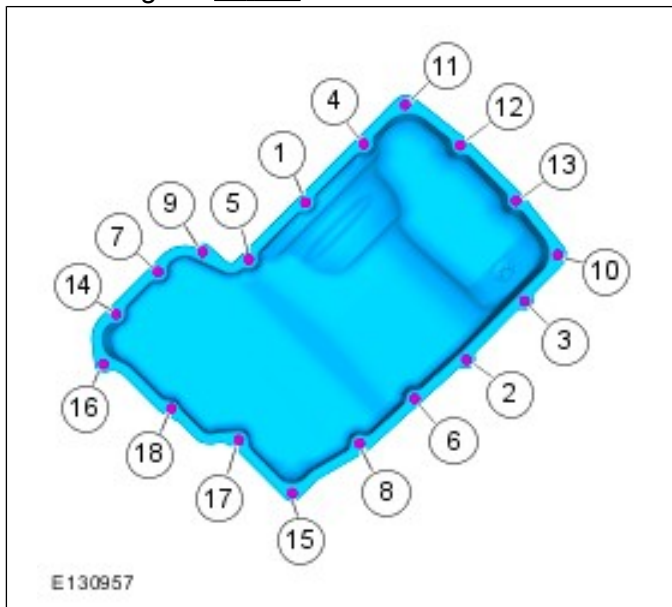
## REMOVAL AND INSTALLATION

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



### 3. Torque:

- Stage 1: 7 Nm
- Stage 2: 14 Nm



4. To install, reverse the removal procedure.

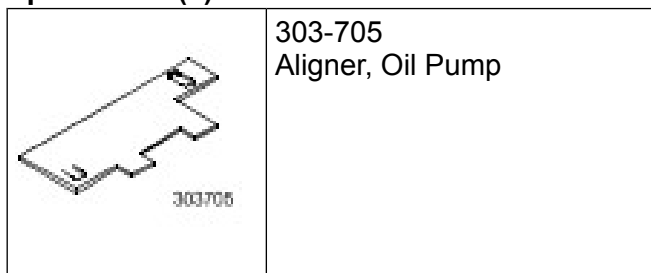
5. Fill the oil pan with clean engine oil.

Refer to: [Specifications](#) (303-01 Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).

## REMOVAL AND INSTALLATION

## Oil Pump(21 714 0)

## Special Tool(s)



## Removal

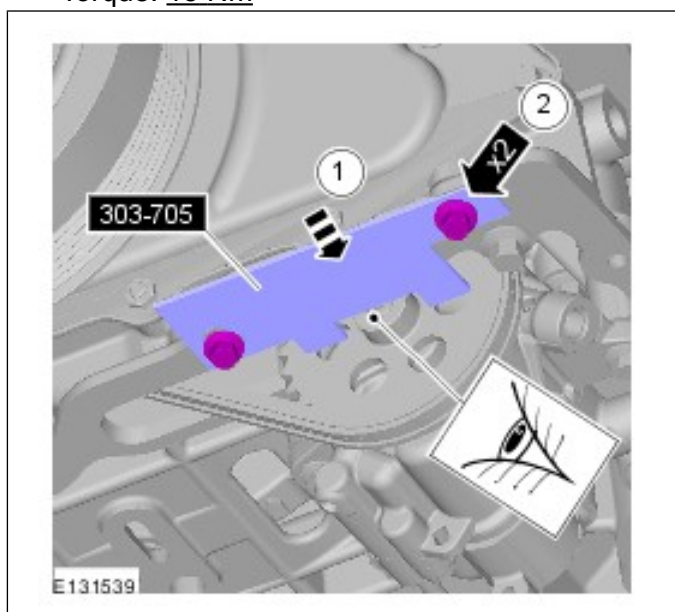
**NOTE:** Removal steps in this procedure may contain installation details.

1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).  
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: [Oil Pan](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

3. Hand tighten the bolts at this stage.

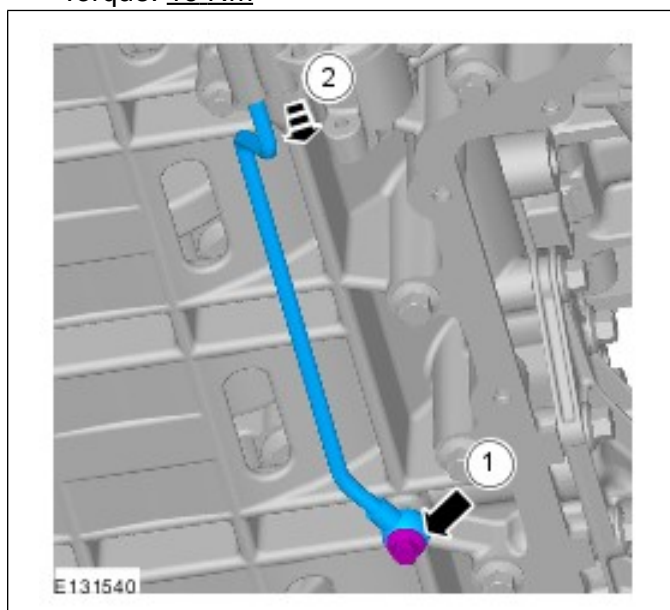
Special Tool(s): 303-705

Torque: 15 Nm



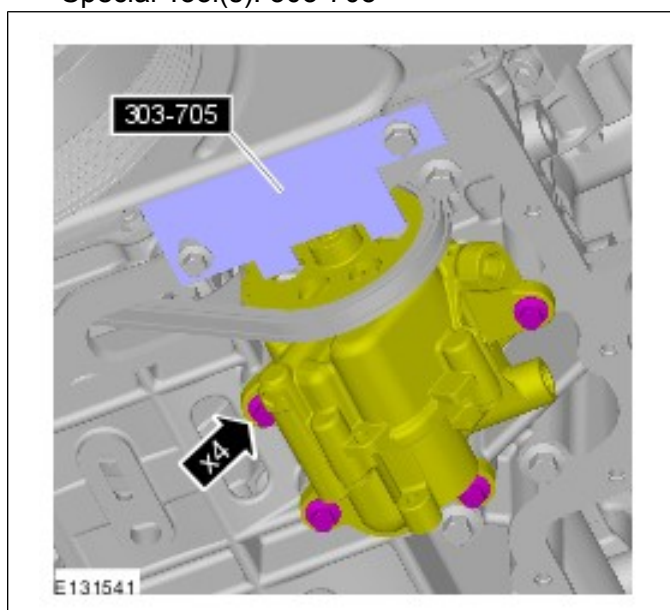
4.  **WARNING:** Be prepared to collect escaping fluids.

Torque: 13 Nm



5. **NOTE:** Do not completely loosen the bolts at this stage.

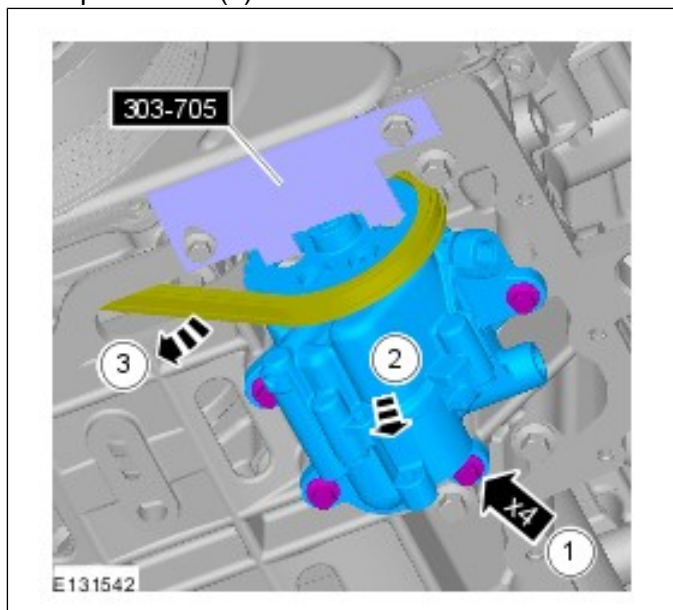
Special Tool(s): 303-705



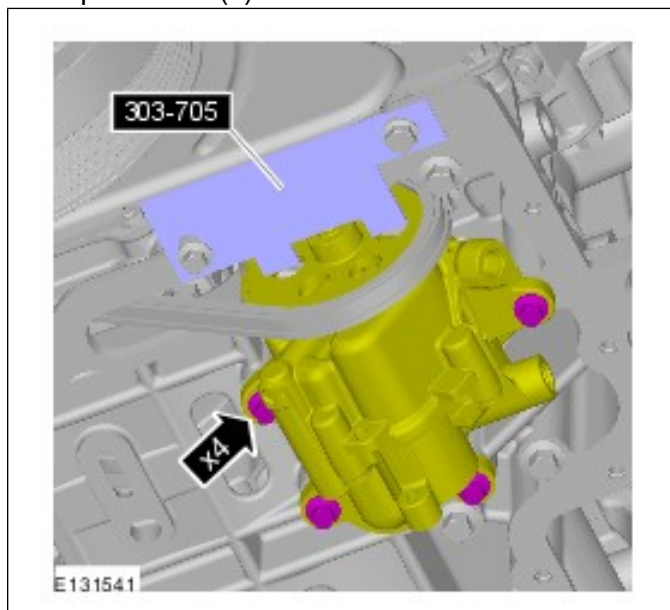


## REMOVAL AND INSTALLATION

## 6. Special Tool(s): 303-705



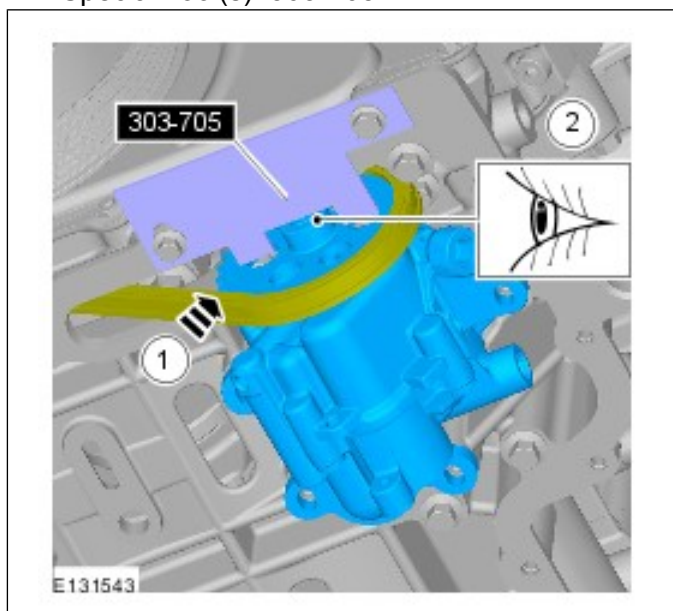
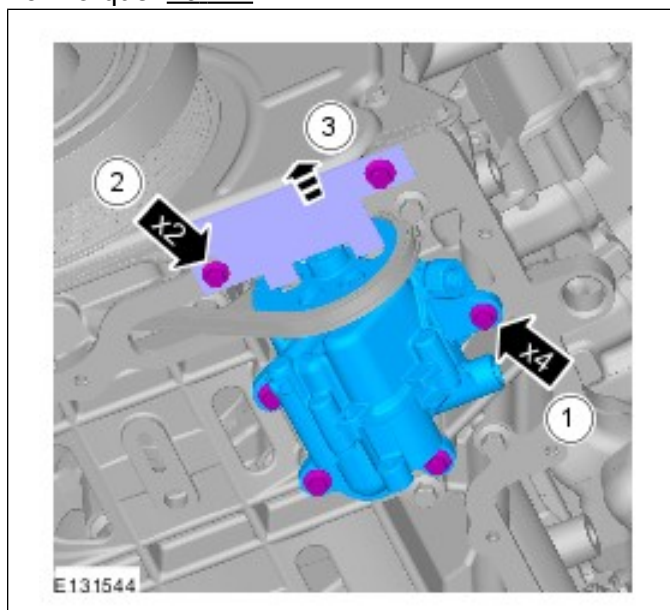
## Special Tool(s): 303-705



## Installation

1. **NOTE:** The profile of the special tool must be in contact with the oil pump sprocket.

Special Tool(s): 303-705

3. Torque: 10 Nm

4. Refer to: [Oil Pan](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).


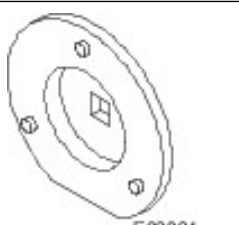
2. **NOTE:** Hand tighten the bolts at this stage.



## REMOVAL AND INSTALLATION

## Engine Front Seal

## Special Tool(s)

 <p>E87614</p>	<p>303-1310 Holding Wrench, Crankshaft</p>
 <p>E62024</p>	<p>303-679A Remover/Installer, Engine Front Cover Inspection Plate</p>

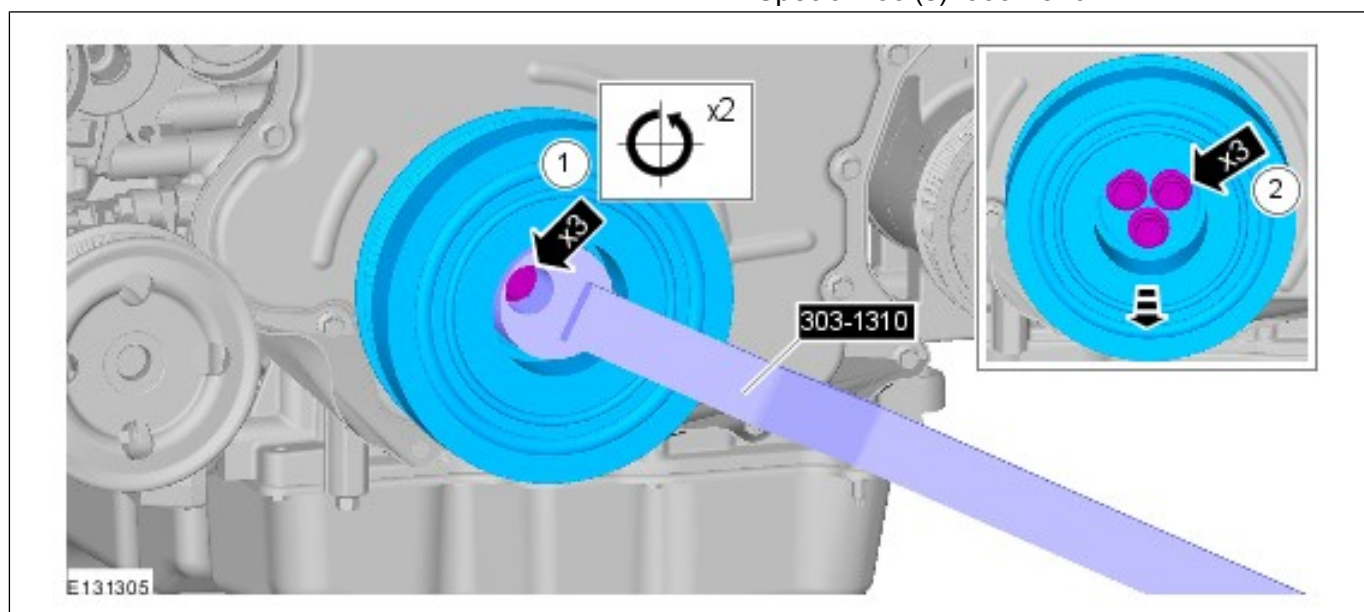
## Removal


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

1. Refer to: [Cooling Fan Motor and Shroud](#) (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

2. 1. Do not completely loosen the crankshaft pulley bolts.

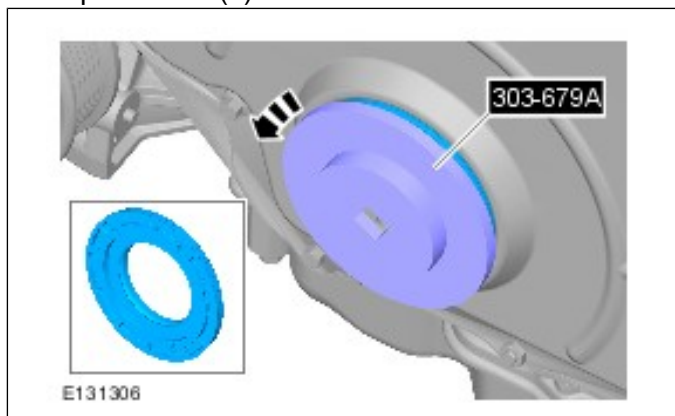
Special Tool(s): 303-1310



3.  **CAUTION:** Rotate the seal assembly until it releases. Failure to follow this instruction may result in damage to the seal assembly.

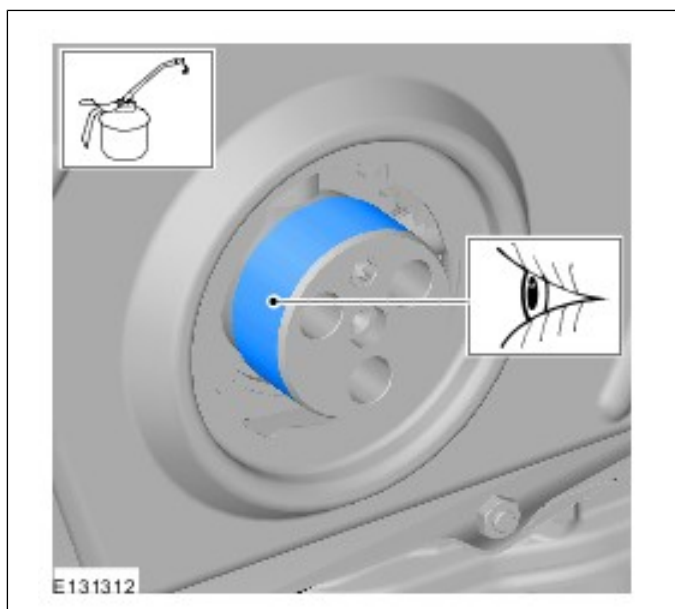
## REMOVAL AND INSTALLATION

Special Tool(s): 303-679A



## Installation

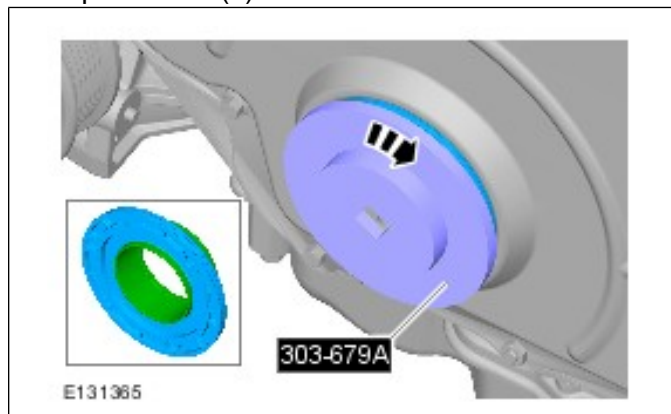
1. **NOTE:** Make sure that the mounting face is clean and lubricated.



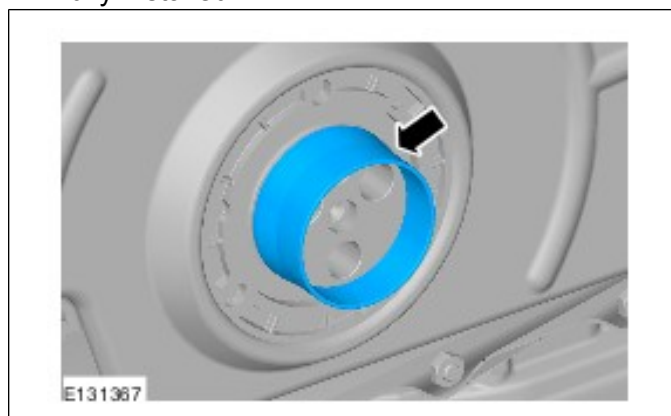
2. **CAUTION:** Rotate the seal assembly until it locks. Failure to follow this instruction may result in damage to the seal assembly.

**NOTE:** A new crankshaft front seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed.

Special Tool(s): 303-679A



3. Remove the alignment sleeve after the seal is fully installed.



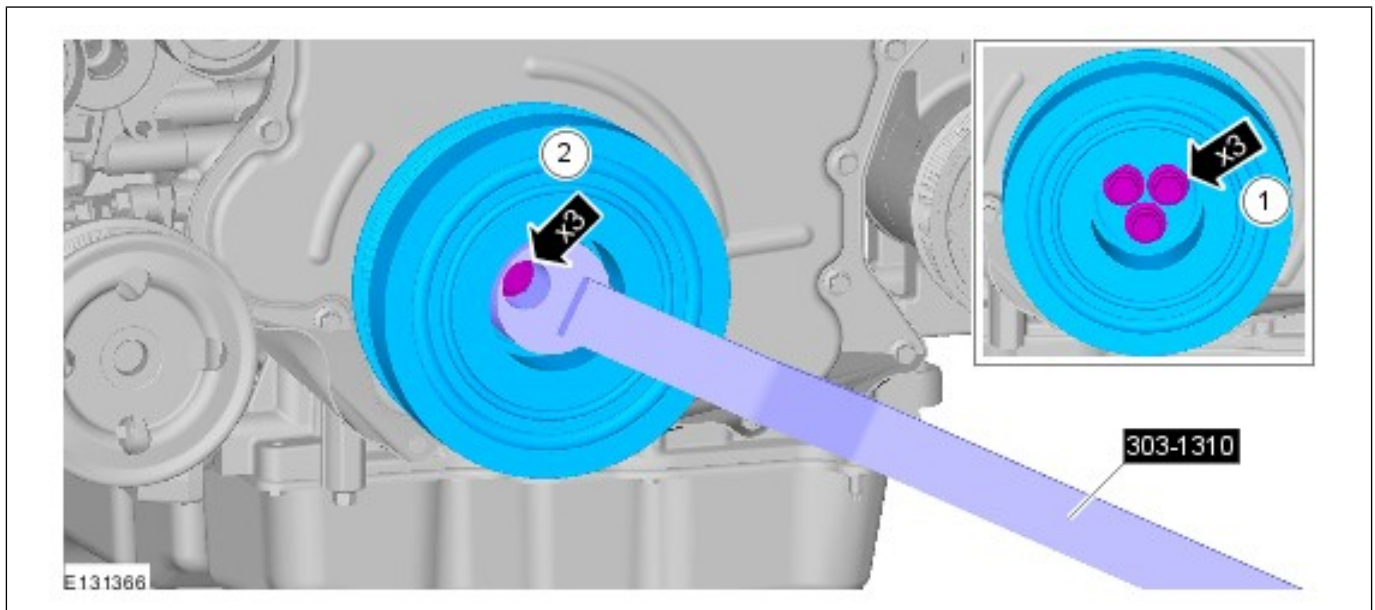
4. **CAUTION:** The crankshaft pulley bolts must not be used more than 3 times.

Special Tool(s): 303-1310

Torque:

- Stage 1: 45 Nm
- Stage 2: 120°

## REMOVAL AND INSTALLATION



5. Refer to: [Cooling Fan Motor and Shroud \(303-03 Engine Cooling - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma, Removal and Installation\)](#).

REMOVAL AND INSTALLATION

Crankshaft Rear Seal(21 468 4)

Special Tool(s)

	303-254 Locking Tool, Flywheel
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Materials

Name	Specification
Silicone Sealant LB 2U7J-M4G323-AA	WSE-M4G323-A4
Silicone Gasket and Sealant TA-30	

Removal

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

## REMOVAL AND INSTALLATION

Vehicles with automatic transmission

1. Refer to: [Transmission - 2WD](#) (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80, Removal).

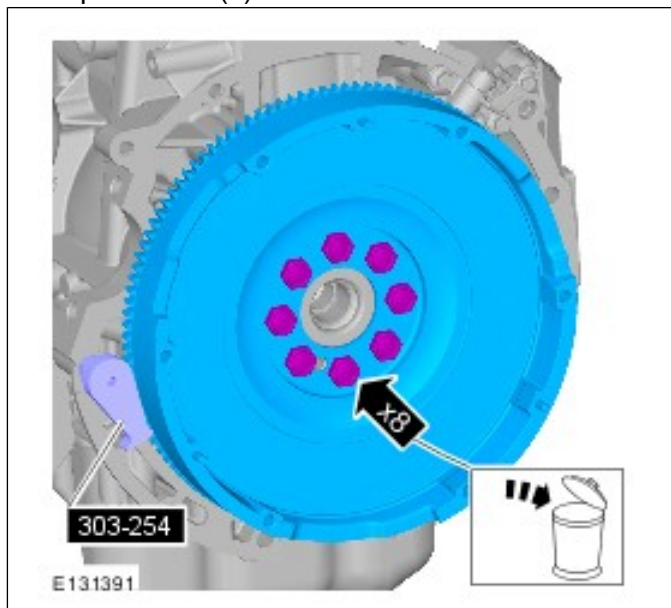
Refer to: [Transmission - 4WD](#) (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80, Removal).

Vehicles with manual transmission

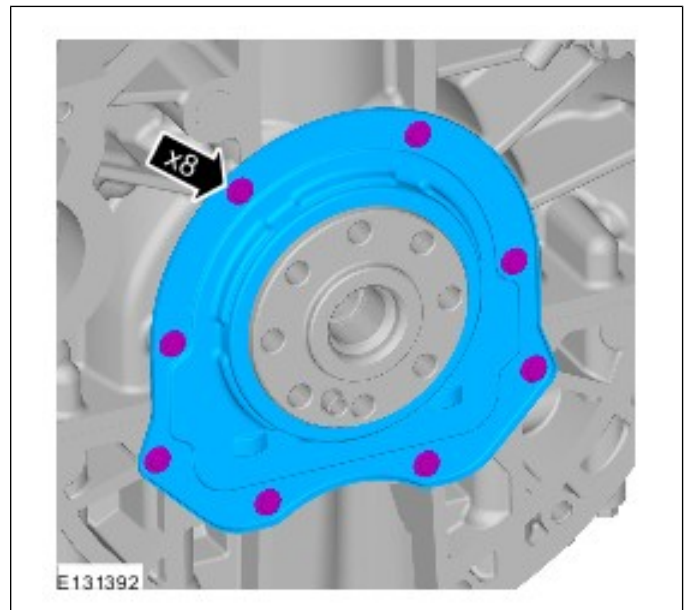
2. Refer to: [Clutch Disc and Pressure Plate](#) (308-01 Clutch - Vehicles With: 6-Speed Manual Transmission - MT82, Removal and Installation).

All vehicles

3. Special Tool(s): 303-254



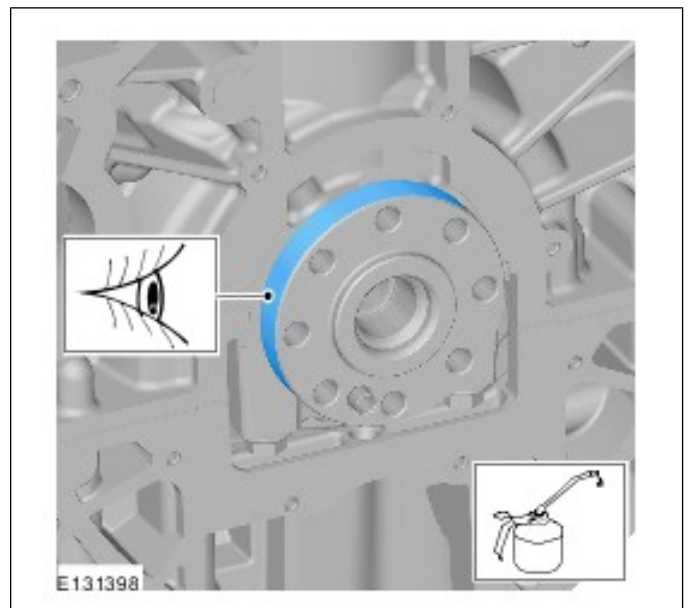
4.



### Installation

All vehicles

1.

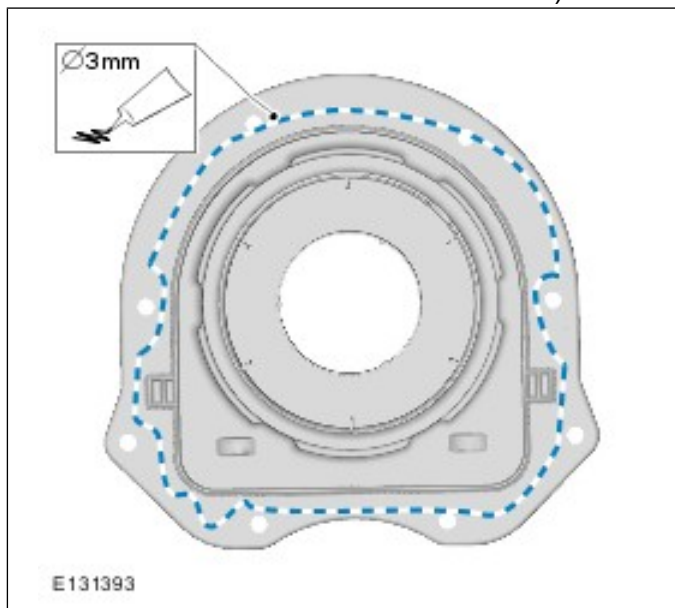


2. **NOTE:** Install the new crankshaft rear seal carrier within five minutes of applying the recommended sealant.



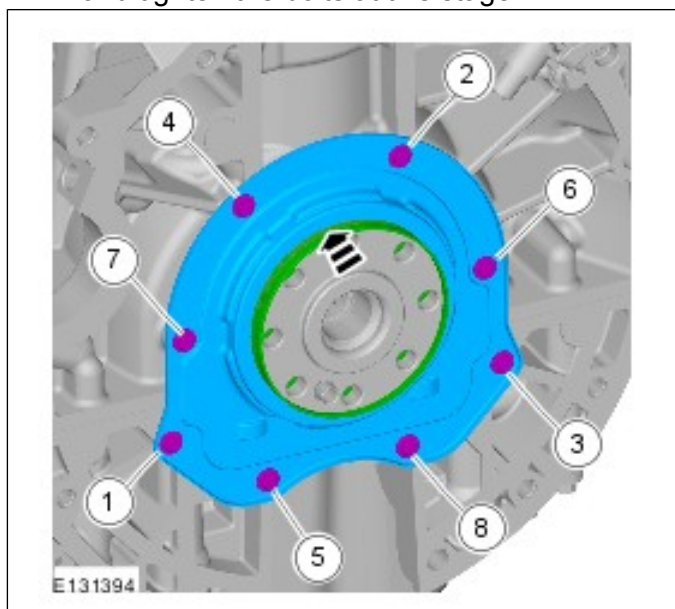
## REMOVAL AND INSTALLATION

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



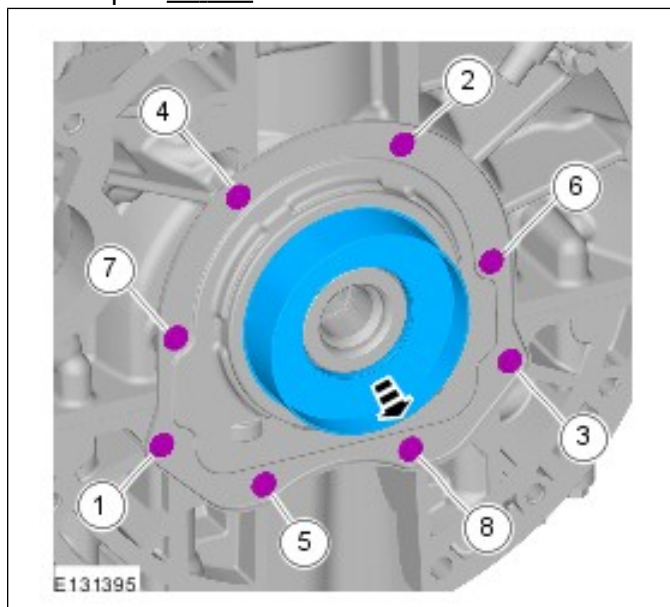
3. **CAUTION:** A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.

Hand tighten the bolts at this stage.



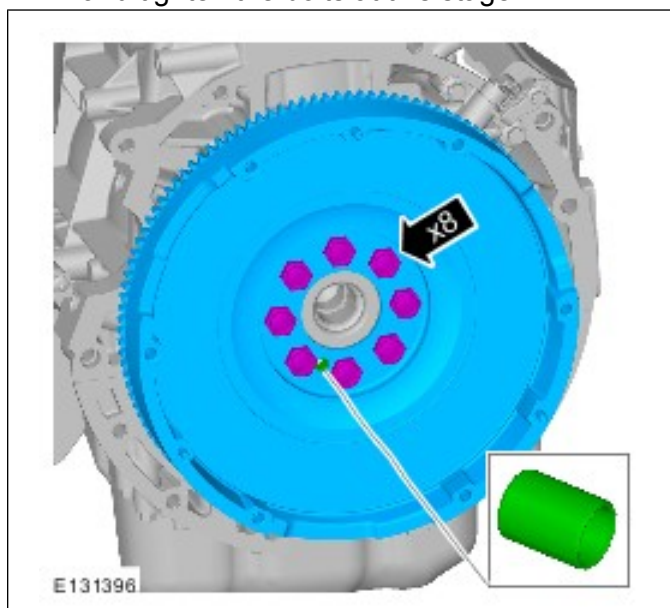
4. **NOTE:** New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

Torque: 10 Nm



5. **NOTE:** Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.

Hand tighten the bolts at this stage.

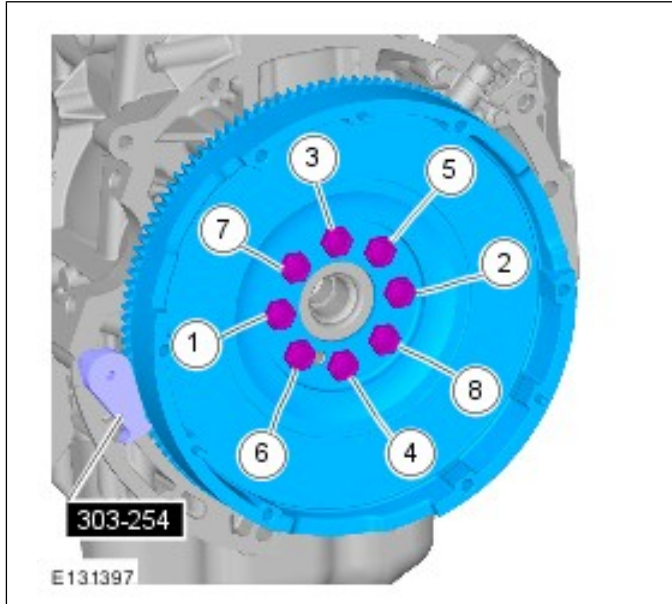


6. Special Tool(s): 303-254

## REMOVAL AND INSTALLATION

Torque:

- Stage 1: 15 Nm
- Stage 2: 30 Nm
- Stage 3: 75 Nm
- Stage 4: 45°



Vehicles with manual transmission

7. Refer to: [Clutch Disc and Pressure Plate](#) (308-01 Clutch - Vehicles With: 6-Speed Manual Transmission - MT82, Removal and Installation).

Vehicles with automatic transmission

8. Refer to: [Transmission - 2WD](#) (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80, Installation).

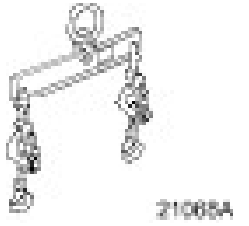
Refer to: [Transmission - 4WD](#) (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80, Installation).

## REMOVAL

# Engine — Vehicles With: 6-Speed Manual Transmission - MT82(21 132 0; 21 132 6; 21 132 7)

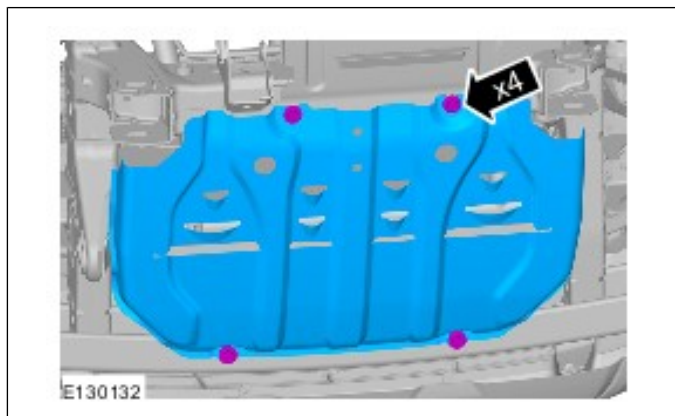
## Removal

## Special Tool(s) / General Equipment

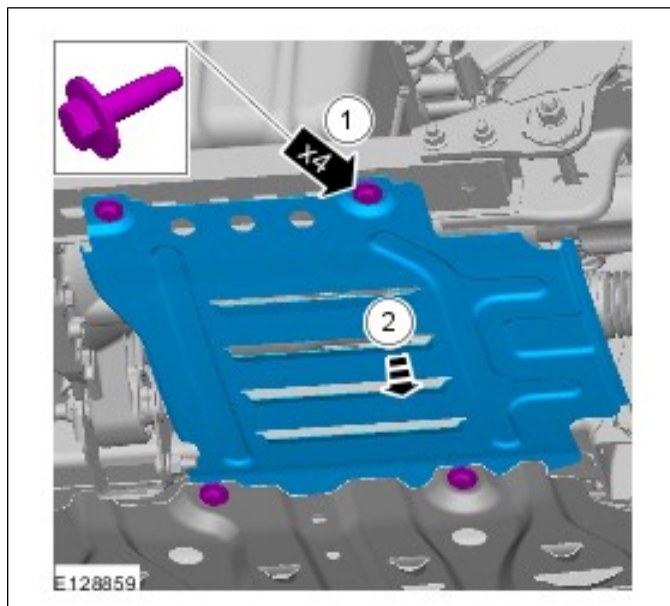
 <p>303-122 Lifting Bracket, Engine</p>	
Transmission Jack	

1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: [Cooling System Draining, Filling and Bleeding](#) - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
4. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

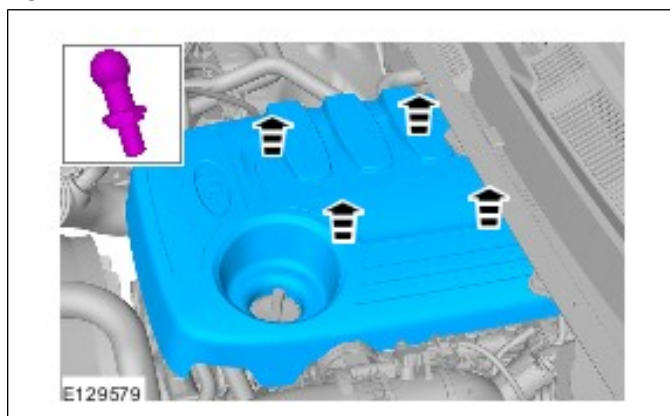
6.



7.

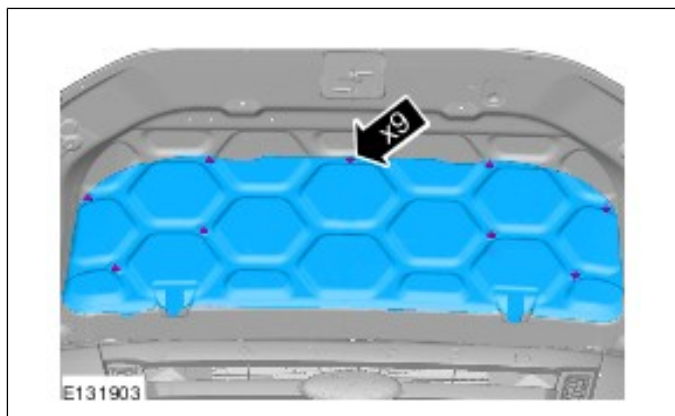


8.

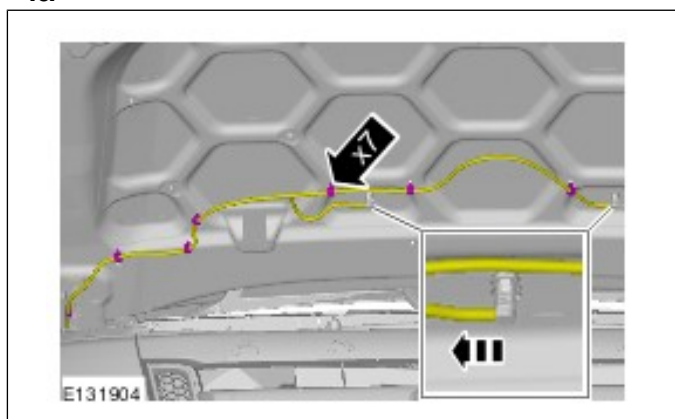


## REMOVAL

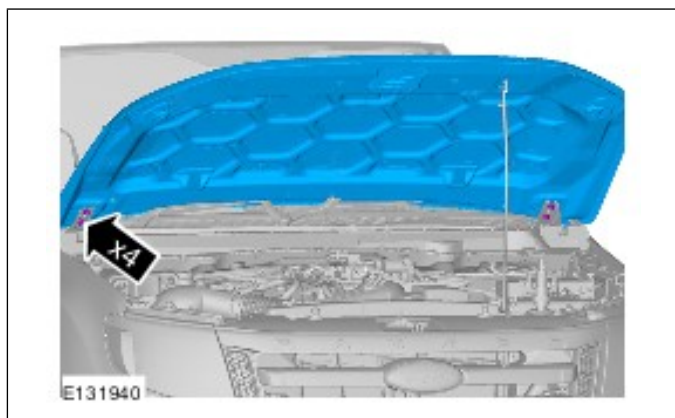
9.



10.

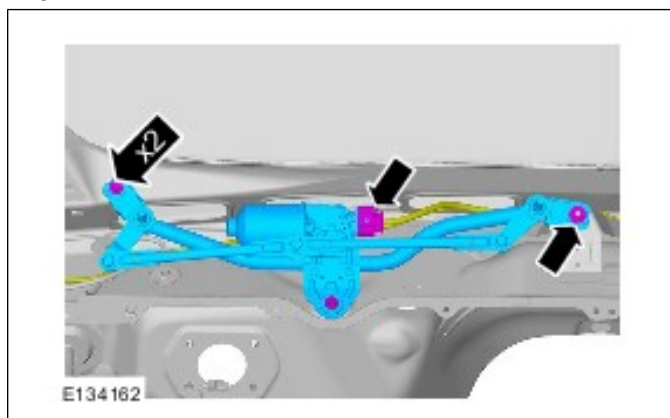


11.

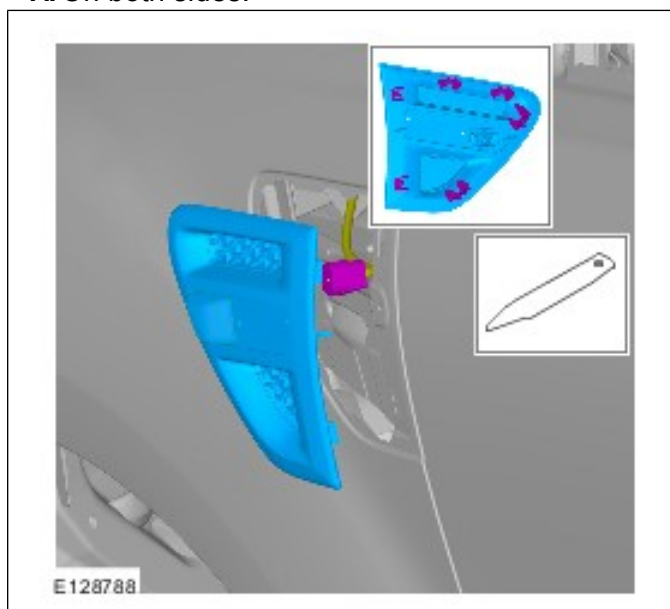


12 Refer to: [Cowl Panel Grille \(501-02 Front End Body Panels, Removal and Installation\)](#).

13.



14. On both sides.



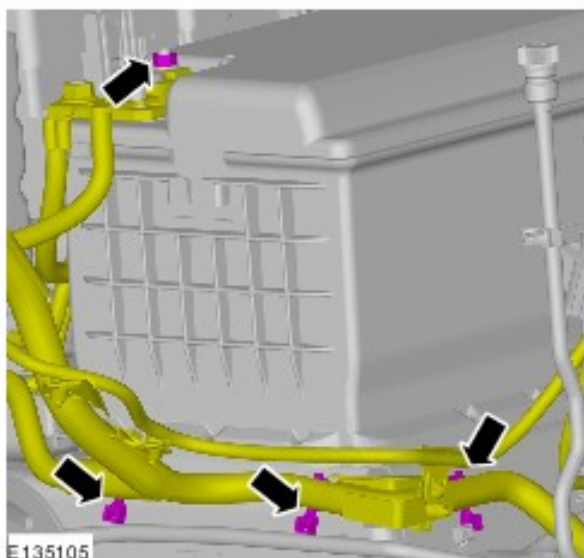
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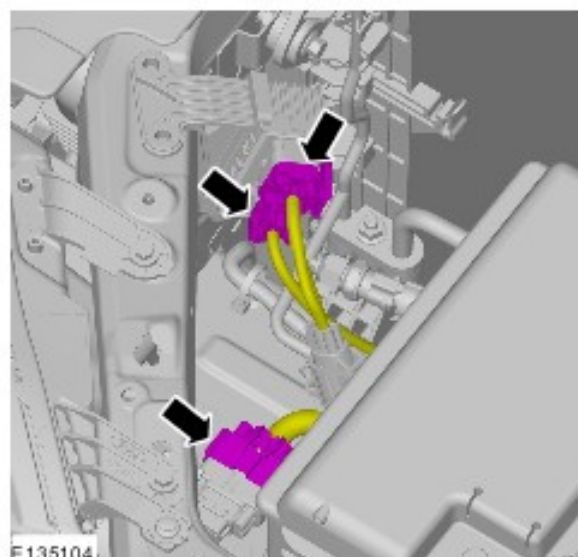
## REMOVAL



16.



17.





## REMOVAL

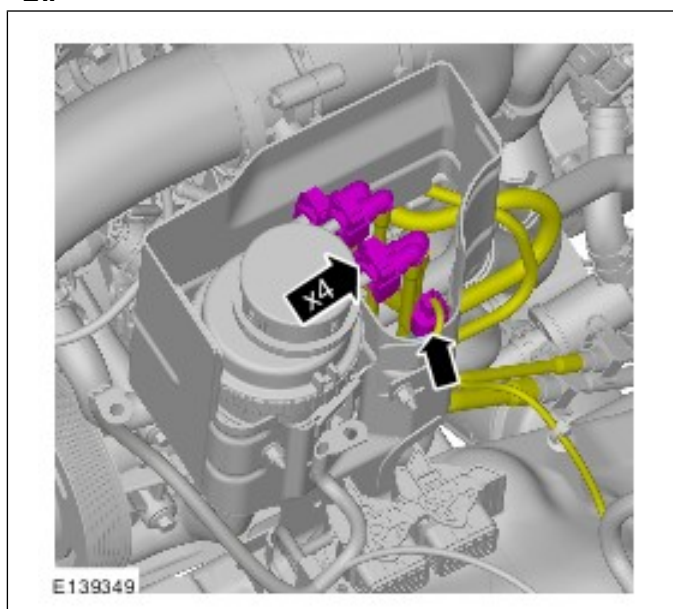
18. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

19. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

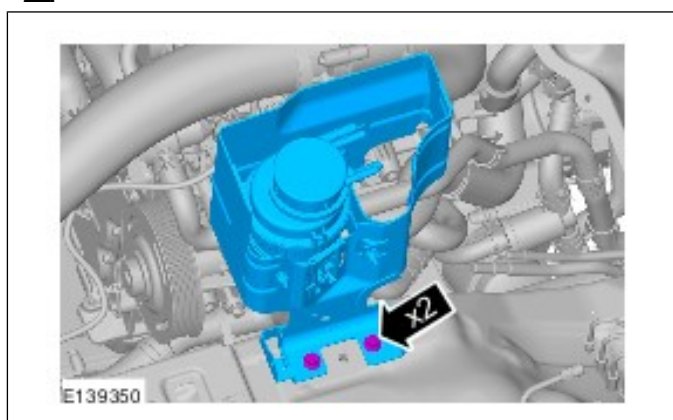
20. Refer to: [Powertrain Control Module \(PCM\)](#) (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Refer to: [Powertrain Control Module \(PCM\)](#) (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

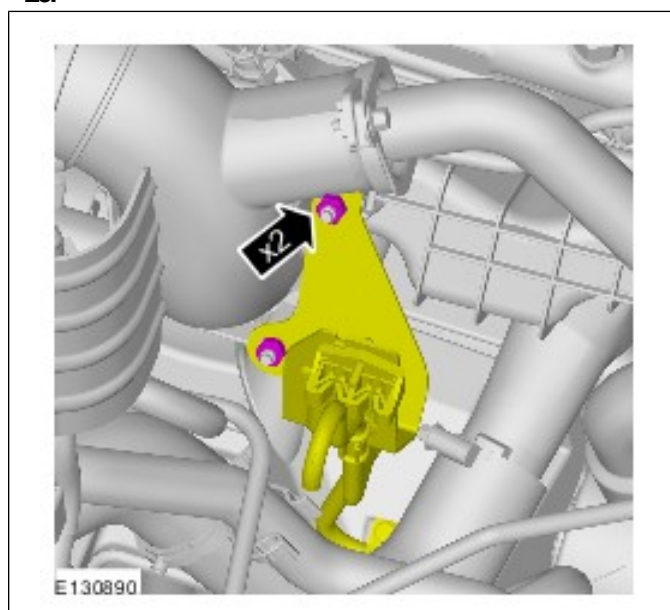
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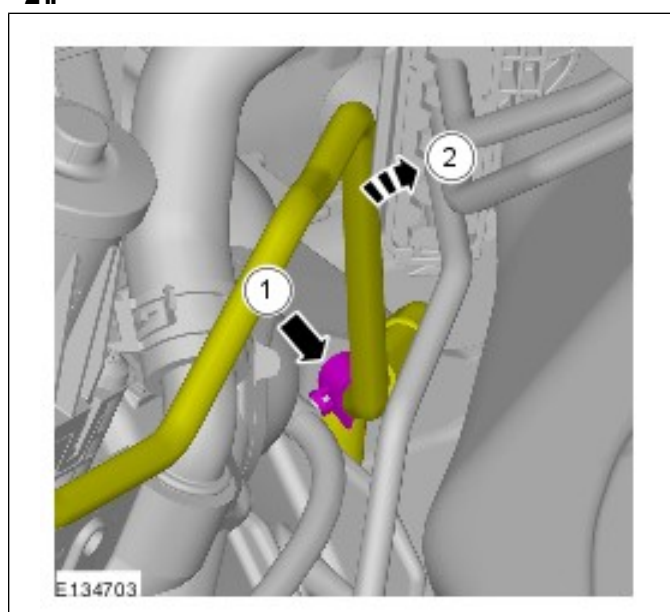
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23.

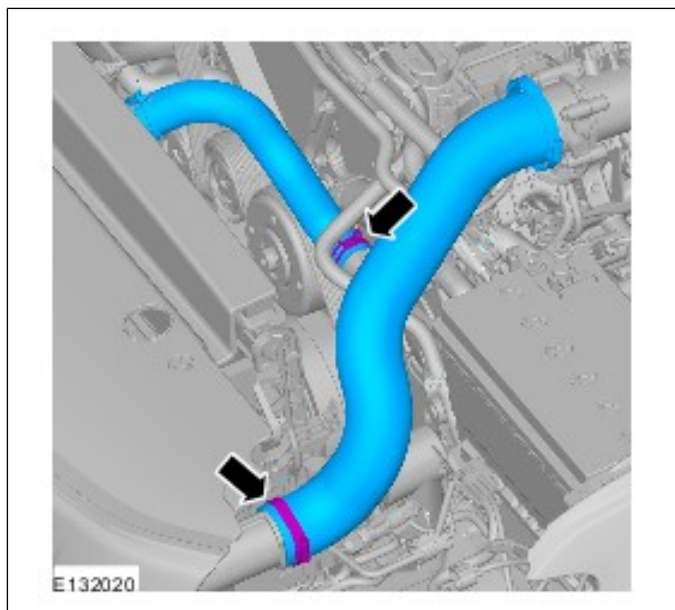


24.



## REMOVAL

25.

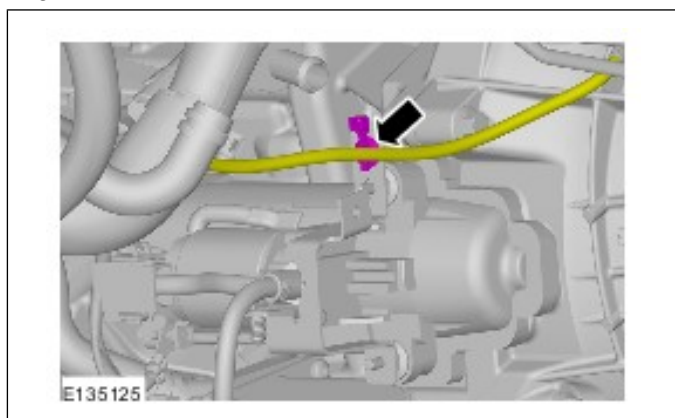


26. Refer to: [Cooling Fan Motor and Shroud](#) (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

27. Refer to: [Radiator](#) (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

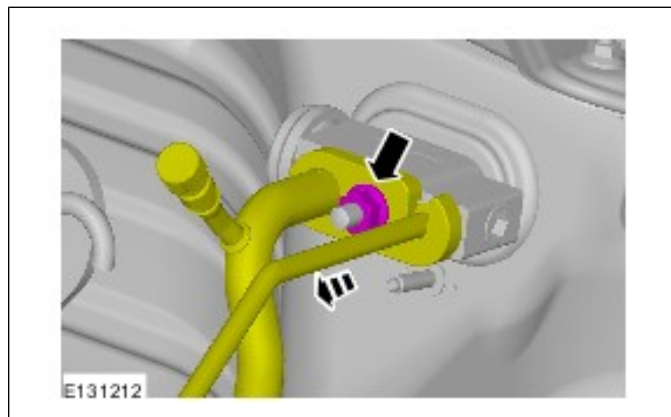
28. Refer to: [Condenser](#) - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (412-01 Climate Control, Removal and Installation).

29.

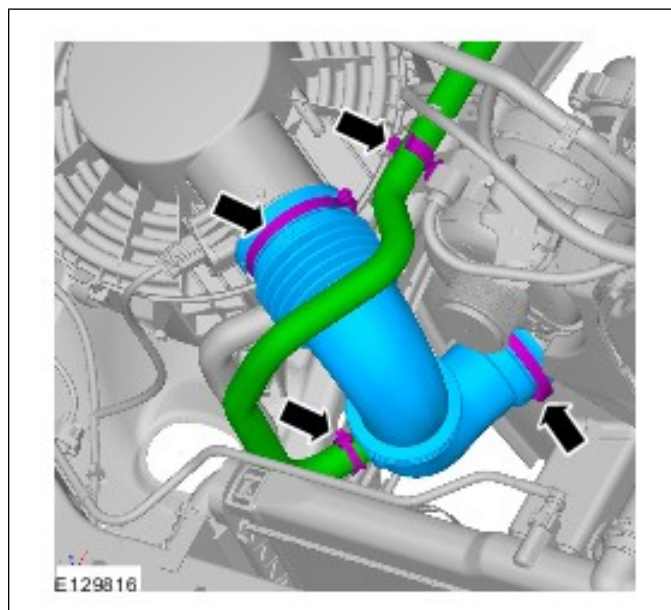


30. Refer to: [Starter Motor](#) - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

31.



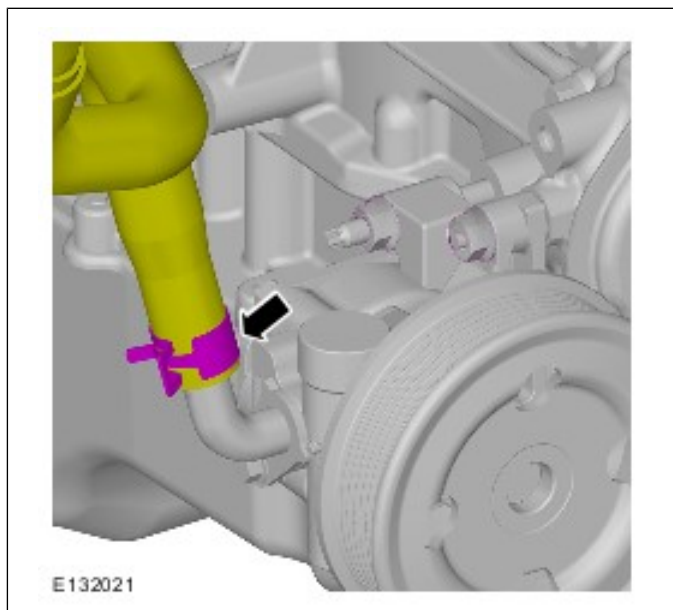
32.



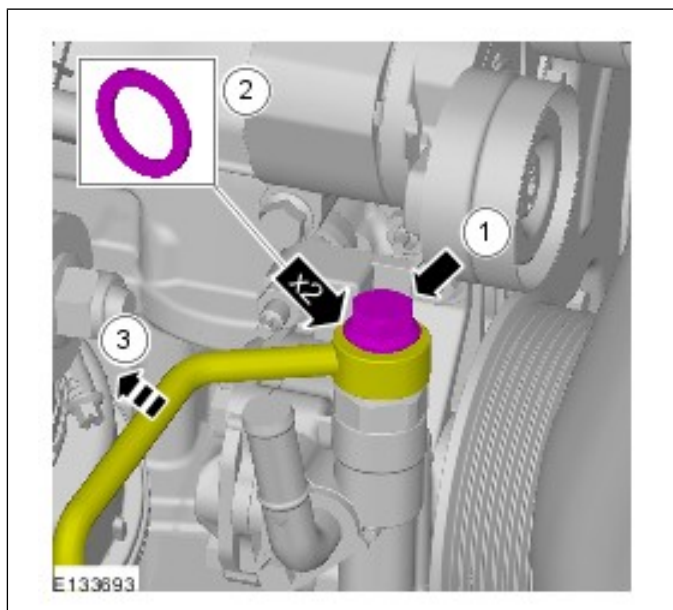
## REMOVAL

33. Refer to: [Air Cleaner - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

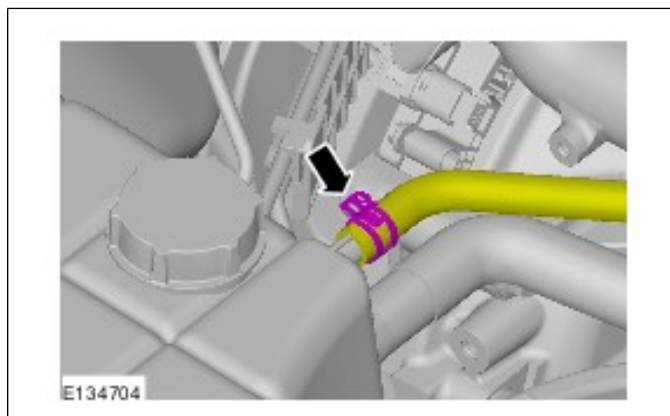
34. **NOTE:** Make sure that all openings are sealed.



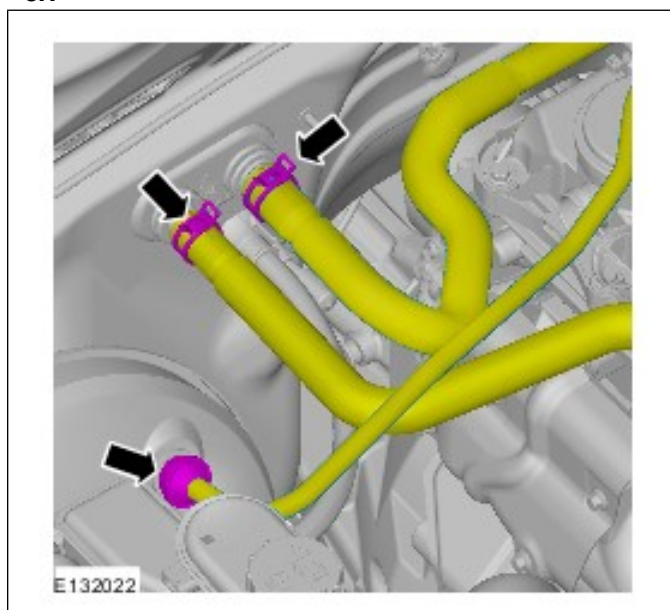
35. **CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.



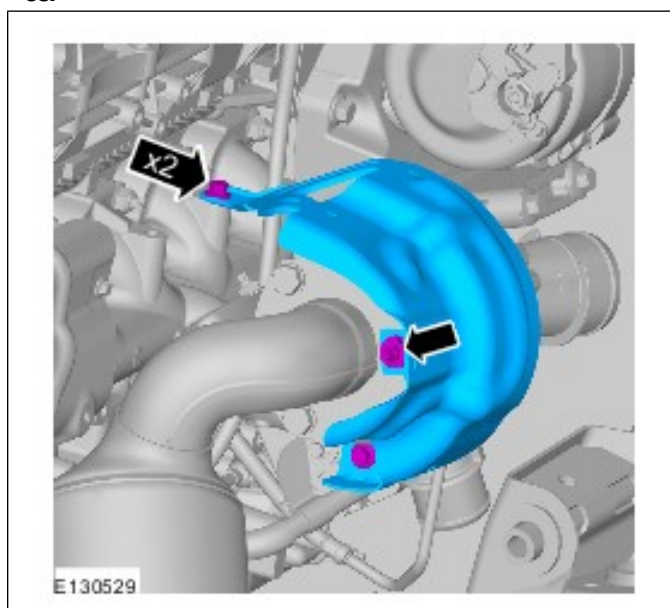
36.



37.



38.

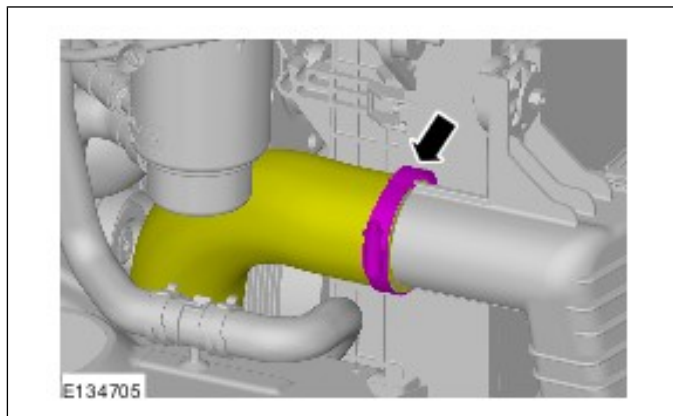




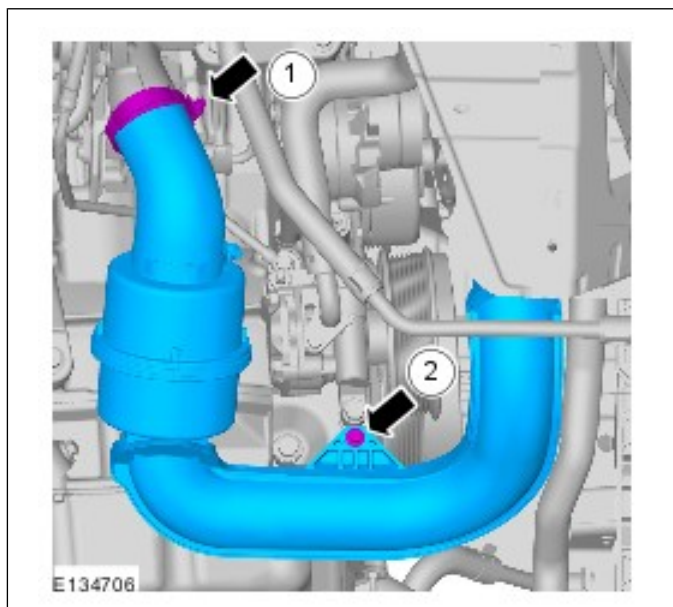
## REMOVAL

39. Refer to: [Catalytic Converter](#) (309-00 Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

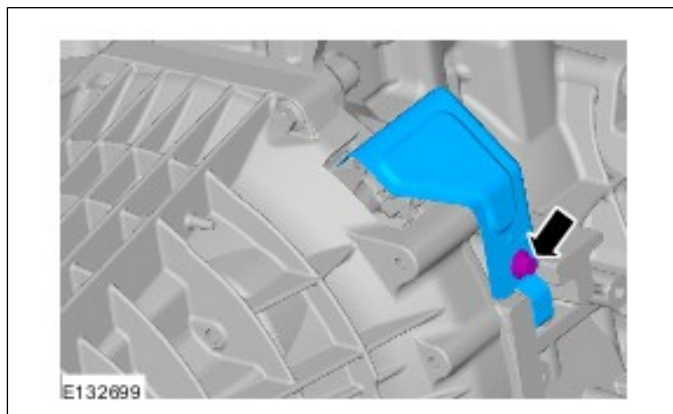
40.



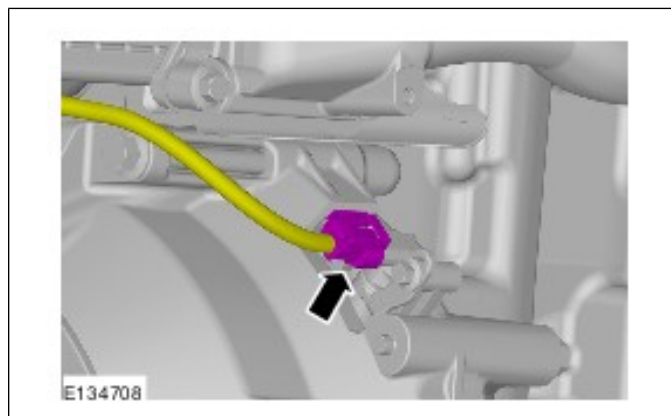
41.



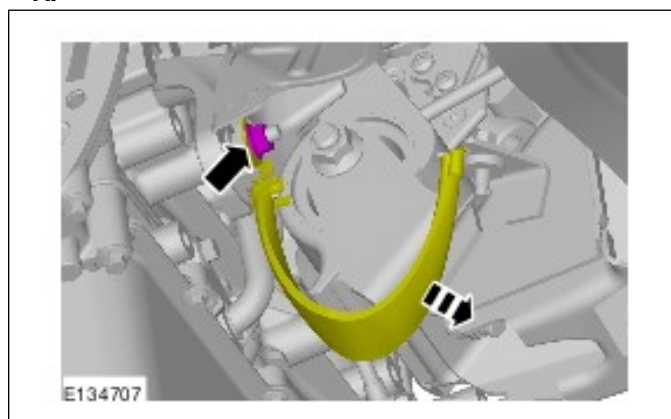
42.



43.



44.



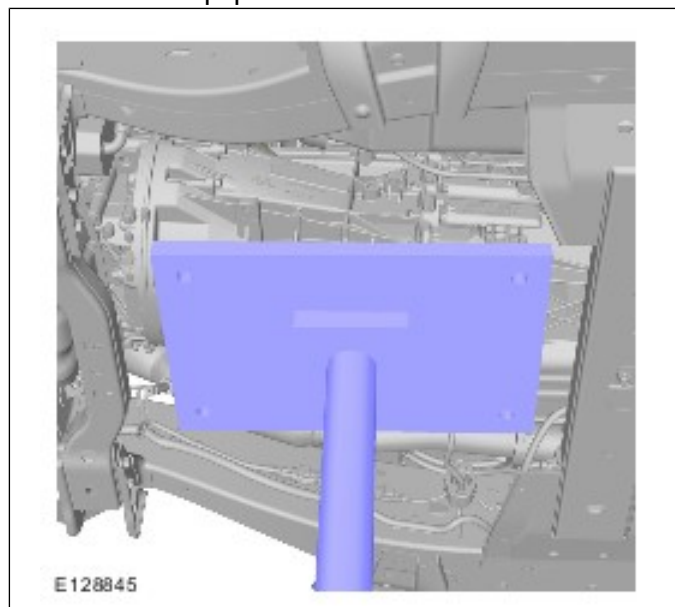
45.  **WARNING:** Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.

-  **CAUTION:** Do not tilt the transmission. This may cause damage to the pilot bearing.

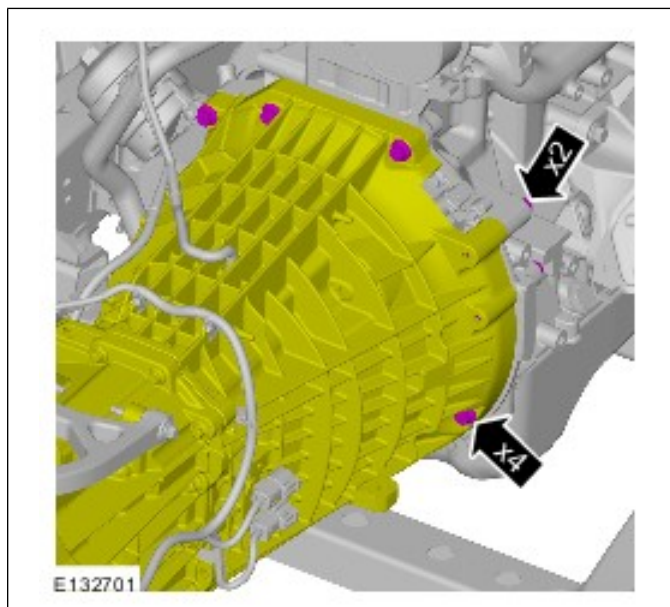
Tie and support the transmission to the chassis with a suitable strap.

## REMOVAL

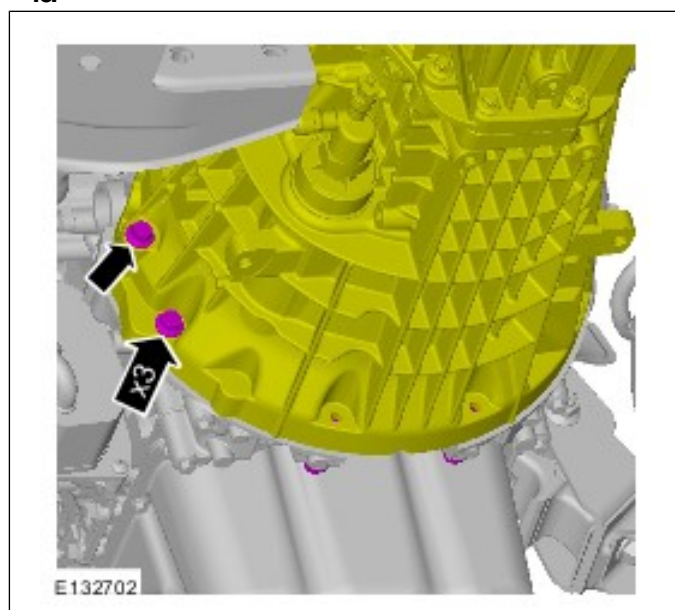
General Equipment: Transmission Jack



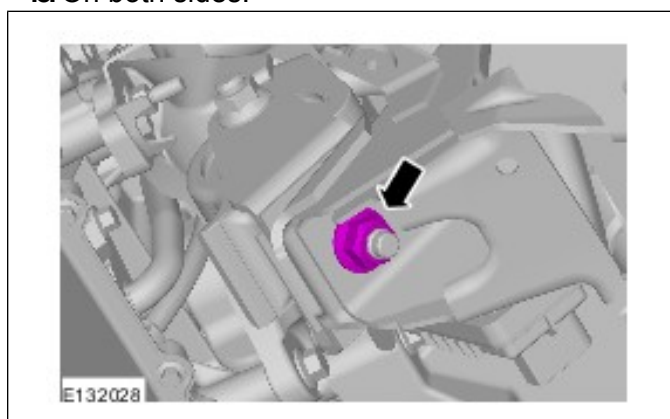
47.



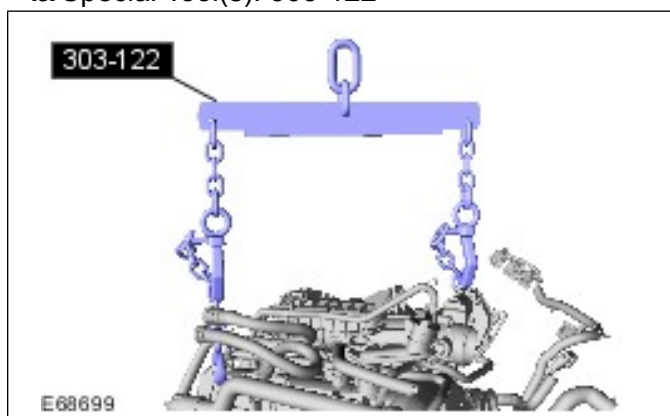
46.



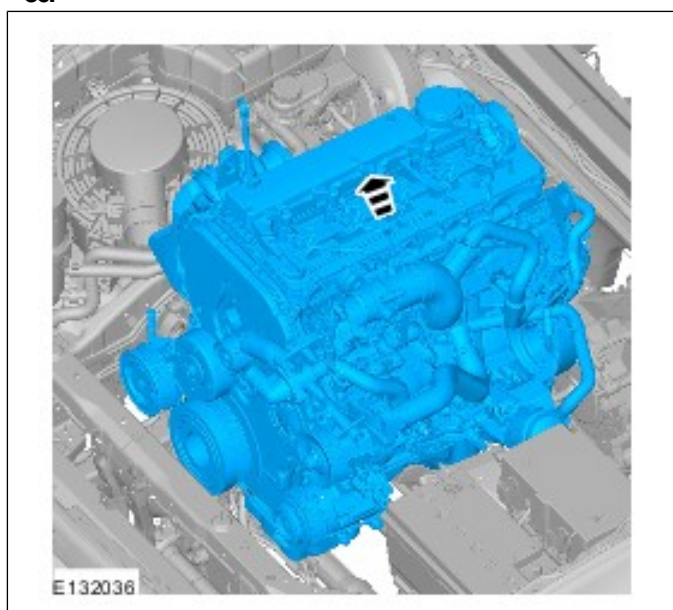
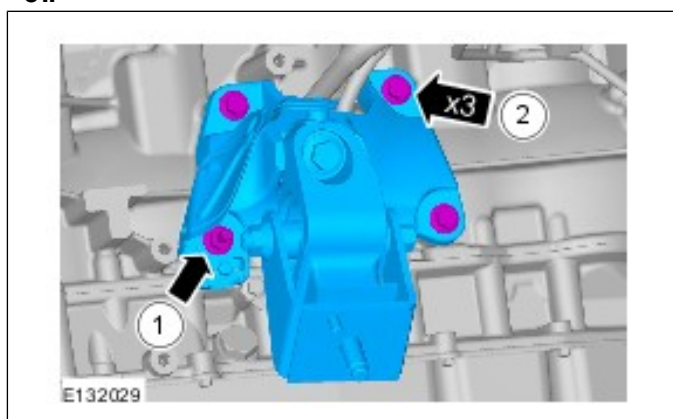
48. On both sides.



49. Special Tool(s): 303-122





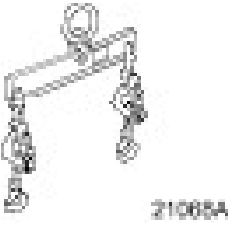
**REMOVAL****50.****51.**

## REMOVAL

Engine — Vehicles With: 6-Speed Automatic Transmission -  
6R80(21 132 0; 21 132 6; 21 132 7)

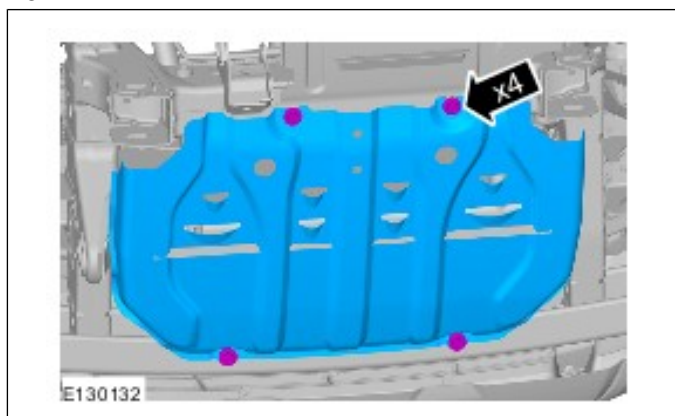
## Removal

## Special Tool(s) / General Equipment

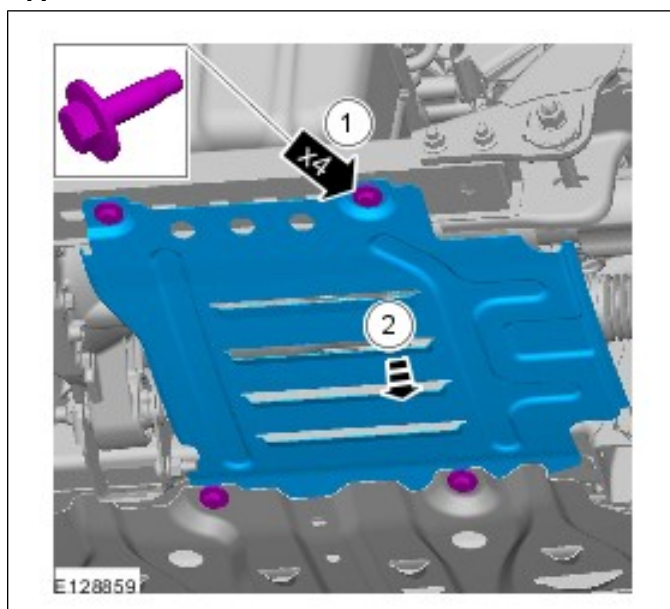
 <p>303-122 Lifting Bracket, Engine</p>	
Transmission Jack	

1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: [Cooling System Draining, Filling and Bleeding](#) - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
4. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

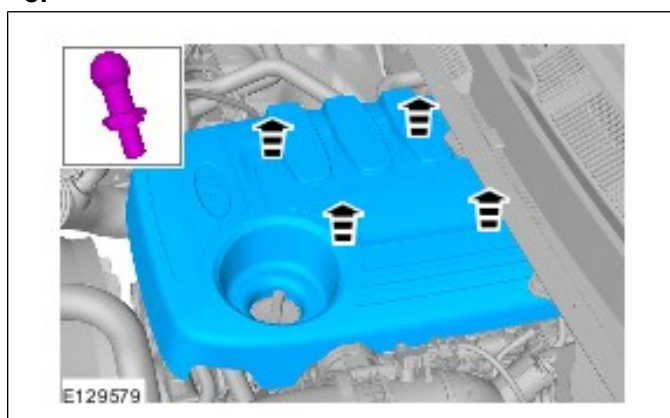
6.



7.

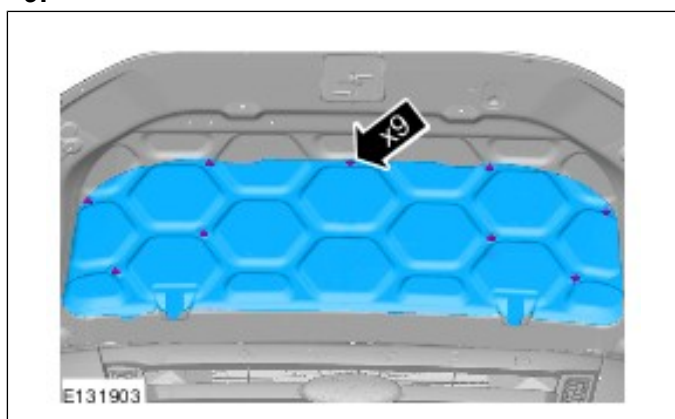


8.

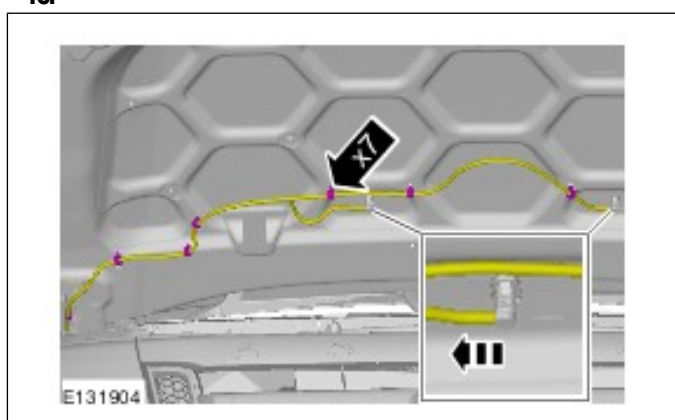


## REMOVAL

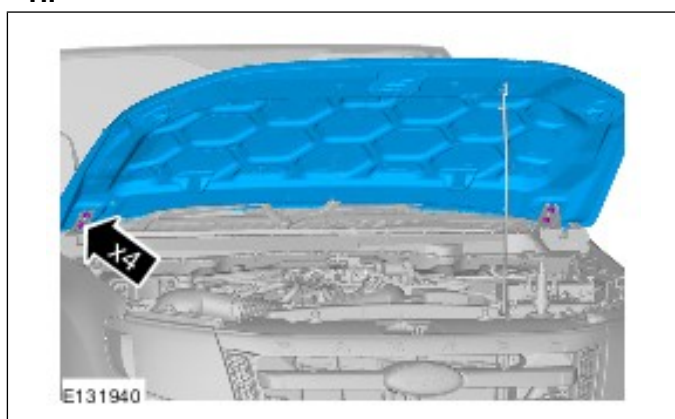
9.



10.

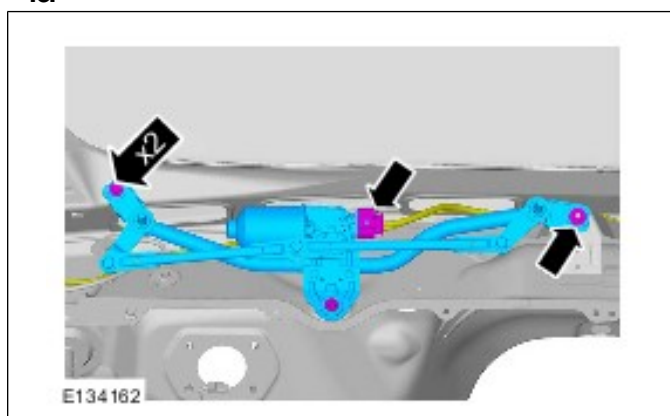


11.

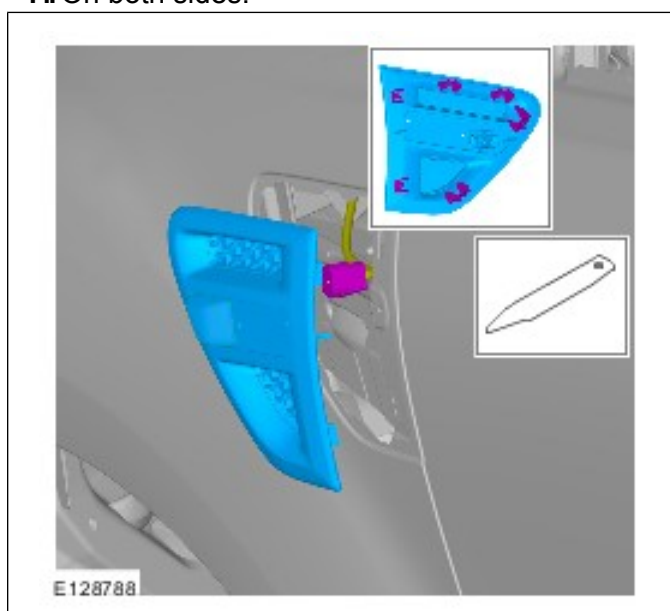


12 Refer to: [Cowl Panel Grille \(501-02 Front End Body Panels, Removal and Installation\)](#).

13.



14. On both sides.

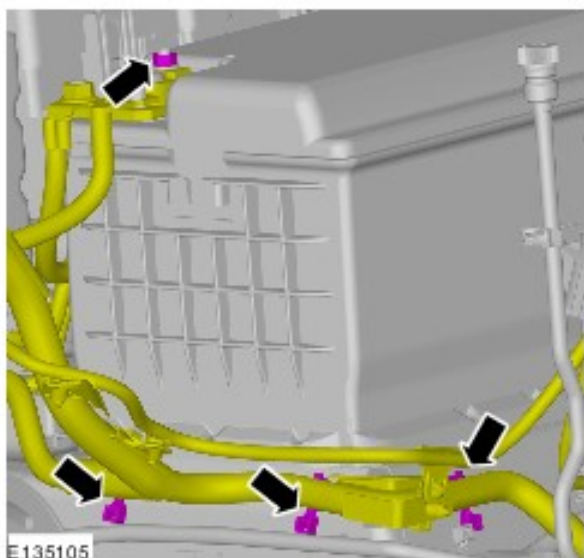


15.

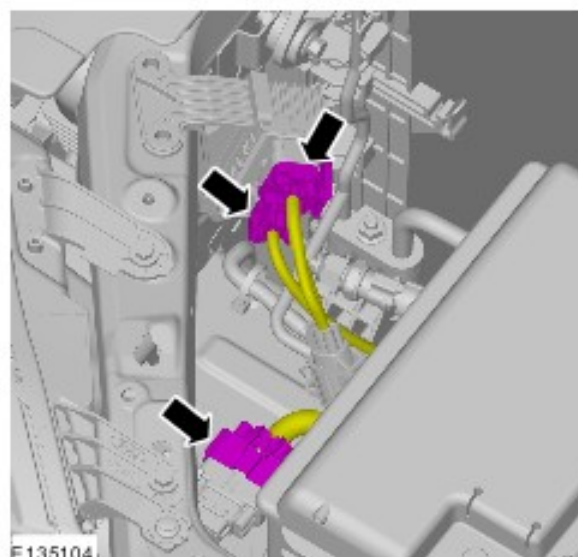
## REMOVAL



16.



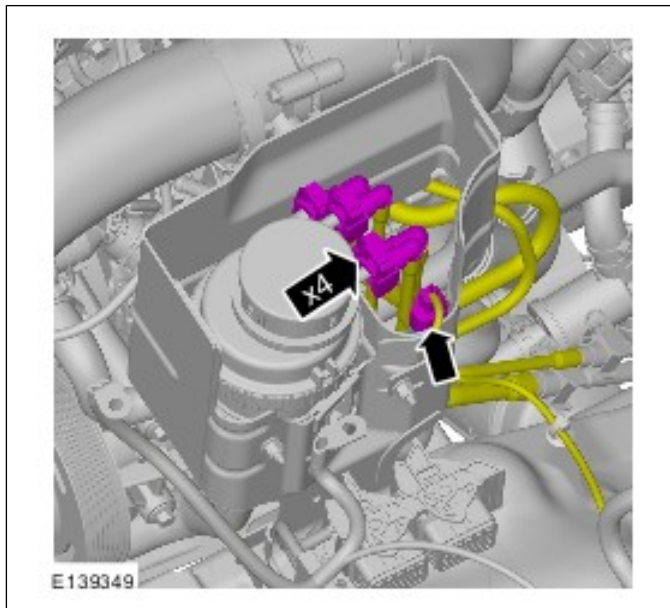
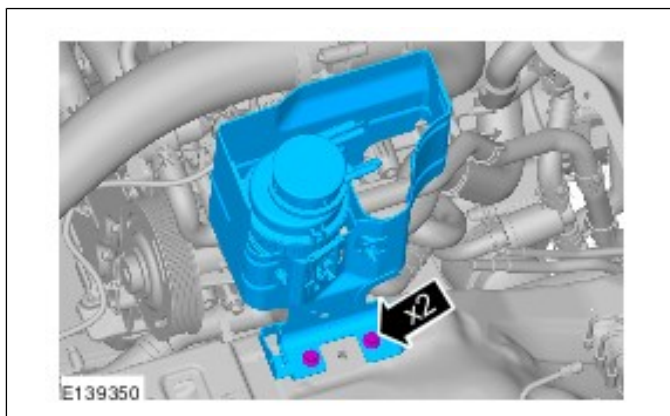
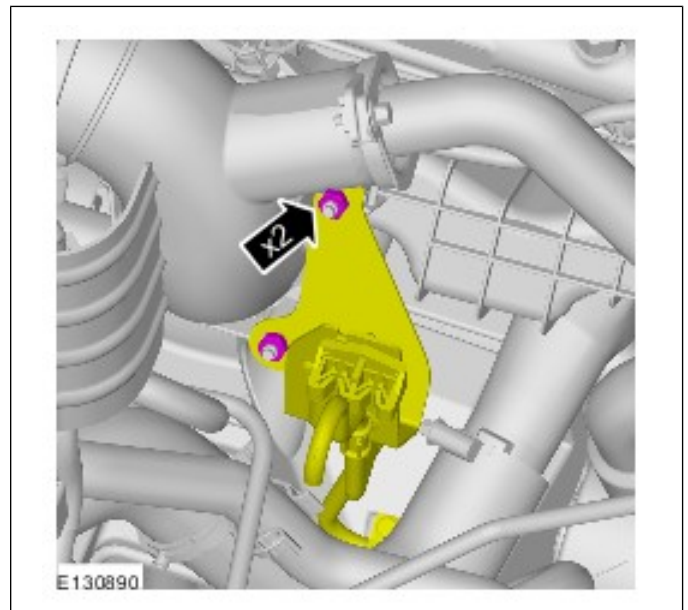
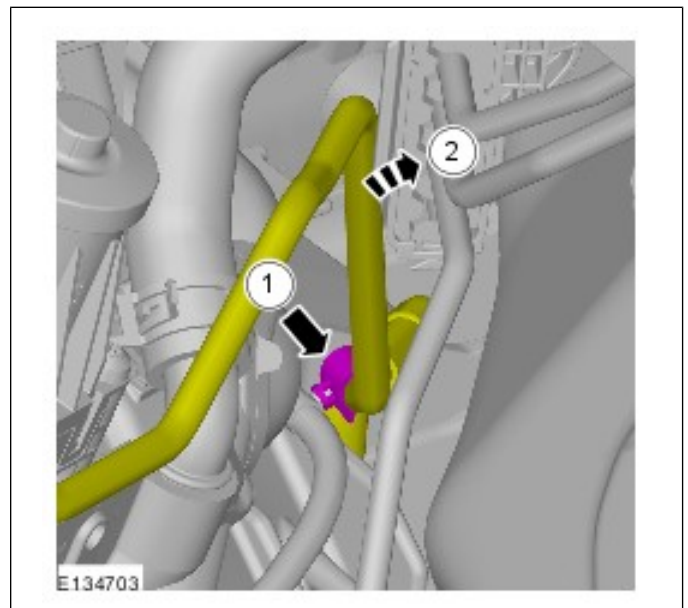
17.





**REMOVAL**

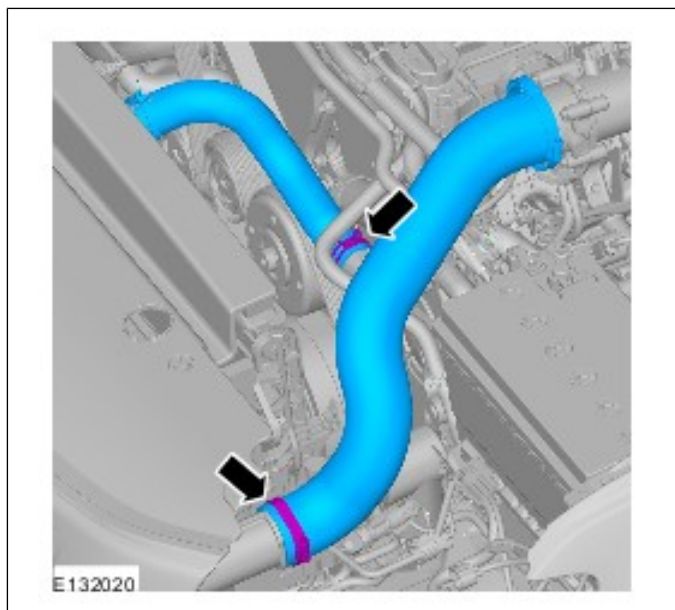
18. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
19. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
20. Refer to: [Powertrain Control Module \(PCM\)](#) (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

**21.****22.****23.****24.**



## REMOVAL

25.

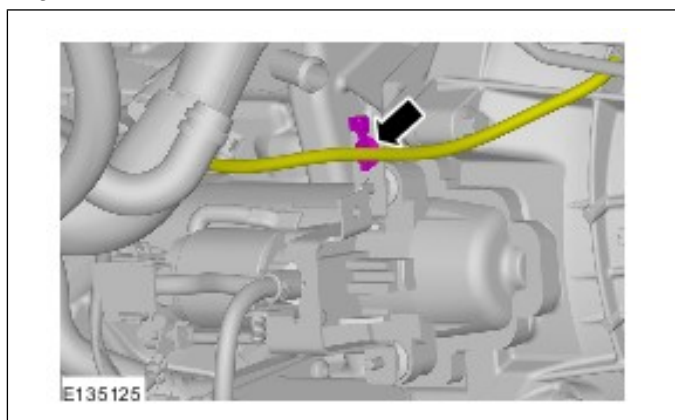


26. Refer to: [Cooling Fan Motor and Shroud](#) (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

27. Refer to: [Radiator](#) (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

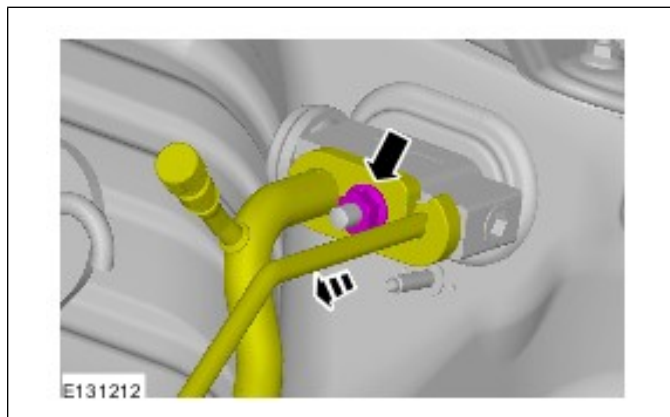
28. Refer to: [Condenser](#) - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (412-01 Climate Control, Removal and Installation).

29.



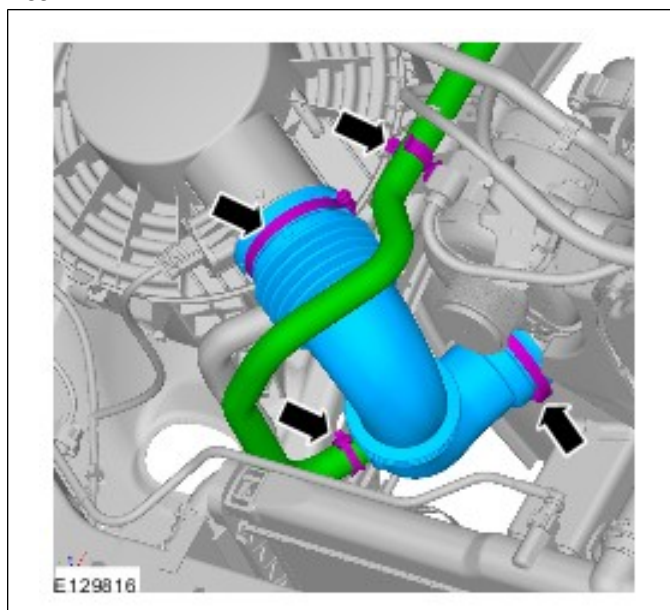
30. Refer to: [Starter Motor](#) - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

31.



32. Refer to: [Transmission Fluid Cooler](#) (307-02 Transmission Cooling, Removal and Installation).

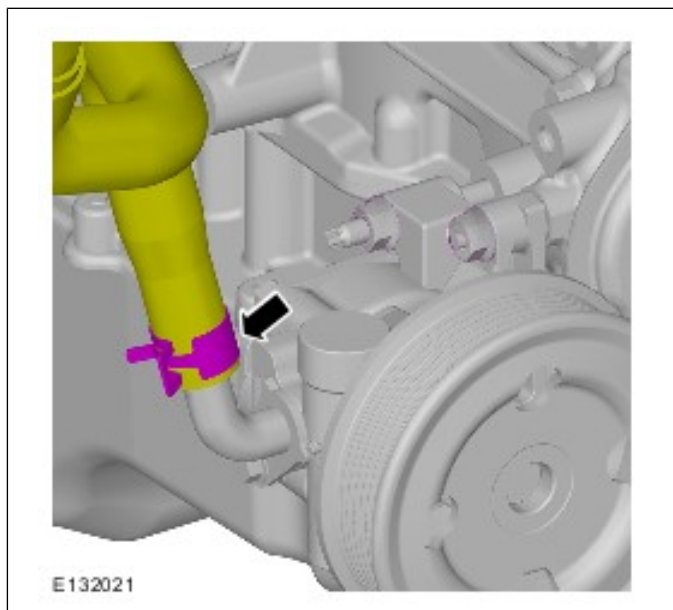
33.



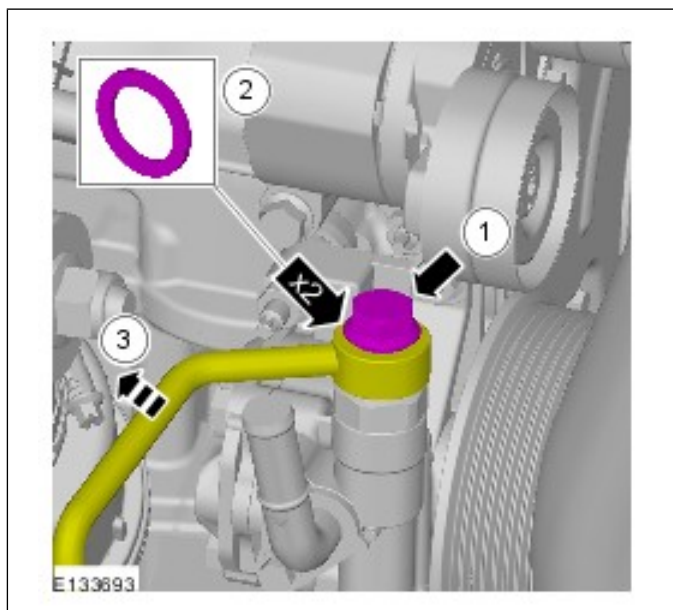
## REMOVAL

34. Refer to: [Air Cleaner - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

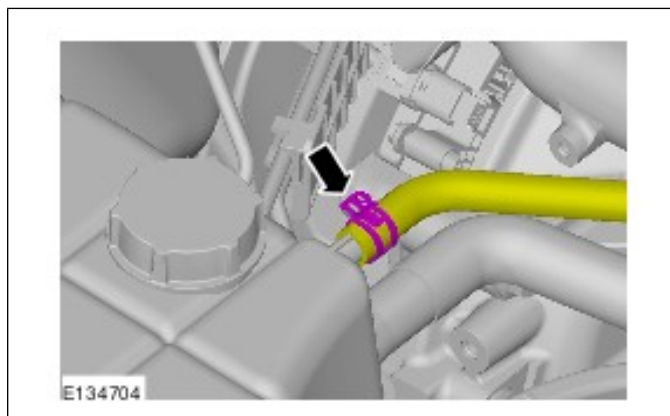
35. **NOTE:** Make sure that all openings are sealed.



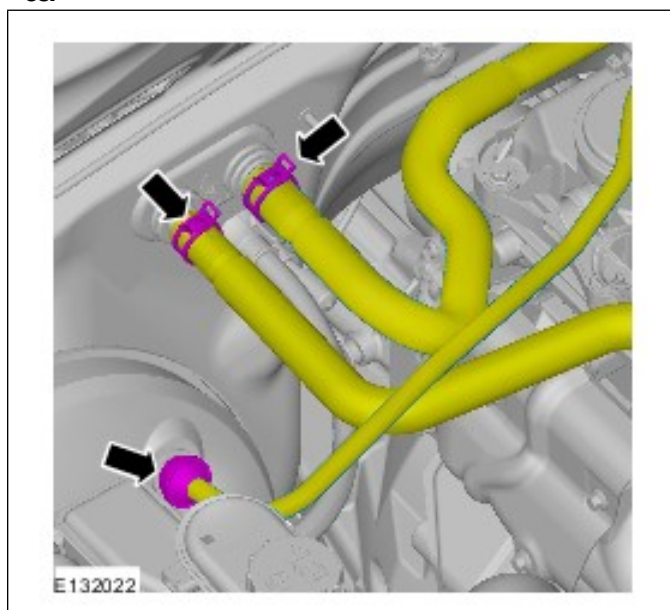
36. **CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.



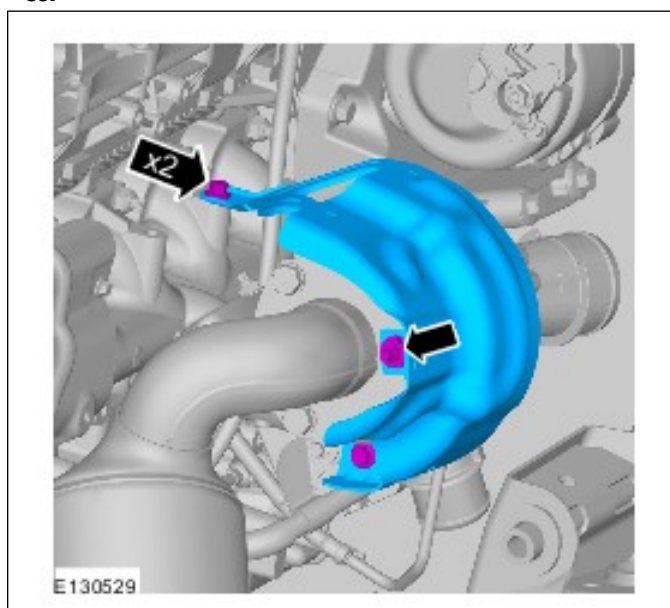
37.



38.



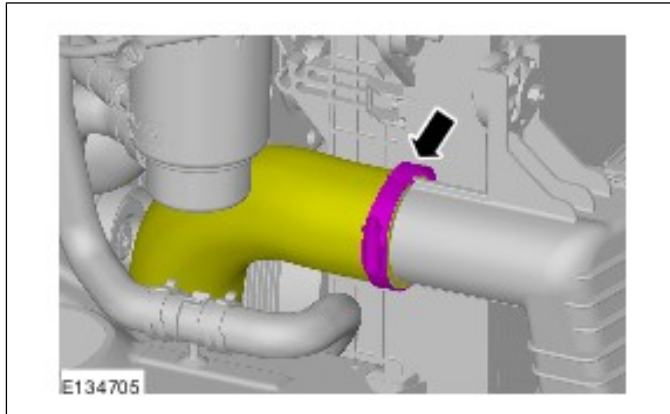
39.



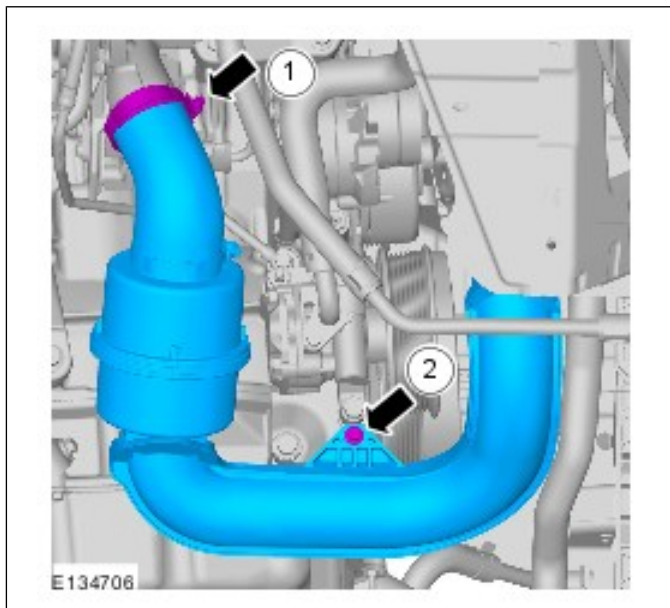
## REMOVAL

40. Refer to: [Catalytic Converter](#) (309-00 Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

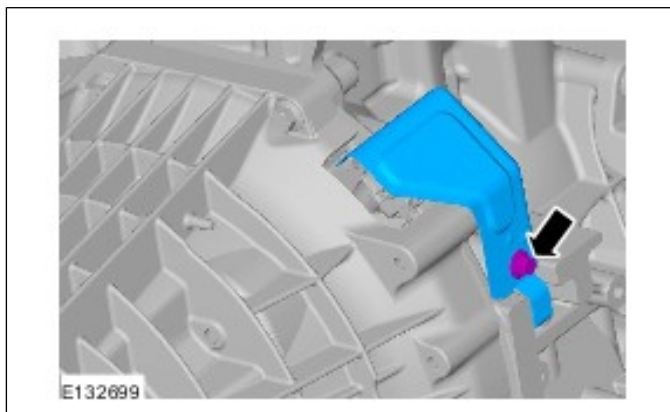
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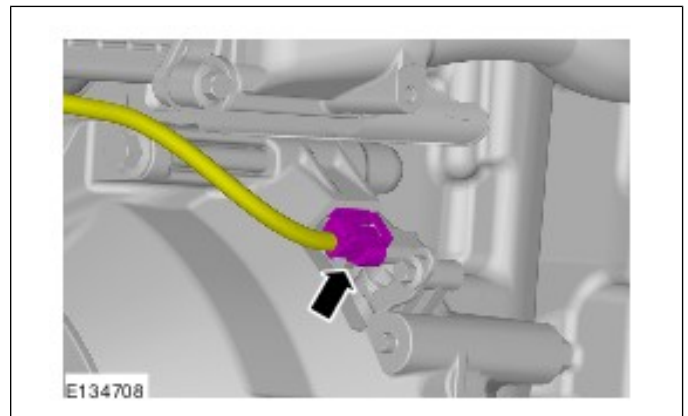
42.



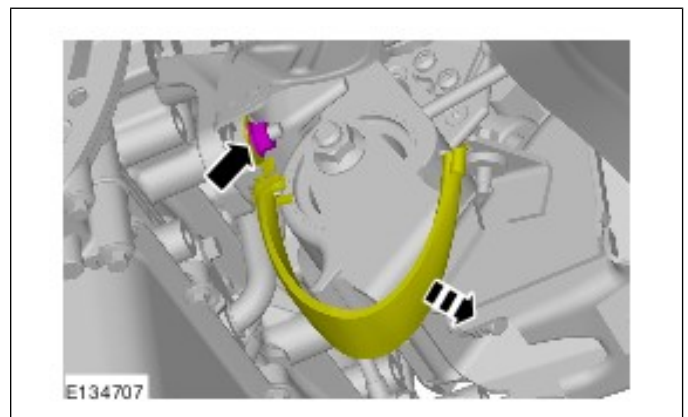
43.



44.



45.



46.  **WARNING:** Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.

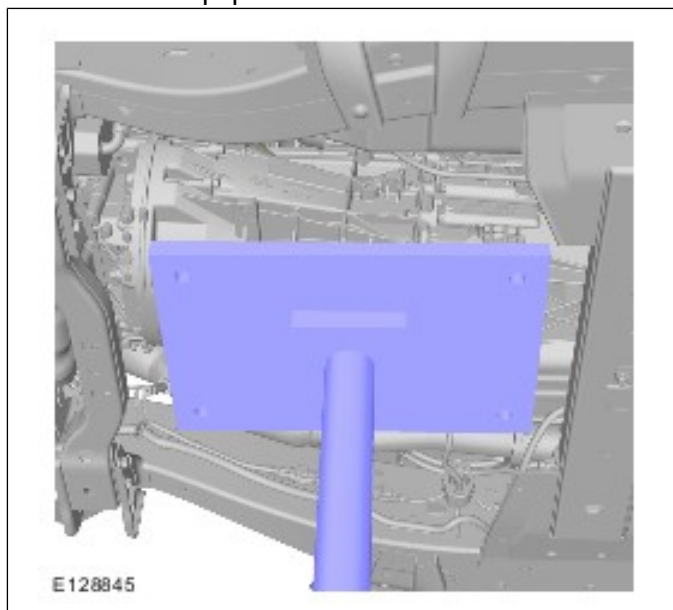
-  **CAUTION:** Do not tilt the transmission. This may cause damage to the pilot bearing.

Tie and support the transmission to the chassis with a suitable strap.

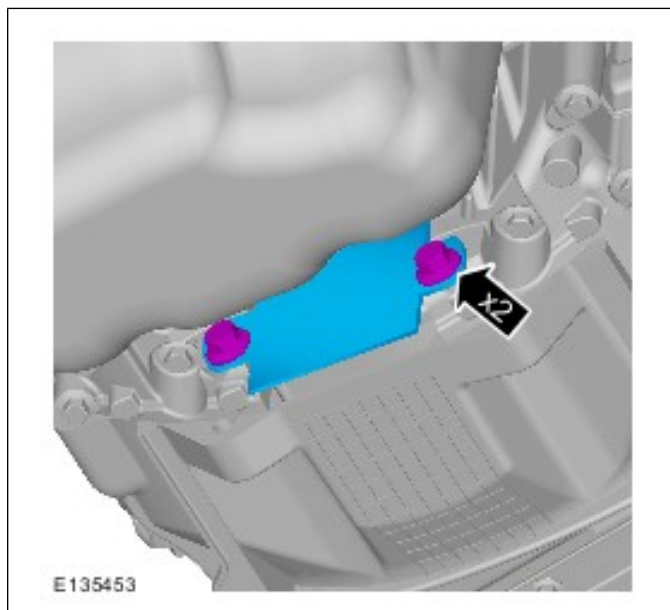


**REMOVAL**

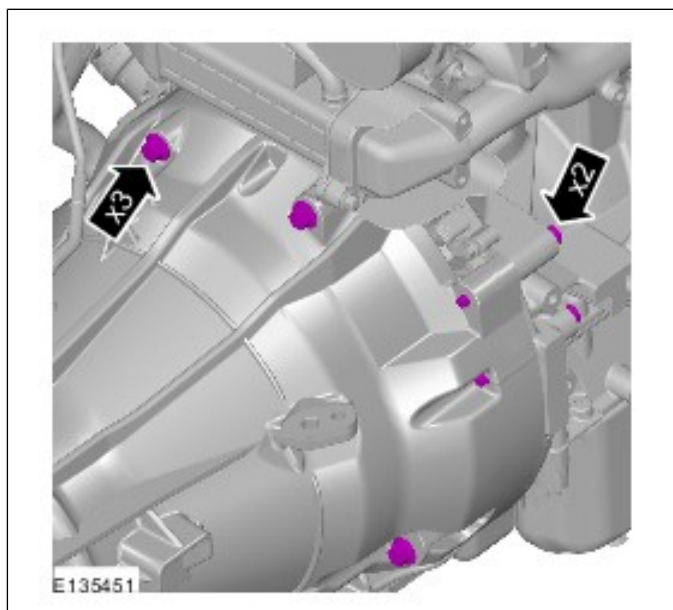
General Equipment: Transmission Jack



48.

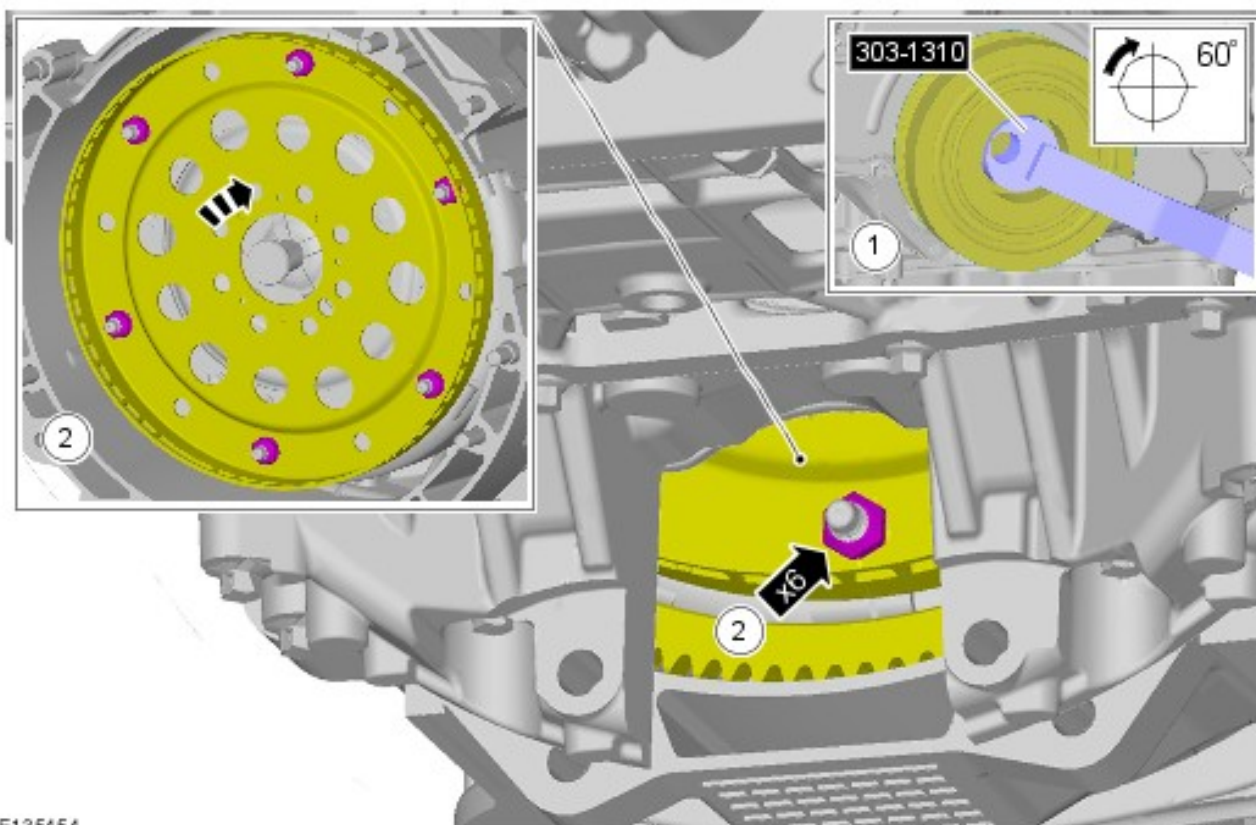


47.



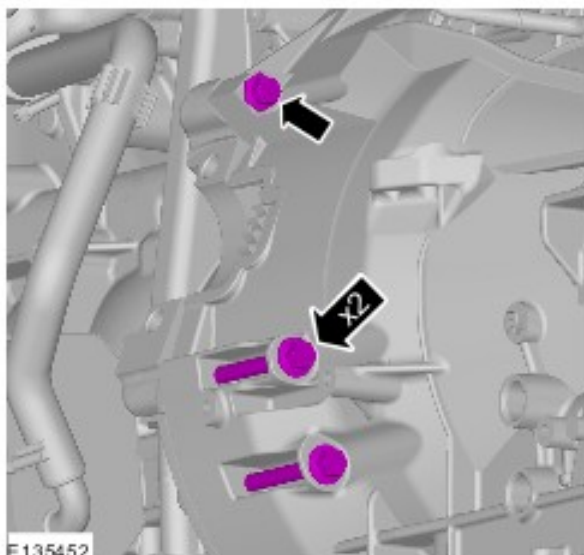
49.

## REMOVAL



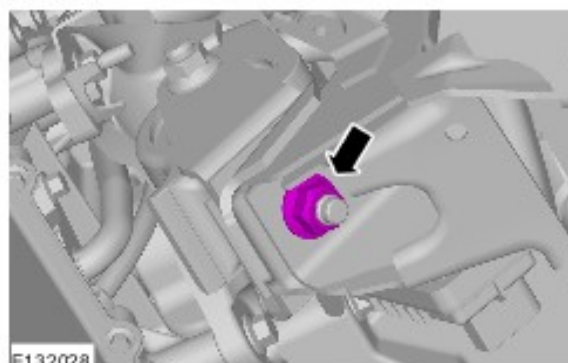
E135454

50.



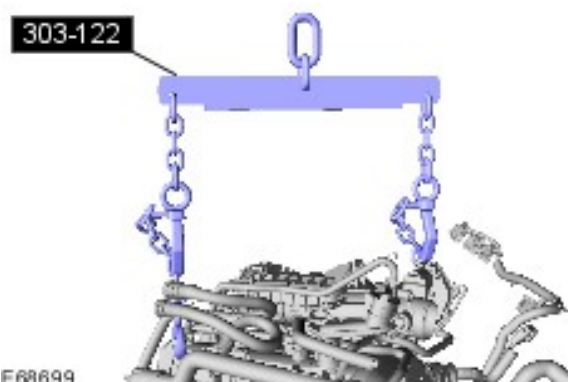
E135452

51. On both sides.



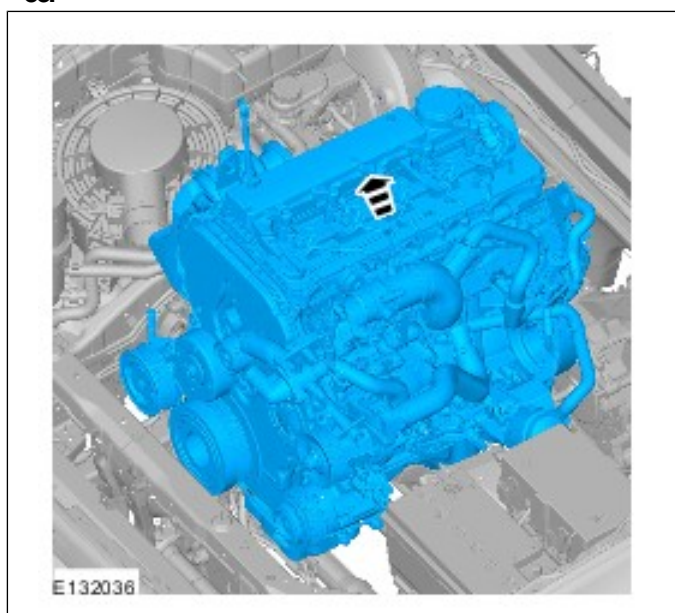
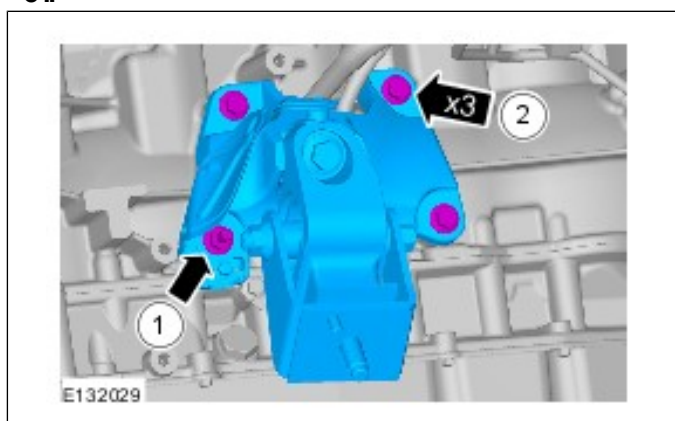
E132028

52. Special Tool(s): 303-122

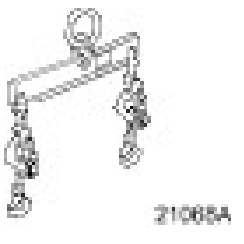
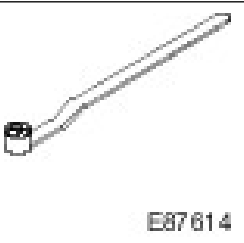
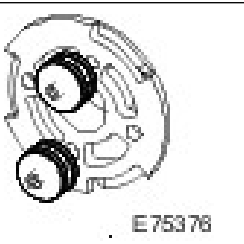
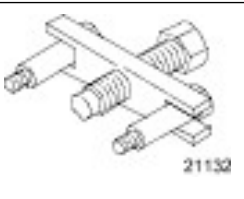
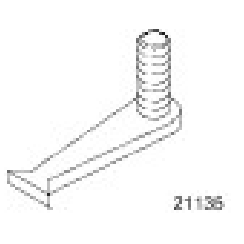



E68699



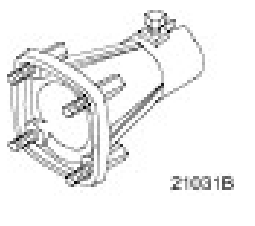
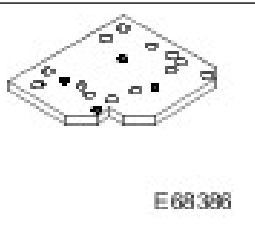
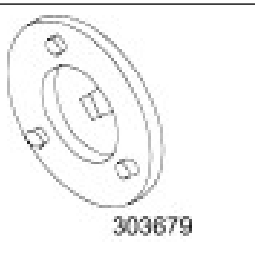
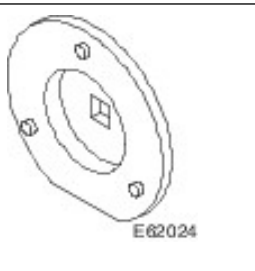
**REMOVAL****53.****54.**

**REMOVAL****Engine Accessories(21 139 4)****Removal****Special Tool(s) / General Equipment**

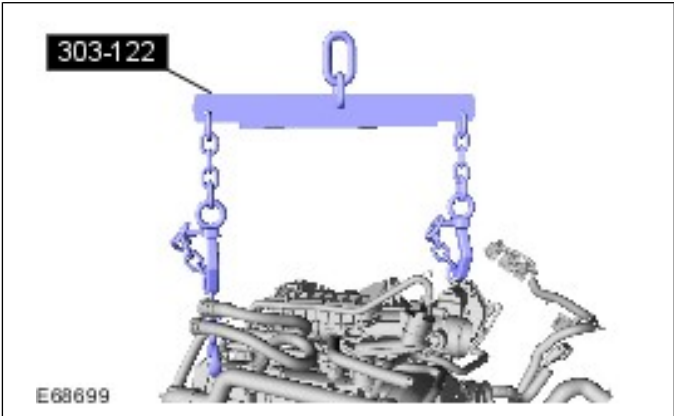
 <p>210854</p>	<p>303-122 Lifting Bracket, Engine</p>
 <p>E87 614</p>	<p>303-1310 Holding Wrench, Crankshaft</p>
 <p>E 753 78</p>	<p>303-1317 Locking Tool, Fuel Injection Pump Sprocket</p>
 <p>21132</p>	<p>303-249 Remover, Crankshaft Timing Pulley</p>
 <p>21126</p>	<p>303-254 Locking Tool, Flywheel</p>
 <p>21187</p>	<p>303-435 Mounting Stand</p>

REMOVAL

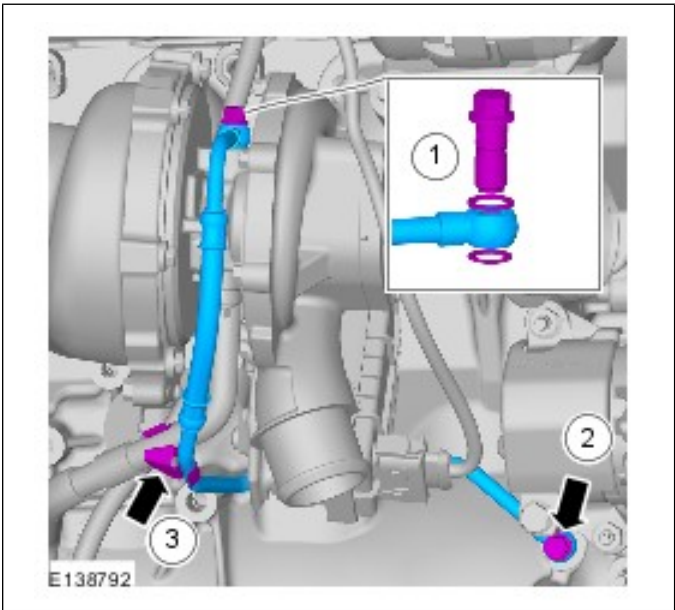
Special Tool(s) / General Equipment

 <p>21031B</p>	303-435-06 Mounting Bracket for 303-435
 <p>E68386</p>	303-435-11B Mounting Plate for 303-435-06
 <p>303679</p>	303-679 Remover/Installer, Engine Front Cover Inspection Plate
 <p>E62024</p>	303-679A Remover/Installer, Engine Front Cover Inspection Plate
1/2 Inch Square Drive Breaker Bar	
Dowel with a Diameter of 6 mm	

1. Install the Special Tool(s): 303-122

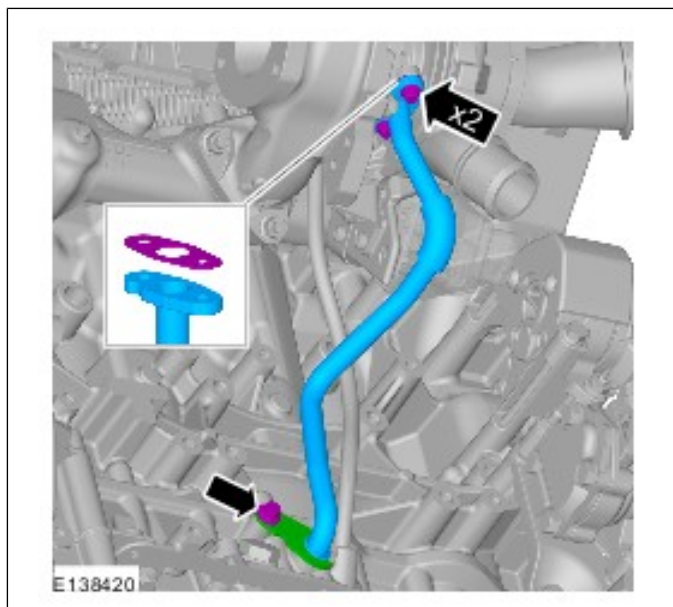


2.

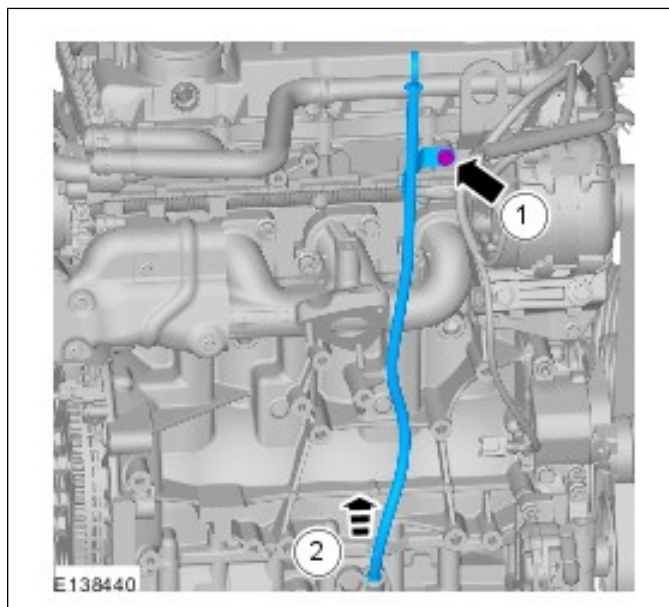


## REMOVAL

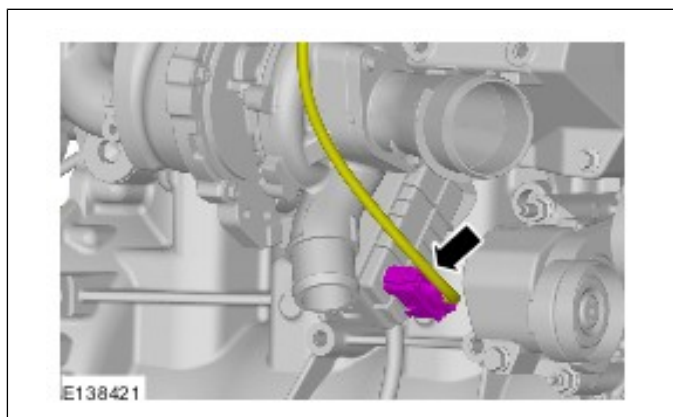
3.



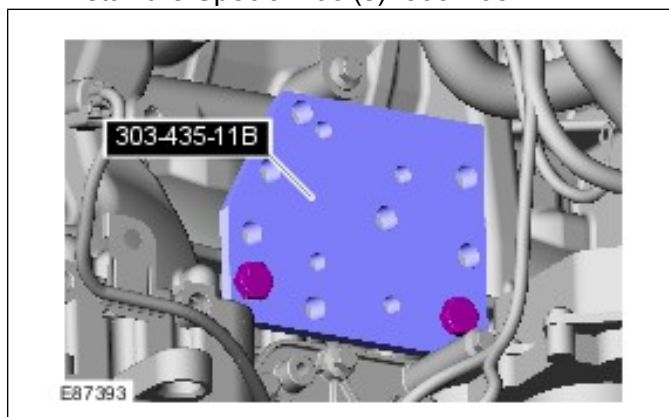
6.



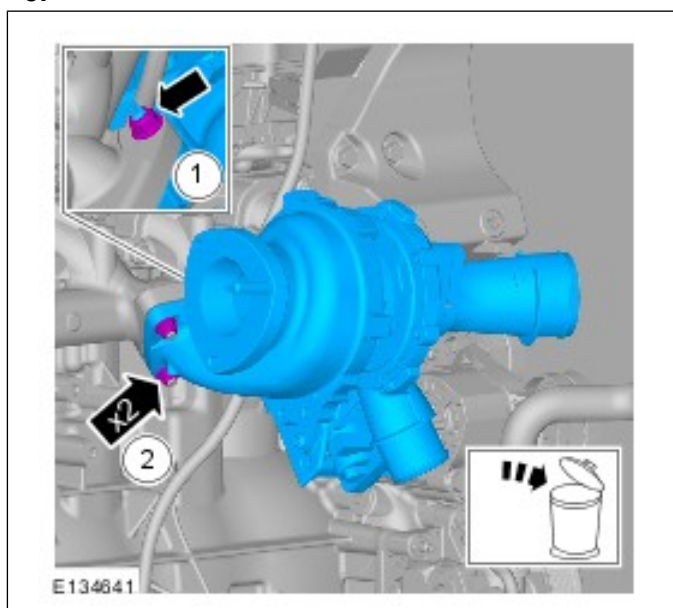
4.



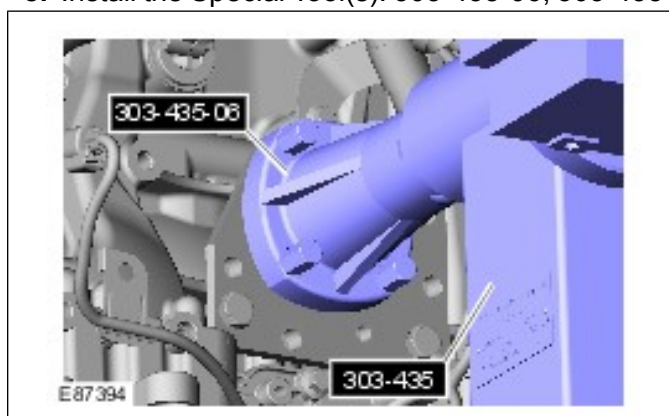
7. Install the Special Tool(s): 303-435-11B



5.



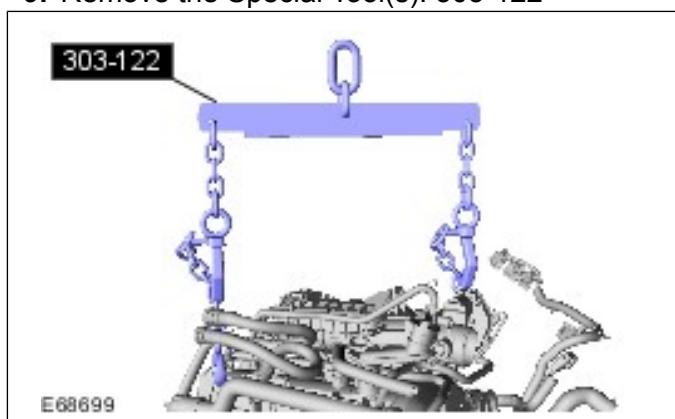
8. Install the Special Tool(s): 303-435-06, 303-435



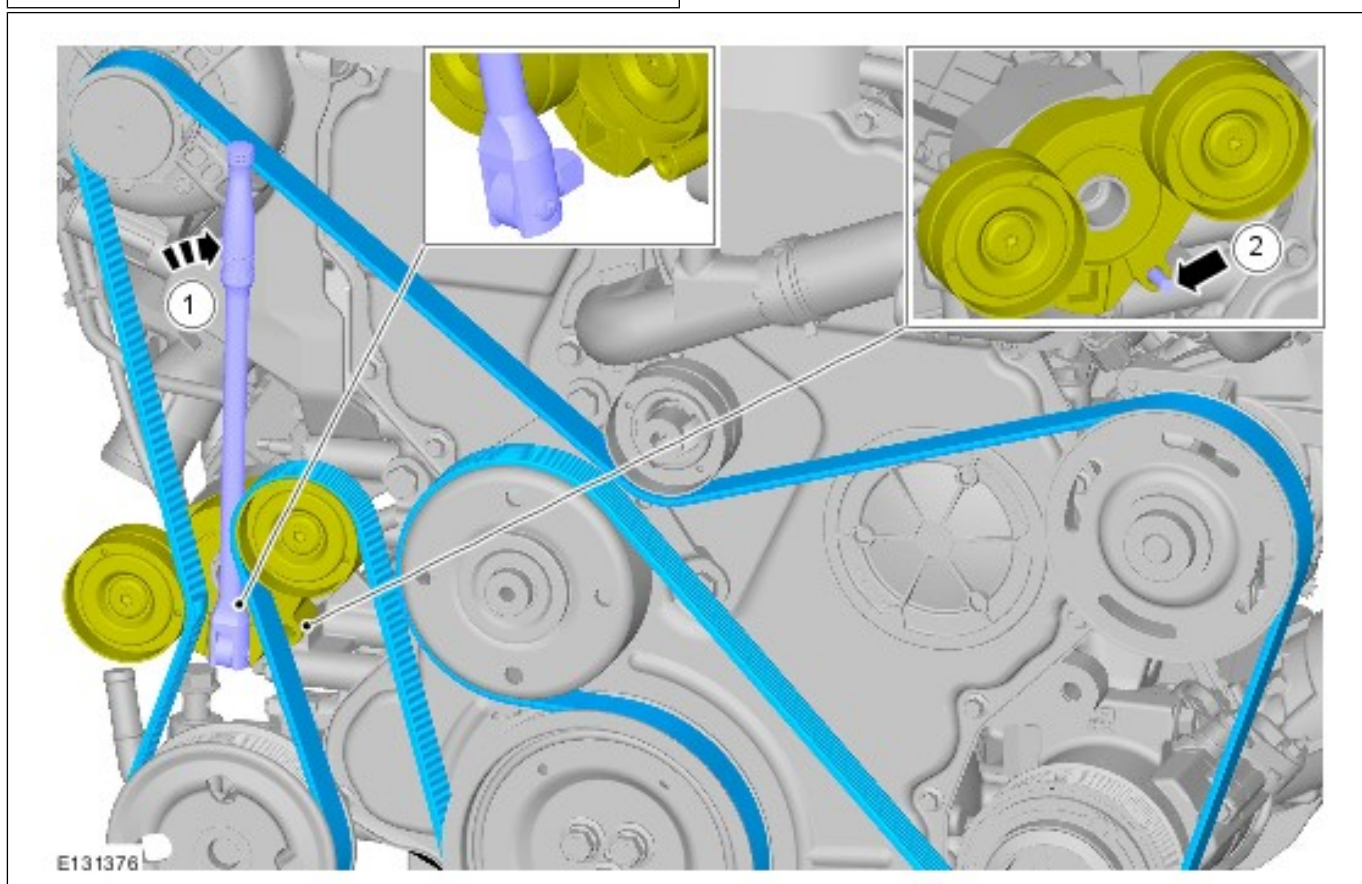


**REMOVAL**

9. Remove the Special Tool(s): 303-122

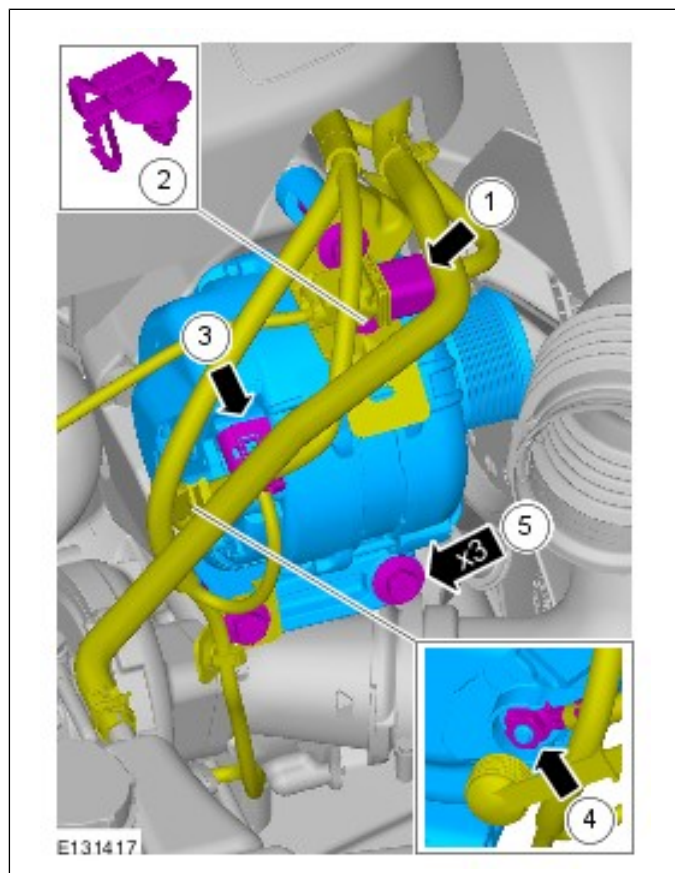


10. General Equipment: 1/2 Inch Square Drive Breaker Bar  
General Equipment: Dowel with a Diameter of 6 mm

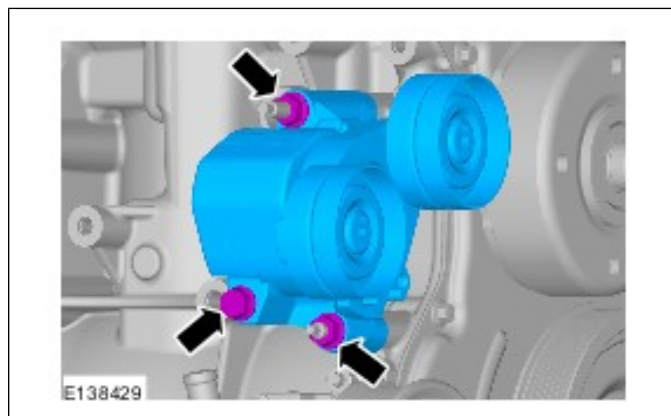


## REMOVAL

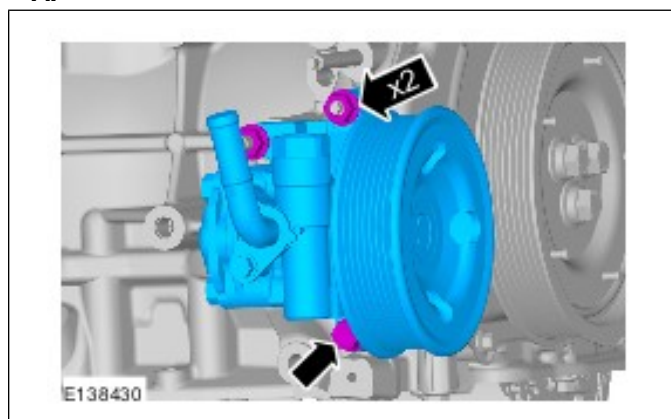
11.  **CAUTION:** Take extra care not to damage the wiring harnesses.



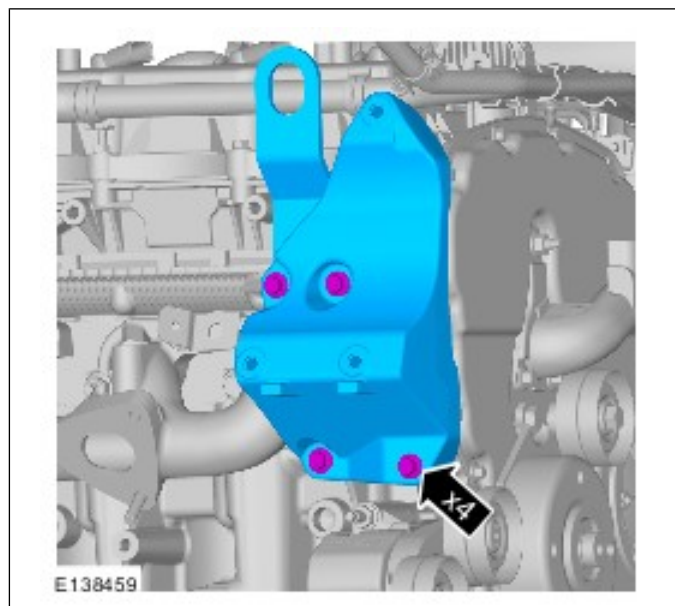
13.



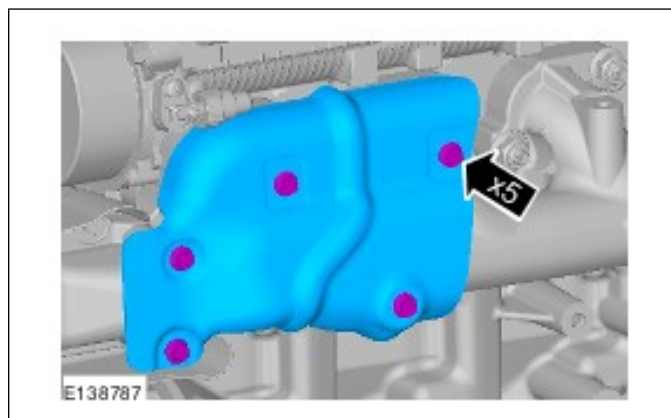
14.



12

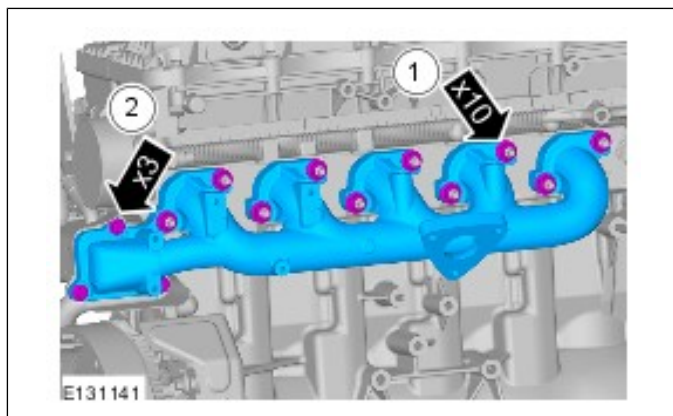


15.



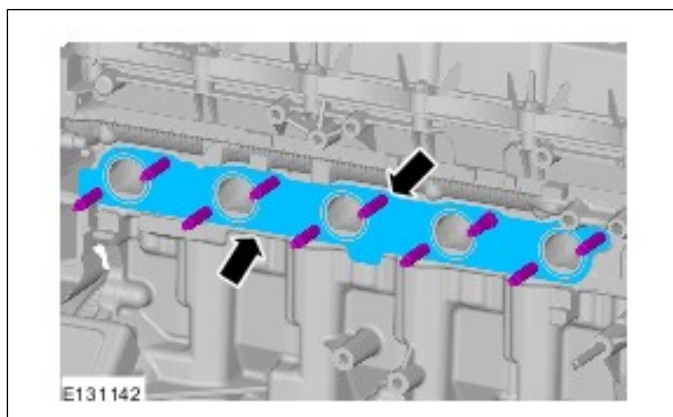
## REMOVAL

16.

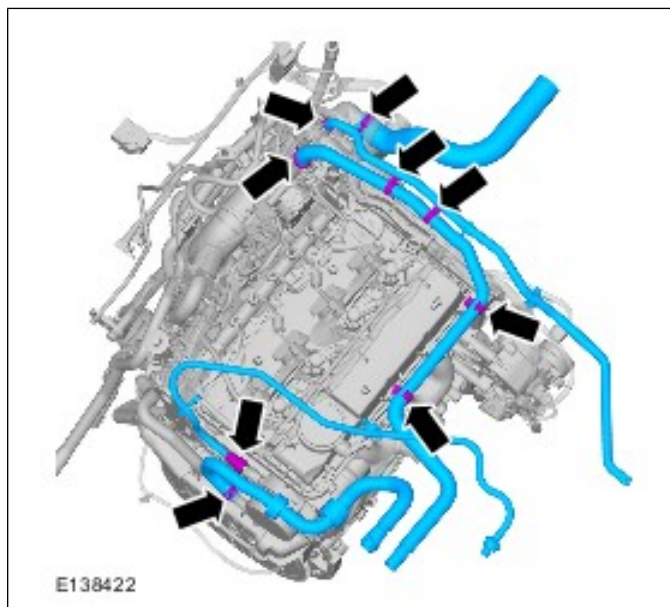


17. **NOTE:** The gasket is to be reused unless damaged.

**NOTE:** The studs are to be reused unless damaged.



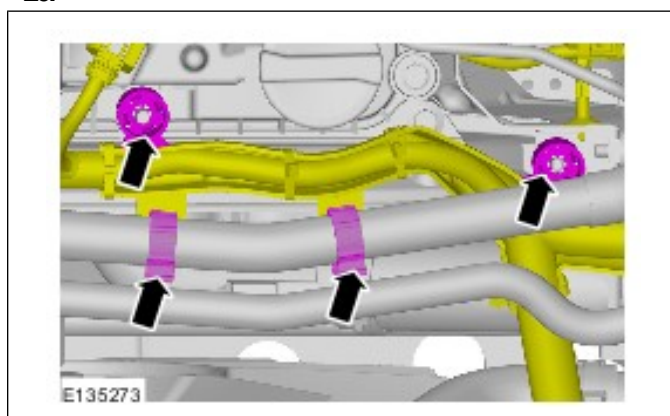
18.



19.



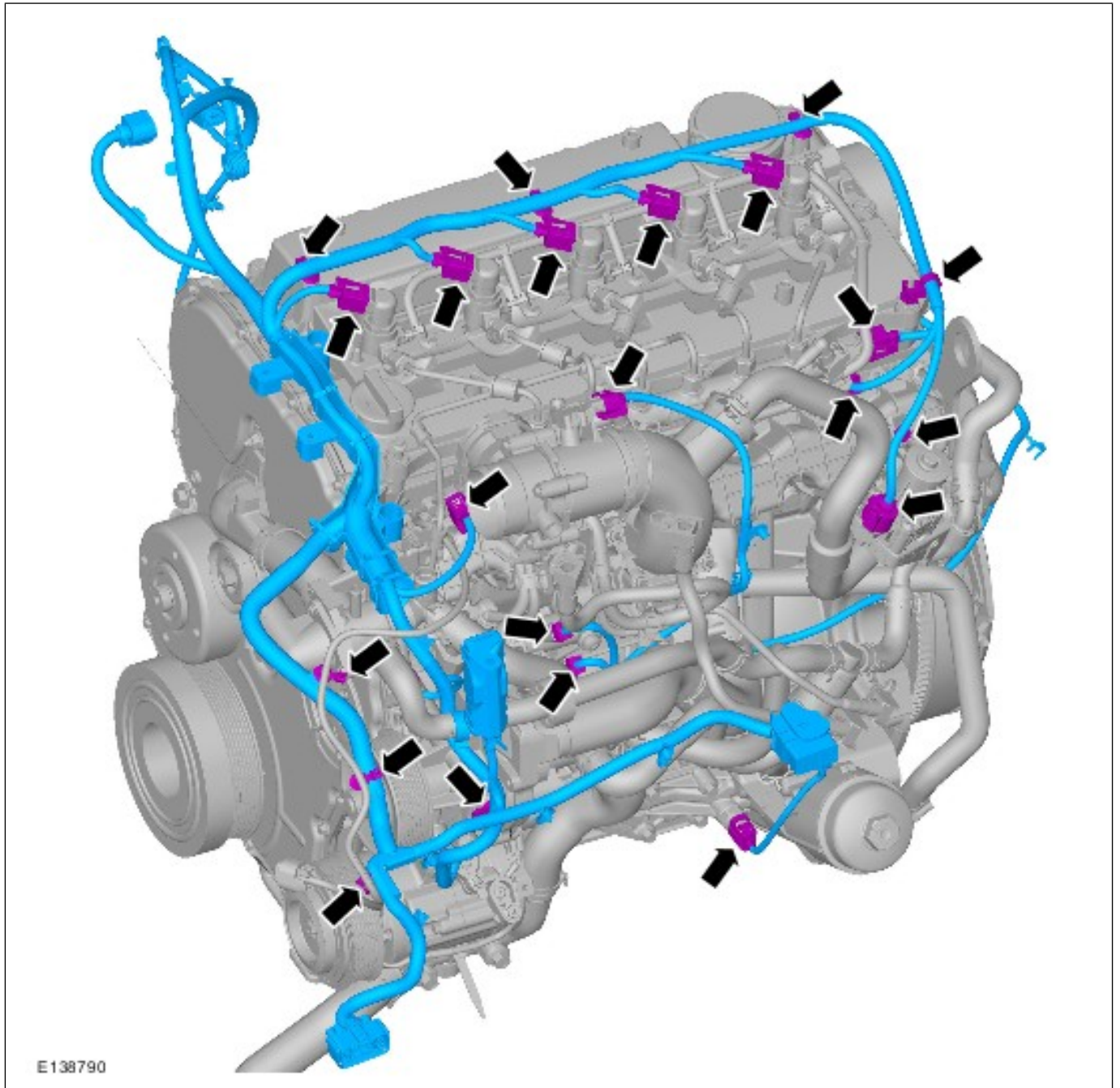
20.



21.



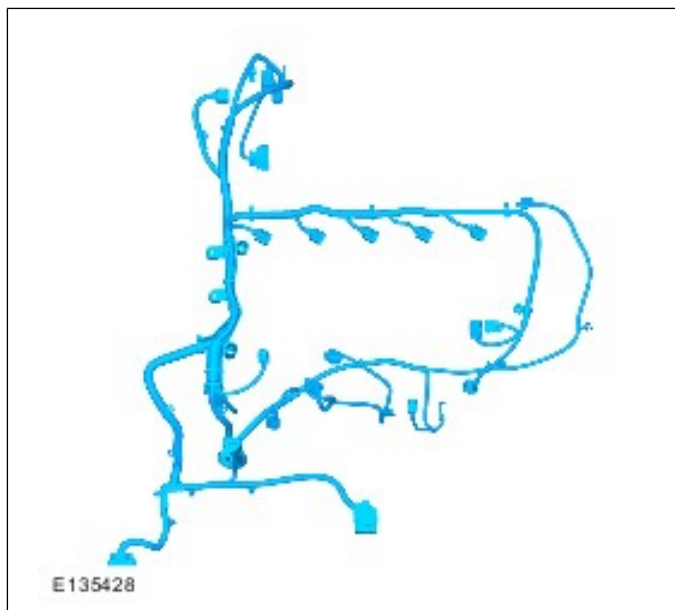
## REMOVAL



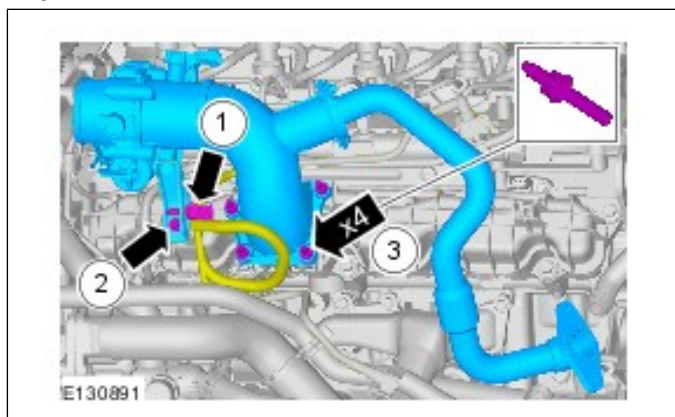


## REMOVAL

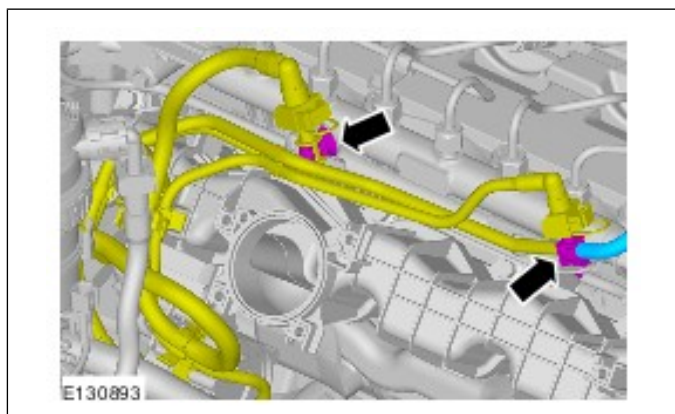
22.



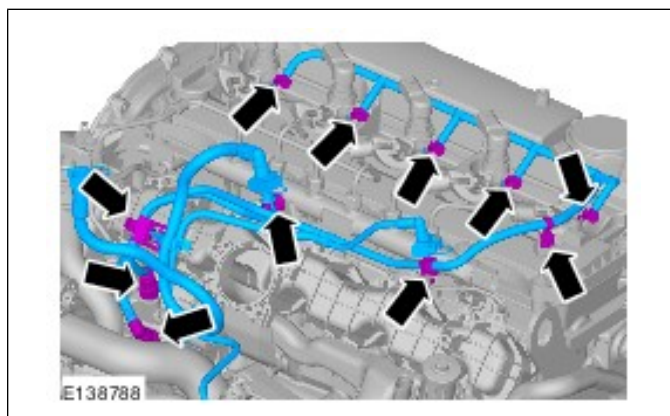
23.



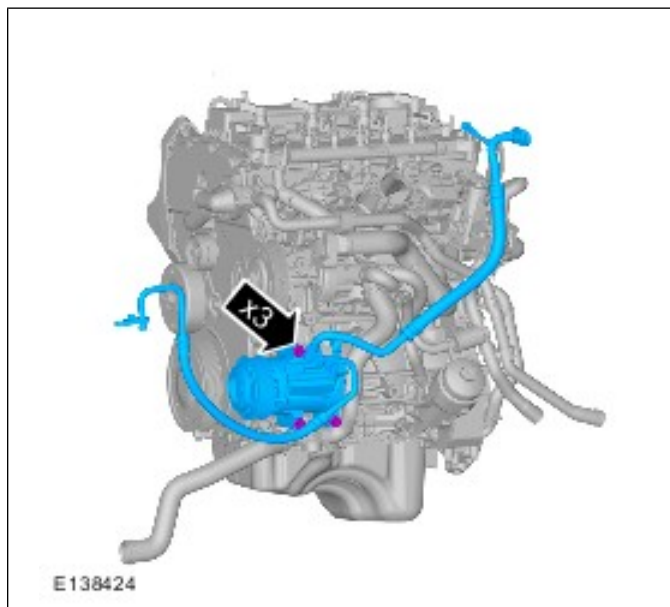
24.



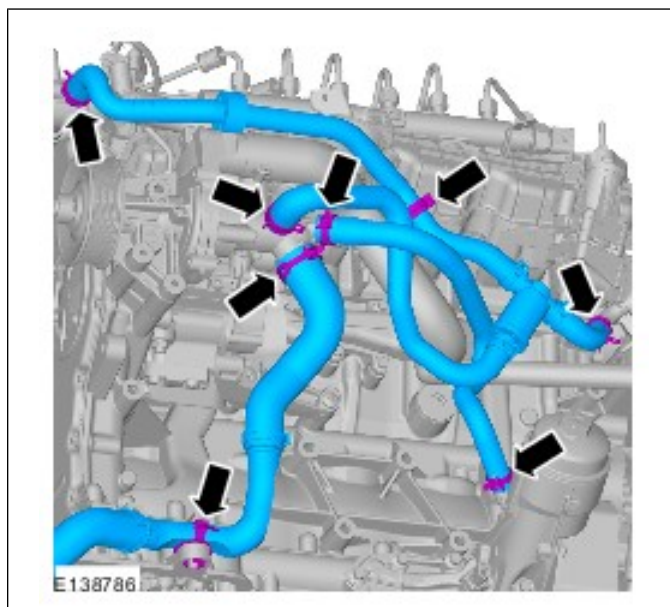
25.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.



26.

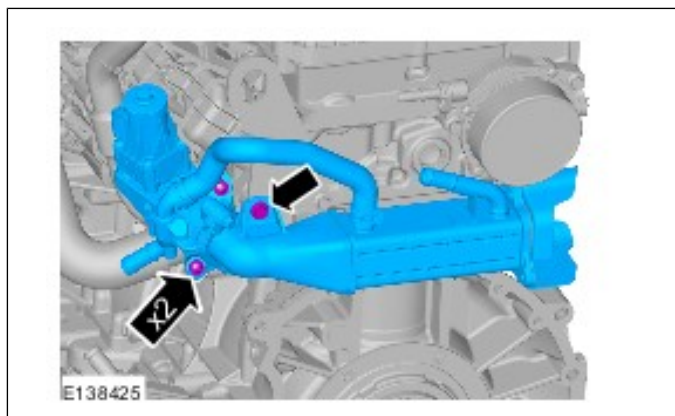


27.

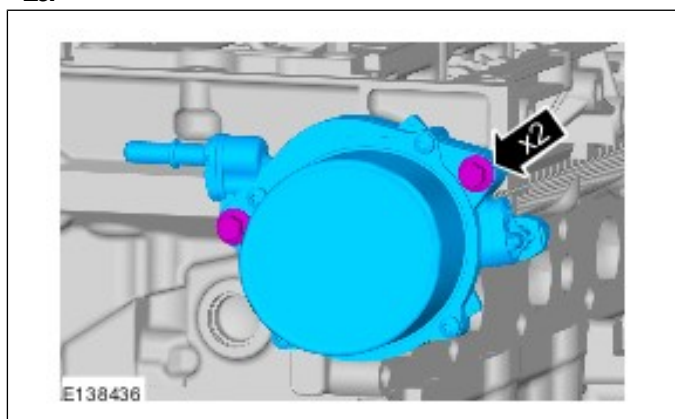


## REMOVAL

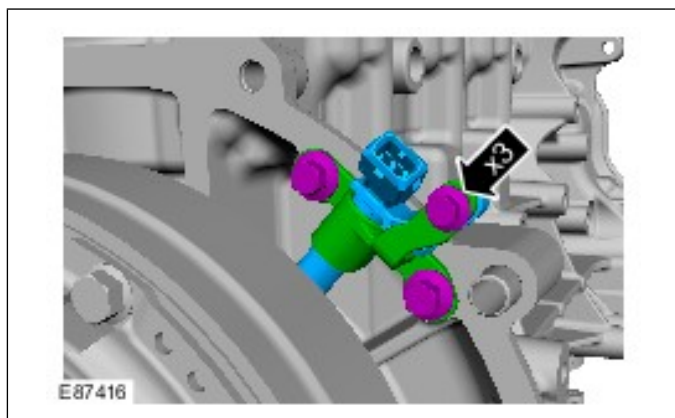
28.



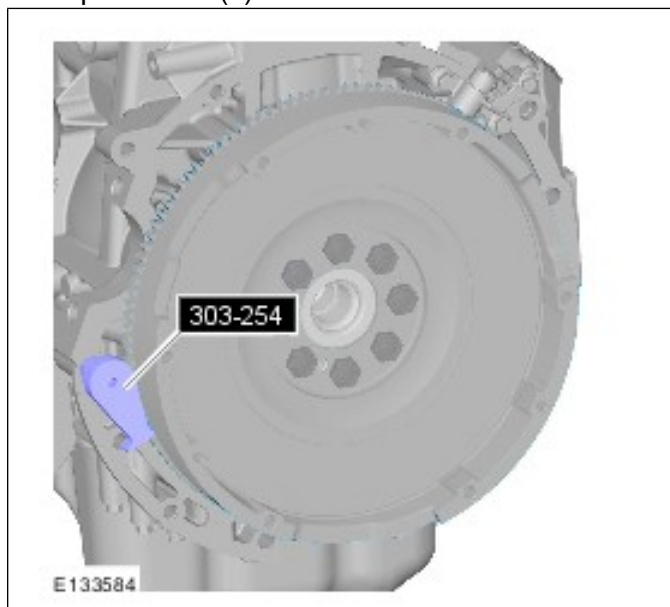
29.



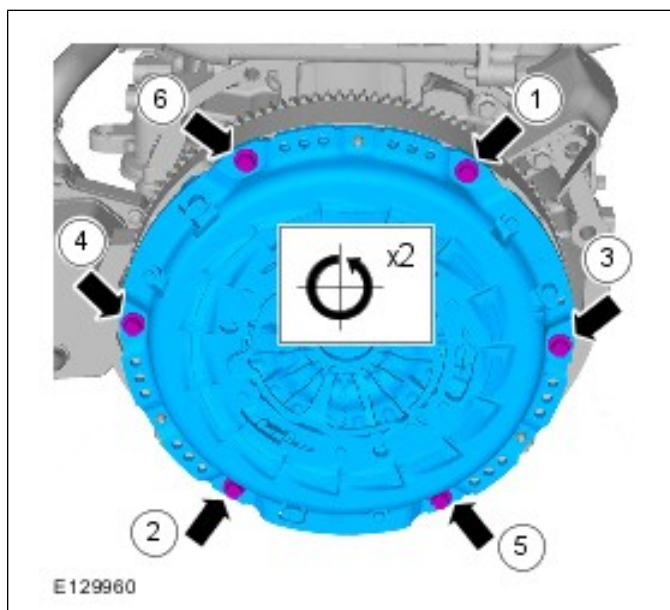
30.



31. Special Tool(s): 303-254



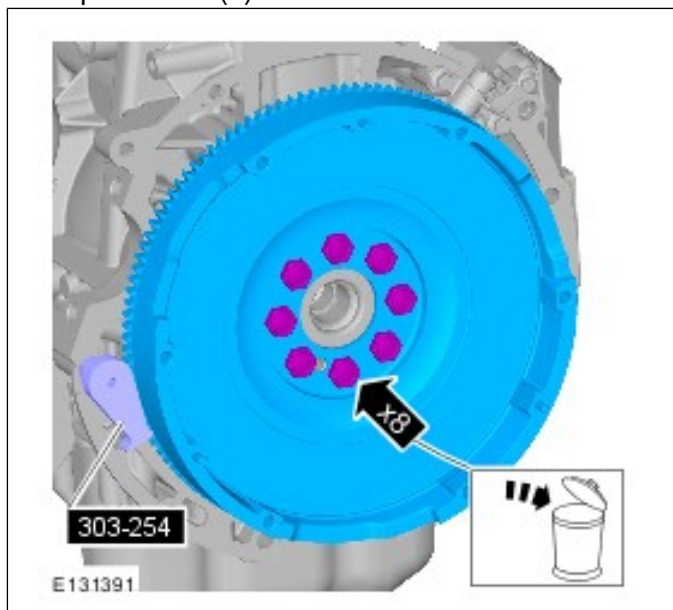
**32 NOTE:** Do not loosen the bolts more than 2 turns.



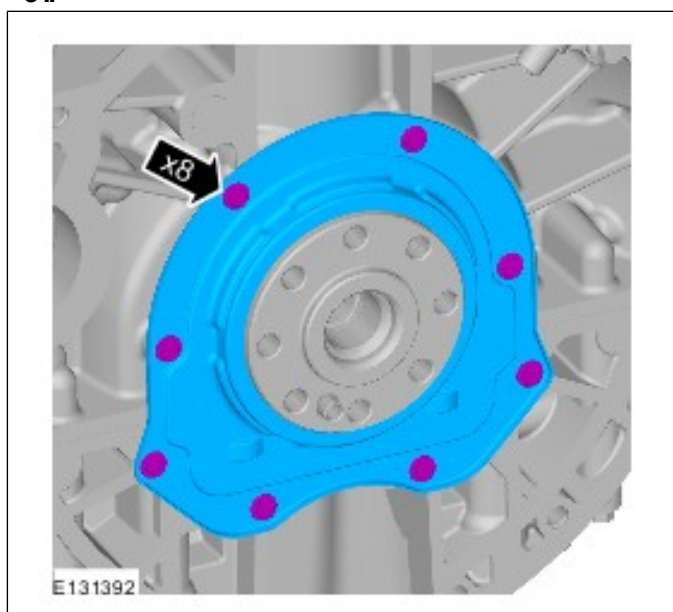


## REMOVAL

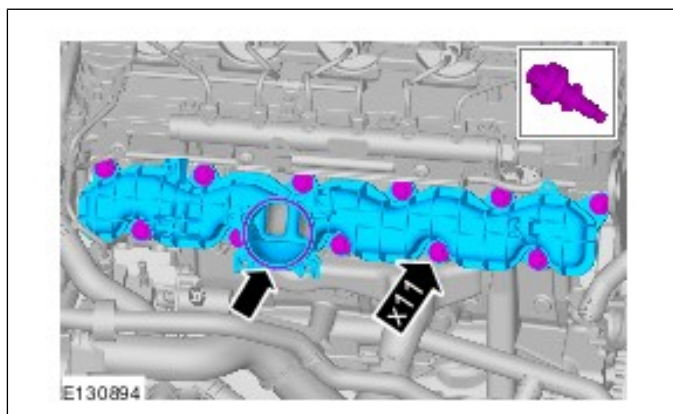
33. Special Tool(s): 303-254



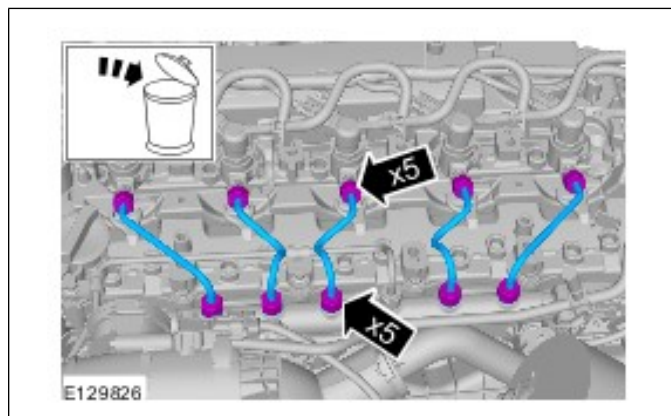
34.



35.

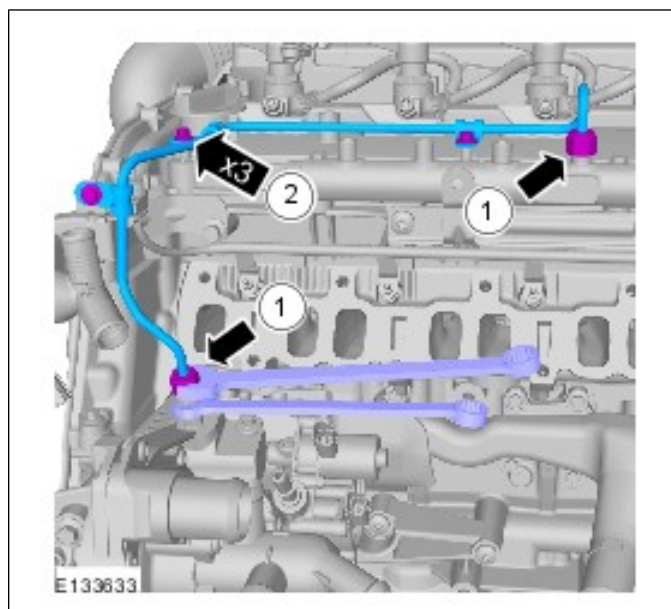


36.



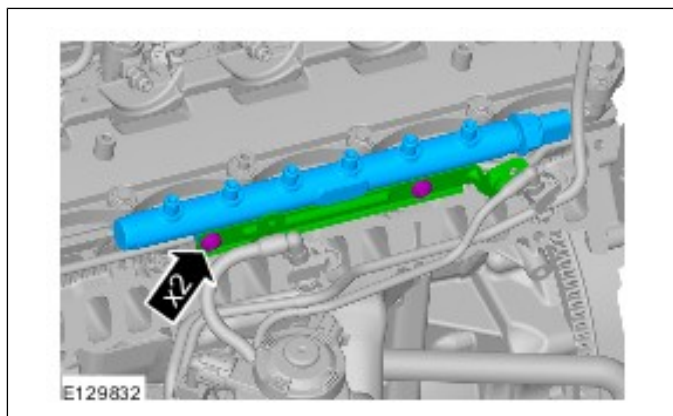
## 37. CAUTIONS:

- ⚠ Make sure that the fuel line remains in contact at both ends until both unions have been unscrewed and the area around the joints thoroughly cleaned.
- ⚠ Make sure that the high-pressure fuel supply line remains in contact with both the fuel pump and the fuel rail until both unions have been detached and cleaned.
- ⚠ Make sure that all openings are sealed. Use new blanking caps.

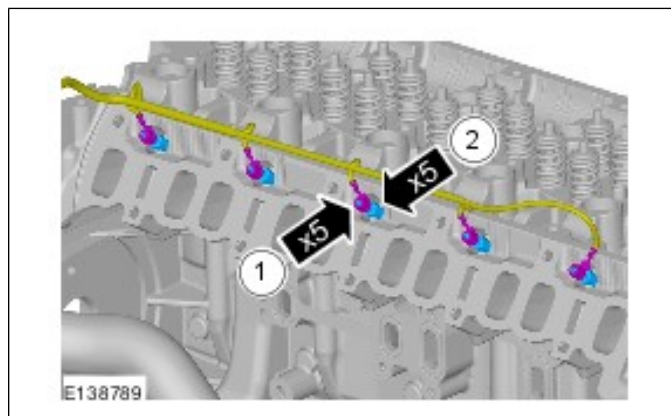


## REMOVAL

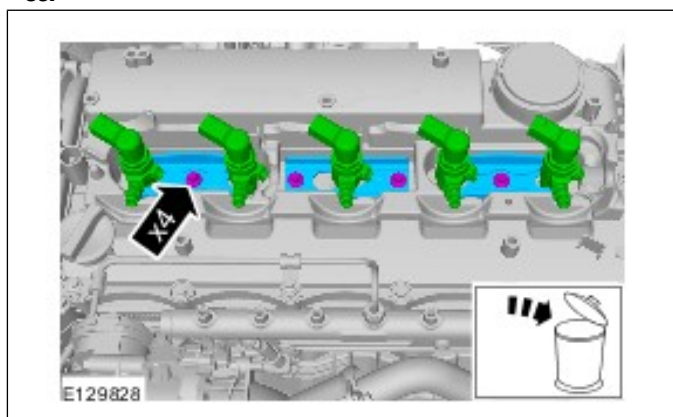
38.



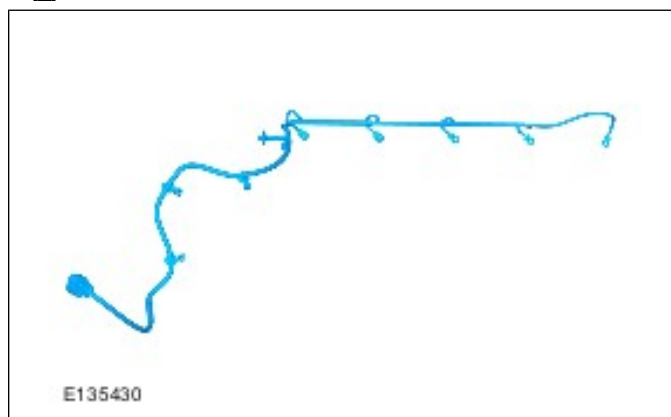
41.



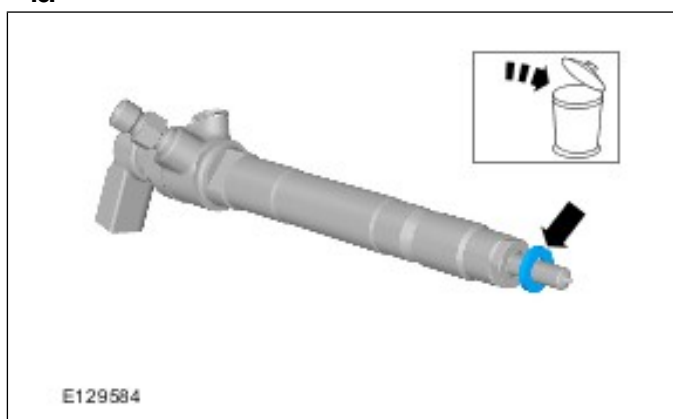
39.



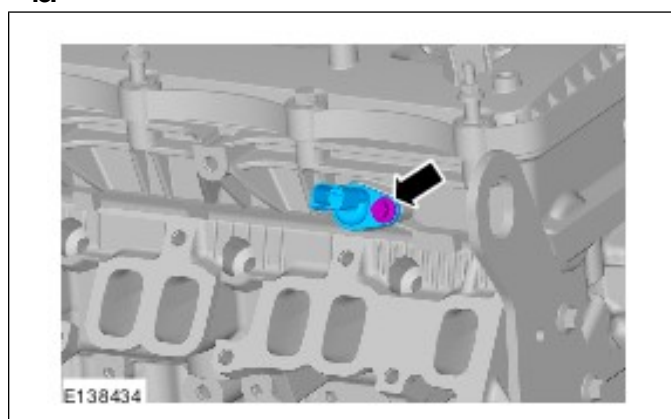
42.



40.



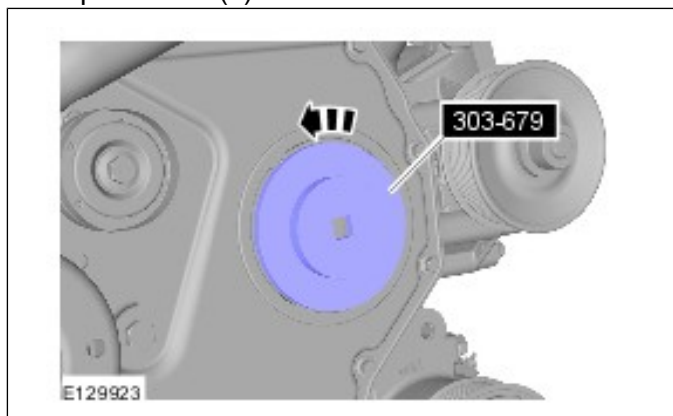
43.



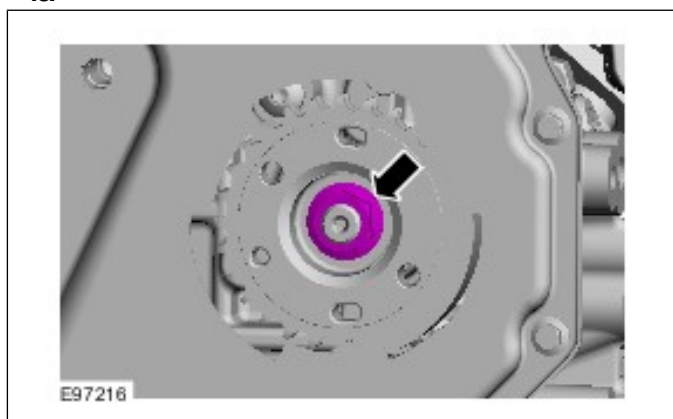


## REMOVAL

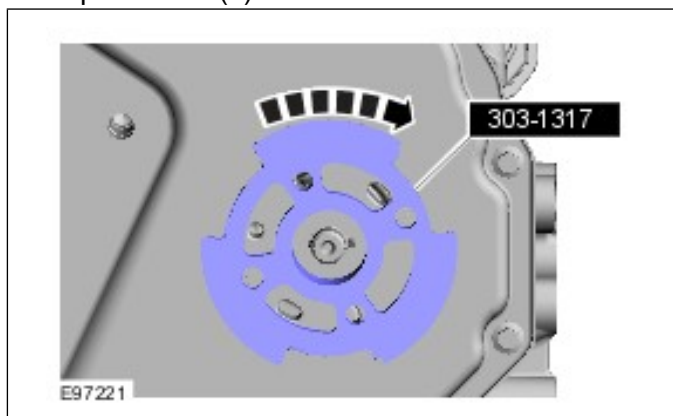
44. Special Tool(s): 303-679



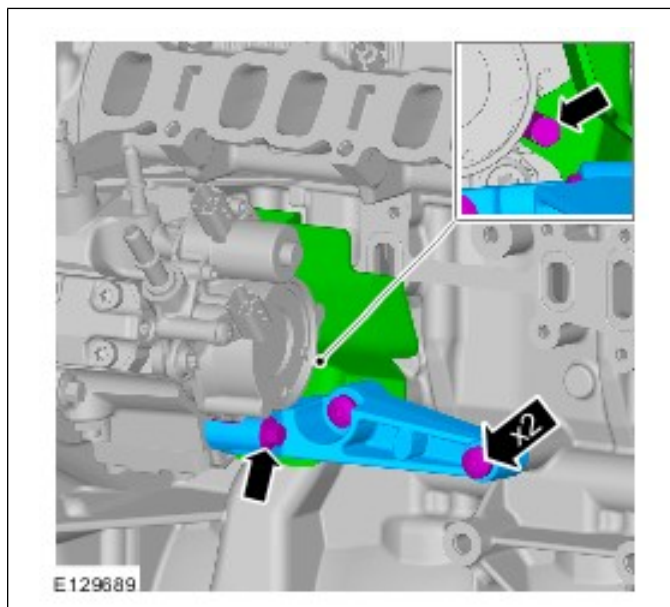
45.



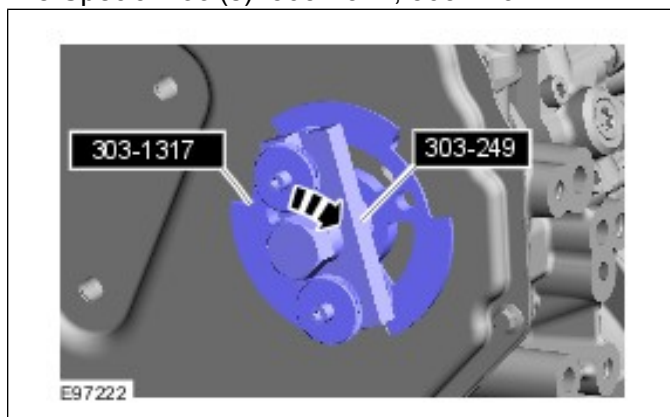
46. Special Tool(s): 303-1317



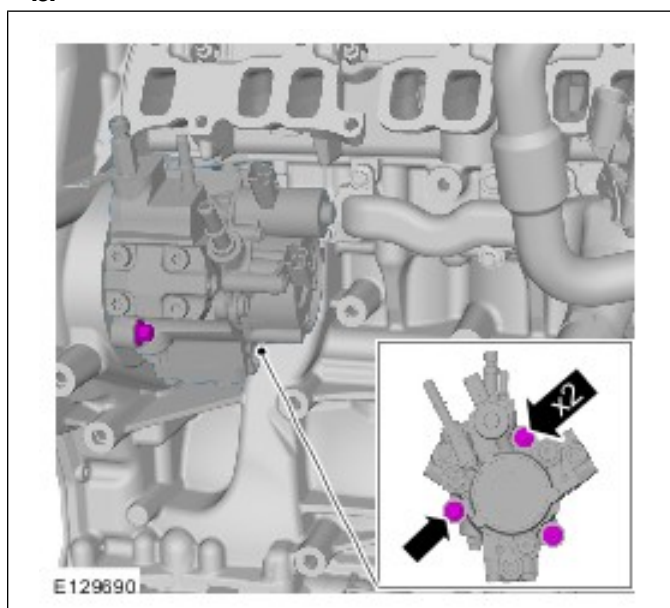
47.



48. Special Tool(s): 303-1317, 303-249

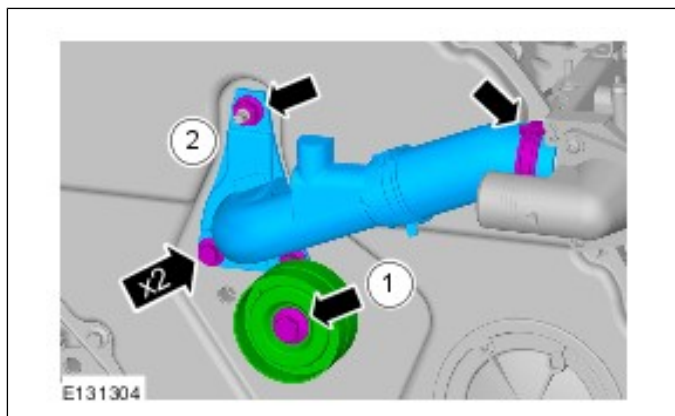


49.

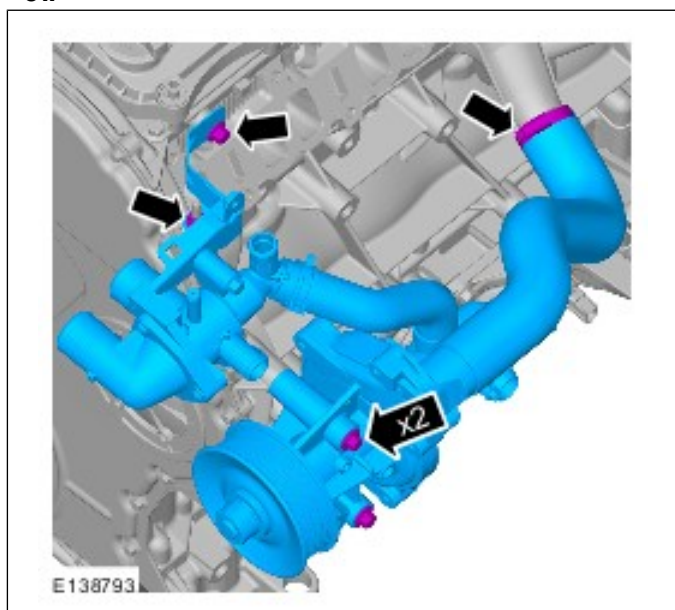


## REMOVAL

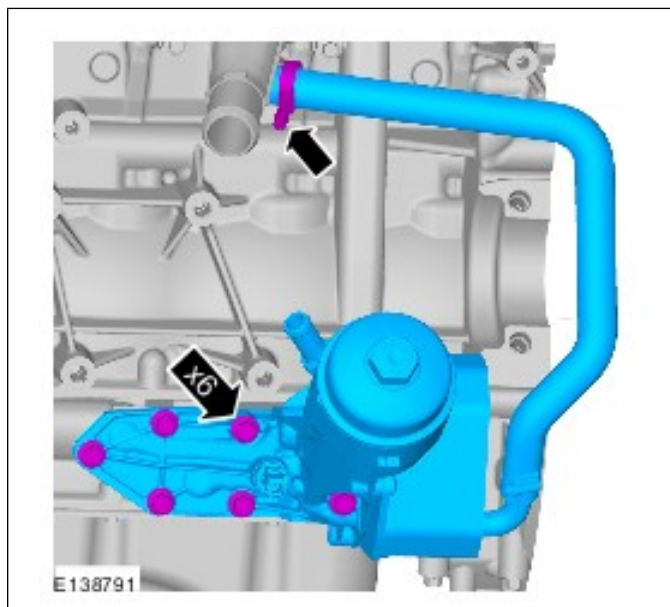
50.



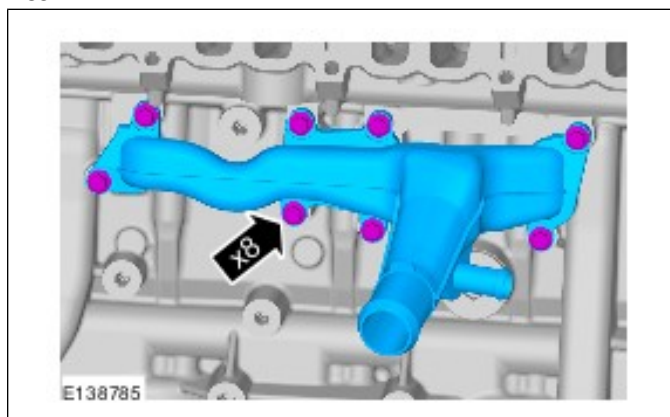
51.



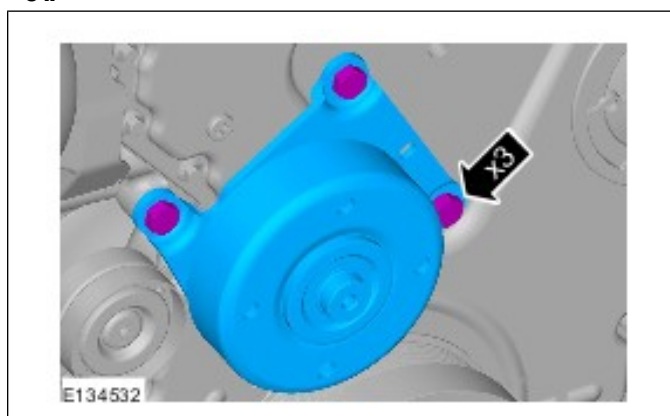
52.



53.

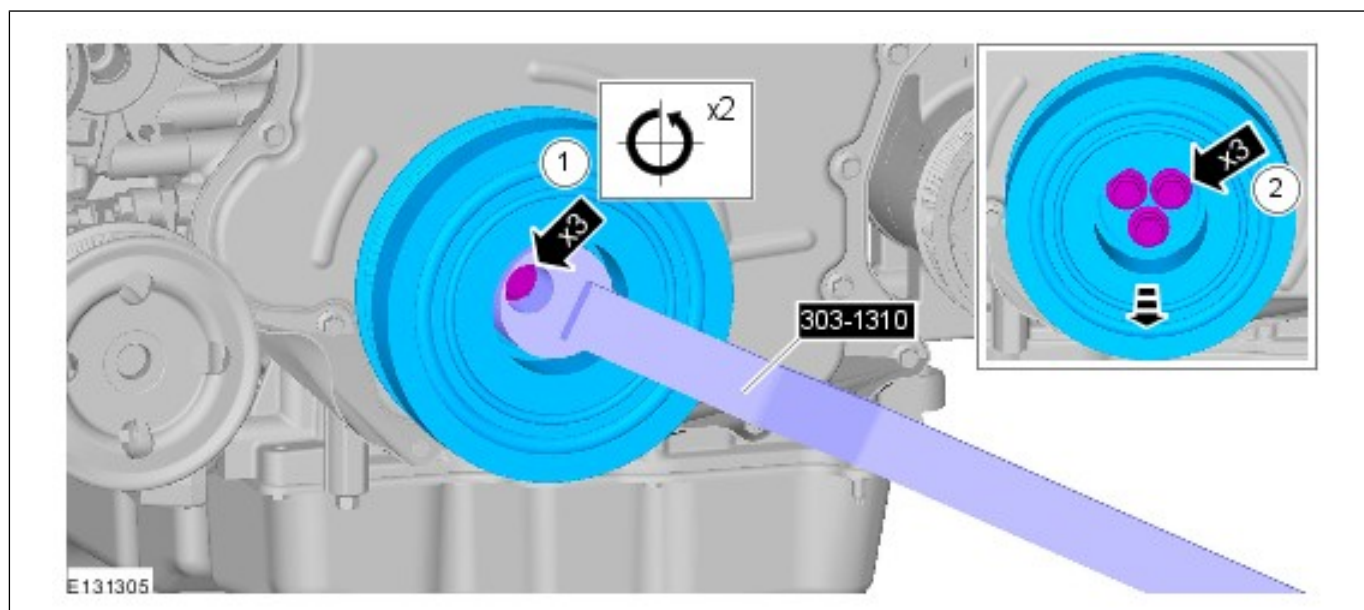


54.

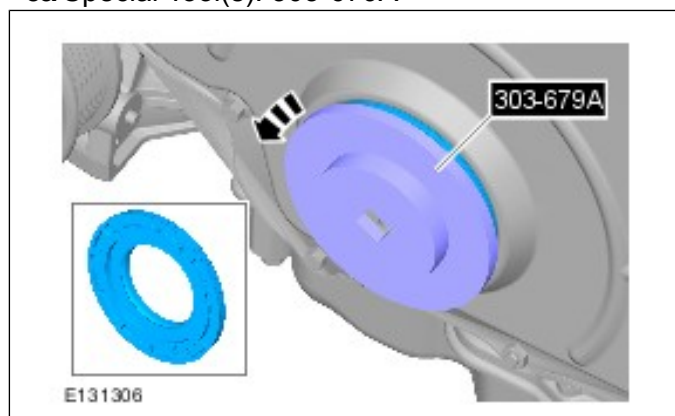


55. Special Tool(s): 303-1310



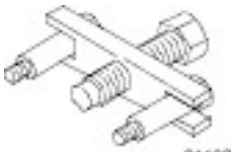


## REMOVAL



## 56. Special Tool(s): 303-679A



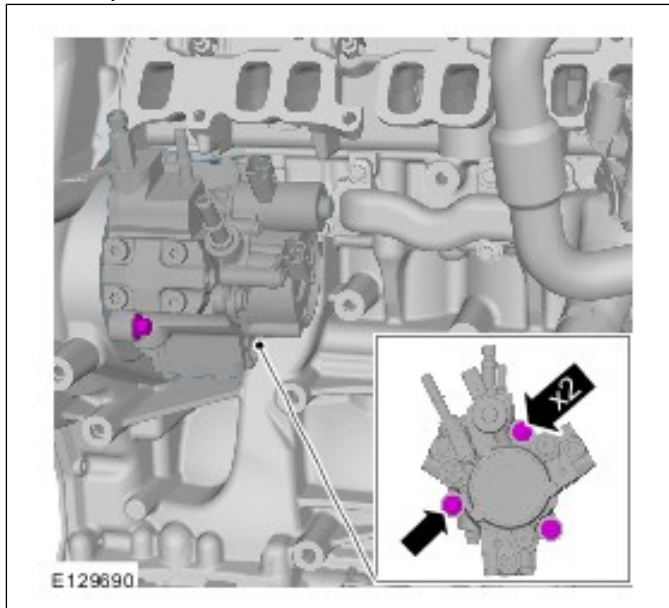
**DISASSEMBLY****Engine(21 134 8)****Disassembly****Special Tool(s) / General Equipment**

 <p>17063</p>	<p>100-010 Remover, O-Ring Seal</p>
 <p>E 753 78</p>	<p>303-1317 Locking Tool, Fuel Injection Pump Sprocket</p>
 <p>21132</p>	<p>303-249 Remover, Crankshaft Timing Pulley</p>
 <p>21179</p>	<p>303-428 Separator, Oil Pan</p>
 <p>E62024</p>	<p>303-679A Remover/Installer, Engine Front Cover Inspection Plate</p>
<p>2 mm Punch</p>	



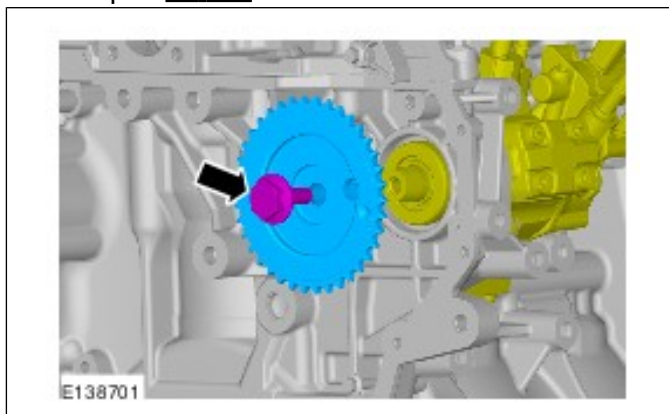
**DISASSEMBLY**

1. Torque: 23 Nm

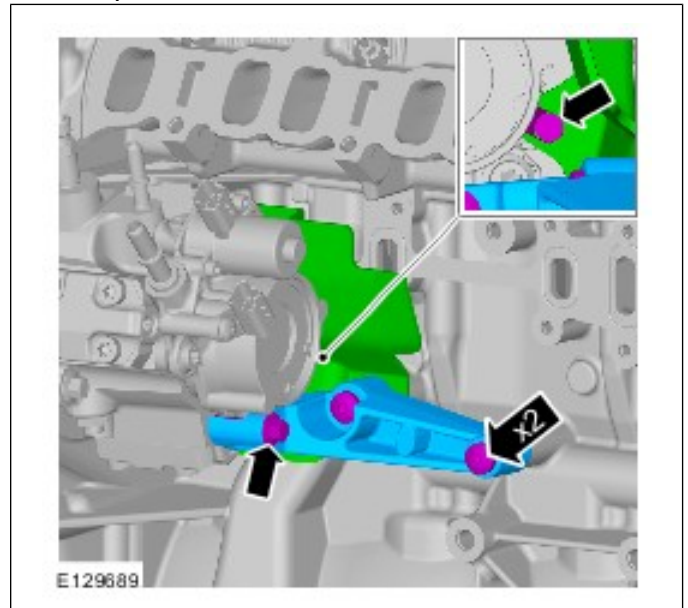


2. **NOTE:** Make sure that a new component is installed.

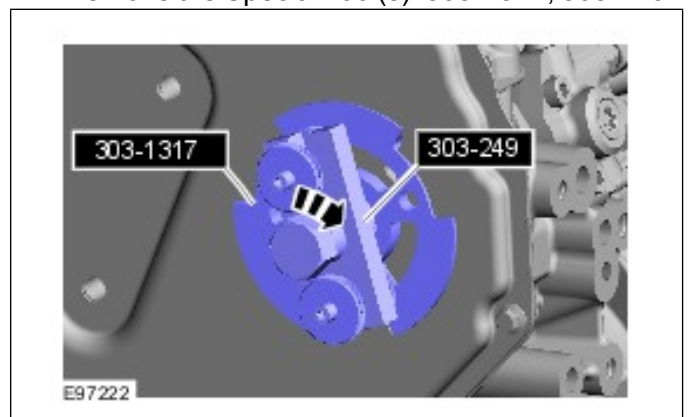
Torque: 45 Nm



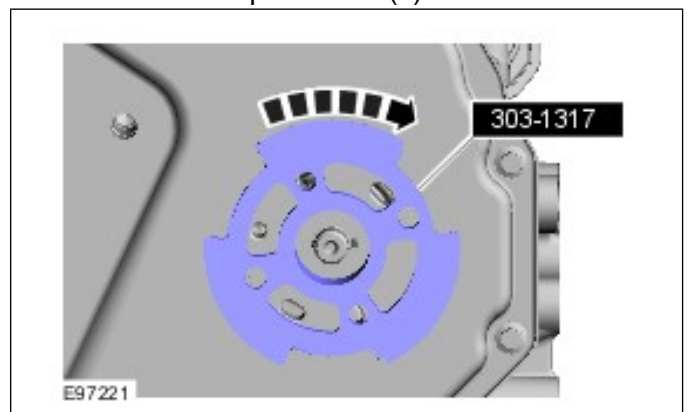
3. Torque: 22 Nm



4. Remove the Special Tool(s): 303-1317, 303-249

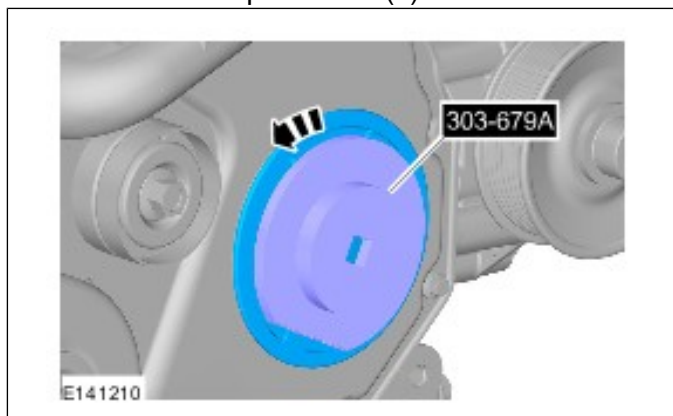


5. Remove the Special Tool(s): 303-1317

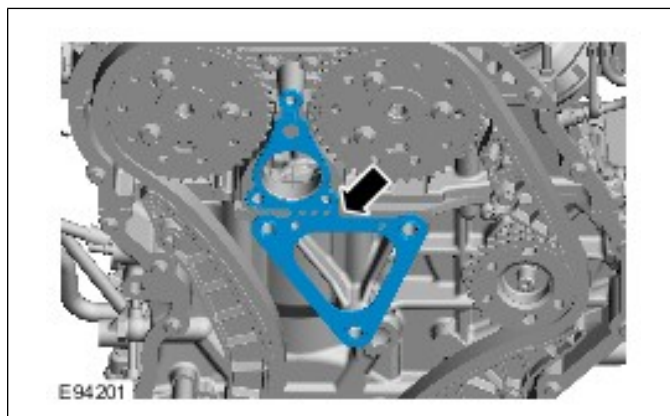


**DISASSEMBLY**

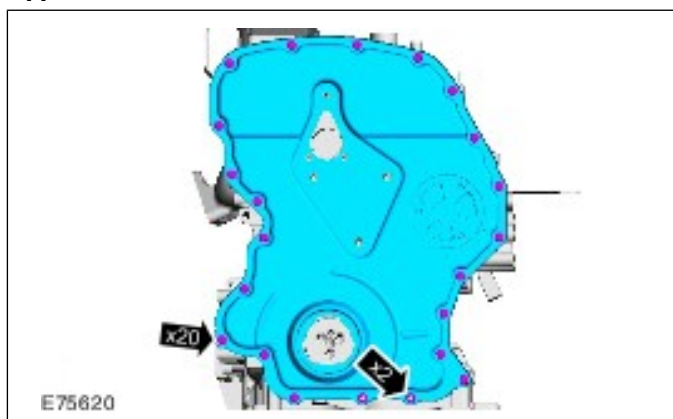
6. Remove the Special Tool(s): 303-679A



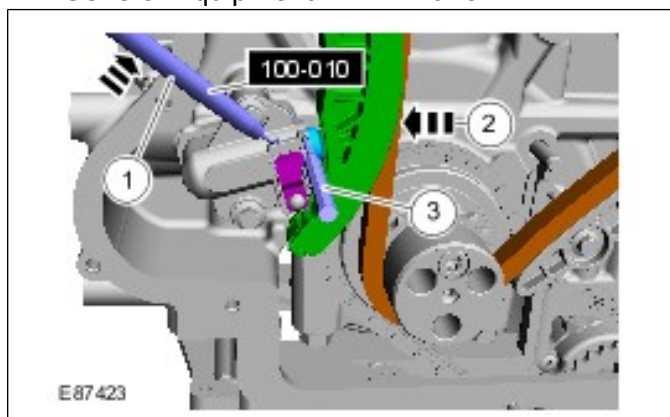
9.



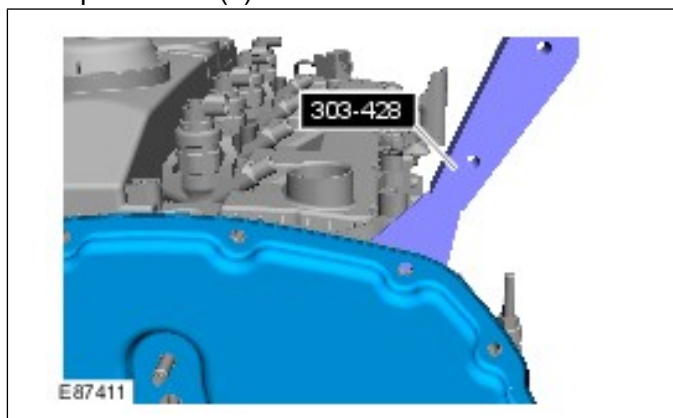
7.



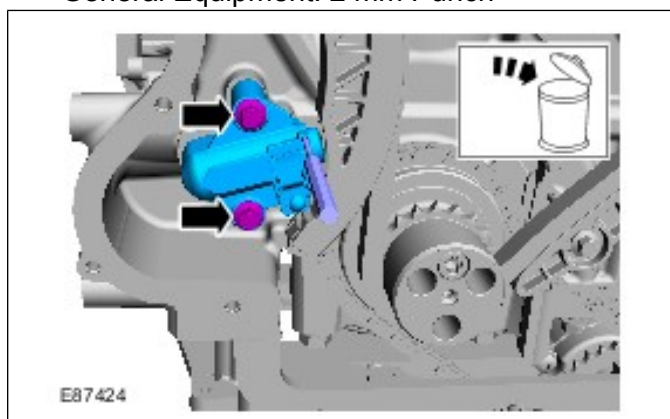
10. Special Tool(s): 100-010  
General Equipment: 2 mm Punch



8. Special Tool(s): 303-428

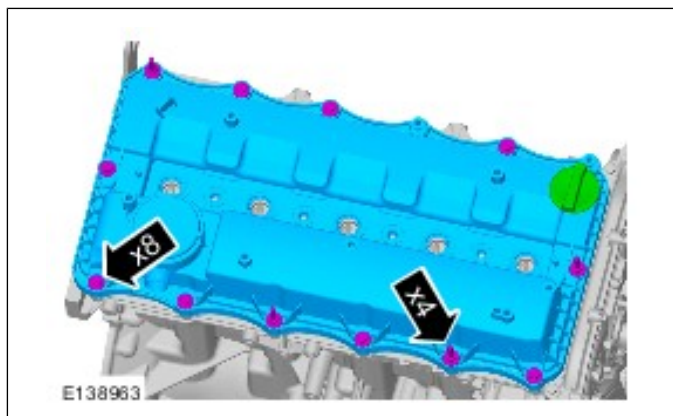


11. Remove and discard the timing chain tensioner.  
General Equipment: 2 mm Punch

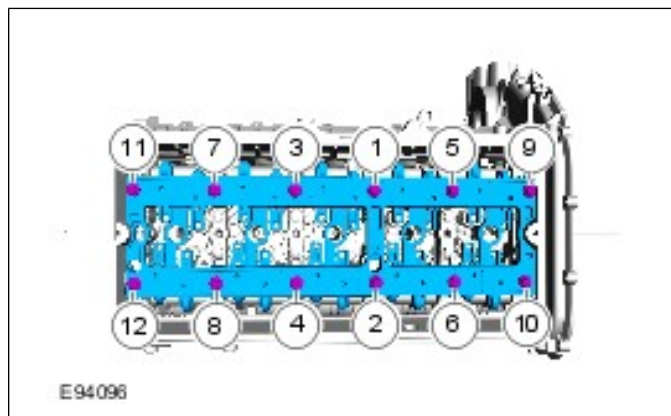


## DISASSEMBLY

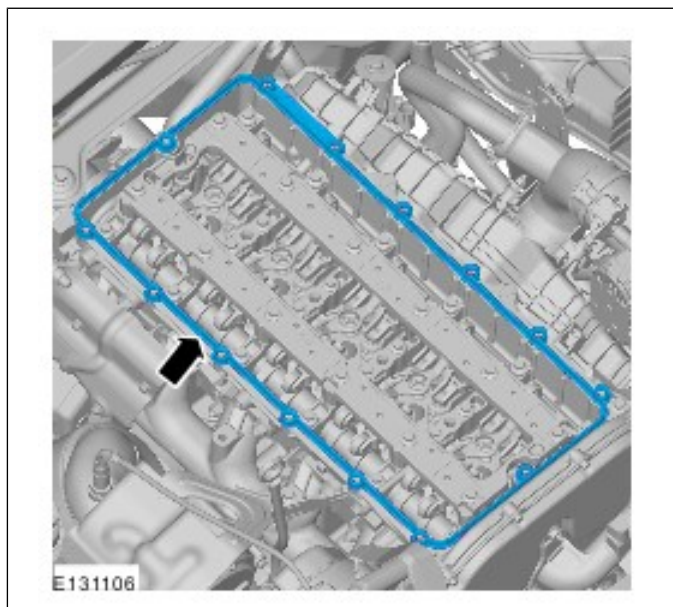
12.



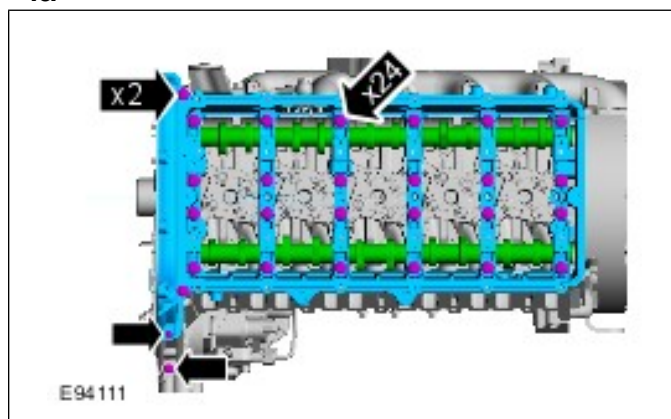
15.



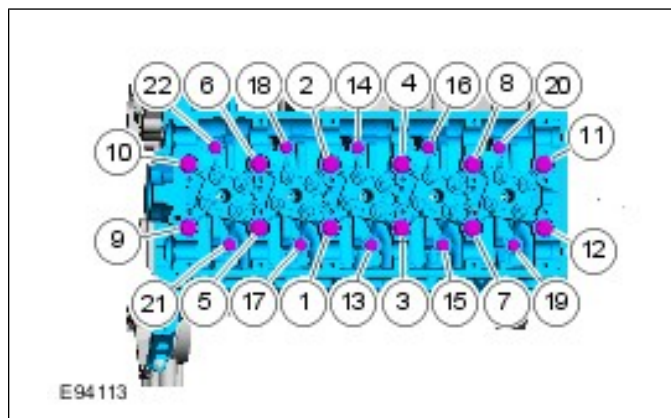
**13. NOTE:** The gasket is to be reused unless damaged.



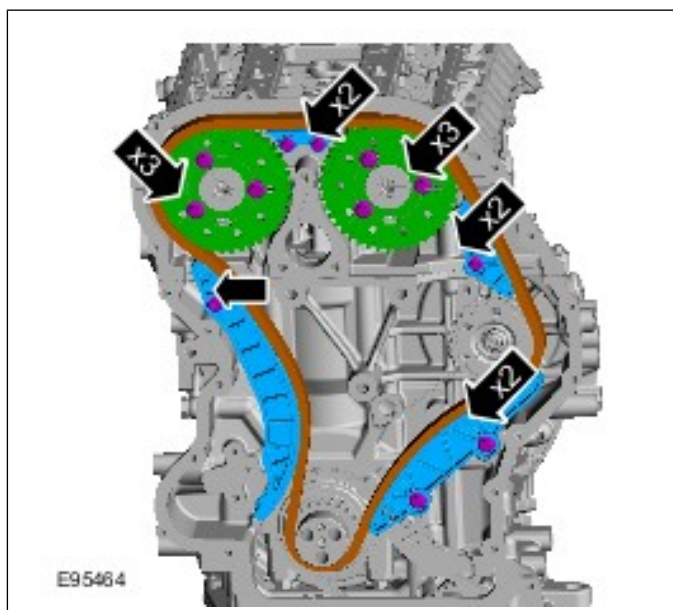
16.



17.




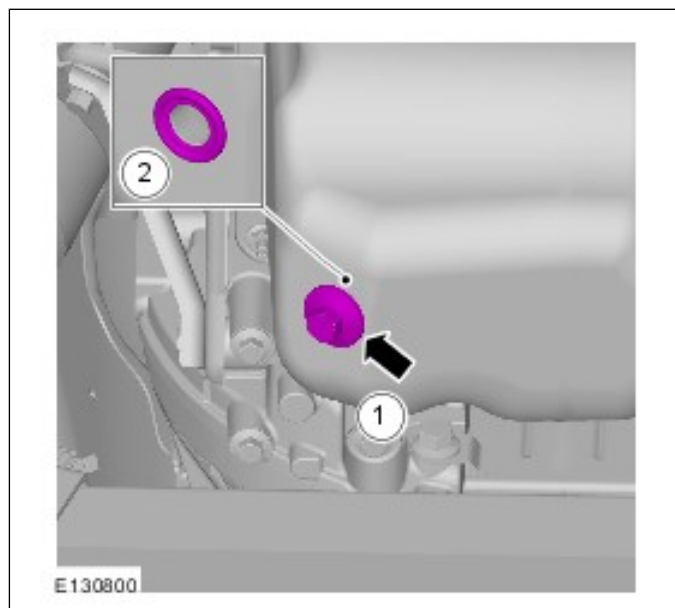
14.



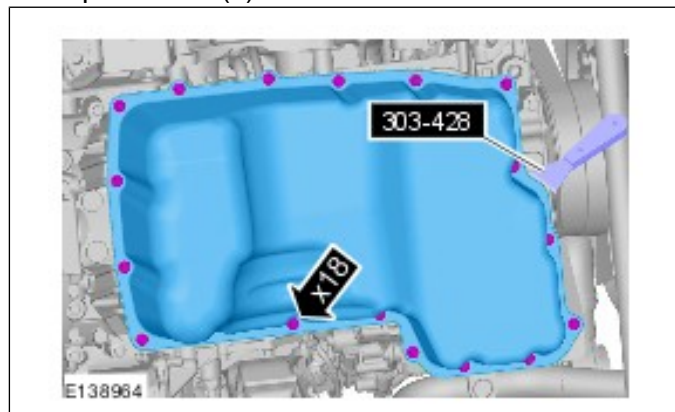


## DISASSEMBLY

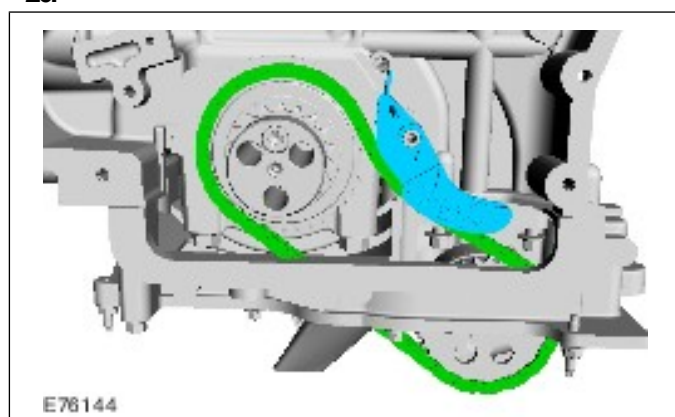
18.  **WARNING:** Be prepared to collect escaping fluid.



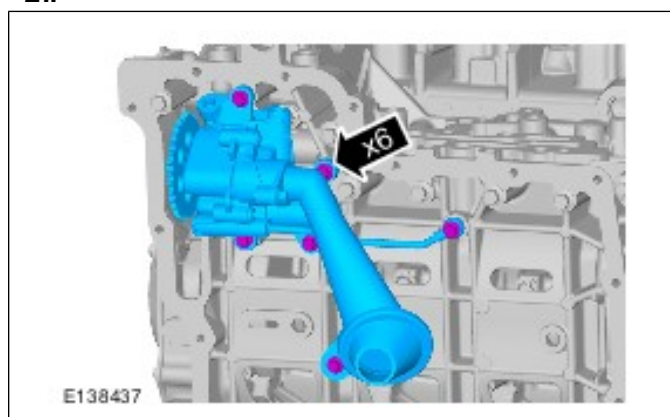
19. Special Tool(s): 303-428



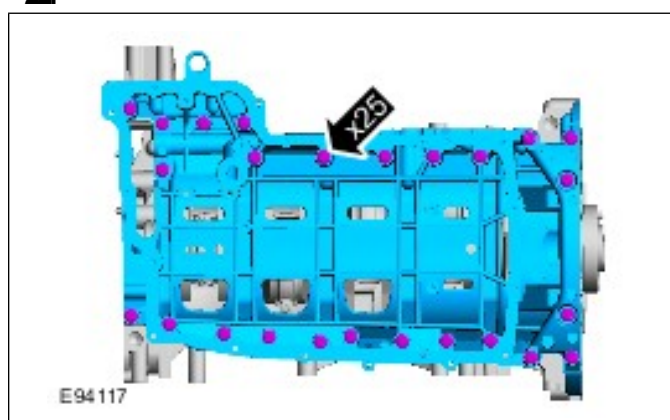
20.



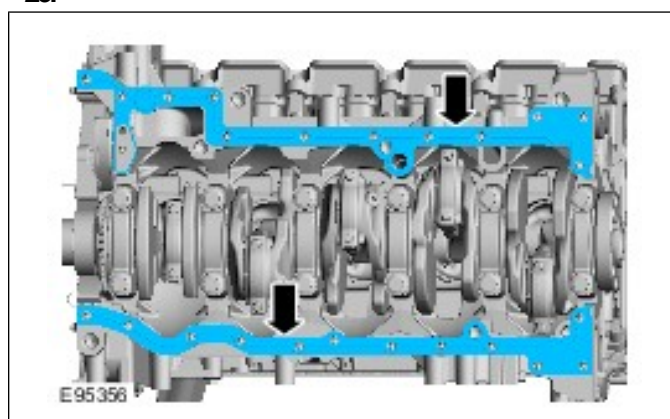
21.



22.



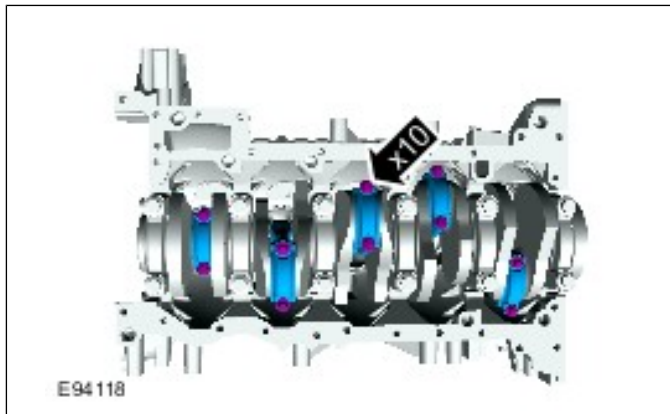
23.



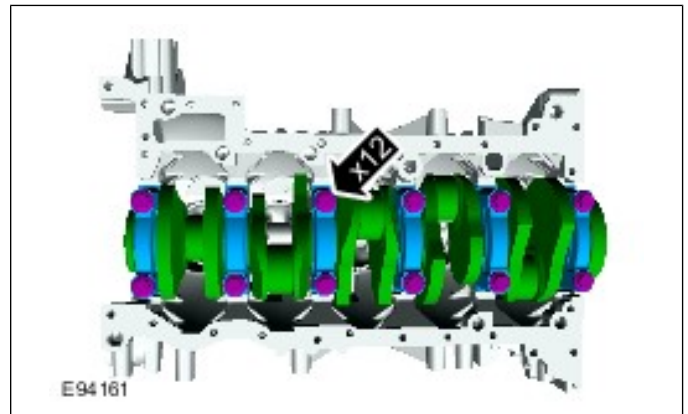


**DISASSEMBLY**

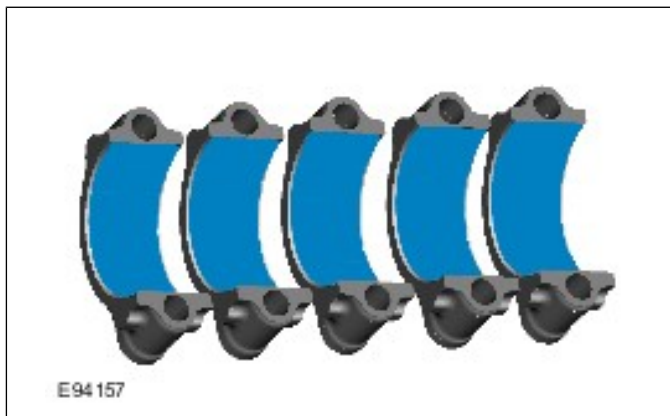
**24. NOTE:** Note the position of each component before removal.



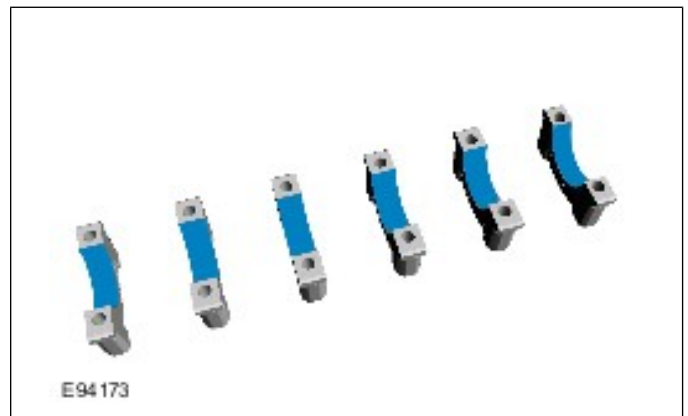
**27. NOTE:** Note the position of each component before removal.



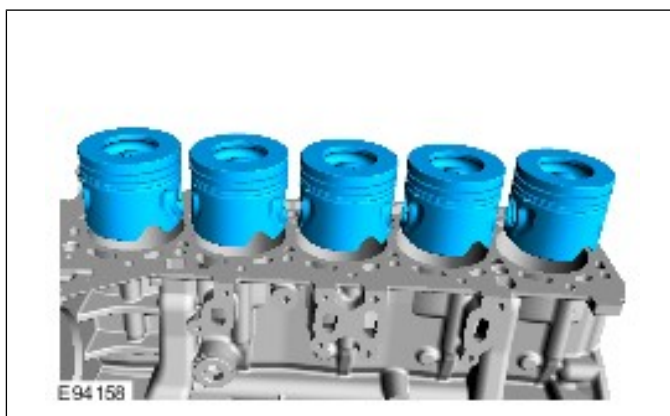
**25. NOTE:** Note the position of each component before removal.



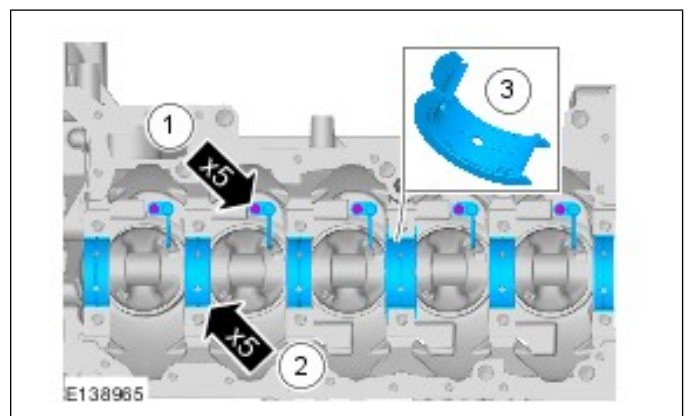
**28. NOTE:** Note the position of each component before removal.



**26. NOTE:** Note the position of each component before removal.

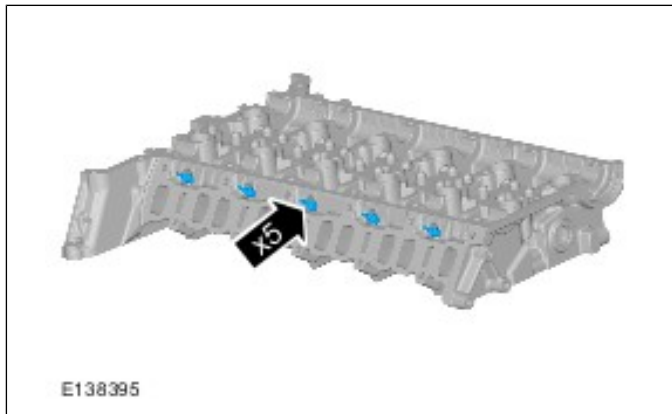


**29. NOTE:** Note the position of each component before removal.

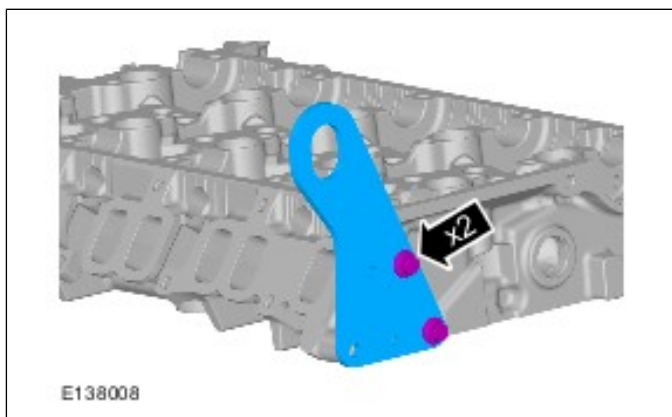


**DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES****Cylinder Head(21 165 6)****Disassembly**

1. For additional information, refer to: **Valves**  
(303-01 Engine - 3.2L Duratorq-TDCi  
(148kW/200PS) - Puma, Removal and  
Installation).
2. Torque : 13Nm

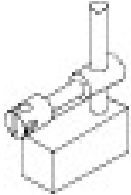

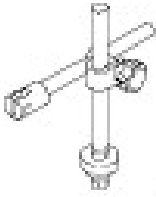

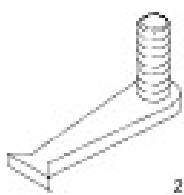
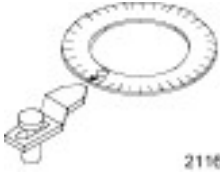



3. Torque : 23Nm

**Assembly**

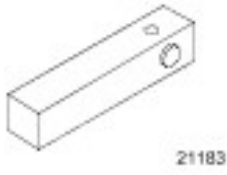

1. To assemble, reverse the disassembly procedure.

**ASSEMBLY****Engine(21 134 8)****Assembly****Special Tool(s) / General Equipment**

 <p>15008</p>	<p>205-044 Holding Fixture, Dial Indicator Gauge</p>
 <p>15046</p>	<p>205-069 Dial Indicator Gauge (Metric)</p>
 <p>15022A</p>	<p>205-070 Holding Fixture, Dial Indicator Gauge</p>
 <p>E 131853</p>	<p>303-1562 Timing Tool</p>
 <p>21126</p>	<p>303-254 Locking Tool, Flywheel</p>
 <p>21166</p>	<p>303-391 Setting Gauge, Crankshaft</p>
 <p>21179</p>	<p>303-428 Separator, Oil Pan</p>

ASSEMBLY

Special Tool(s) / General Equipment

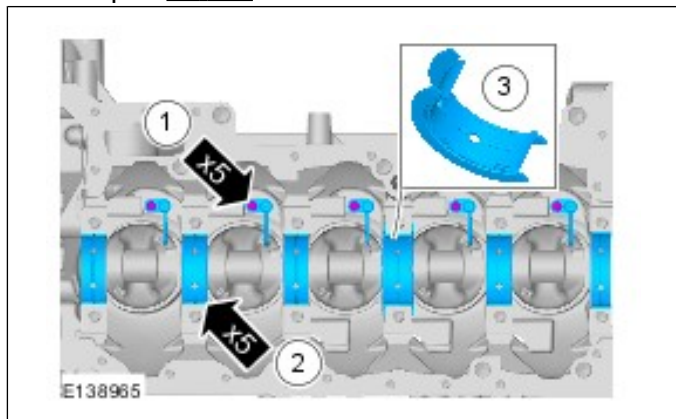
	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion)
	303-682 Aligner, Engine Front Cover
6 mm Drill Bit	
Piston Ring Compressor	
Round-Ended Steel Rule	

Materials

Name	Specification
Silicone Sealant LB 2U7J-M4G323-AA	WSE-M4G323-A4
Silicone Gasket and Sealant TA-30	
Engine Oil - 5W-30	WSS-M2C913-C

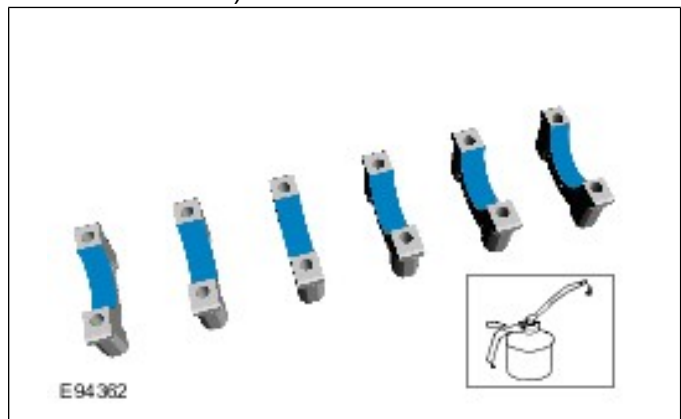
1. **NOTE:** Make sure that these components are installed to the noted removal position.

Material: engine oil WSS-M2C913-C (Engine Oil - 5W-30)  
Torque: 10 Nm



2. **NOTE:** Make sure that these components are installed to the noted removal position.

Material: engine oil WSS-M2C913-C (Engine Oil - 5W-30)



3. **NOTE:** Make sure that these components are installed to the noted removal position.

**NOTE:** Install all the bolts finger tight before final tightening.



## ASSEMBLY

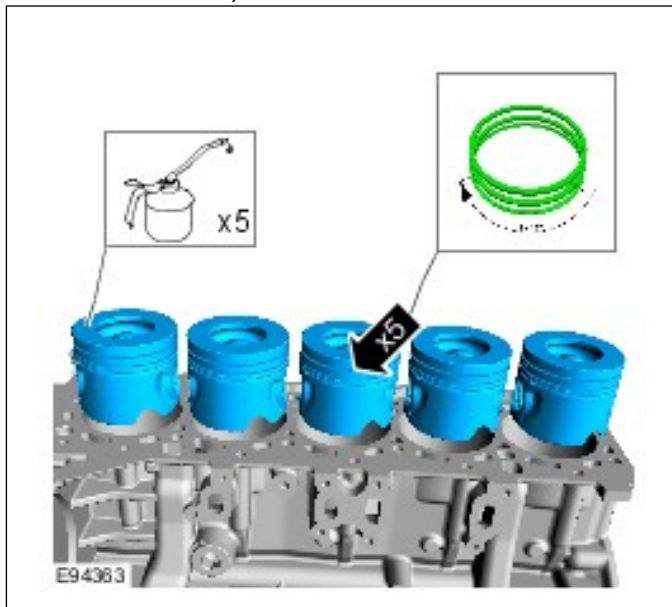
Torque:

- Stage 1: 15 Nm
- Stage 2: 20 Nm
- Stage 3: 35 Nm
- Stage 4: 80 Nm
- Stage 5: 90°



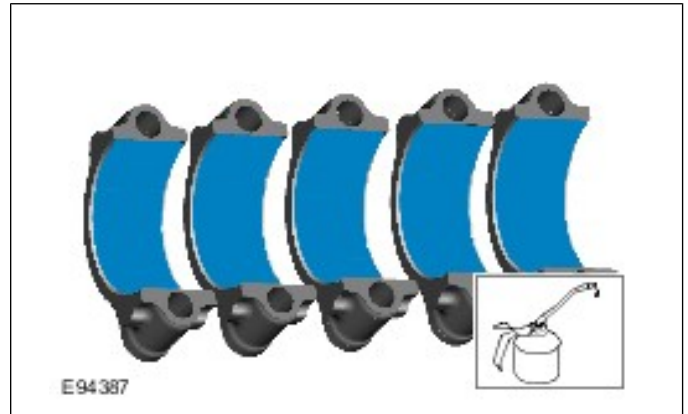
- 4. NOTE:** Make sure that these components are installed to the noted removal position.

General Equipment: Piston Ring Compressor  
Material: engine oil WSS-M2C913-C (Engine Oil - 5W-30)



- 5. NOTE:** Make sure that these components are installed to the noted removal position.

Material: engine oil WSS-M2C913-C (Engine Oil - 5W-30)

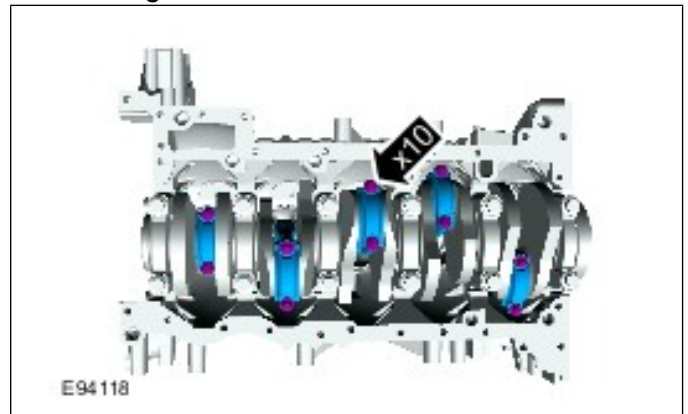


- 6. NOTE:** Make sure that these components are installed to the noted removal position.

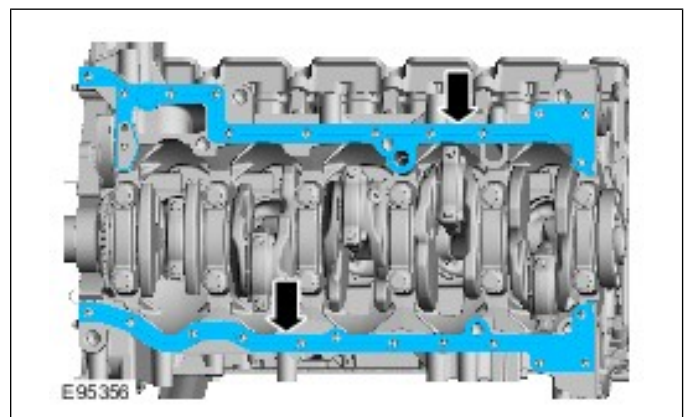
**NOTE:** Install all the bolts finger tight before final tightening.

Torque:

- Stage 1: 25 Nm
- Stage 2: 60 Nm
- Stage 3: 90°

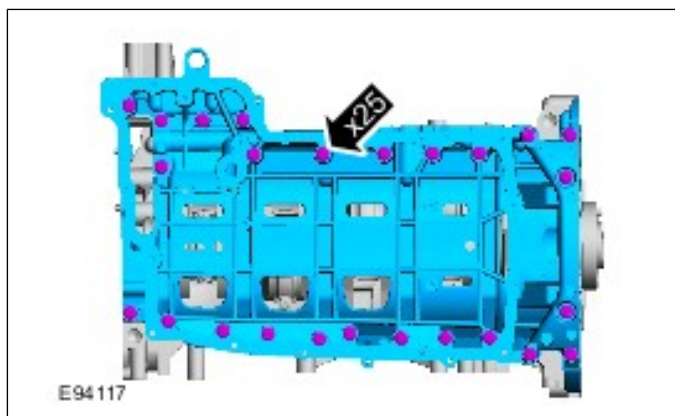


7.



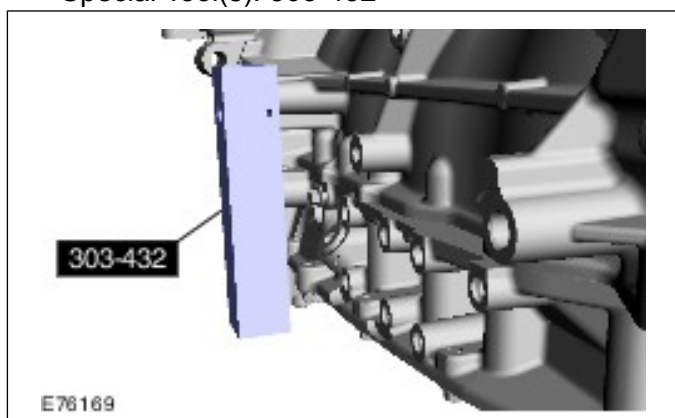
## ASSEMBLY

8. **NOTE:** Only tighten the bolts finger tight at this stage.



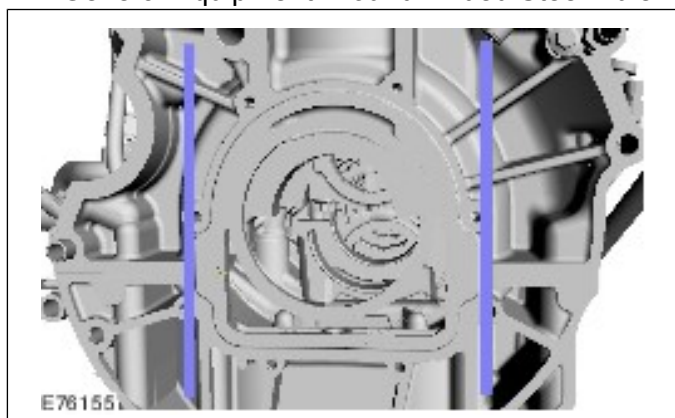
9. The ladder frame and the cylinder block must be aligned so that the side clearance does not exceed 0.05 mm overlap to 0.05 mm gap.

Special Tool(s): 303-432

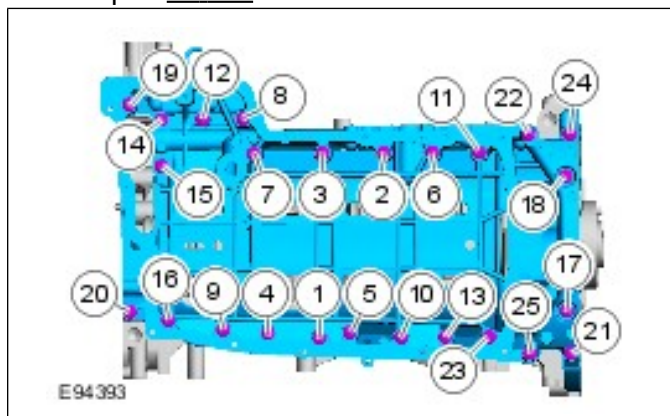


10. The ladder frame and the cylinder block must be aligned so that the rear clearance does not exceed 0.01 mm overlap to 0.2 mm gap.

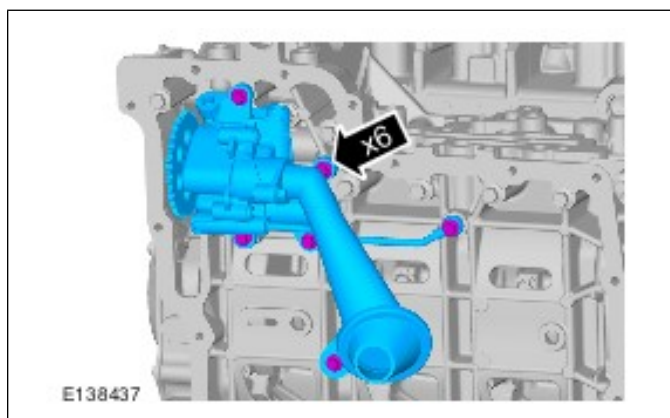
General Equipment: Round-Ended Steel Rule



11. Torque: 23 Nm

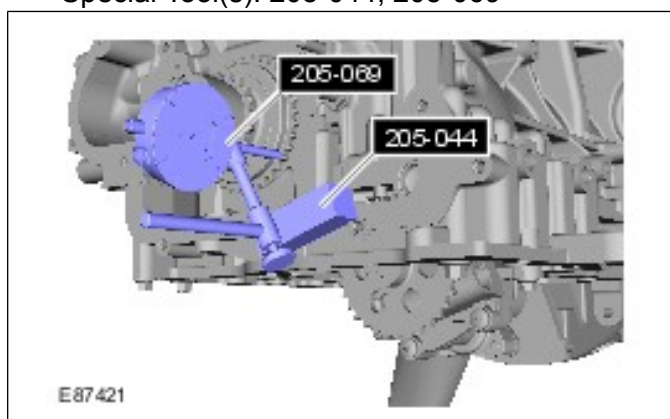


- 12 **NOTE:** Only tighten the bolts finger tight at this stage.



13. Take a reference measurement from the front face of the crankshaft sprocket.

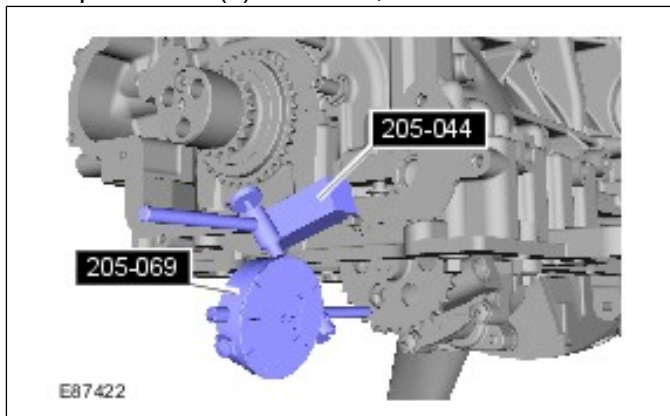
Special Tool(s): 205-044, 205-069



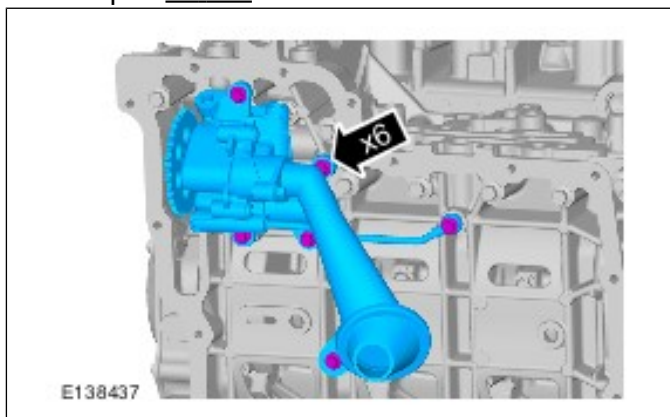
14. Take measurements at two different points on the oil pump sprocket and align the oil pump sprocket.

## ASSEMBLY

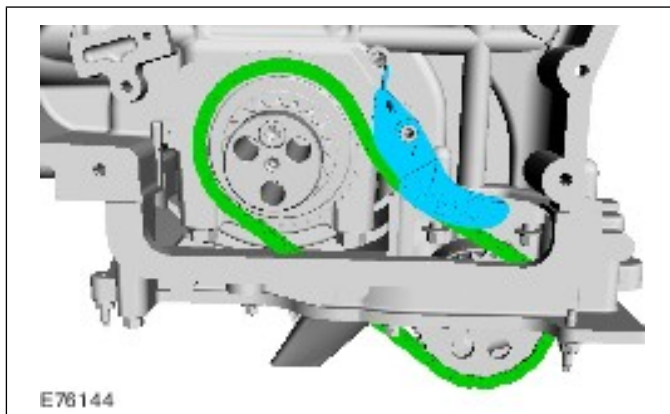
Special Tool(s): 205-044, 205-069



15. Torque: 10 Nm



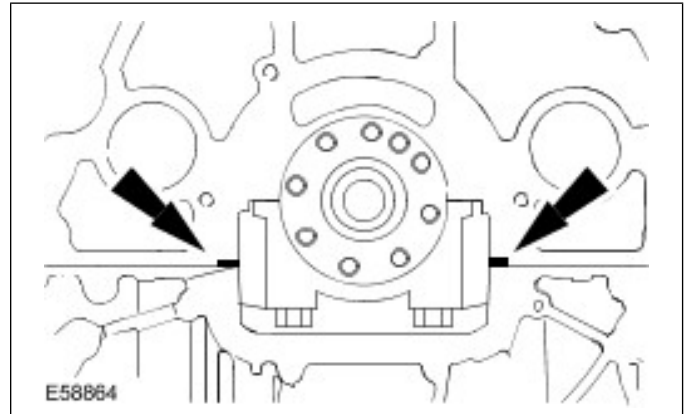
16.



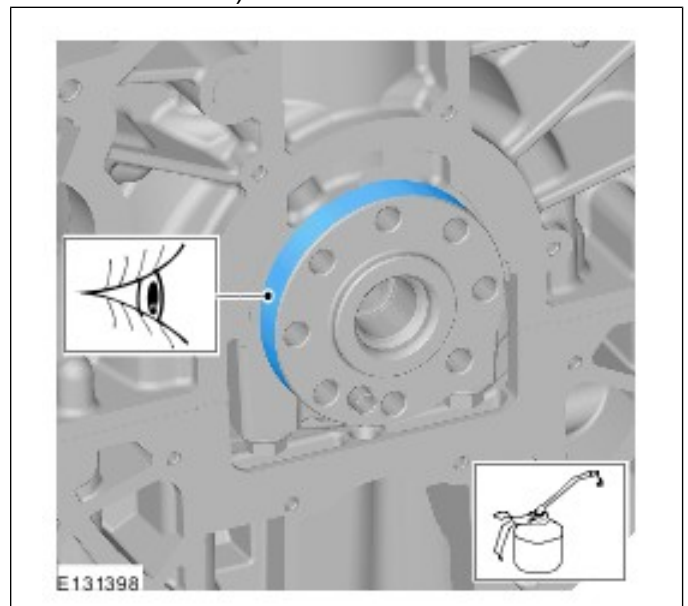
**17. NOTE:** A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully

installed. Failure to follow this instruction may result in damage to the vehicle.

- Clean the area on the engine before installing a new crankshaft rear seal carrier.
- Check the two foam pads are located as shown on the ladder frame gasket.



18. Material: engine oil WSS-M2C913-C (Engine Oil - 5W-30)

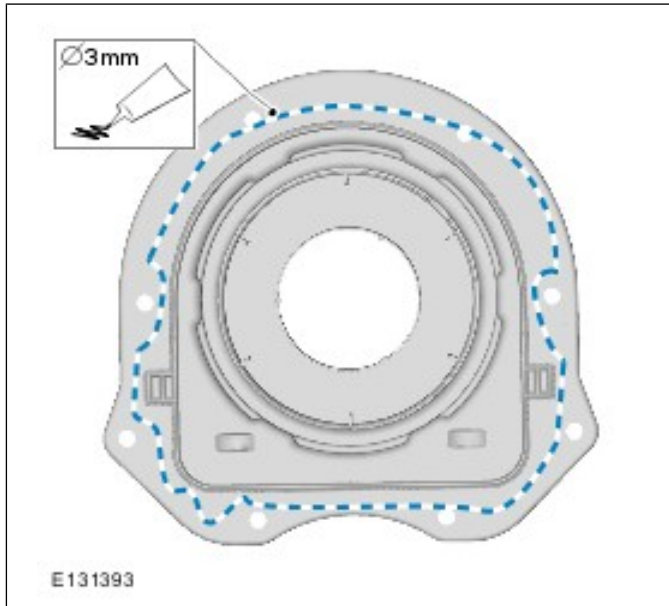


**19. NOTE:** Install the new crankshaft rear seal carrier within five minutes of applying the recommended sealant.



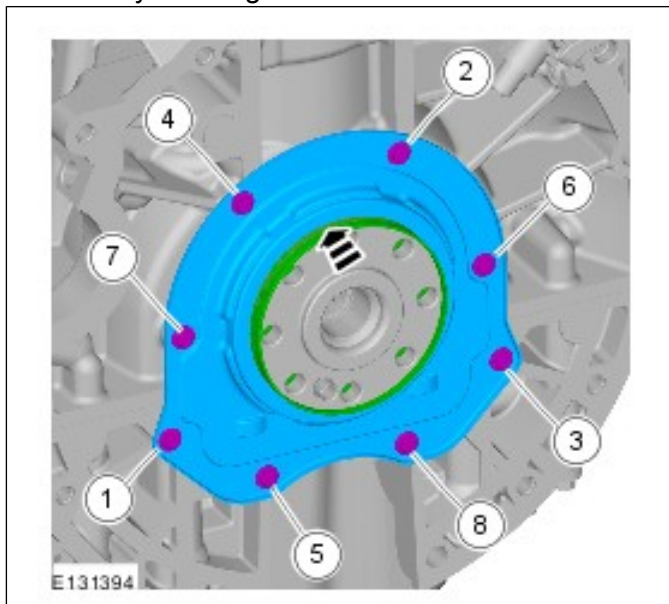
## ASSEMBLY

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



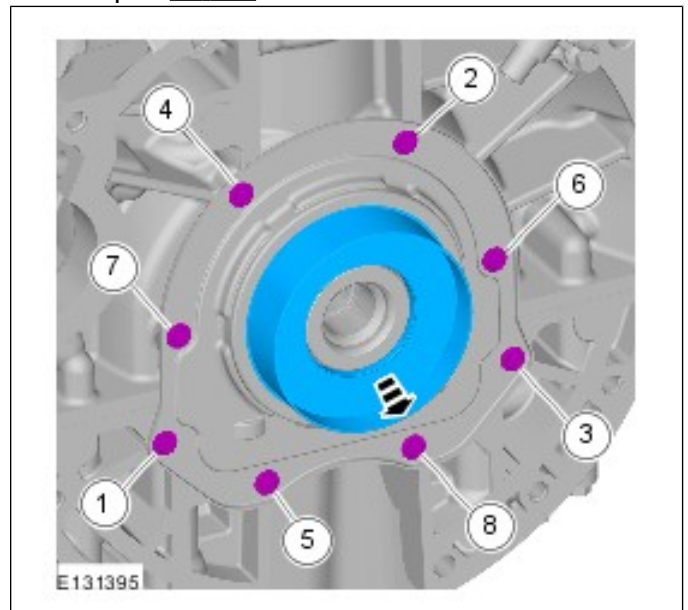
- 20. ⚠ CAUTION:** A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.

Initially hand tighten the fasteners.



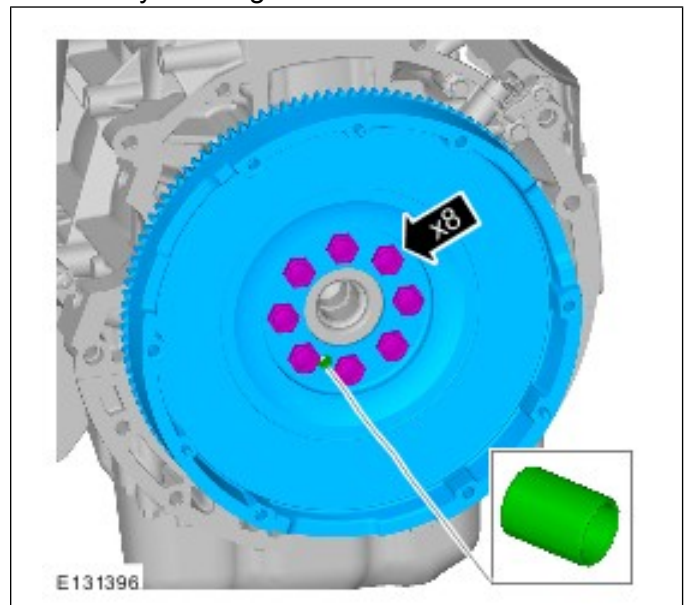
- 21. NOTE:** New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

Torque: 20 Nm



- 22. NOTE:** Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.

Initially hand tighten the fasteners.



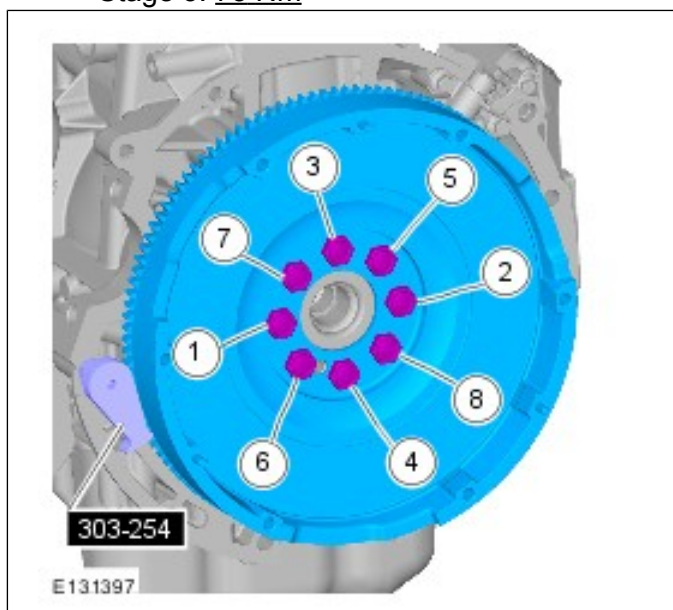
- 23. Special Tool(s):** 303-254



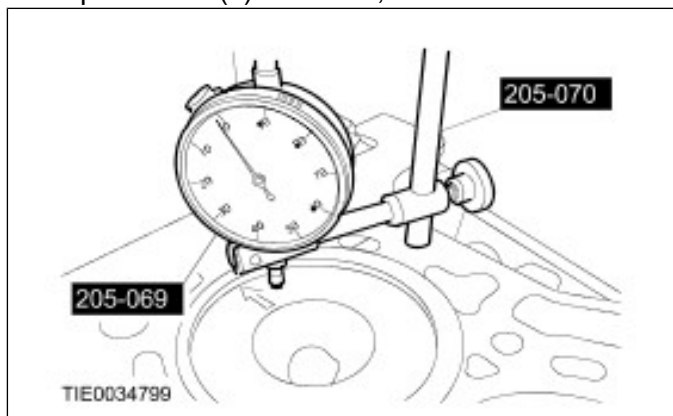
## ASSEMBLY

Torque:

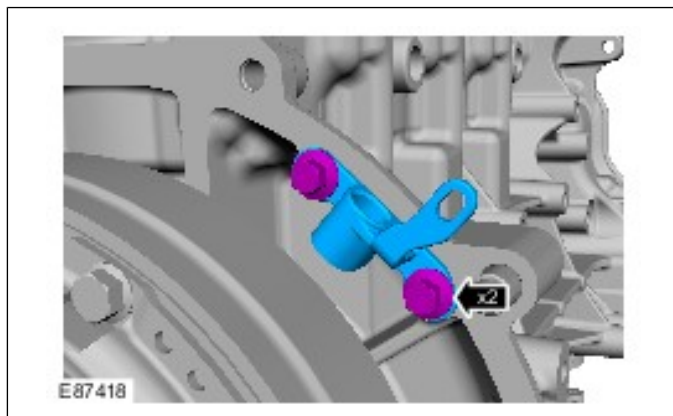
- Stage 1: 15 Nm
- Stage 2: 30 Nm
- Stage 3: 75 Nm



24. Special Tool(s): 205-069, 205-070

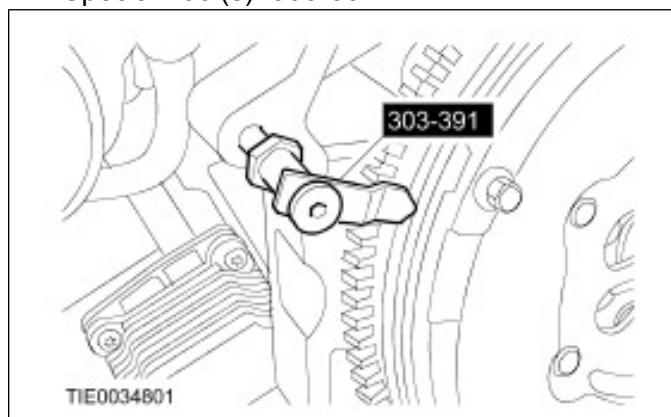


25. **NOTE:** Do not fully tighten the crankshaft position sensor bracket retaining bolts at this stage.



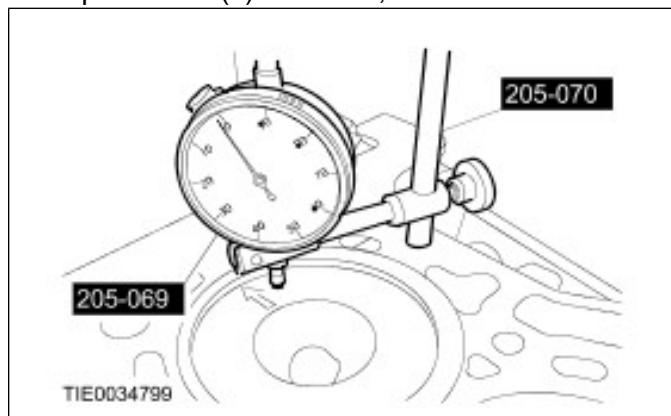
26. **NOTE:** After installation do not move the special tool.

Special Tool(s): 303-391



27. Rotate the crankshaft until piston No. one is approximately 10 mm before top dead center (TDC).

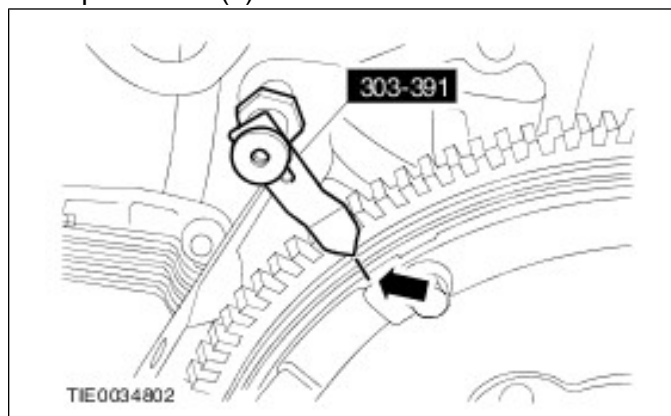
Special Tool(s): 205-069, 205-070



28. Zero the dial indicator gauge.

29. Mark the position on the flywheel primary mass.

Special Tool(s): 303-391

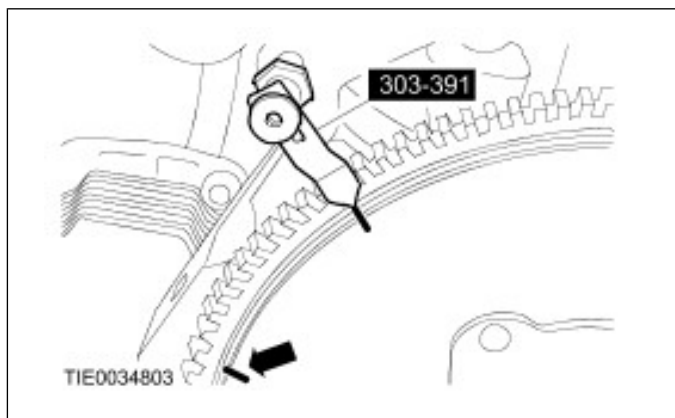


## ASSEMBLY

**30. NOTE:** Rotate the crankshaft counterclockwise.

1. Rotate the crankshaft until the piston No. one achieves zero on the dial indicator gauge.
2. Mark the position on the flywheel primary mass.

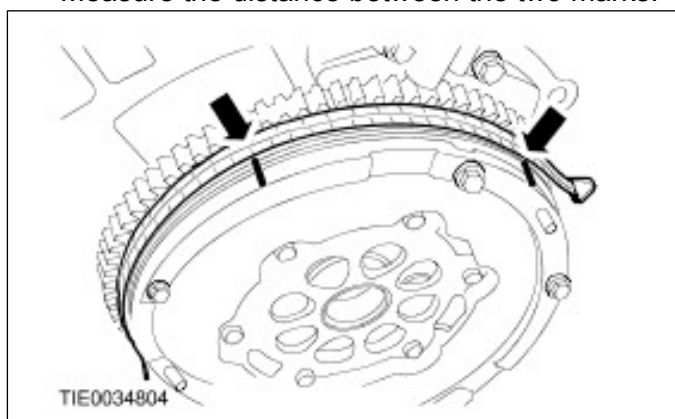
Special Tool(s): 303-391



**31.** Repeat the previous steps to make sure that the marking is correct.

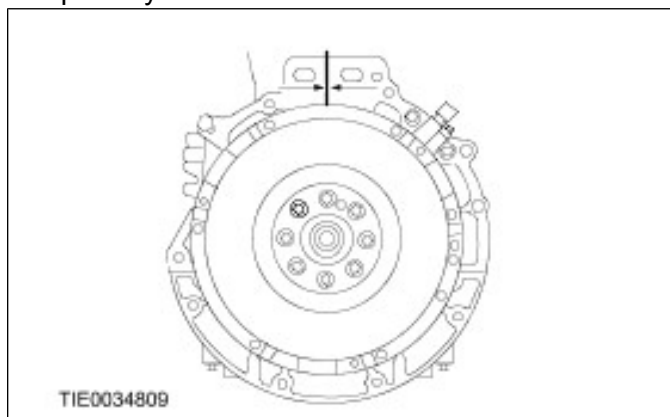
**32 NOTE:** The middle of the markings is TDC.

Measure the distance between the two marks.



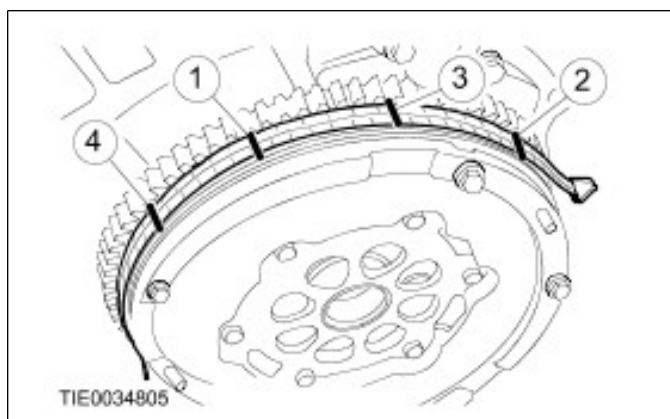
**33.** Divide the amount by two and mark the position TDC on the flywheel primary mass.

**34.** Measure the circumference of the flywheel primary mass.



**35.** Multiply the circumference by 0.1388 and mark the calculated amount on the flywheel primary mass by measuring from TDC counterclockwise.

- 36.** 1. First mark.
2. Second mark.
3. Determined TDC.
4. Determined 50 degrees before top dead center (BTDC).



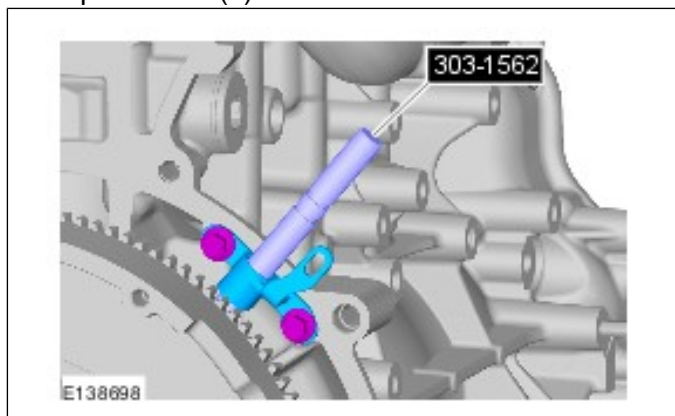
**37. ⚠ CAUTION:** Do not turn the crankshaft when the special tool is fully located into the flywheel. Failure to follow this instruction will cause damage to the CKP sensor hole.

**NOTE:** Rotate the crankshaft in the normal direction of rotation to the mark of the calculated 50 degrees BTDC.

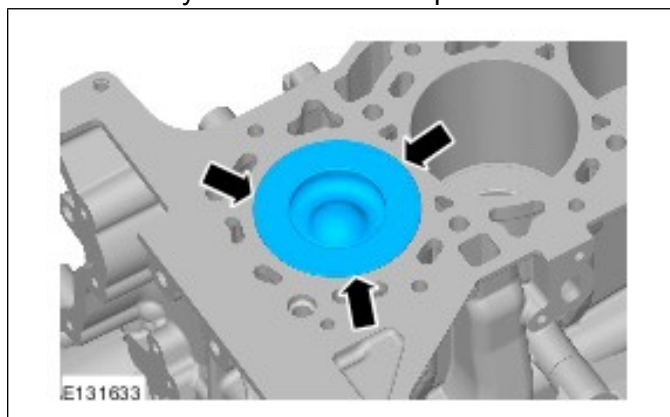
**NOTE:** Make sure that the special tool is fully located in the flywheel so that the engine cannot be rotated in either direction.

## ASSEMBLY

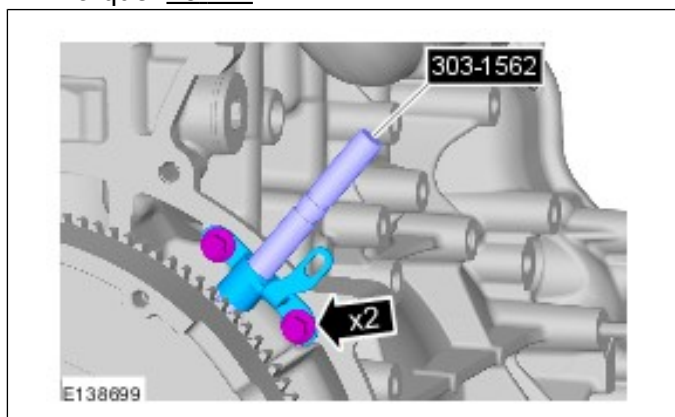
Special Tool(s): 303-1562



Measure the distance between the piston crown and the cylinder block at the points indicated.



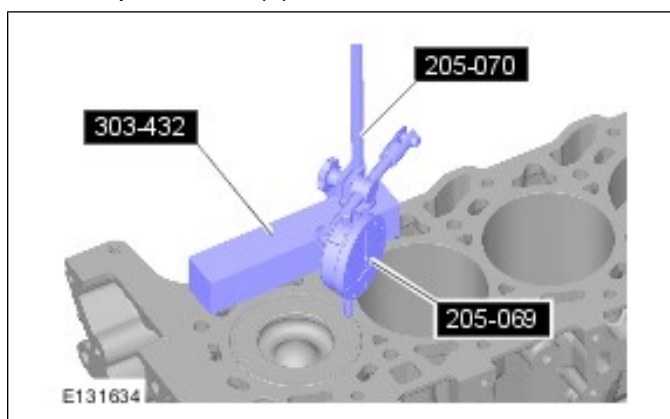
38. Remove the Special Tool(s): 303-1562  
Torque: 25 Nm



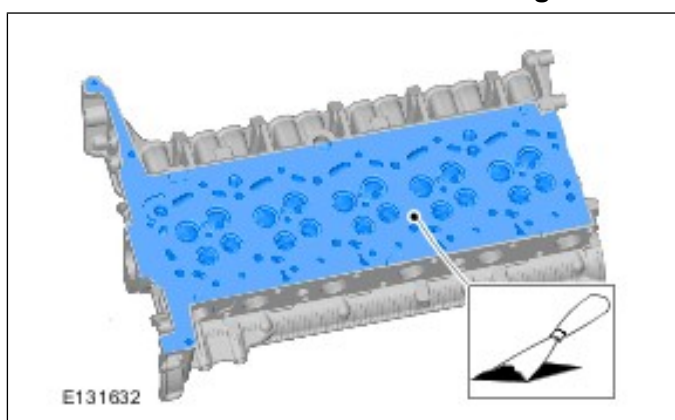
41. **NOTE:** The largest measurement determines the choice of the cylinder head gasket.

- Using the special tools, measure the piston protrusion.

Special Tool(s): 205-070, 205-069, 303-432



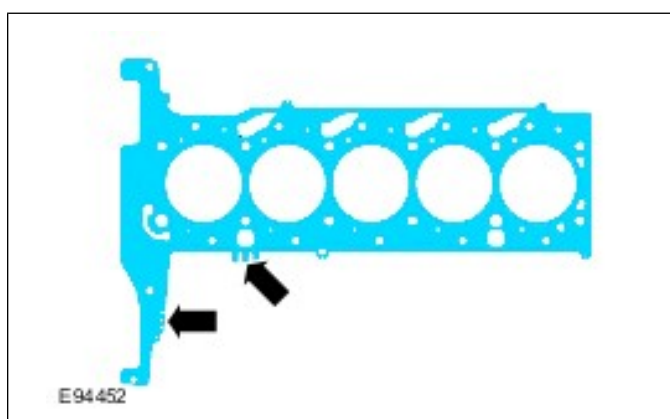
39. **WARNING:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.



42. Determine the cylinder head gasket.

Refer to: [Specifications](#) (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

43. **NOTE:** Make sure that a new component is installed.

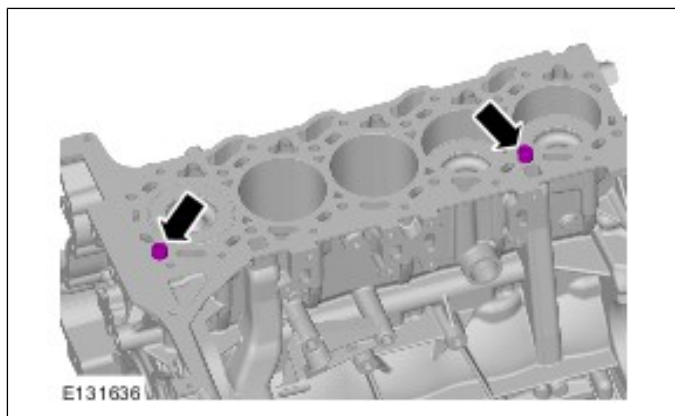


40. **NOTE:** Measure the piston protrusion of each cylinder at top dead center (TDC).



## ASSEMBLY

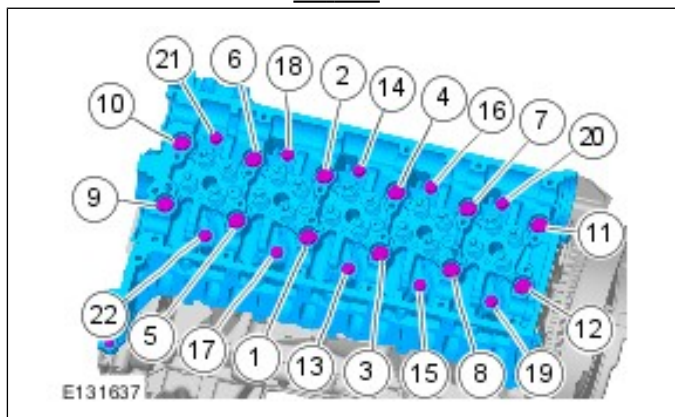
44.



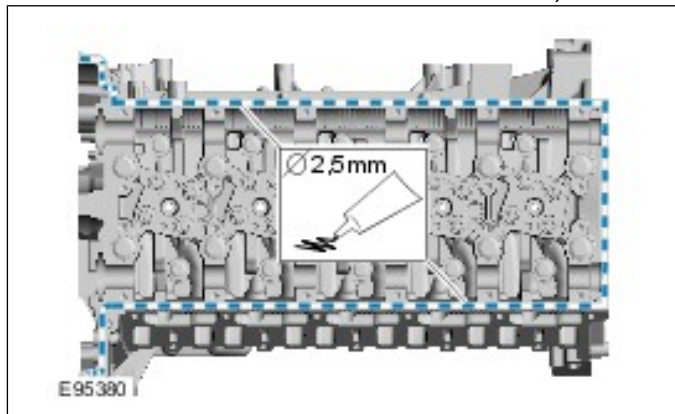
45. **CAUTION:** Make sure that new cylinder head bolts are installed.

Torque:

- Bolts 1 to 12: 10 Nm
- Bolts 13 to 22: 5 Nm
- Bolts 1 to 12: 20 Nm
- Bolts 13 to 22: 10 Nm
- Bolts 1 to 12: 180°
- Bolts 1 to 12: 50 Nm
- Bolts 13 to 22: 180°
- Bolts 13 to 22: 25 Nm

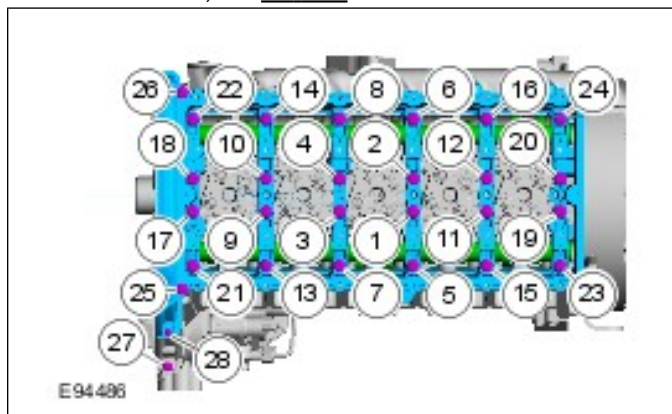


46. Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



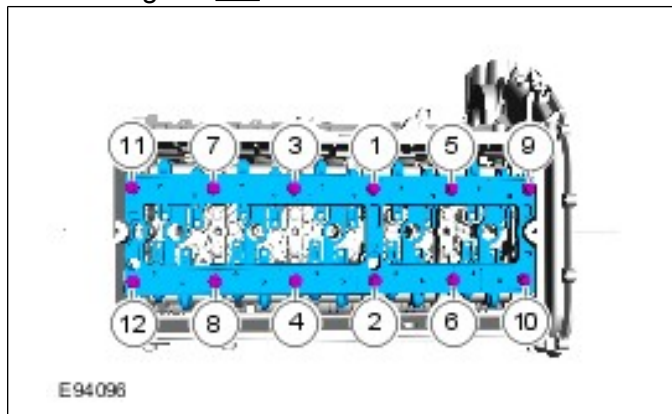
47. Torque:

- Bolts 1 to 26 23 Nm
- Bolts 27, 28 10 Nm

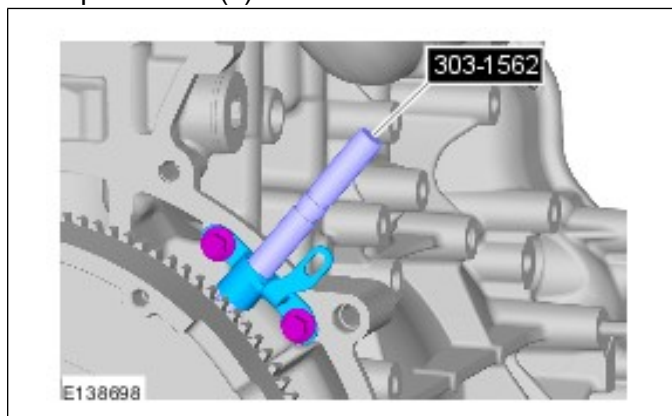


48. Torque:

- Stage 1: 10 Nm
- Stage 2: 30°



49. Special Tool(s): 303-1562

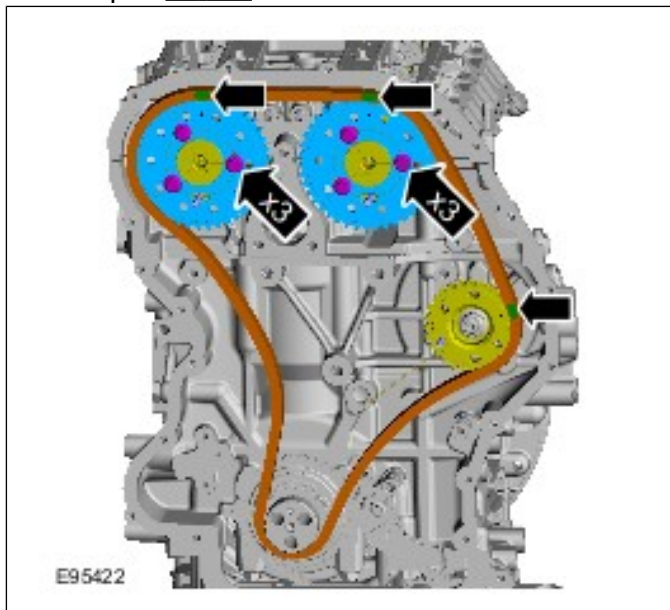


50. **NOTE:** Make sure that the installation marks are aligned.

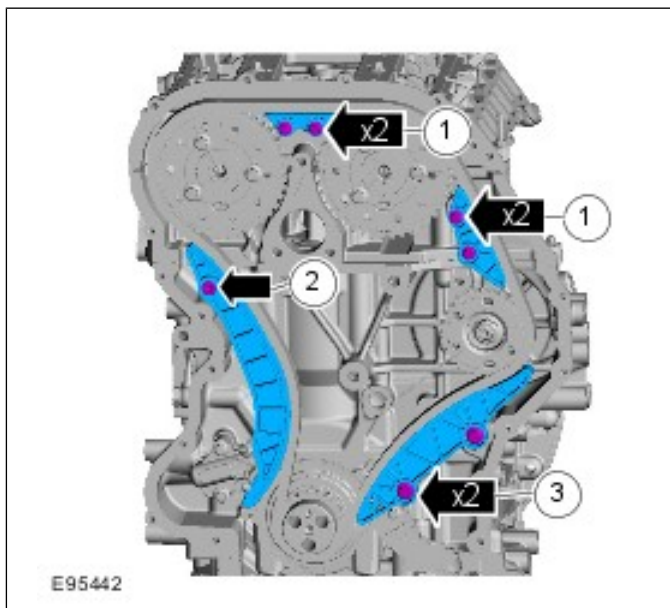
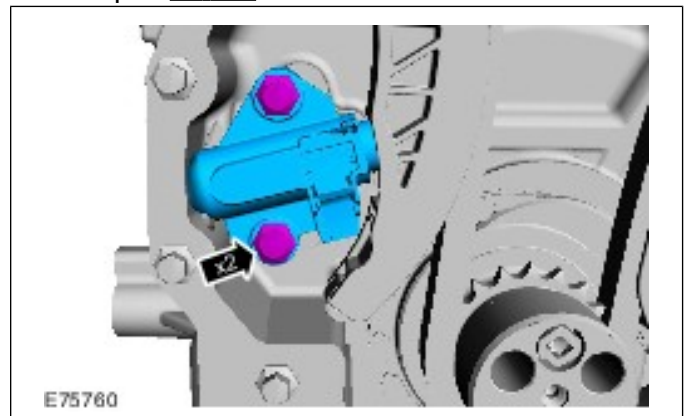
General Equipment: 6 mm Drill Bit



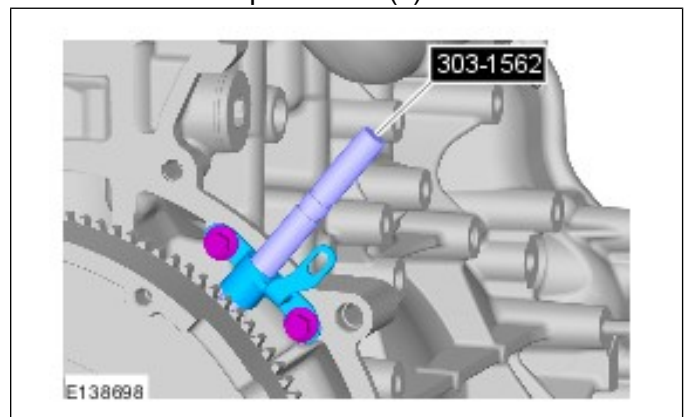
## ASSEMBLY

Torque: 33 Nm

51. Remove the 6 mm drill bits.

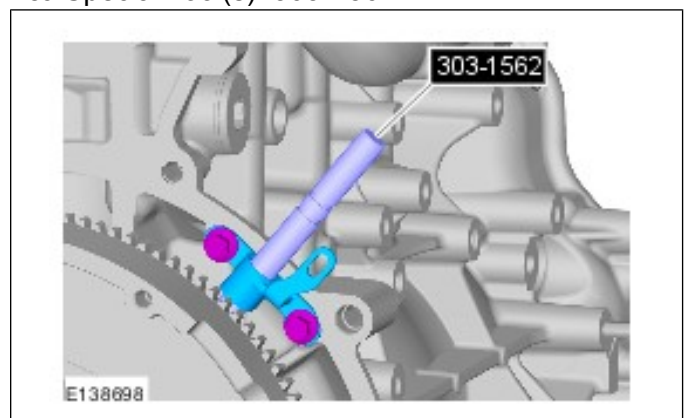
52 1. Torque: 15 Nm2. Torque: 40 Nm3.  **CAUTION:** Make sure that new bolts are installed.53. **NOTE:** Make sure that a new component is installed.Torque: 15 Nm

54. Remove the Special Tool(s): 303-1562



55. Rotate the engine two revolutions.

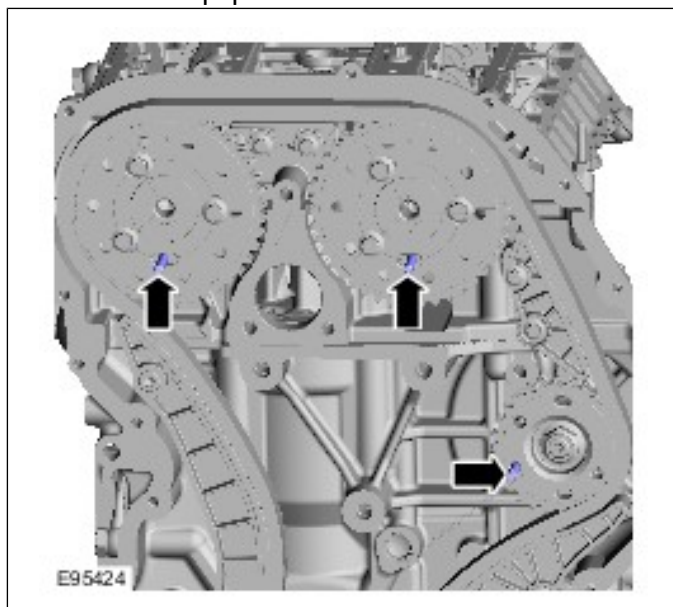
56. Special Tool(s): 303-1562



57. Check the position of the timing marks and correct if necessary.

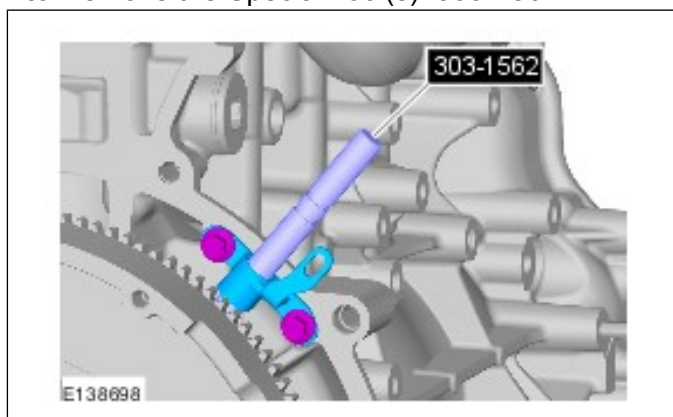
## ASSEMBLY

General Equipment: 6 mm Drill Bit

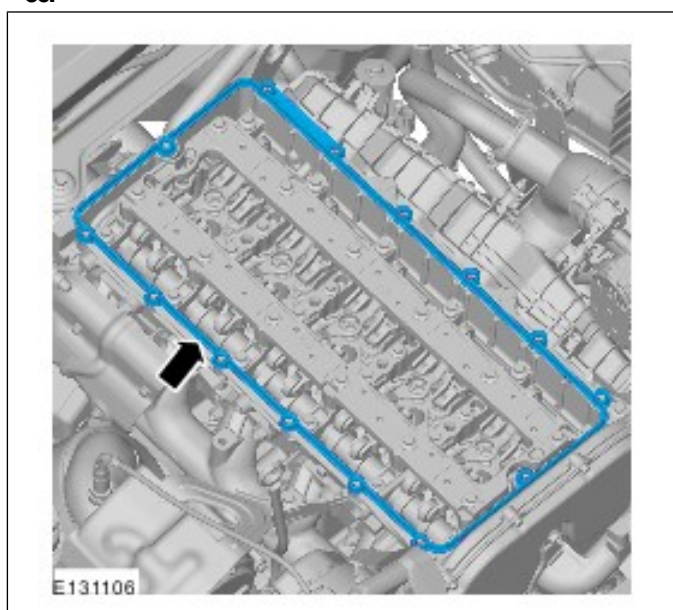


58. Remove the 6 mm drill bits.

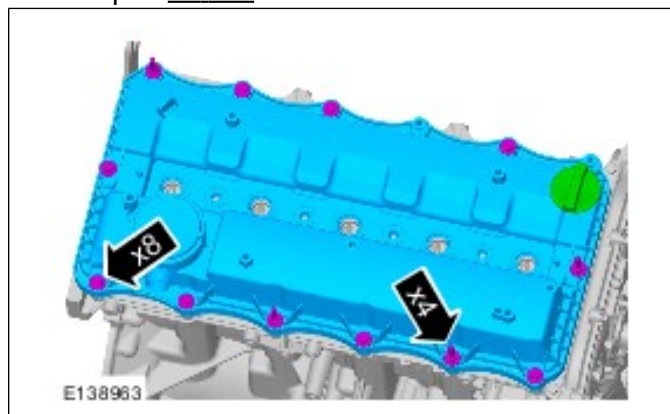
59. Remove the Special Tool(s): 303-1562



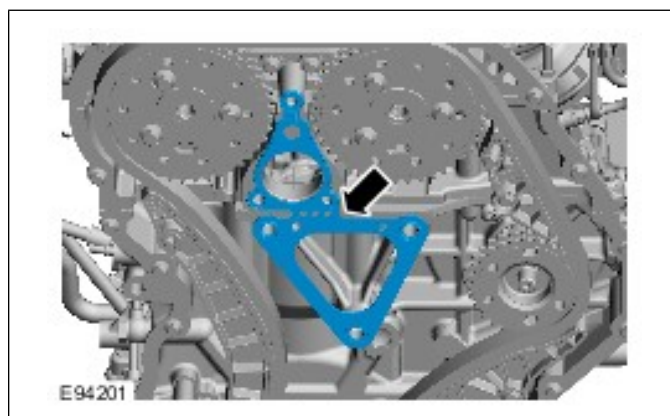
60.



61. Torque: 10 Nm



62. **NOTE:** Make sure that a new component is installed.

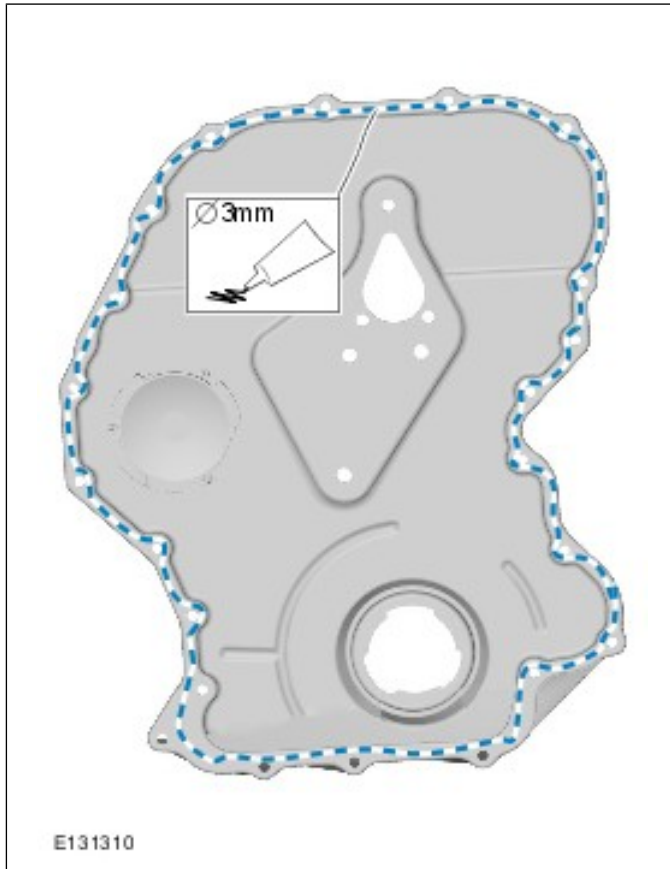


63. **NOTE:** The component must be installed within 5 minutes of applying the sealant.

**NOTE:** Make sure that a new component is installed.

## ASSEMBLY

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



64. Special Tool(s): 303-682

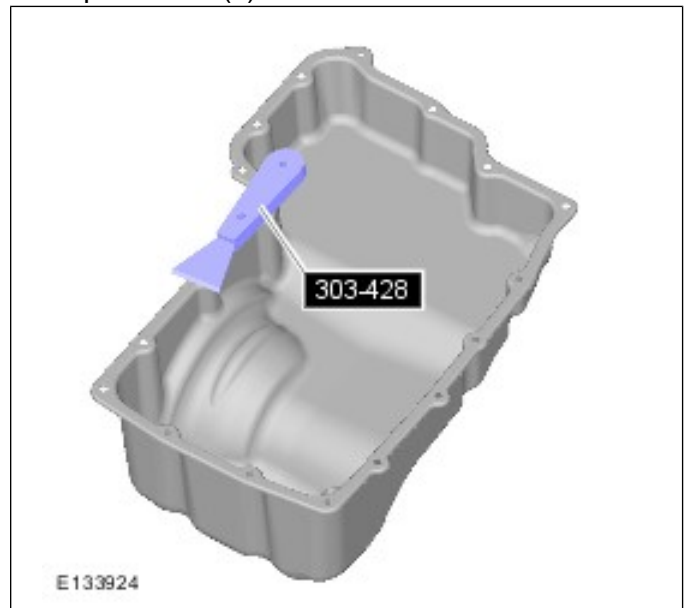
Torque:

- 1 10 Nm
- 2 14 Nm



65. NOTE: Do not damage the mating faces.

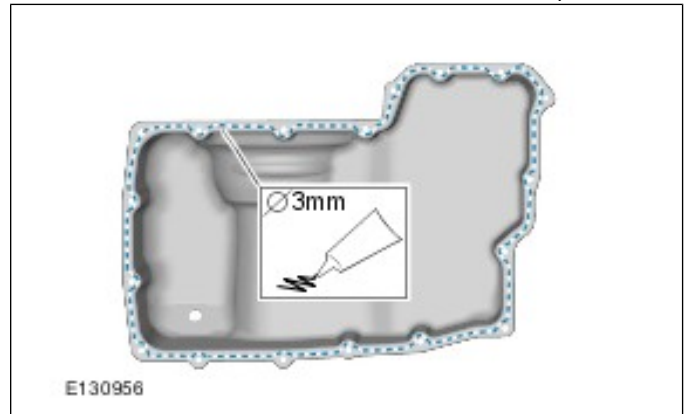
Special Tool(s): 303-428



66. **CAUTION:** Install the oil pan within five minutes of applying the sealer.

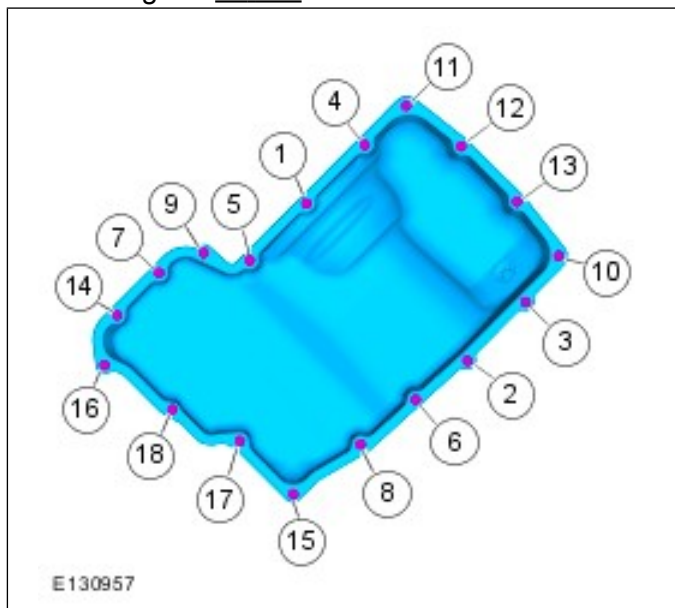
NOTE: Do not damage the mating faces.

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



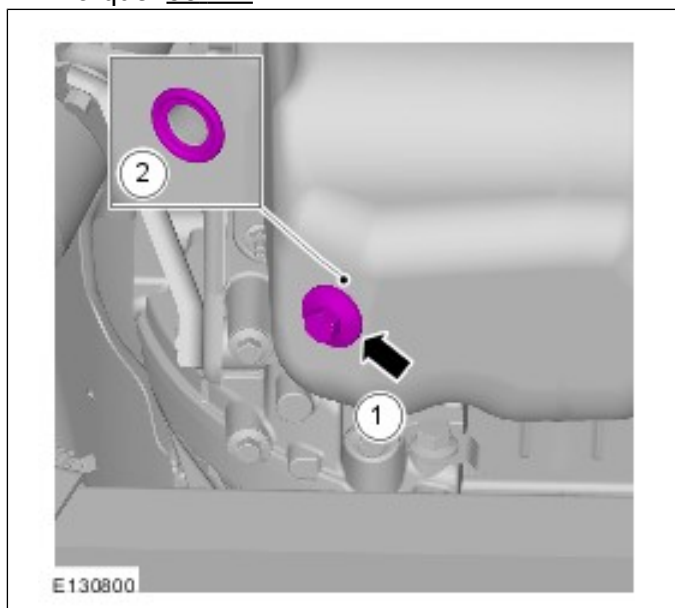
**ASSEMBLY****67. Torque:**

- Stage 1: 12 Nm
- Stage 2: 15 Nm



**68. NOTE:** The seal is to be reused unless damaged.

Torque: 35 Nm



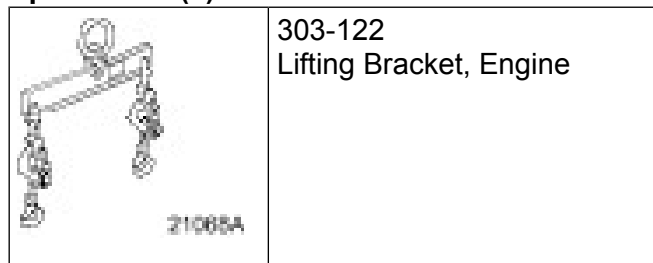


## INSTALLATION

# Engine — Vehicles With: 6-Speed Manual Transmission - MT82(21 132 0; 21 132 6; 21 132 7)

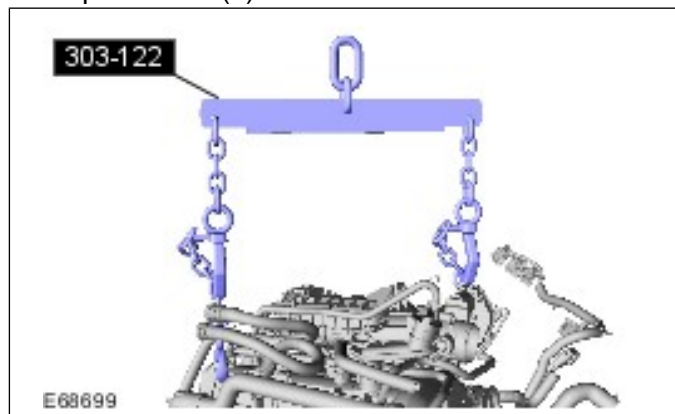
## Installation

## Special Tool(s)

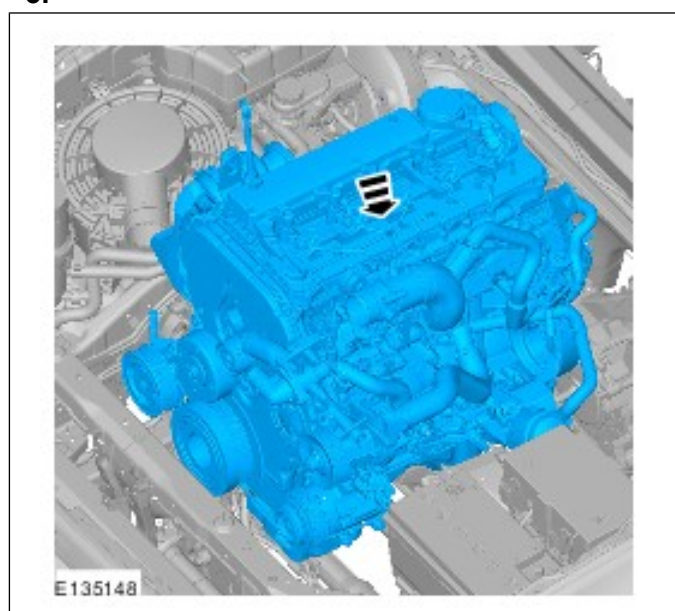


1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

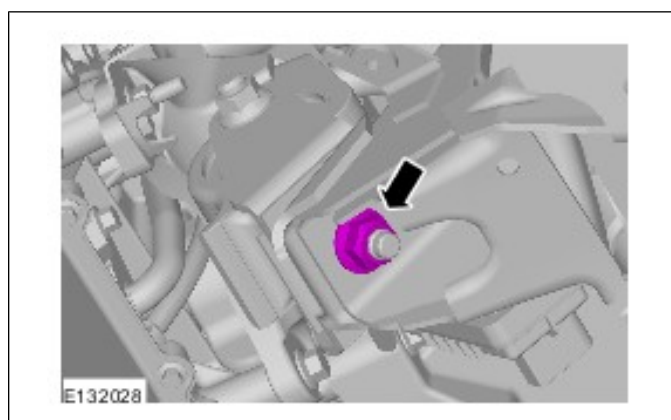
2. Special Tool(s): 303-122



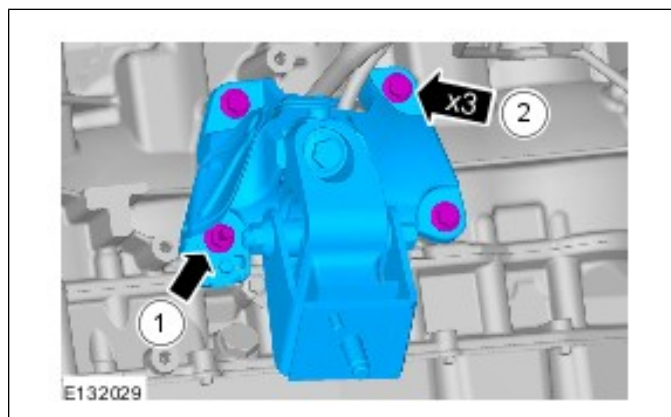
3.



4. **NOTE:** Hand tighten the nut at this stage.

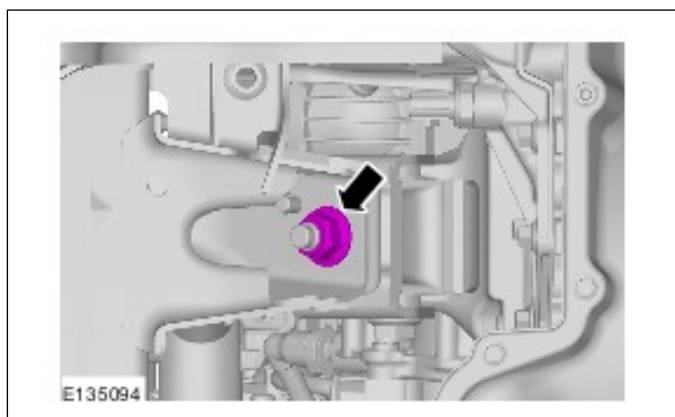


5. **NOTE:** Hand tighten the nuts at this stage.

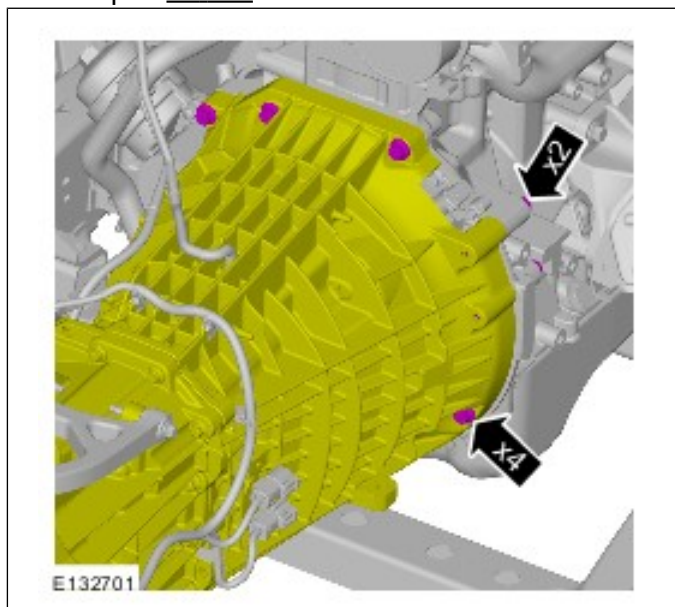


## INSTALLATION

6. **NOTE:** Hand tighten the nut at this stage.

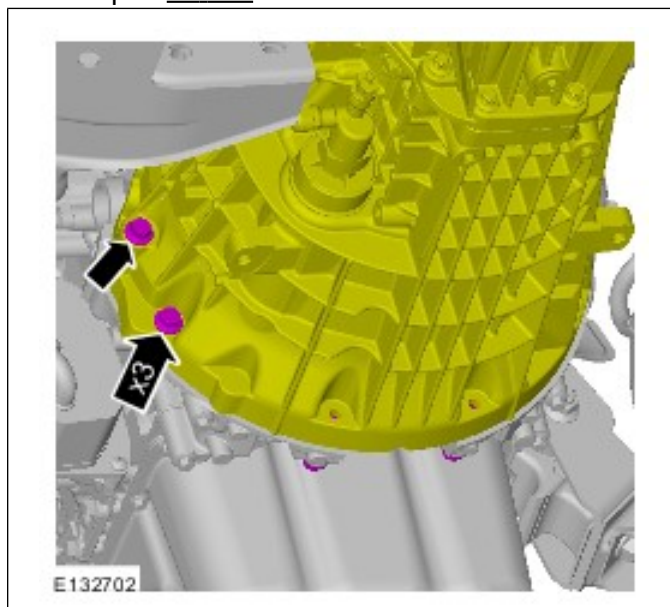


7. Initially hand tighten the fasteners.  
Torque: 48 Nm

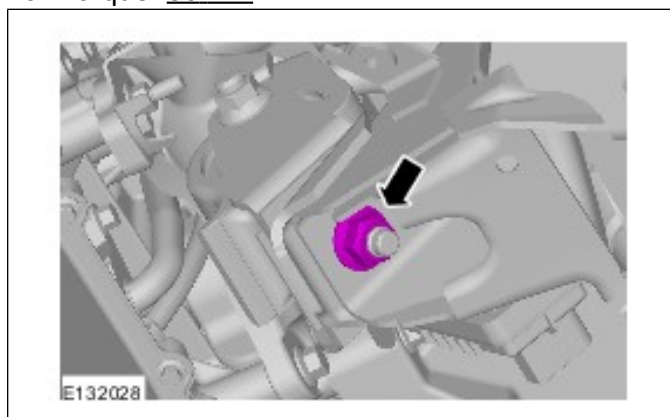


8. Initially hand tighten the fasteners.

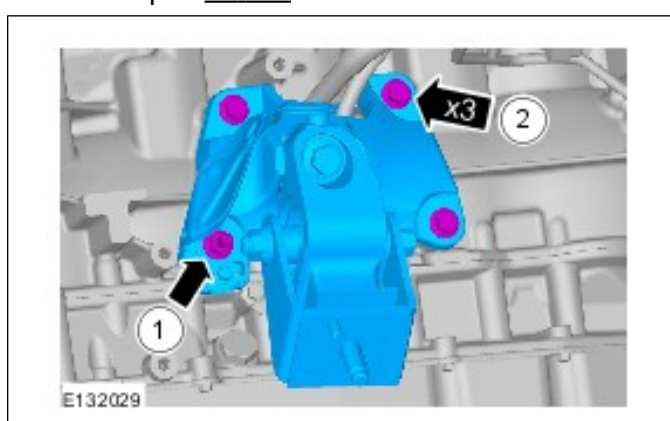
Torque: 48 Nm

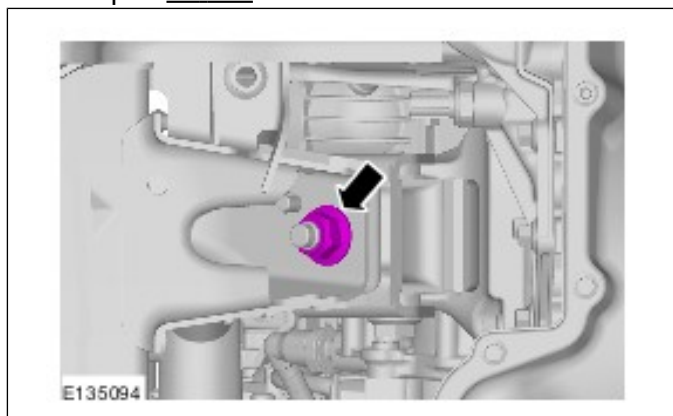
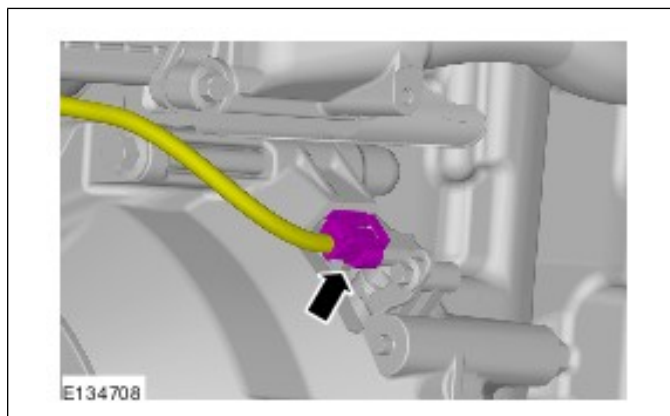
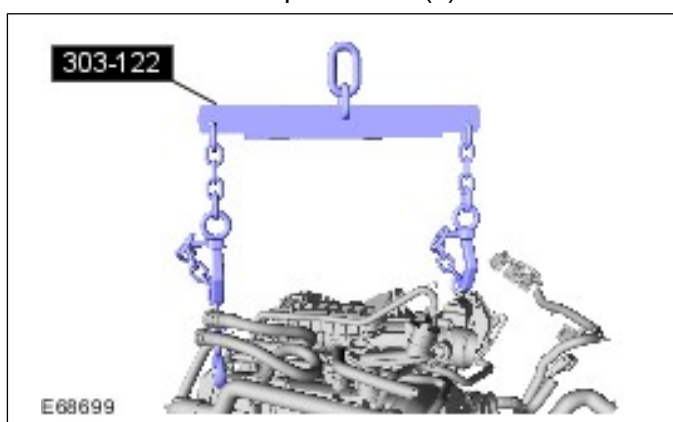
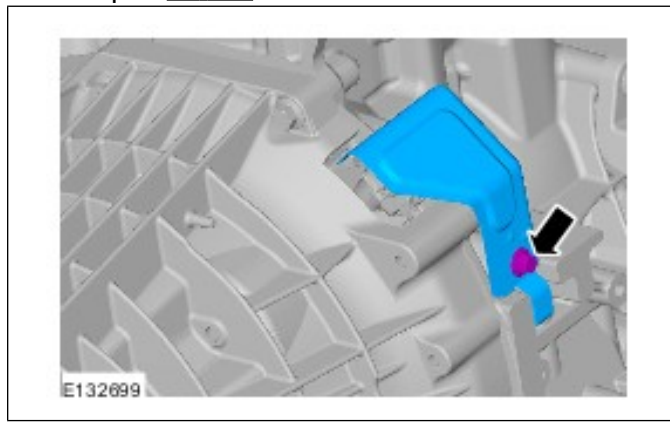
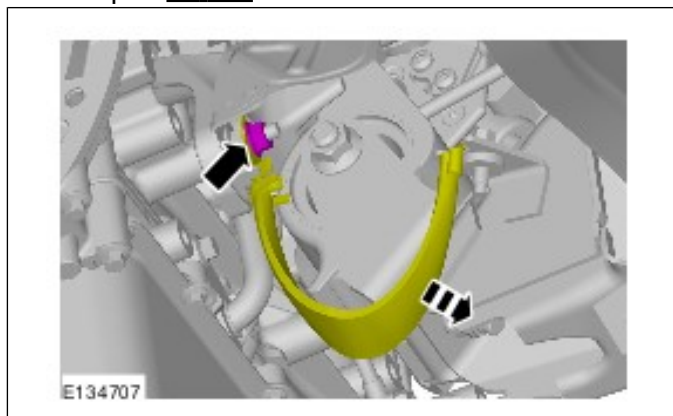
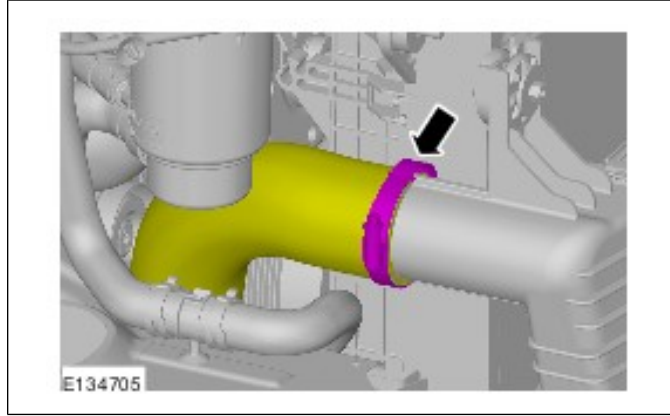


9. Torque: 80 Nm

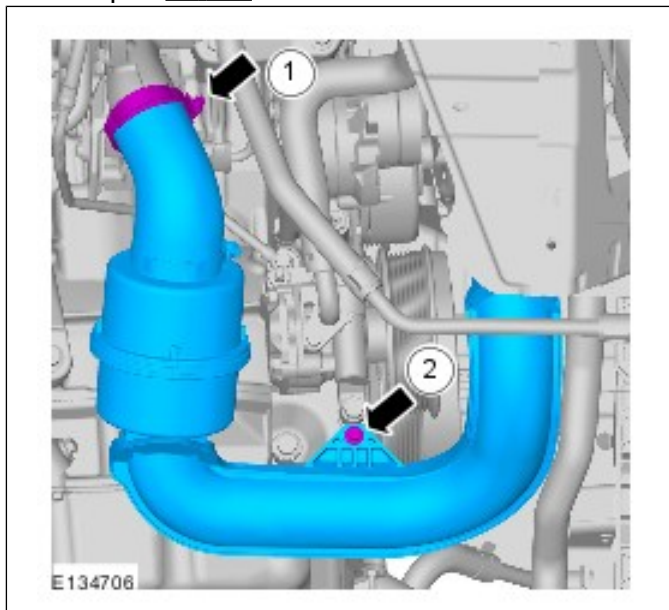


10. 1. Torque: 48 Nm  
2. Torque: 25 Nm

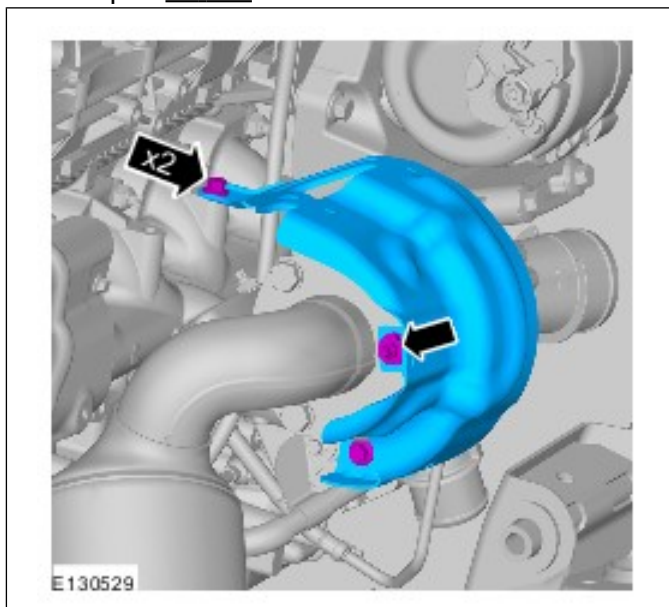
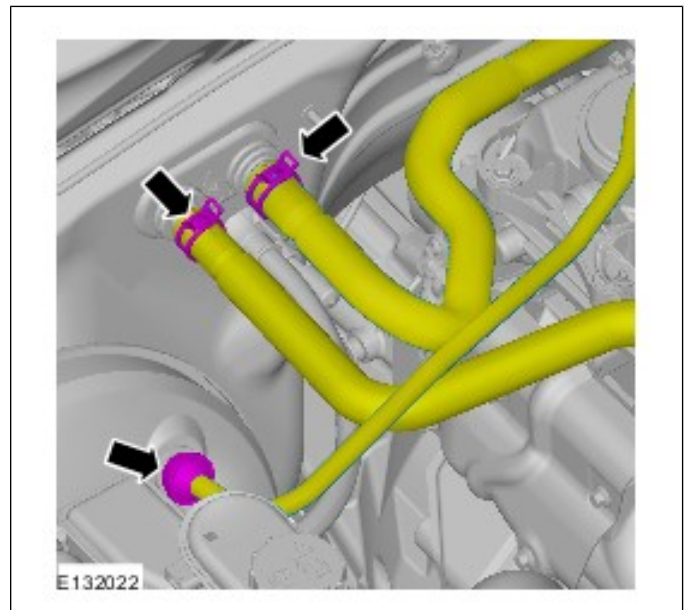
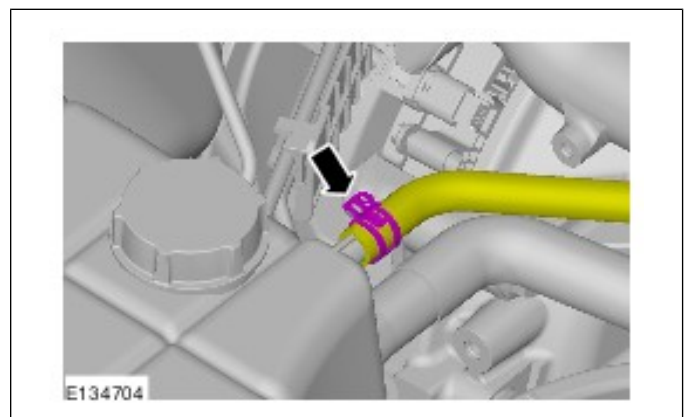
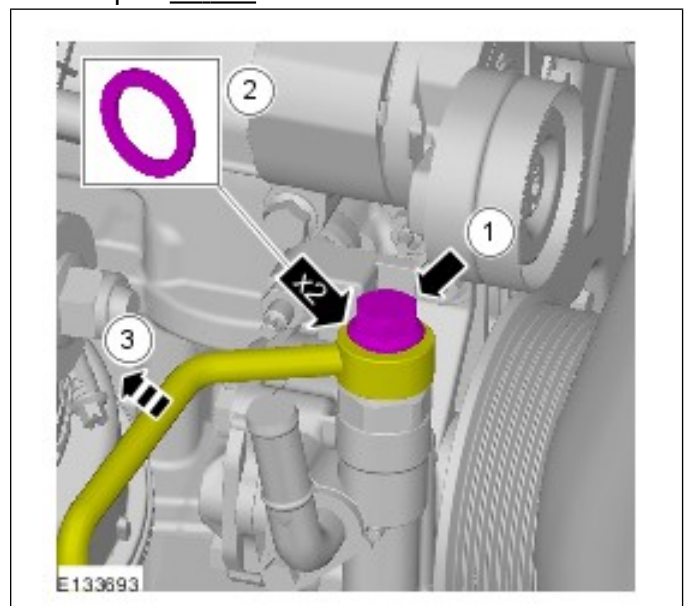


**INSTALLATION****11. Torque: 80 Nm****14.****12 1. Remove the Special Tool(s): 303-122****15. Torque: 12 Nm****13. Torque: 13 Nm****16.**



**INSTALLATION****17. Torque: 10 Nm**

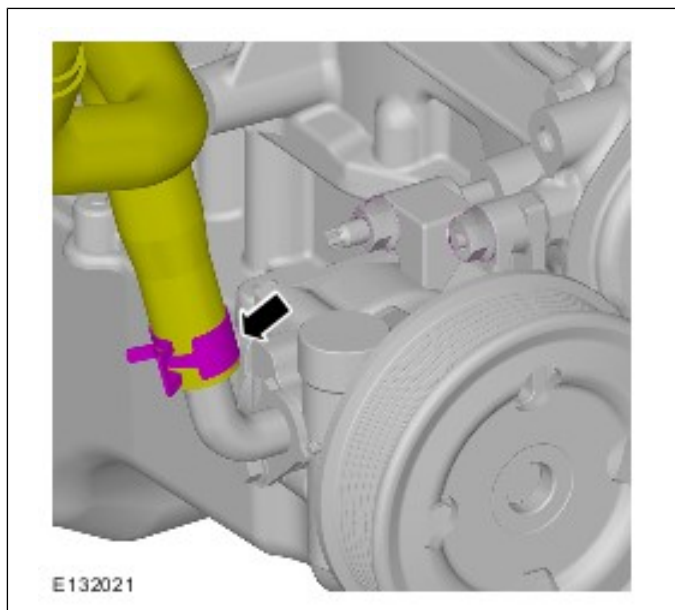
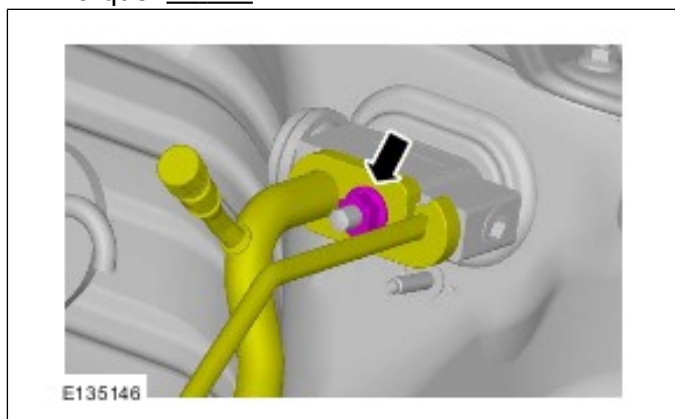
**18. Refer to: [Catalytic Converter](#) (309-00 Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).**

**19. Torque: 22 Nm****20.****21.****22 Torque: 35 Nm**



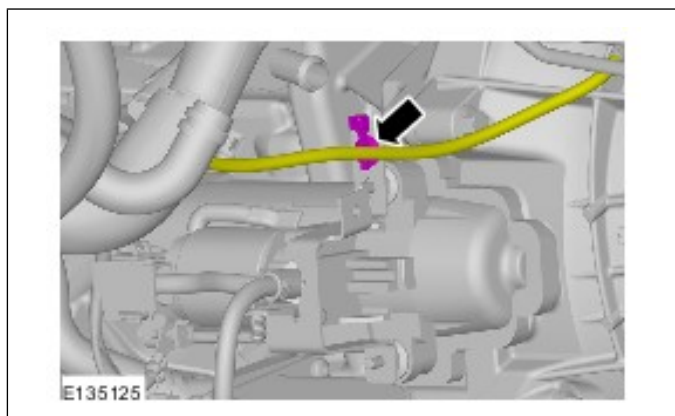
## INSTALLATION

23.

24. Torque: 22 Nm

25. Refer to: [Starter Motor - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

26.



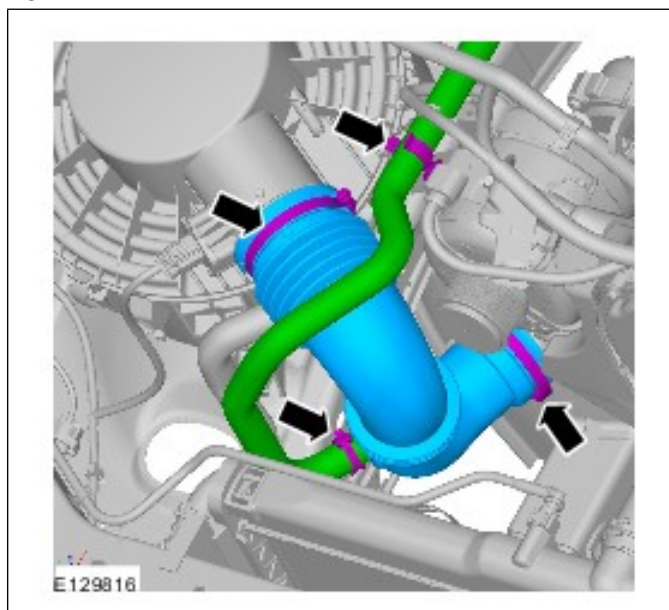
27. Refer to: [Condenser - 2.2L Duratorq-TDCi \(88kW/120PS\) - Puma/2.2L Duratorq-TDCi \(96kW/130PS\) - Puma/2.2L Duratorq-TDCi \(110kW/150PS\) - Puma/3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (412-01 Climate Control, Removal and Installation).

28. Refer to: [Radiator](#) (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

29. Refer to: [Cooling Fan Motor and Shroud](#) (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

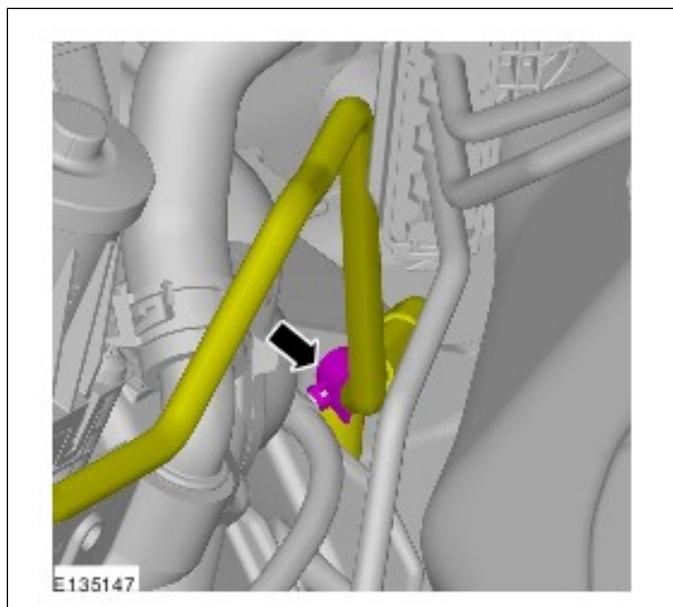
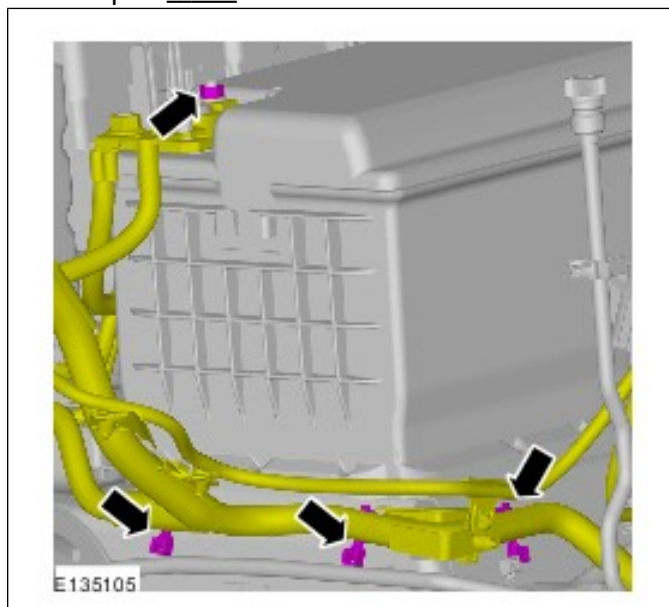
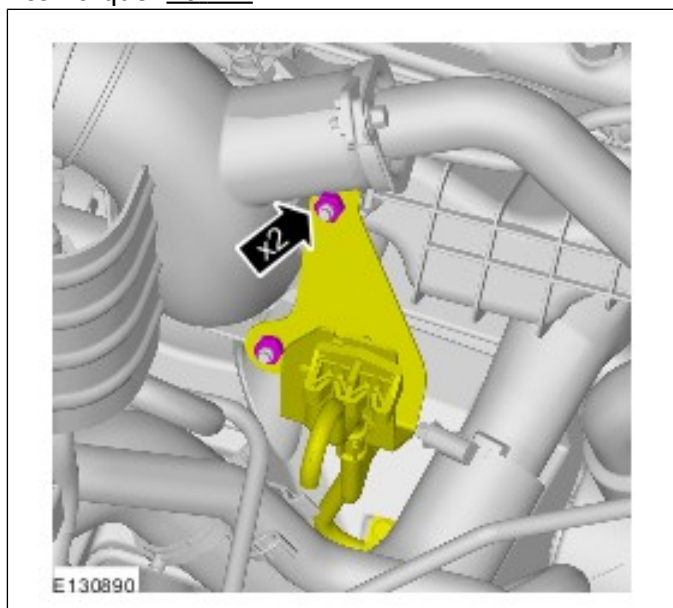
30. Refer to: [Air Cleaner - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

31.

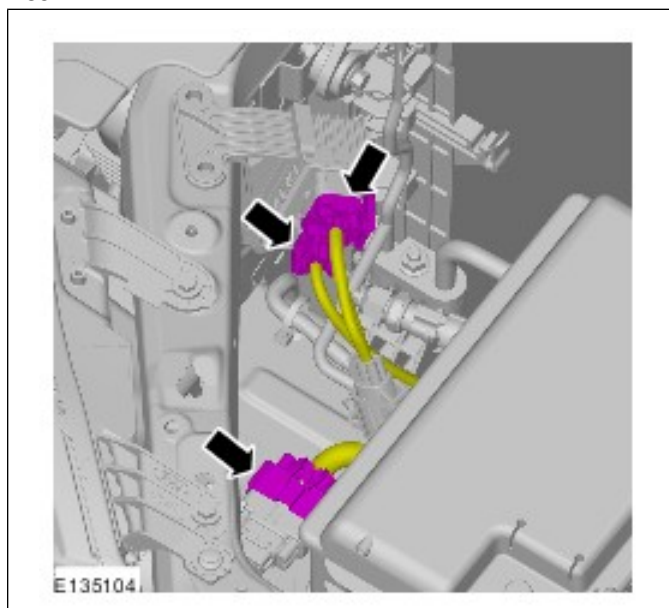
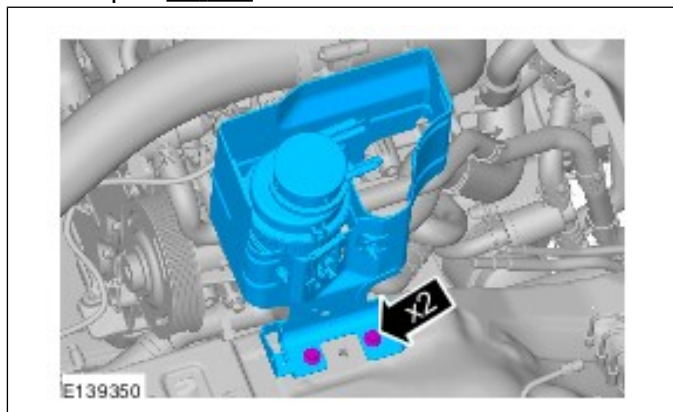


## INSTALLATION

32.

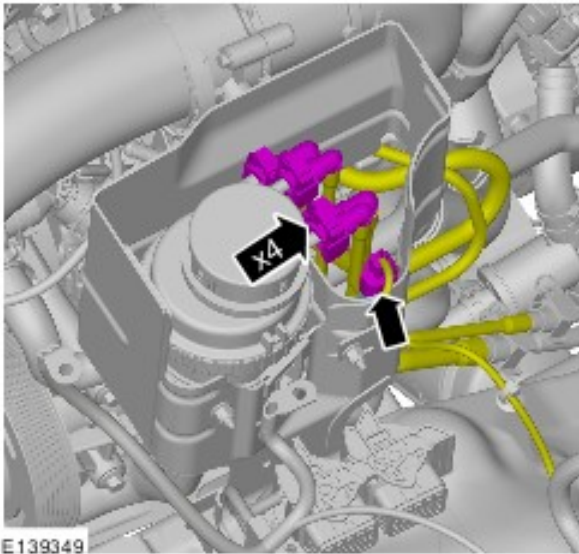
35. Torque: 5 Nm33. Torque: 10 Nm

36.

34. Torque: 18 Nm

## INSTALLATION

37.



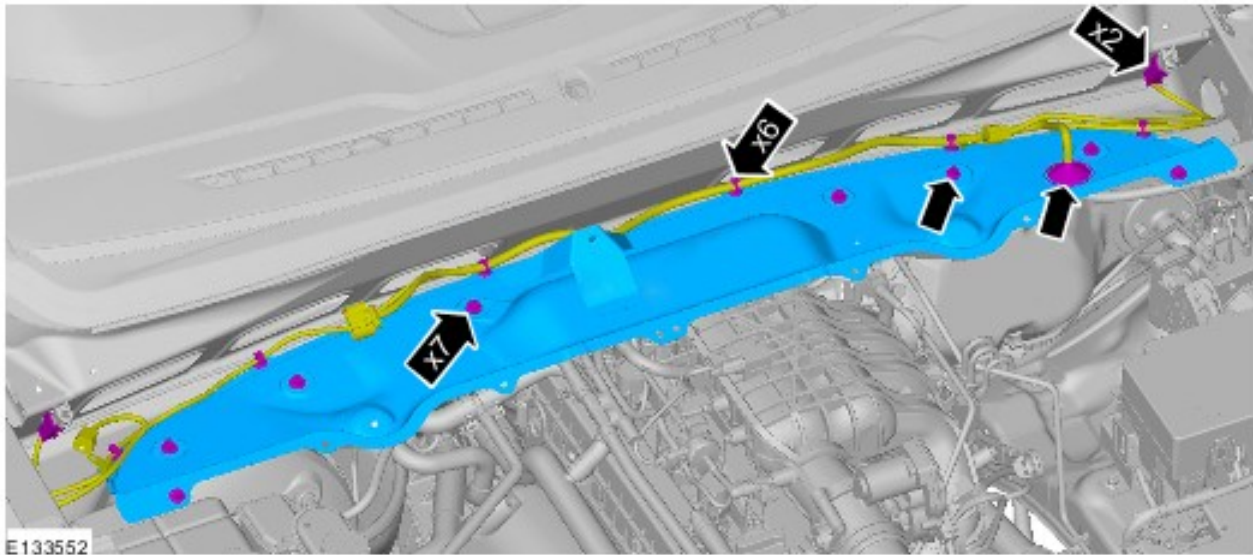
38. Refer to: [Powertrain Control Module \(PCM\)](#) (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Refer to: [Powertrain Control Module \(PCM\)](#) (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

39. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

40. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

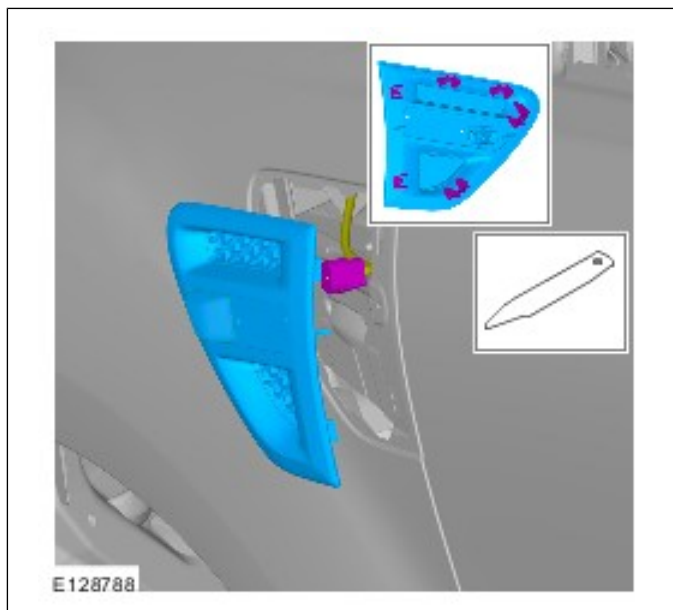
41. Torque: 10 Nm



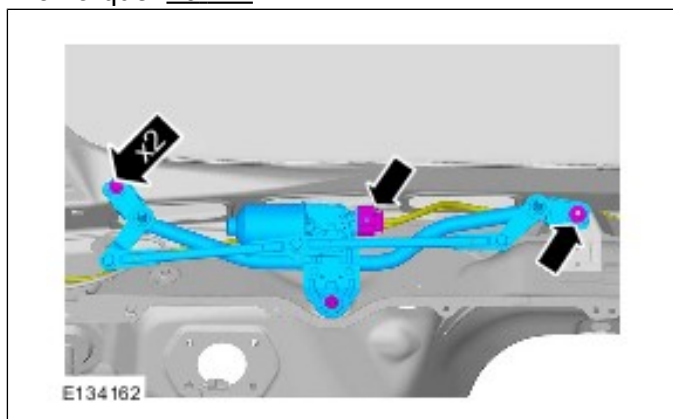


## INSTALLATION

42. On both sides.

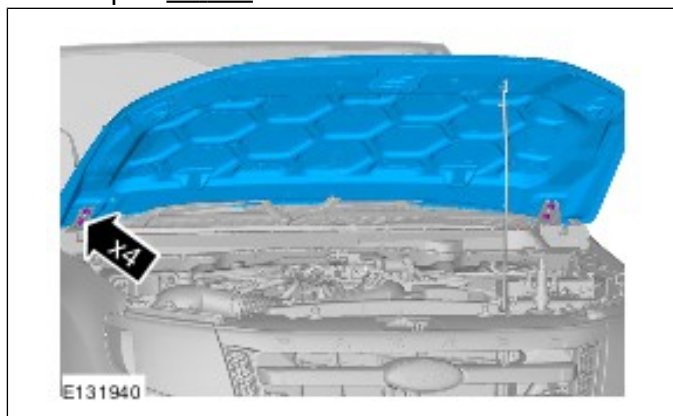


43. Torque: 10 Nm

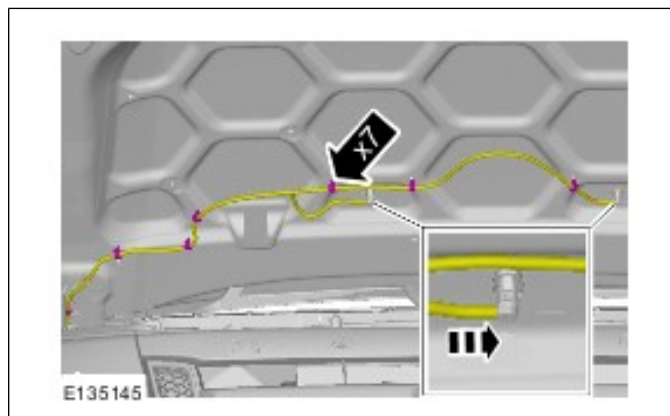


44. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).

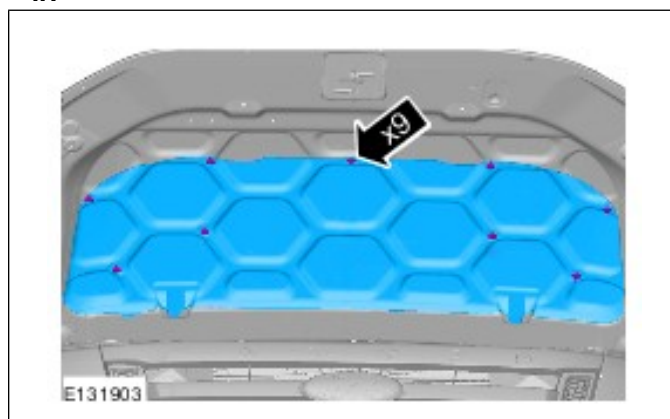
45. Torque: 25 Nm



46.

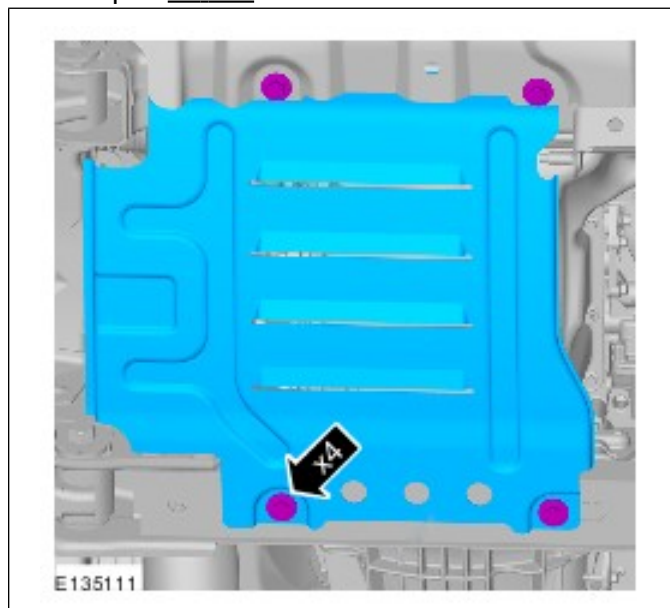


47.



48. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

49. Torque: 30 Nm





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**INSTALLATION**

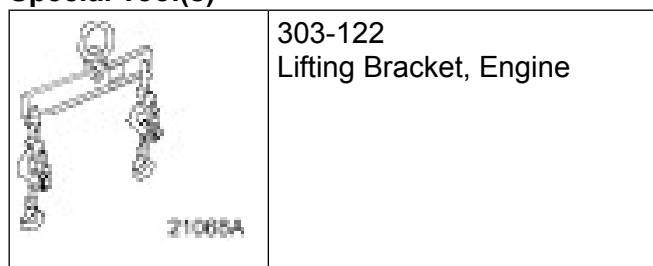
- 50.** Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
- 51.** Refer to: [Cooling System Draining, Filling and Bleeding](#) - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
- 52.** Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## INSTALLATION

Engine — Vehicles With: 6-Speed Automatic Transmission -  
6R80(21 132 0; 21 132 6; 21 132 7)

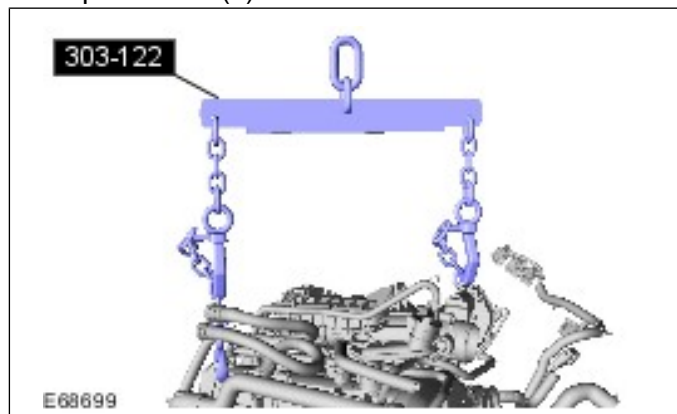
## Installation

## Special Tool(s)

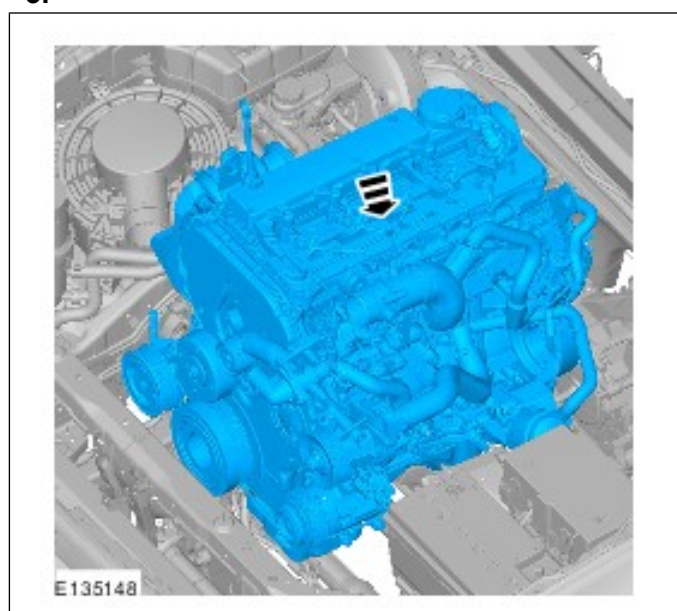


1. Refer to: [Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

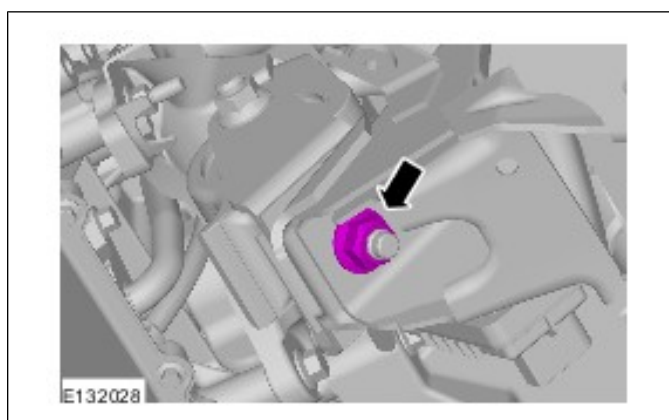
2. Special Tool(s): 303-122



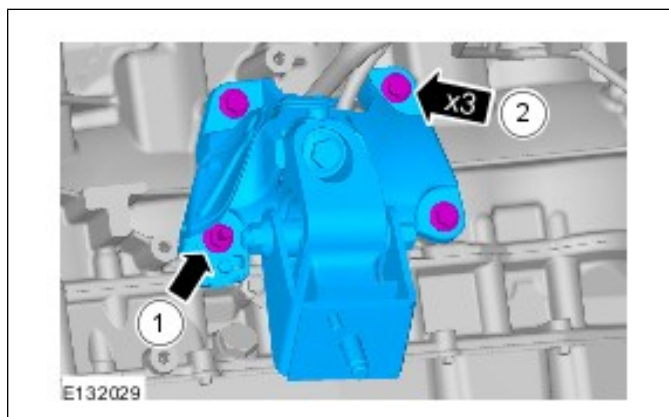
3.



4. **NOTE:** Hand tighten the nut at this stage.

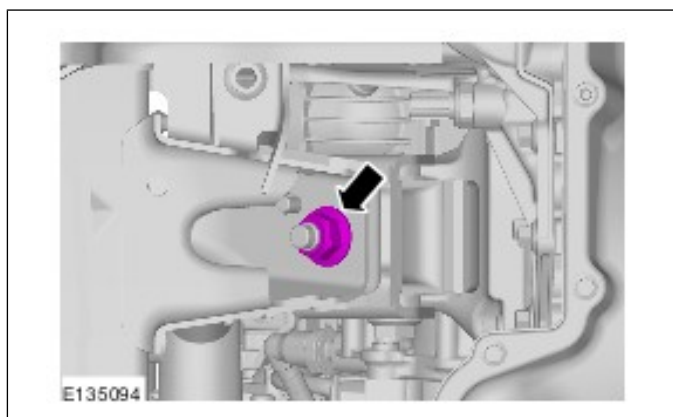


5. **NOTE:** Hand tighten the nuts at this stage.

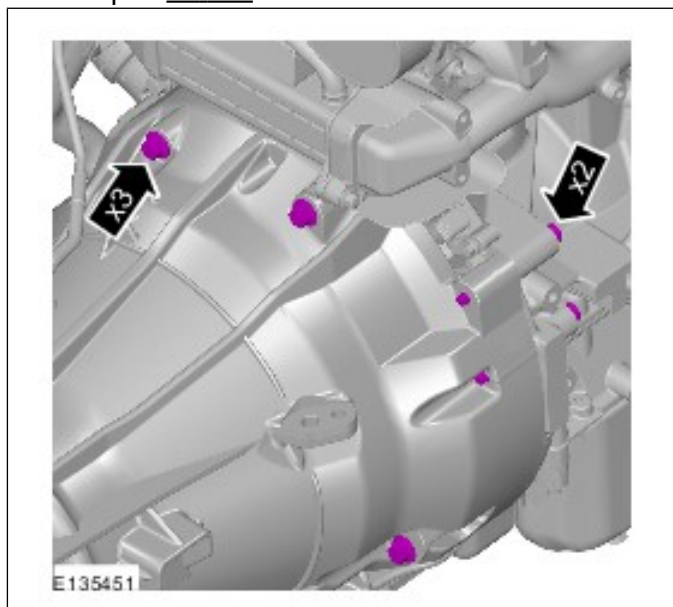


## INSTALLATION

6. **NOTE:** Hand tighten the nut at this stage.

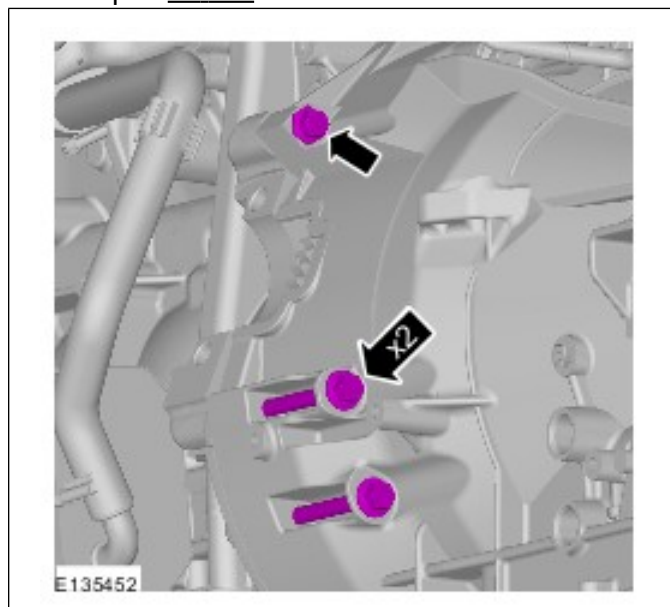


7. Initially hand tighten the fasteners.  
Torque: 48 Nm

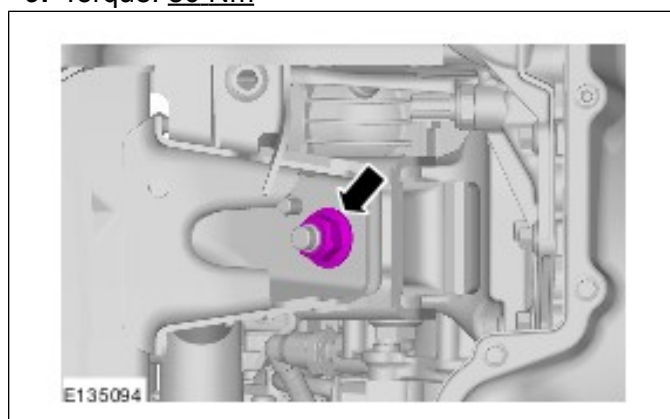


8. Initially hand tighten the fasteners.

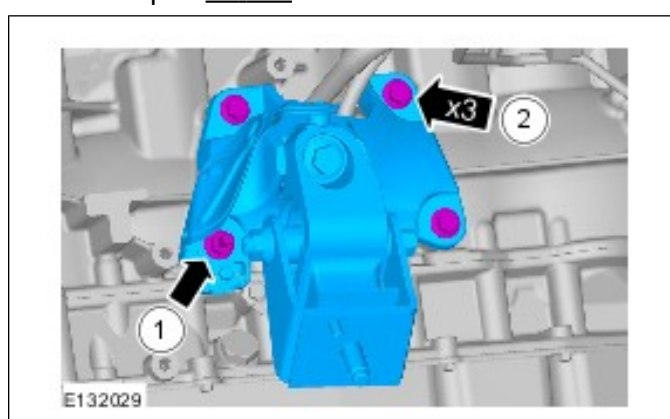
Torque: 48 Nm



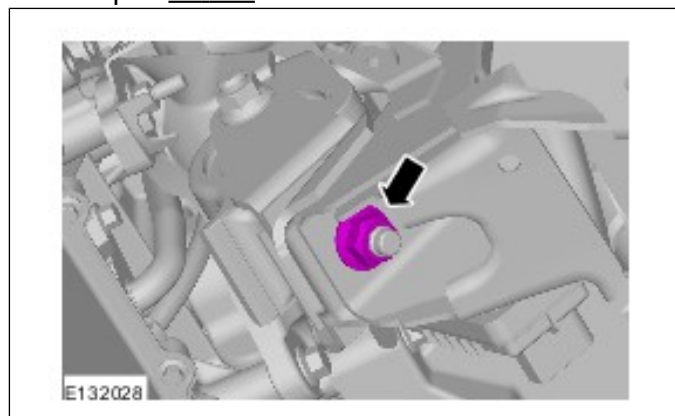
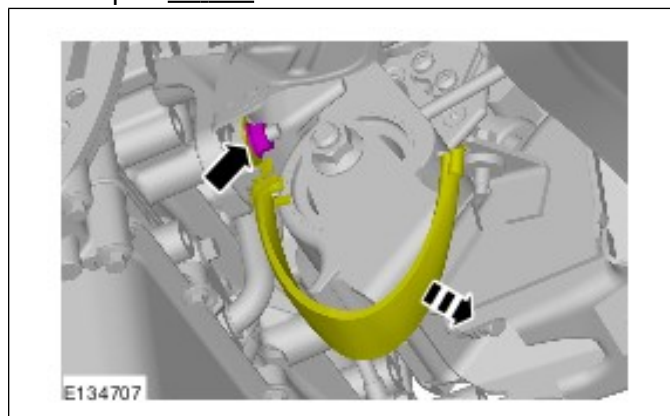
9. Torque: 80 Nm



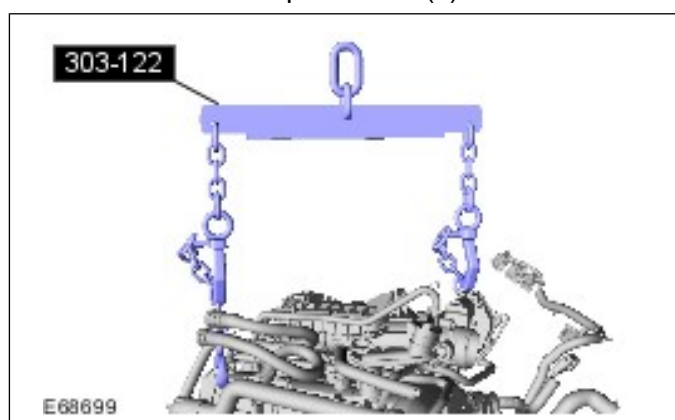
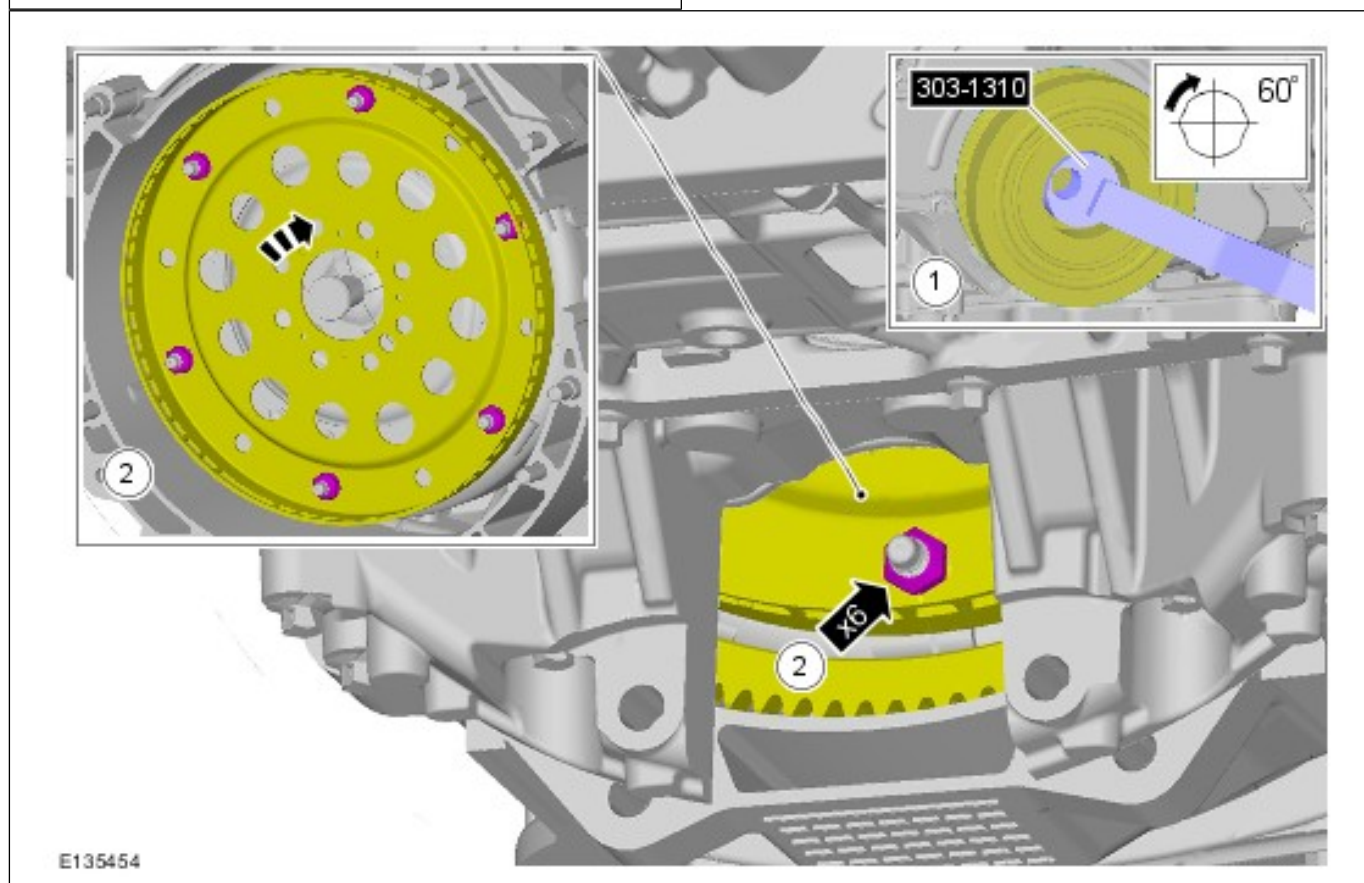
10. 1. Torque: 48 Nm  
2. Torque: 48 Nm



## INSTALLATION

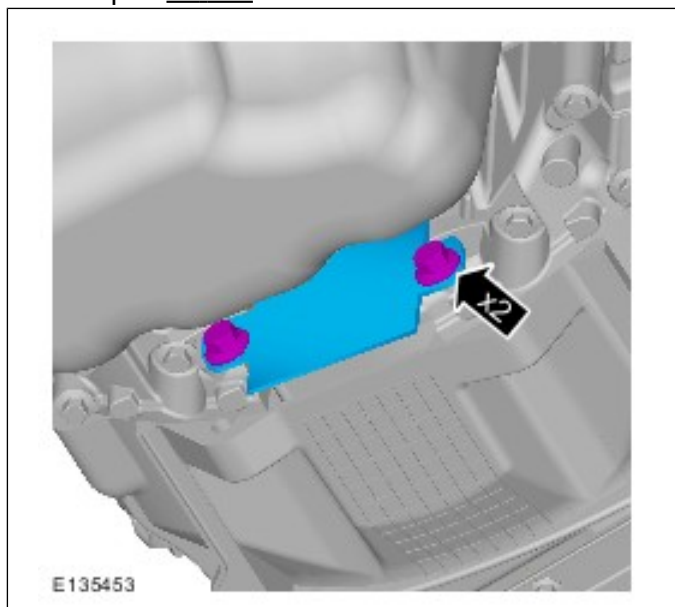
11. Torque: 80 Nm13. Torque: 13 Nm

12 1. Remove the Special Tool(s): 303-122

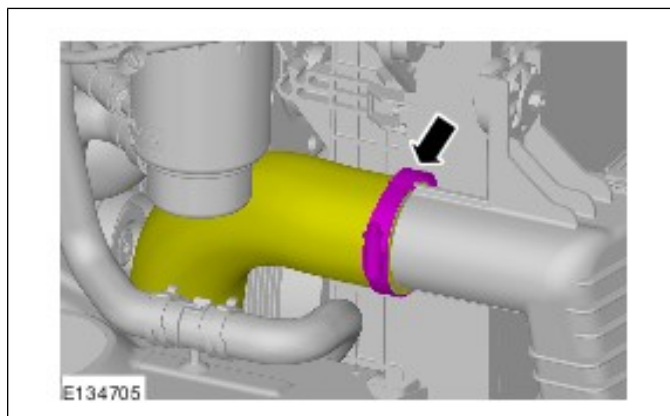
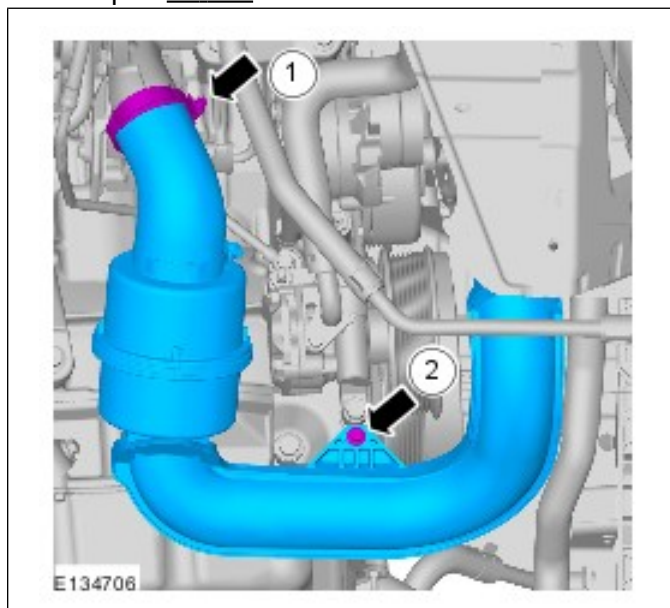
14. Torque: 40 Nm



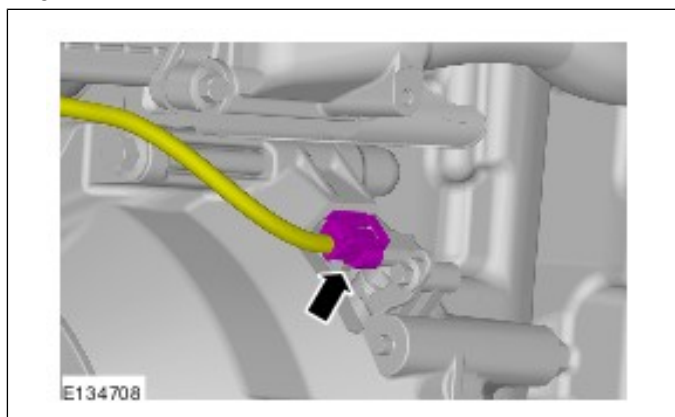
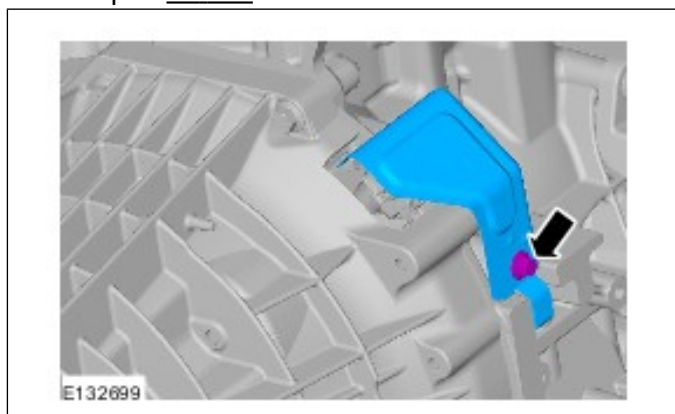
## INSTALLATION

15. Torque: 22 Nm

18.

19. Torque: 10 Nm

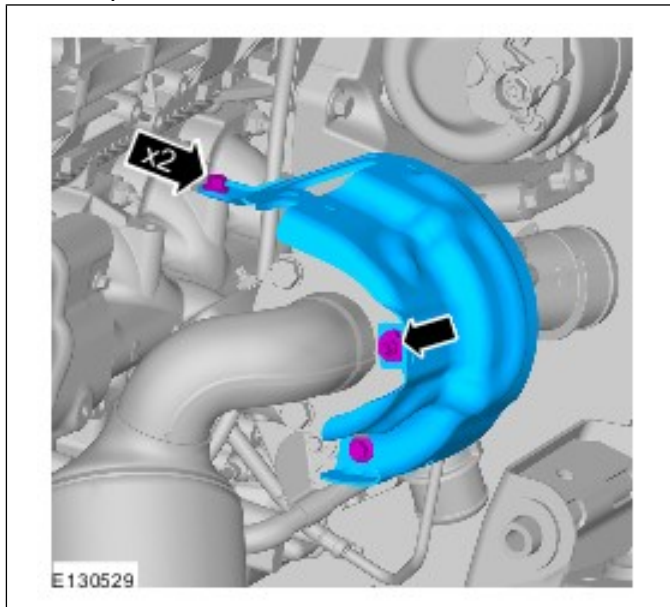
16.

17. Torque: 12 Nm

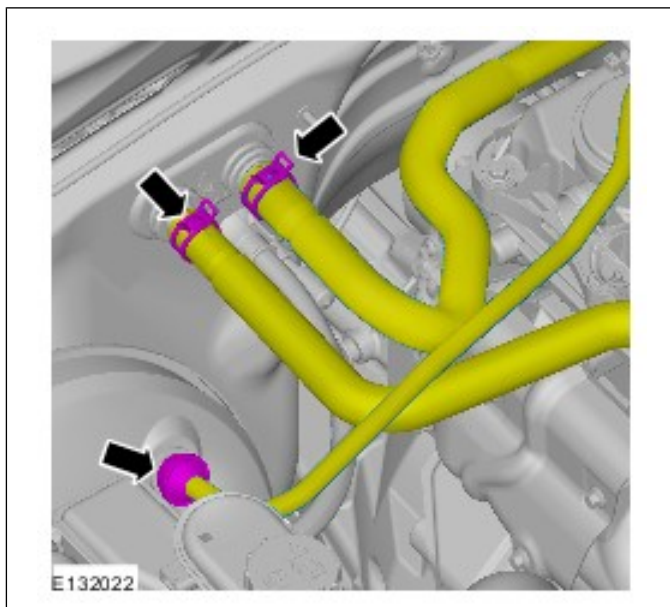
## INSTALLATION

20. Refer to: [Catalytic Converter](#) (309-00 Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

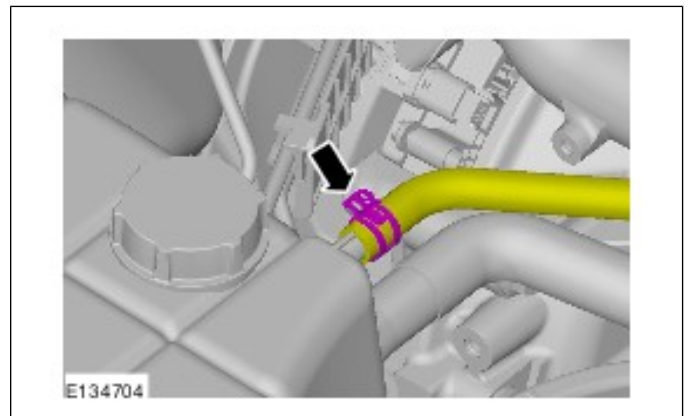
21. Torque: 22 Nm



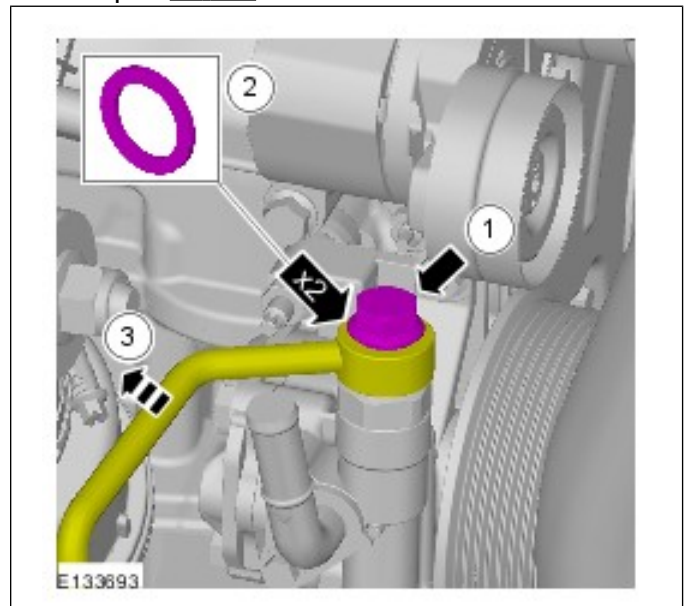
22.



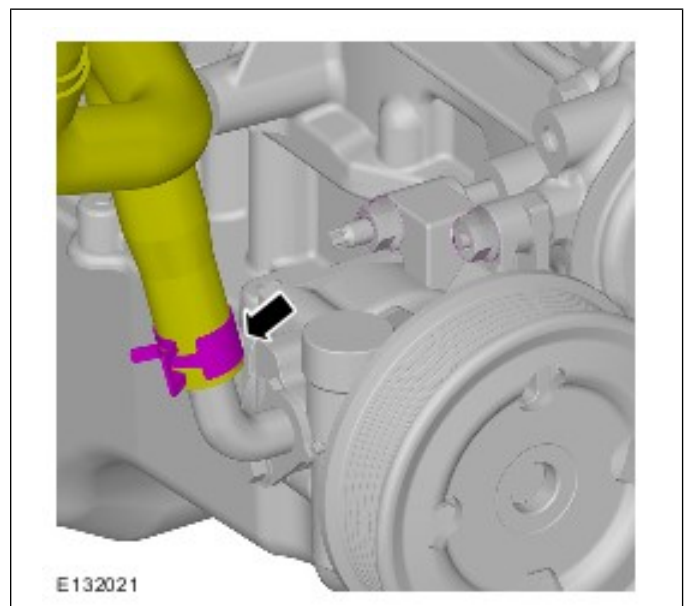
23.



24. Torque: 35 Nm

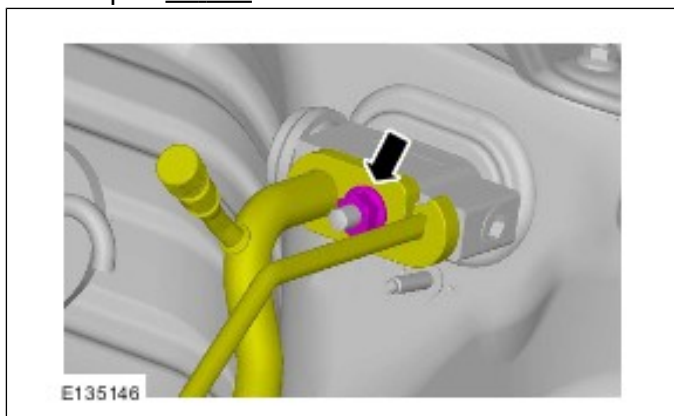


25.



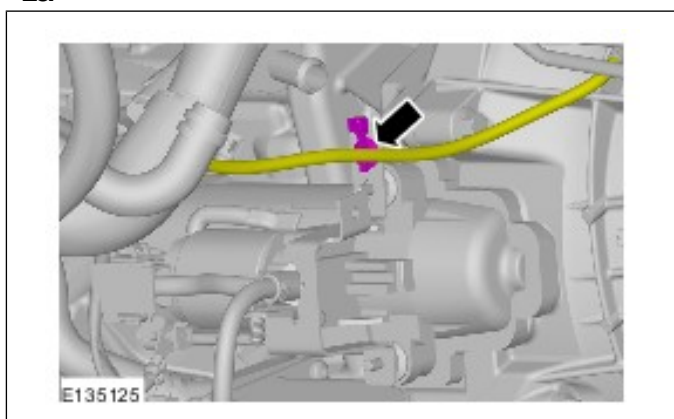
## INSTALLATION

26. Torque: 22 Nm



27. Refer to: [Starter Motor - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

28.



29. Refer to: [Transmission Fluid Cooler](#) (307-02 Transmission Cooling, Removal and Installation).

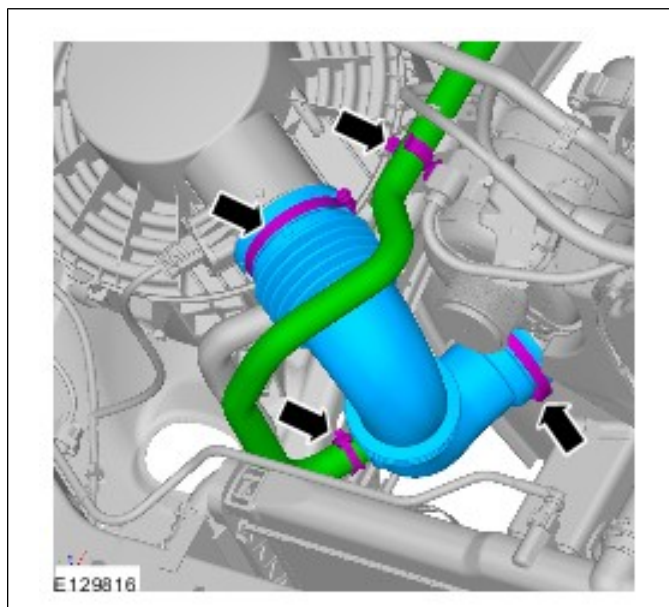
30. Refer to: [Condenser - 2.2L Duratorq-TDCi \(88kW/120PS\) - Puma/2.2L Duratorq-TDCi \(96kW/130PS\) - Puma/2.2L Duratorq-TDCi \(110kW/150PS\) - Puma/3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (412-01 Climate Control, Removal and Installation).

31. Refer to: [Radiator](#) (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

32. Refer to: [Cooling Fan Motor and Shroud](#) (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

33. Refer to: [Air Cleaner - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma](#) (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

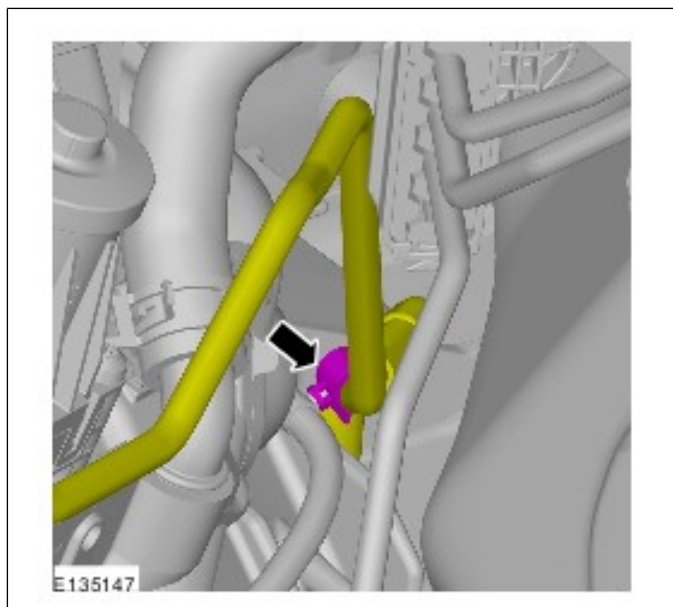
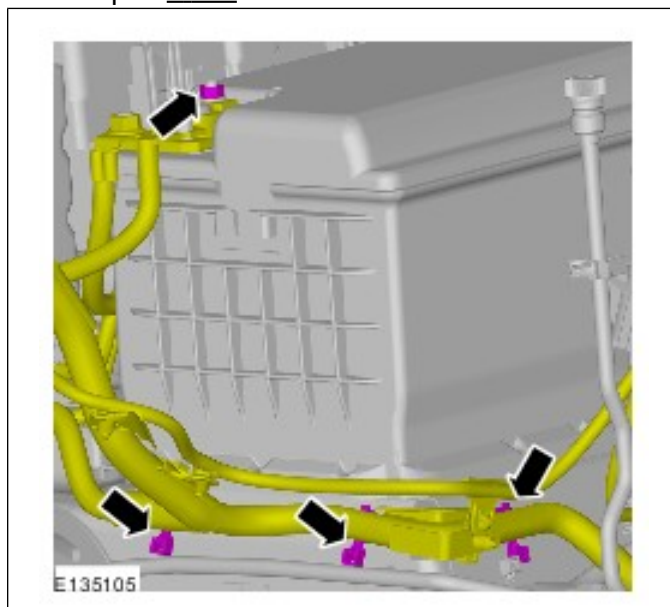
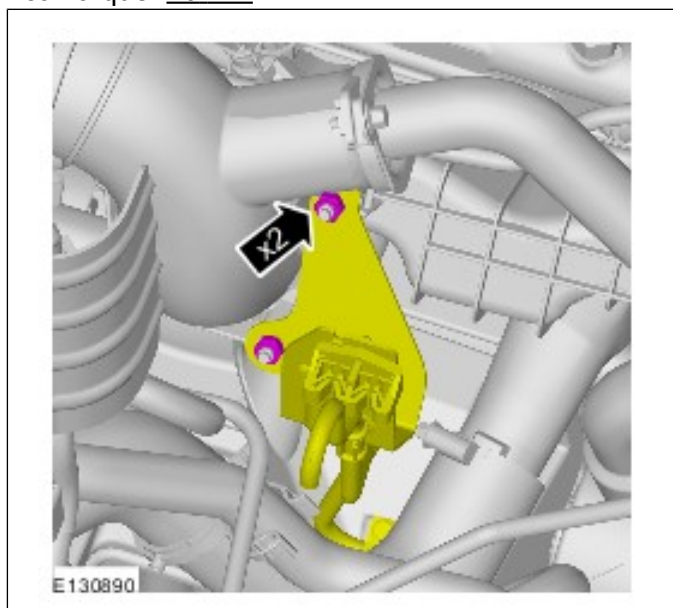
34.



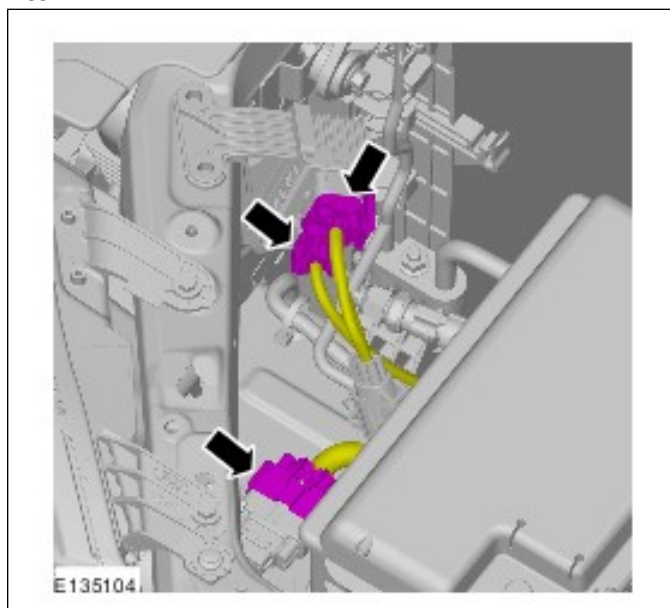
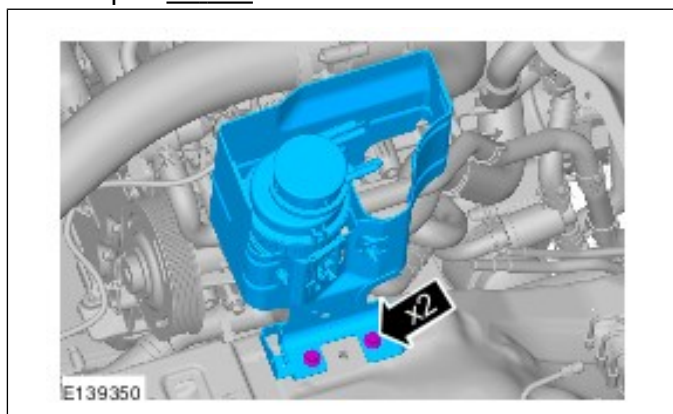


## INSTALLATION

35.

38. Torque: 5 Nm36. Torque: 10 Nm

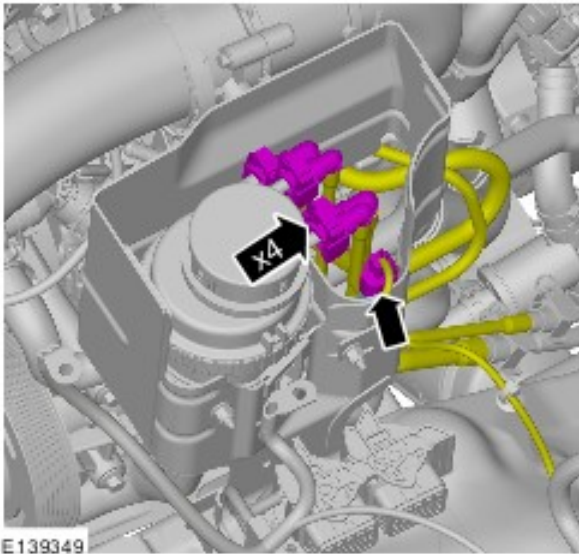
39.

37. Torque: 18 Nm

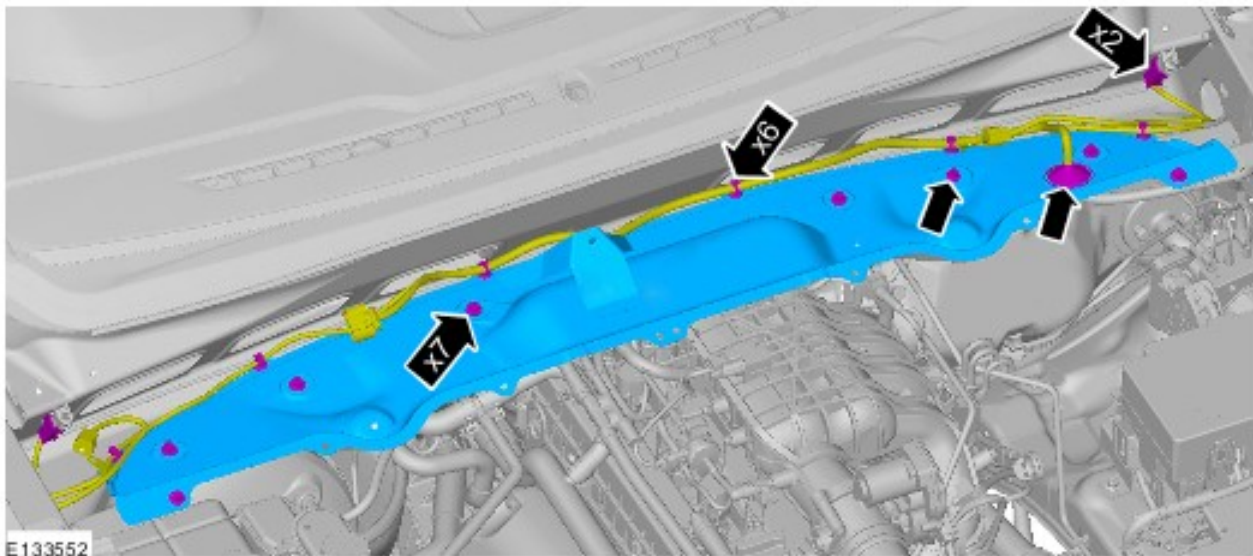


## INSTALLATION

40.

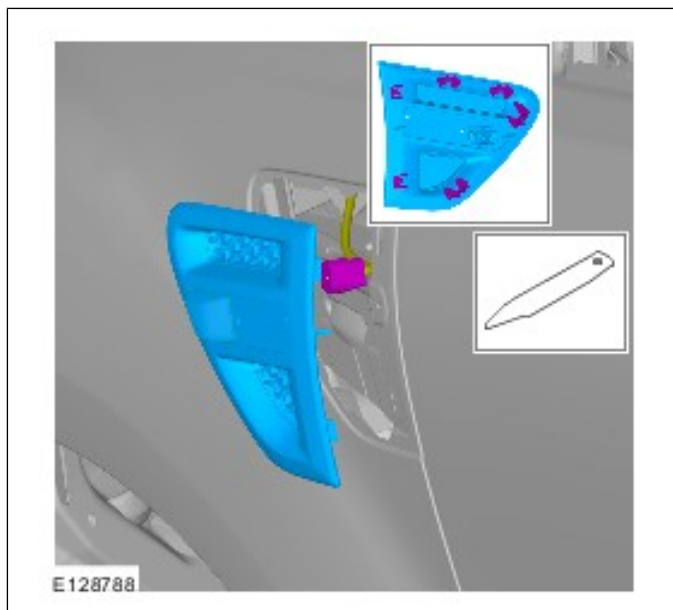


41. Refer to: [Powertrain Control Module \(PCM\)](#) (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
42. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
43. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
44. Torque: 10 Nm

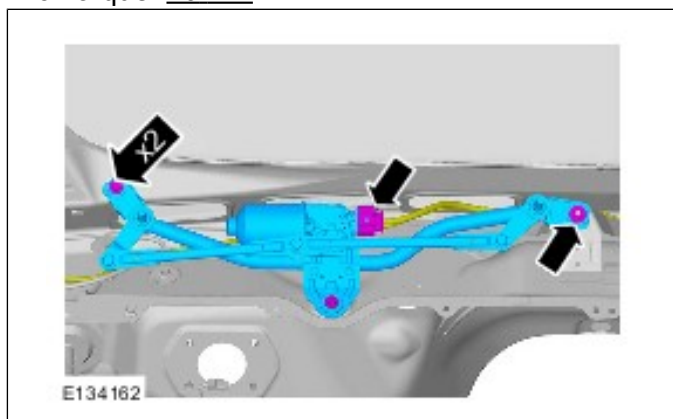


## INSTALLATION

45. On both sides.

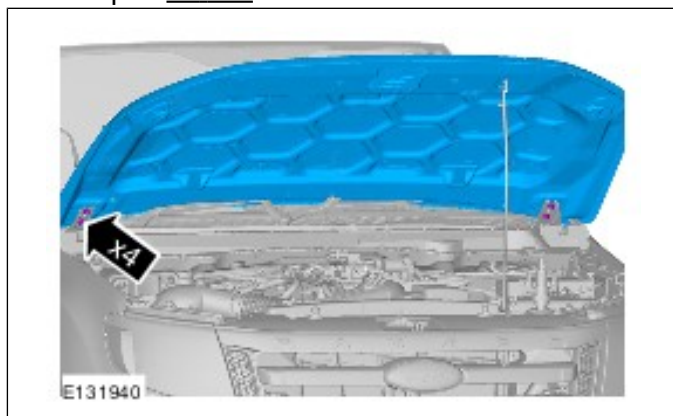


46. Torque: 10 Nm

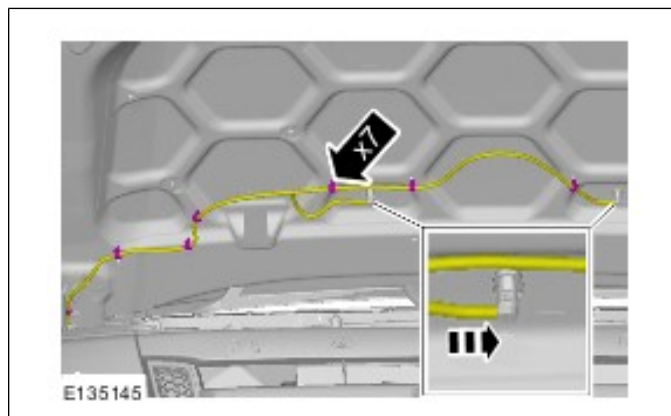


47. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).

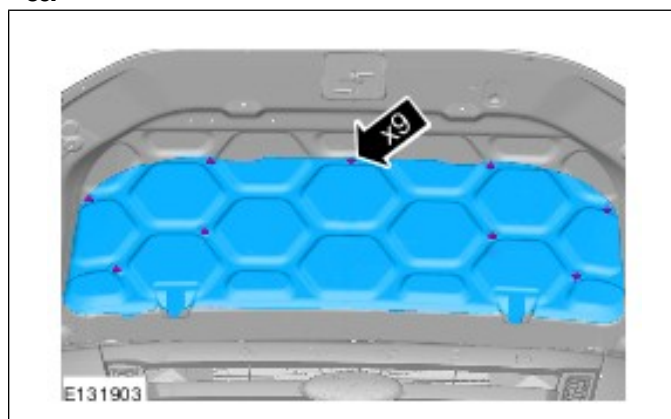
48. Torque: 25 Nm



49.

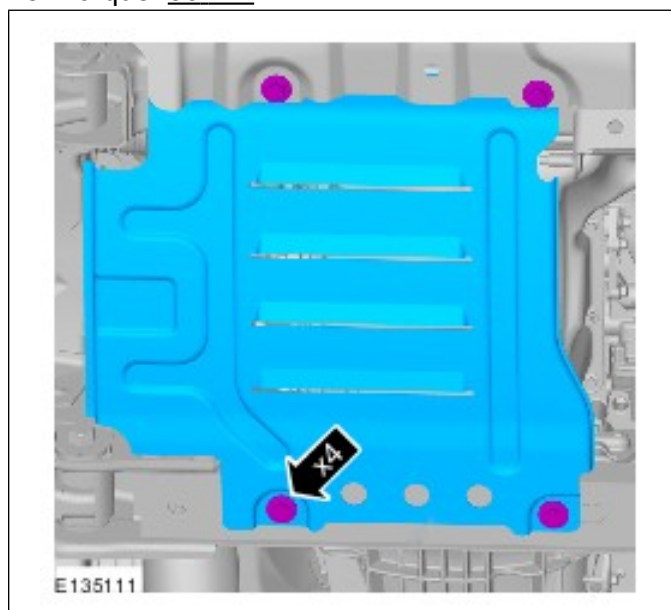


50.



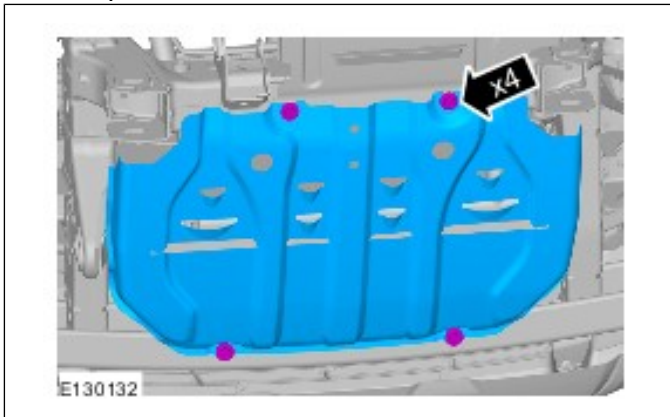
51. Refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

52. Torque: 30 Nm



**INSTALLATION**

**53.** Torque: 20 Nm



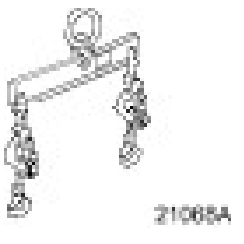
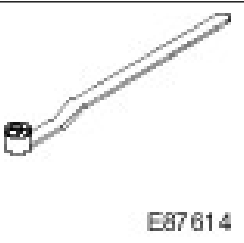
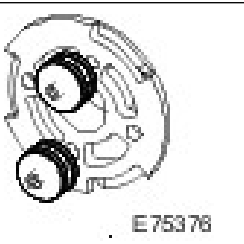
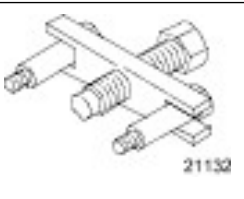
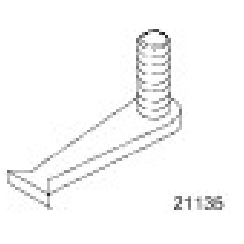

- 54.** Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
- 55.** Refer to: [Cooling System Draining, Filling and Bleeding](#) - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
- 56.** Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

## INSTALLATION

### Engine Accessories(21 139 4)

#### Installation

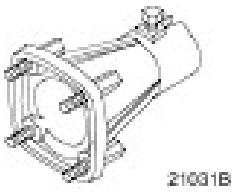
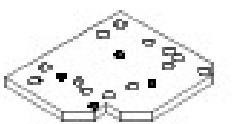
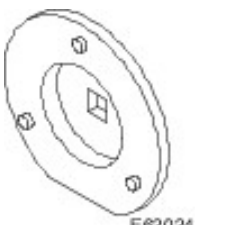
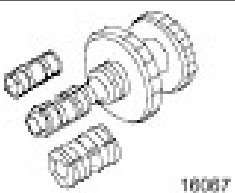
#### Special Tool(s) / General Equipment

 <p>210854</p>	<p>303-122 Lifting Bracket, Engine</p>
 <p>E87 614</p>	<p>303-1310 Holding Wrench, Crankshaft</p>
 <p>E 753 78</p>	<p>303-1317 Locking Tool, Fuel Injection Pump Sprocket</p>
 <p>21132</p>	<p>303-249 Remover, Crankshaft Timing Pulley</p>
 <p>21126</p>	<p>303-254 Locking Tool, Flywheel</p>
 <p>21187</p>	<p>303-435 Mounting Stand</p>



INSTALLATION

Special Tool(s) / General Equipment

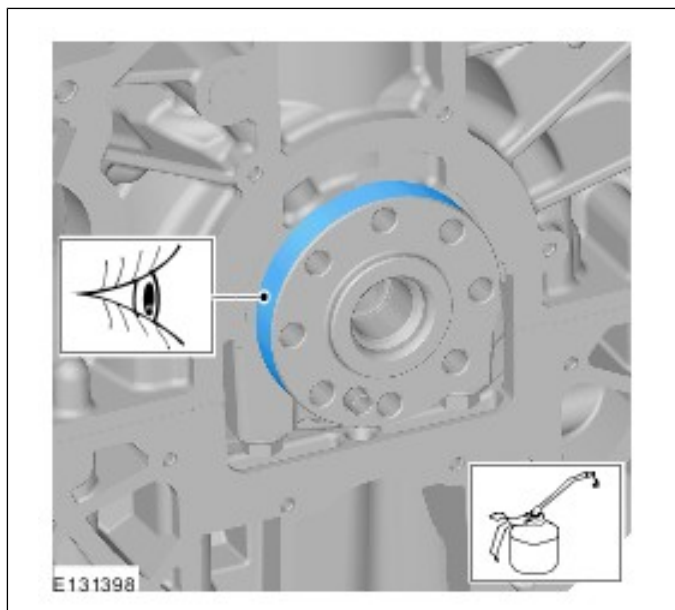
 21031B	303-435-06 Mounting Bracket for 303-435
 E68388	303-435-11B Mounting Plate for 303-435-06
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate
 18087	308-204 Aligner, Clutch Disc
1/2 Inch Square Drive Breaker Bar	
Dowel with a Diameter of 6 mm	

Materials

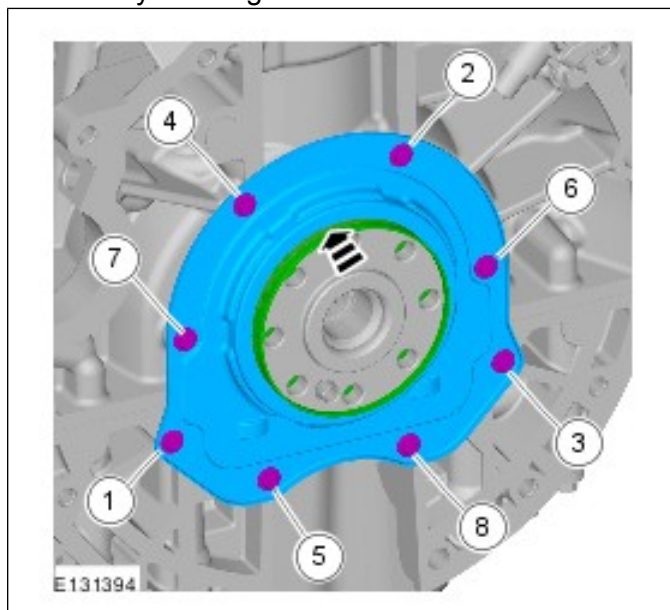
Name	Specification
Silicone Sealant LB 2U7J-M4G323-AA	WSE-M4G323-A4
Silicone Gasket and Sealant TA-30	

## INSTALLATION

1.

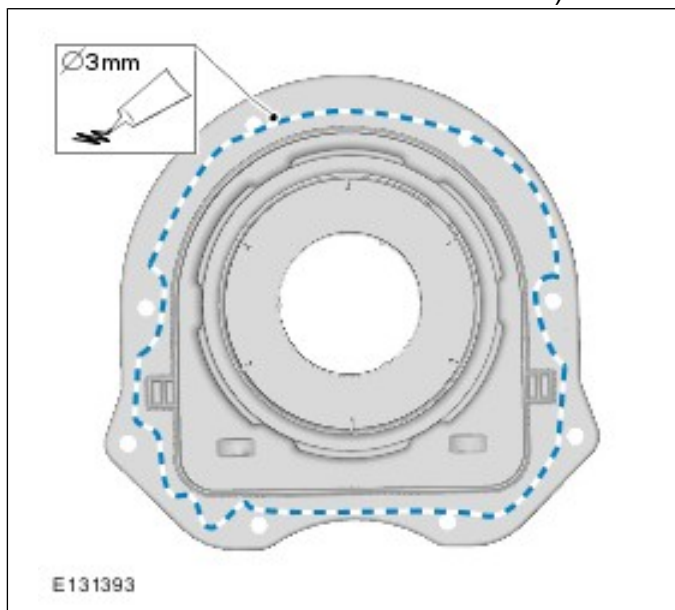


Initially hand tighten the fasteners.



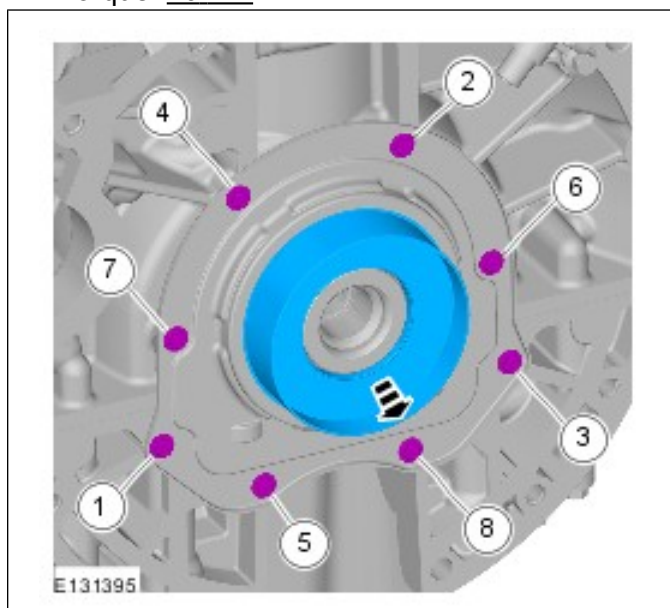
2. **NOTE:** Install the new crankshaft rear seal carrier within five minutes of applying the recommended sealant.

Material: sealant WSE-M4G323-A4 (Silicone Sealant LB / 2U7J-M4G323-AA; Silicone Gasket and Sealant / TA-30)



4. **NOTE:** New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

Torque: 20 Nm



3. **CAUTION:** A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.

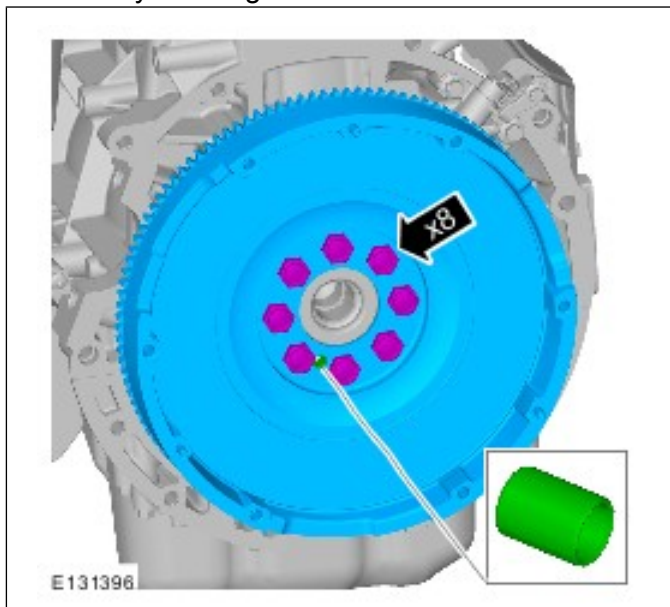
## INSTALLATION

### 5. Special Tool(s): 303-254



- 6. NOTE:** Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.

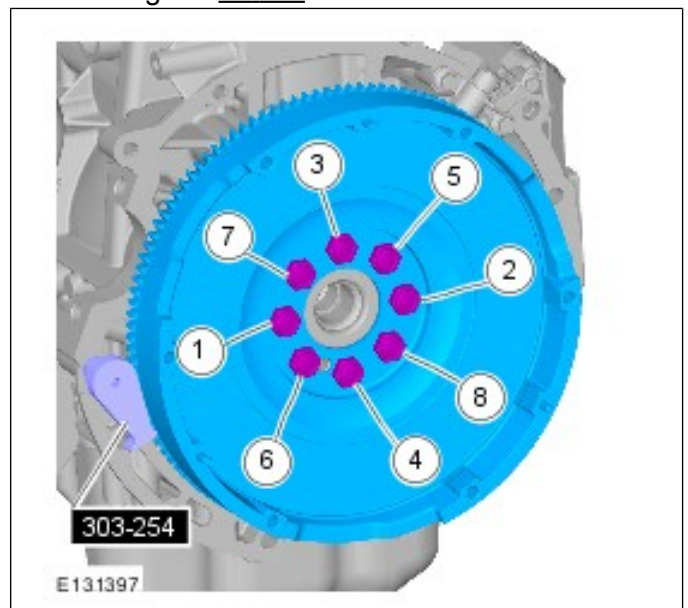
Initially hand tighten the fasteners.



### 7. Special Tool(s): 303-254

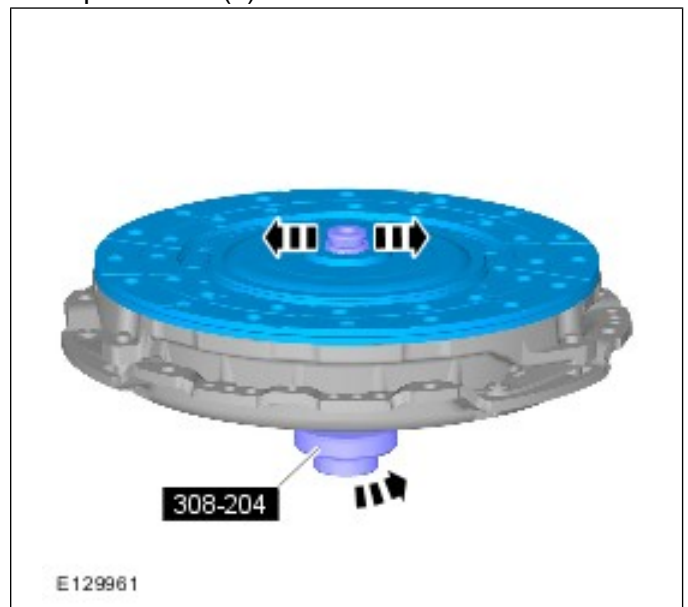
Torque:

- Stage 1: 15 Nm
- Stage 2: 30 Nm
- Stage 3: 75 Nm



- 8. NOTE:** The cone on the special tool must only be tightened finger tight to prevent damage to the clutch disc.

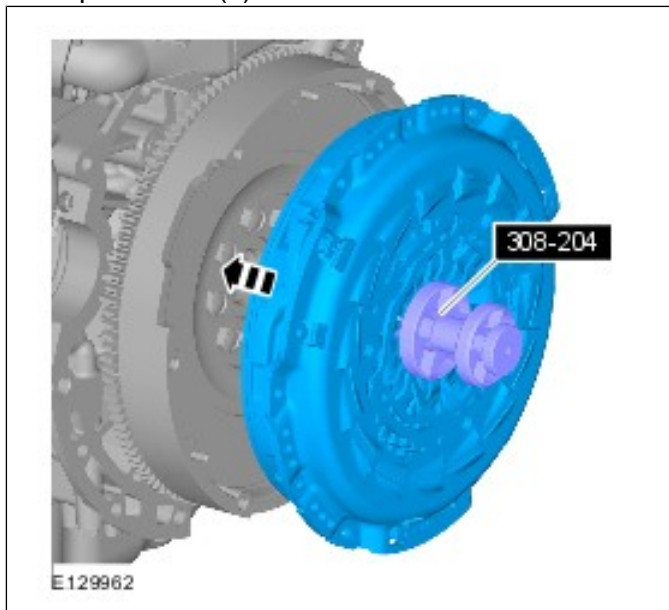
Special Tool(s): 308-204



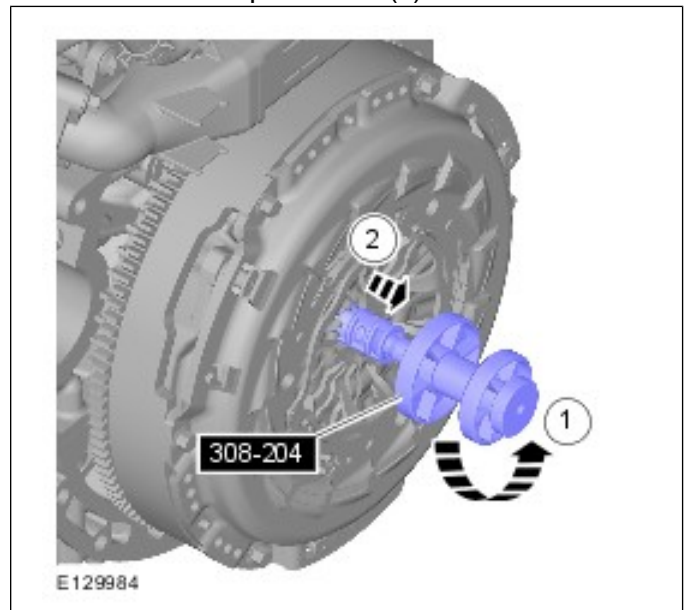
- 9. NOTE:** Only tighten the bolt finger tight at this stage.

## INSTALLATION

Special Tool(s): 308-204



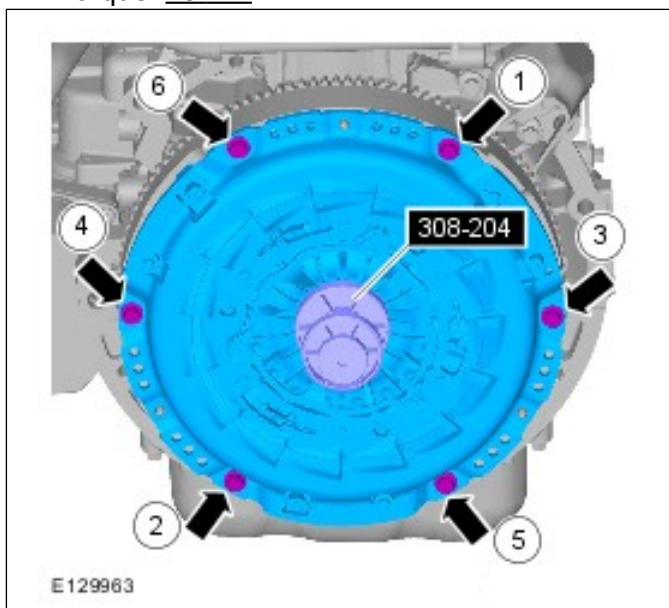
11. Remove the Special Tool(s): 308-204



10. **CAUTION:** Tighten the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.

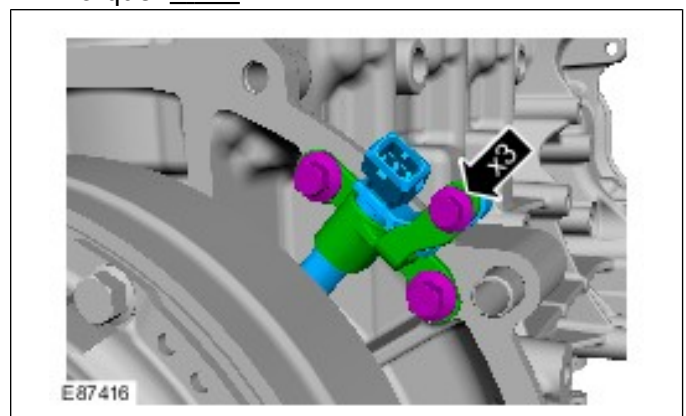
Special Tool(s): 308-204

Torque: 45 Nm



- 12 **NOTE:** Make sure that a new component is installed.

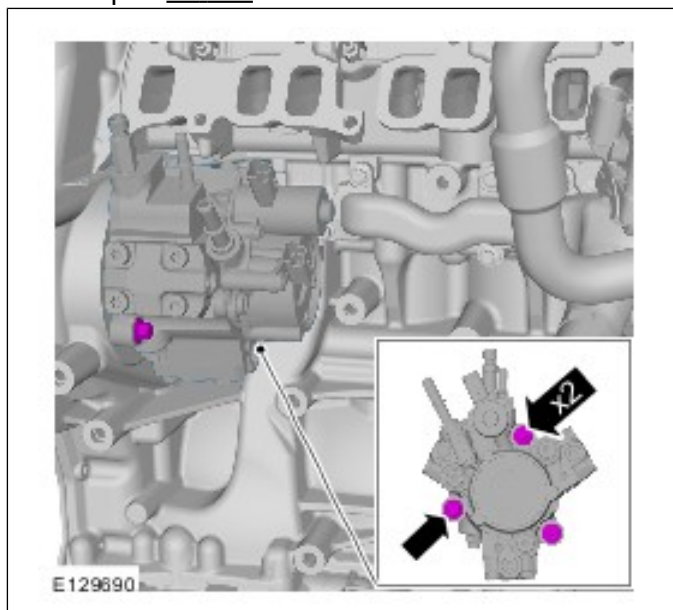
Torque: 7 Nm



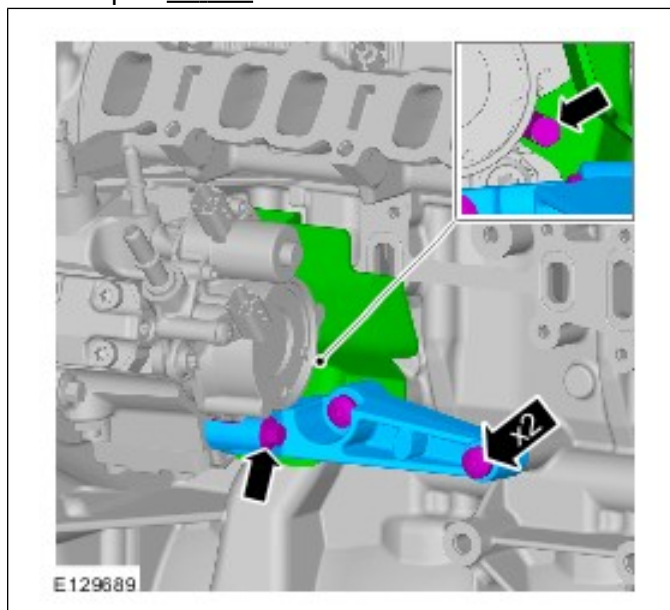


## INSTALLATION

13. Torque: 23 Nm

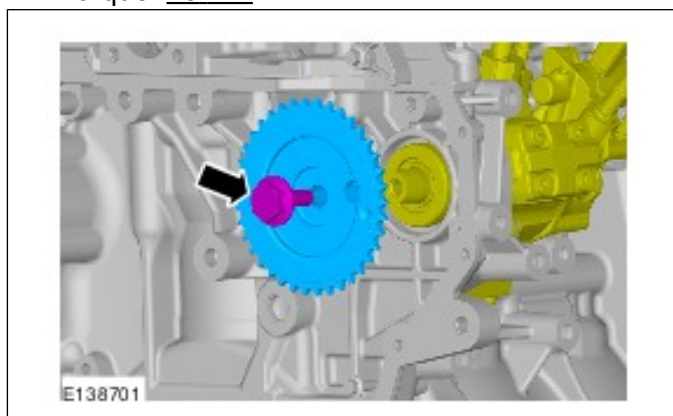


15. Torque: 22 Nm

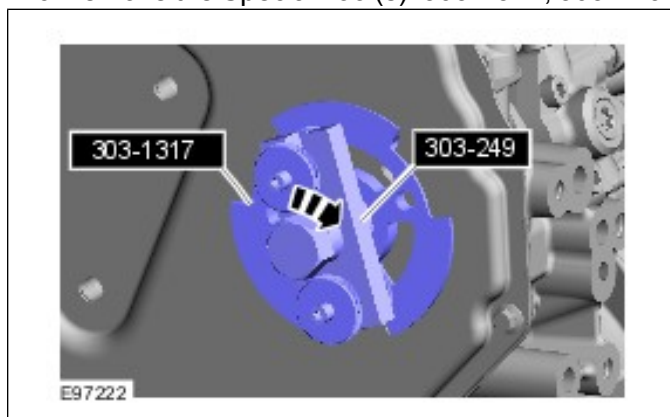


14. **NOTE:** Make sure that a new component is installed.

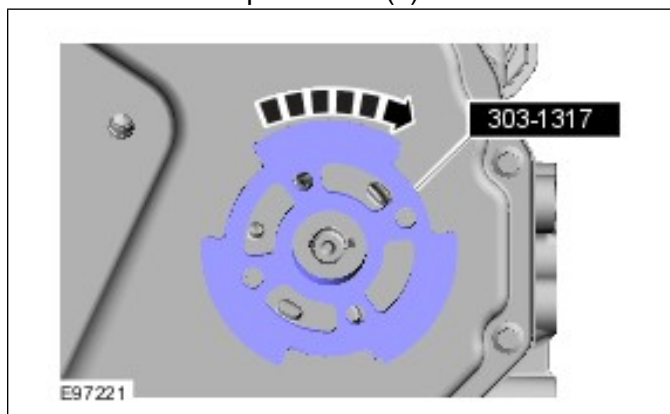
Torque: 45 Nm



16. Remove the Special Tool(s): 303-1317, 303-249

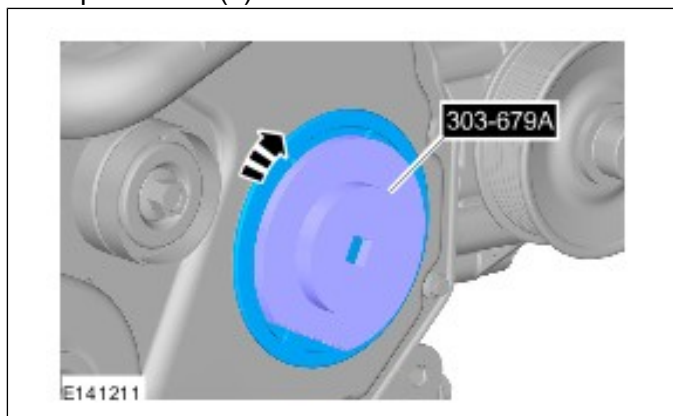


17. Remove the Special Tool(s): 303-1317

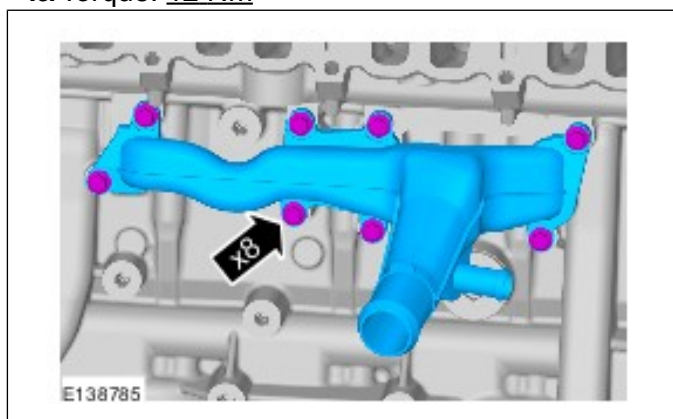


## INSTALLATION

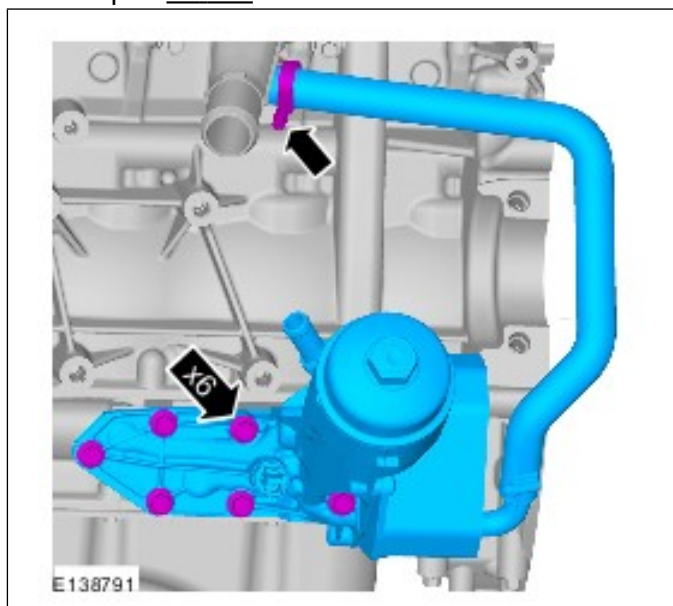
18. Special Tool(s): 303-679A



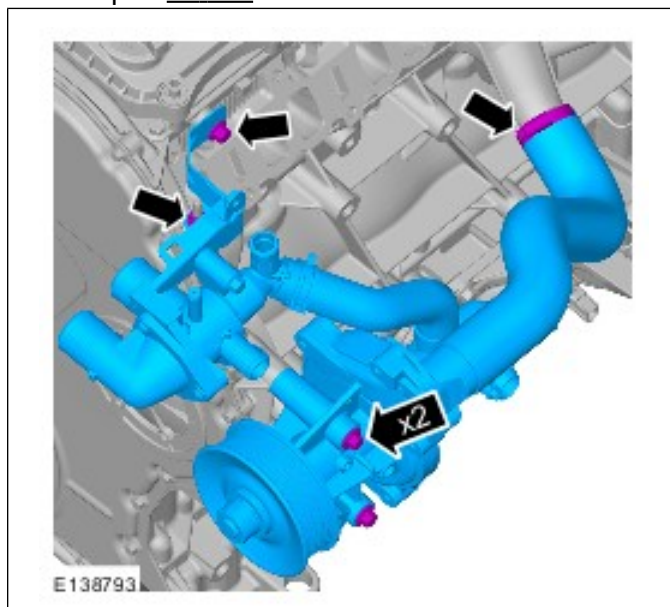
19. Torque: 12 Nm



20. Torque: 23 Nm

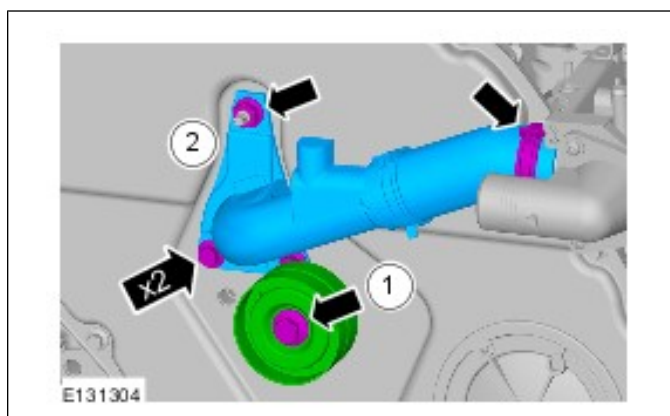


21. Torque: 23 Nm

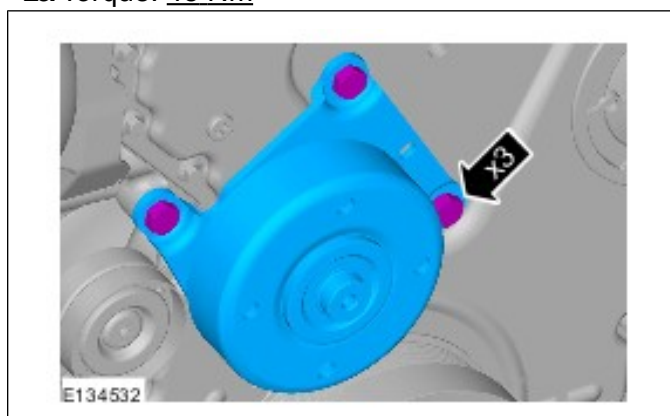


22 1. Torque: 48 Nm

2. Torque: 23 Nm

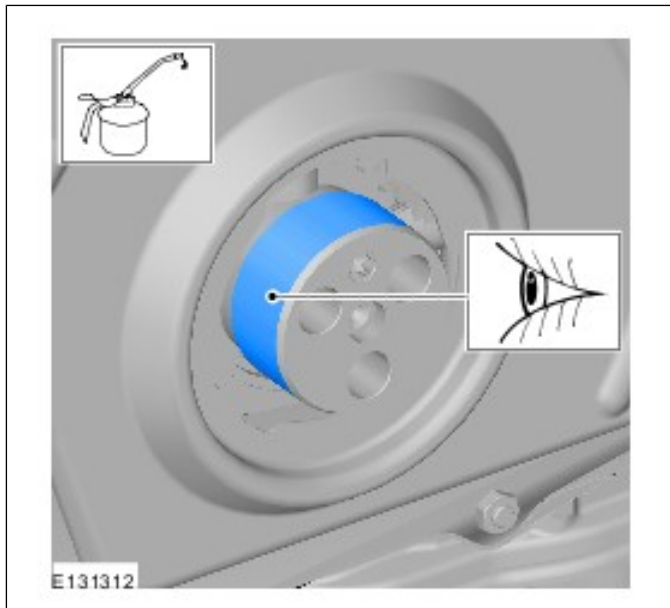


23. Torque: 48 Nm



## INSTALLATION

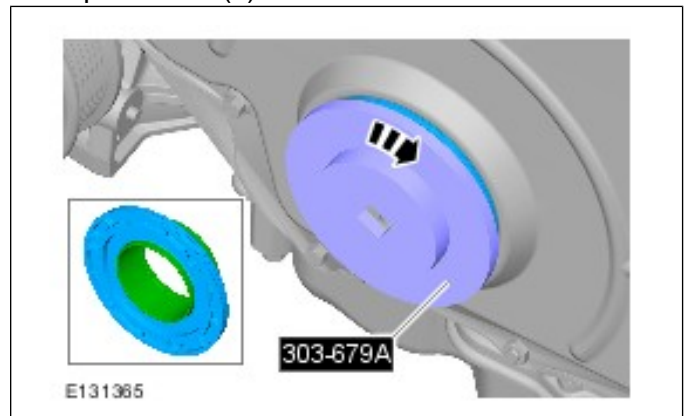
- 24. NOTE:** Make sure that the mounting face is clean and lubricated.



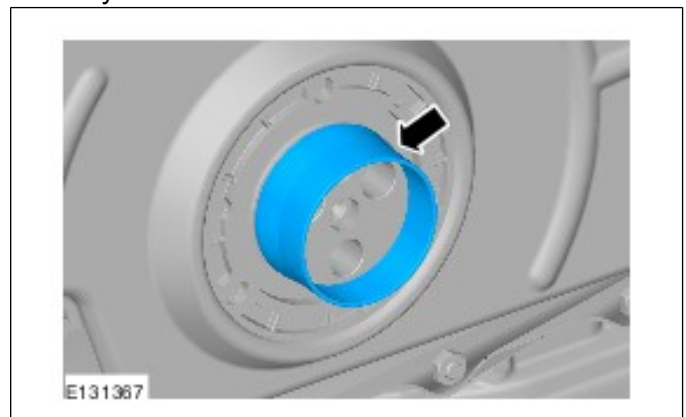
- 25. ⚠ CAUTION:** Rotate the seal assembly until it locks. Failure to follow this instruction may result in damage to the seal assembly.

**NOTE:** A new crankshaft front seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed.

Special Tool(s): 303-679A



- 26.** Remove the alignment sleeve after the seal is fully installed.



- 27. ⚠ CAUTION:** Crankshaft pulley retaining bolts must only be used three times.

**NOTE:** Initially hand tighten the fasteners.

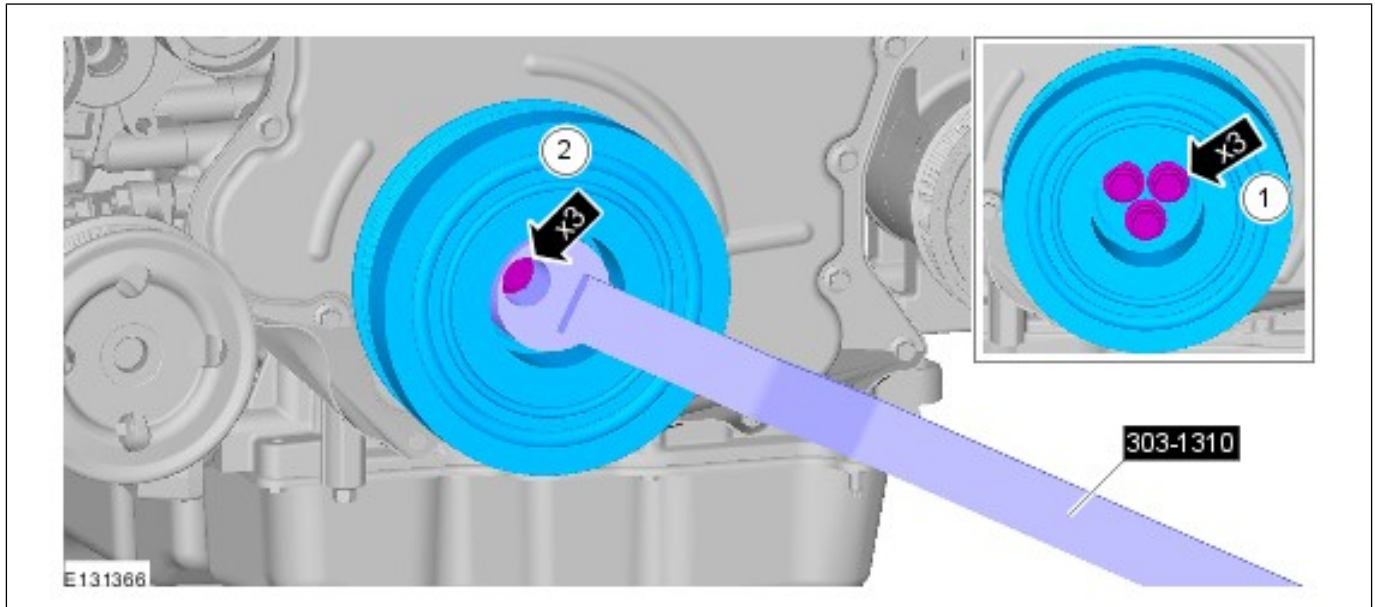
Special Tool(s): 303-1310

Torque:

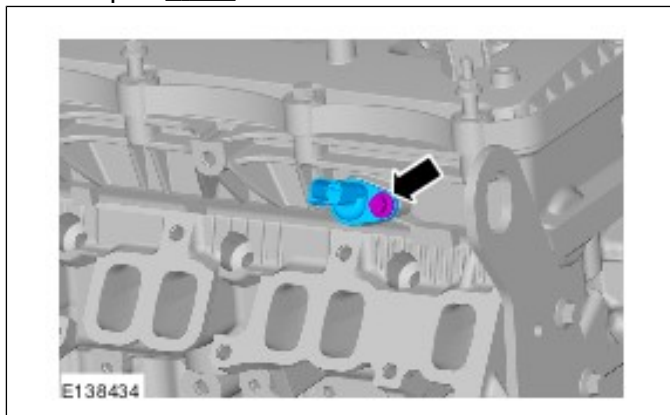
- Stage 1: 45 Nm
- Stage 2: 120°



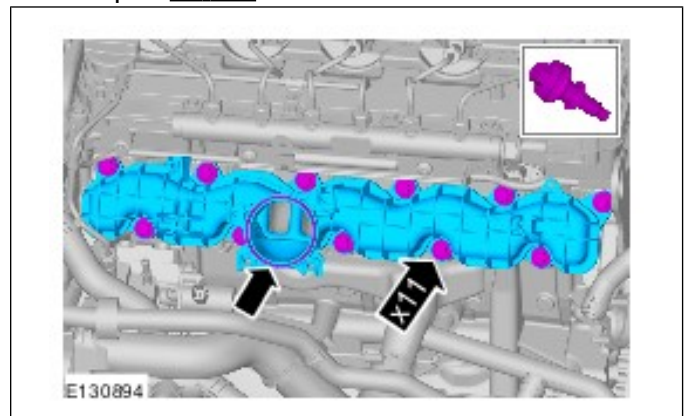
## INSTALLATION



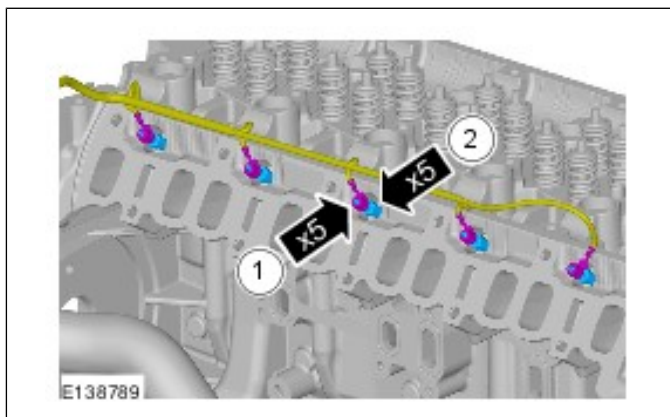
28. Torque: 9 Nm



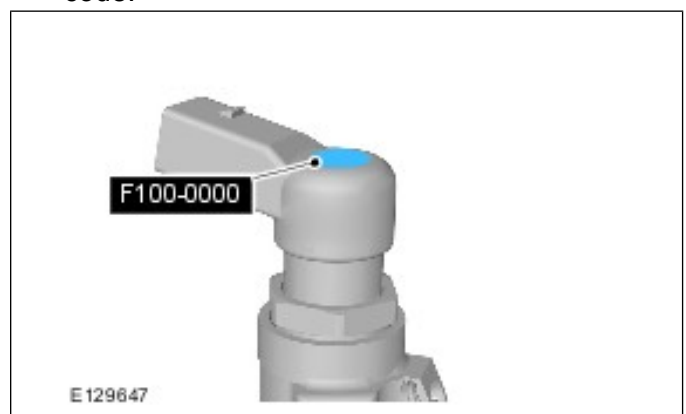
30. Torque: 15 Nm



29.



31. Record the new fuel injector correction factor code.

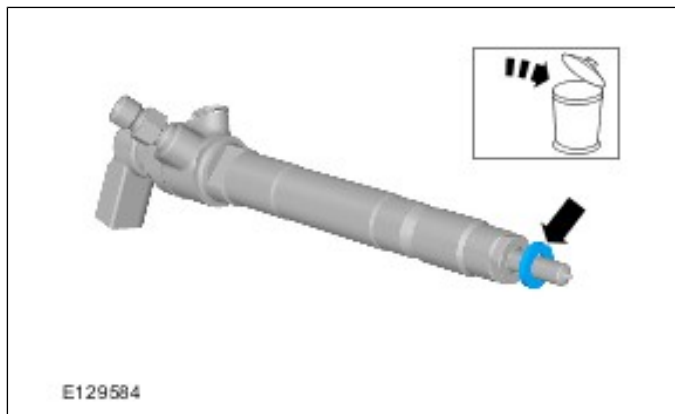


32. **NOTE:** Using a socket (or similar), press the new fuel injector copper seals onto the fuel



## INSTALLATION

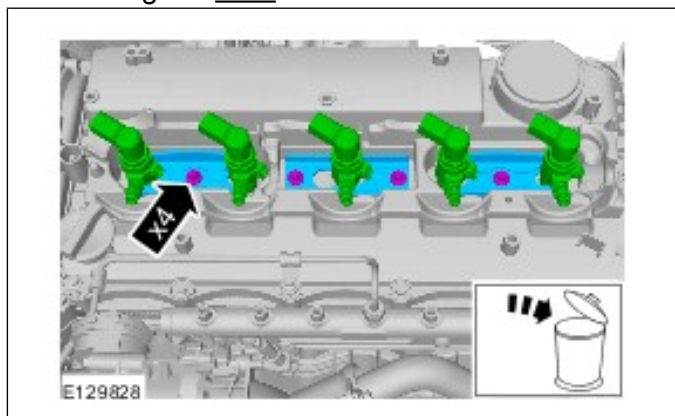
injectors making sure that the copper seals are pushed fully home to prevent uneven clamping.



### 33. **CAUTION:** Make sure that new bolts are installed.

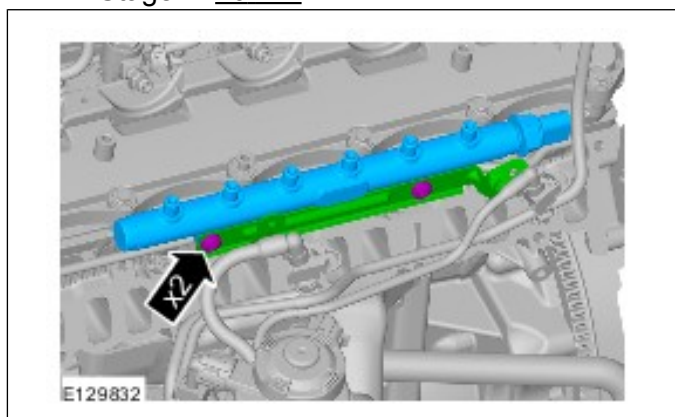
Torque:

- Stage 1: 5 Nm
- Stage 2: 180°




34. Torque:

- Stage 1: 7 Nm
- Stage 2: 20 Nm



### 35. CAUTIONS:

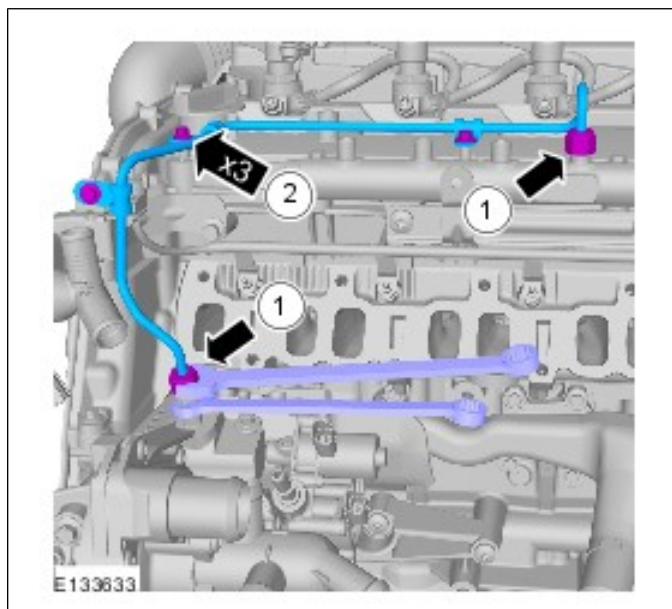
-  Make sure that the fuel line remains in contact at both ends until both unions

nuts have been unscrewed and the area around the joints thoroughly cleaned.

-  Make sure that all openings are sealed. Use new blanking caps.

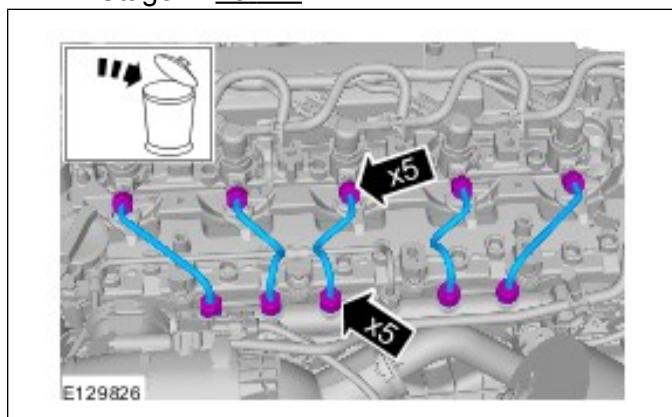
**NOTE:** Vacuum foreign material from the high-pressure fuel supply line, the fuel pump and the fuel rail.

- Torque:
  - Stage 1: 10 Nm
  - Stage 2: 35 Nm
- Refer to: [Fuel Injection Component Cleaning](#) (303-04 Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).  
Torque: 12 Nm

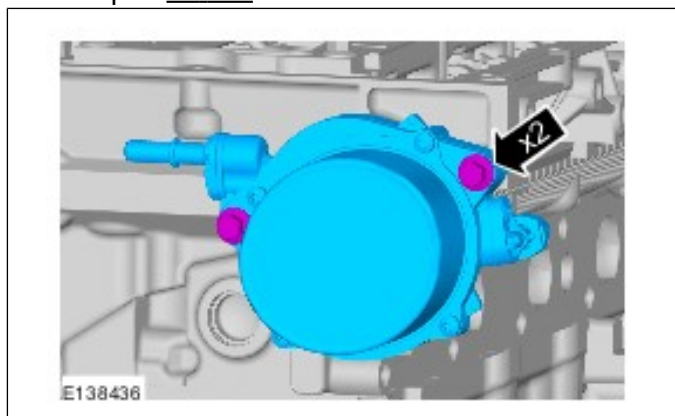
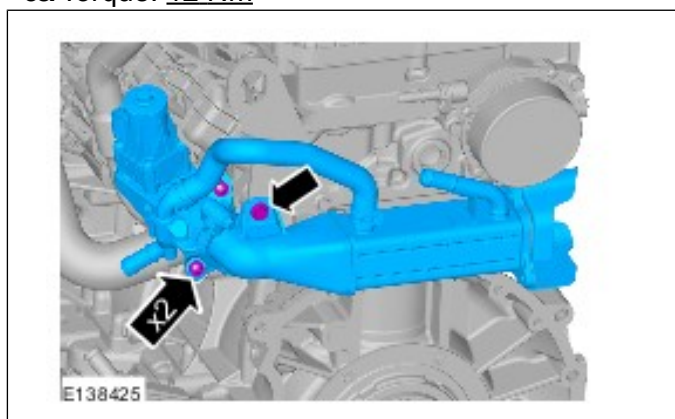


36. Torque:

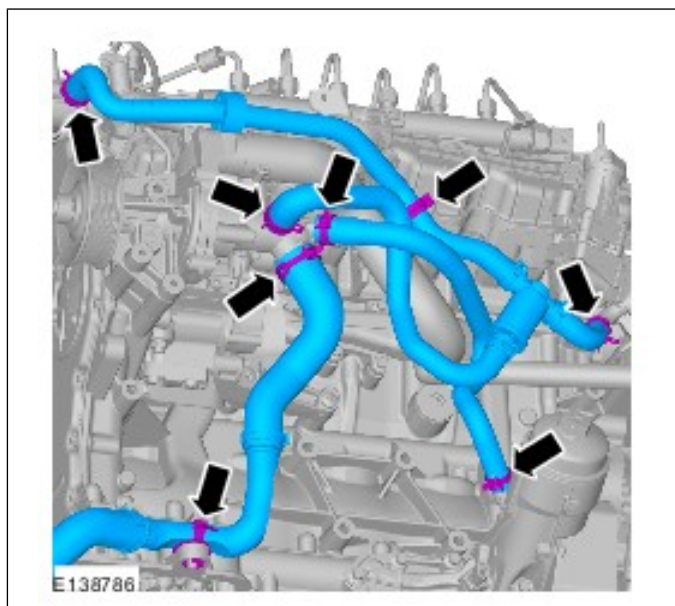
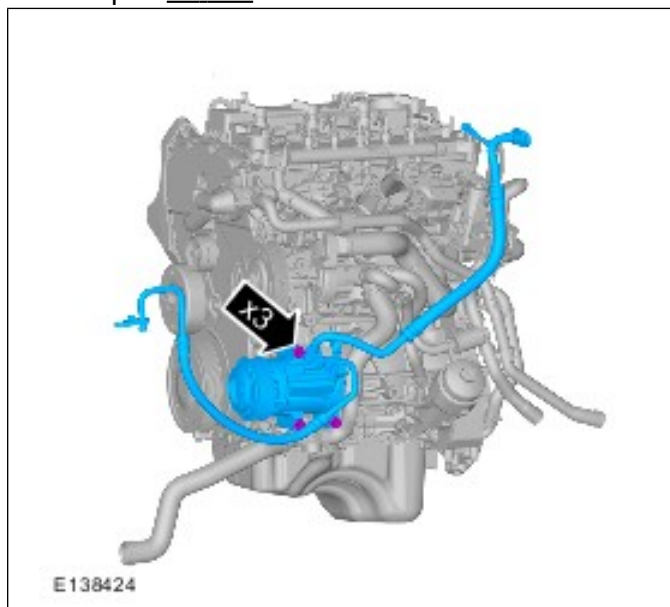
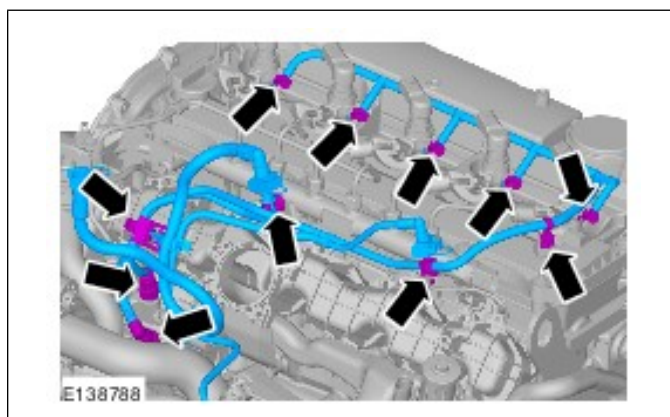
- Stage 1: 20 Nm
- Stage 2: 25 Nm



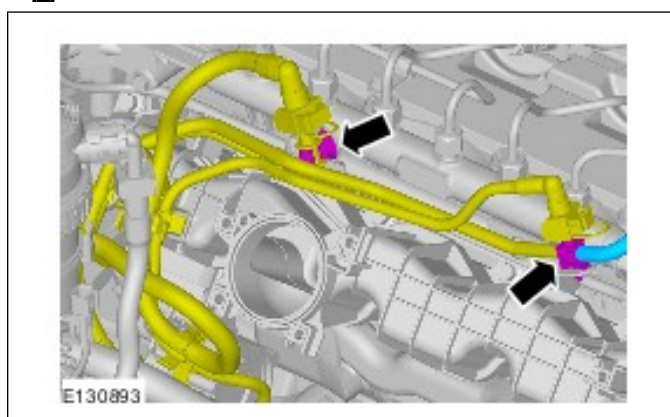
## INSTALLATION

37. Torque: 22 Nm38. Torque: 12 Nm

39.

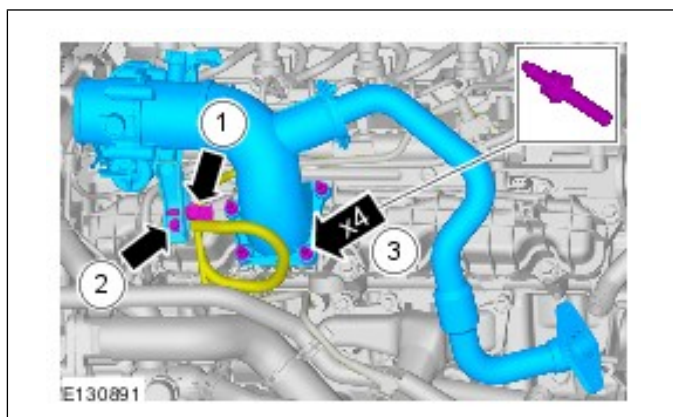
40. Torque: 25 Nm41.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

42

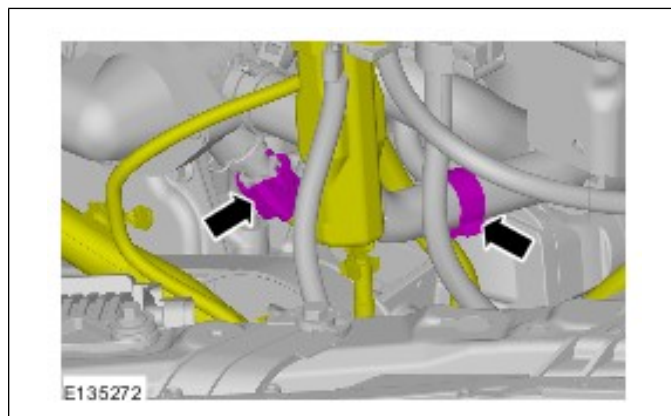


**INSTALLATION**

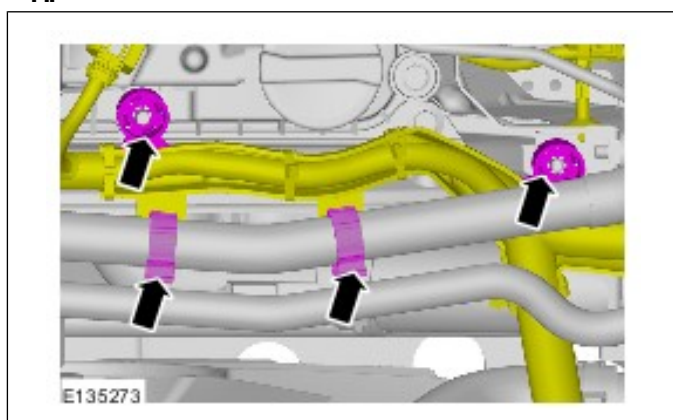
43. 3. Torque: 25 Nm



45.



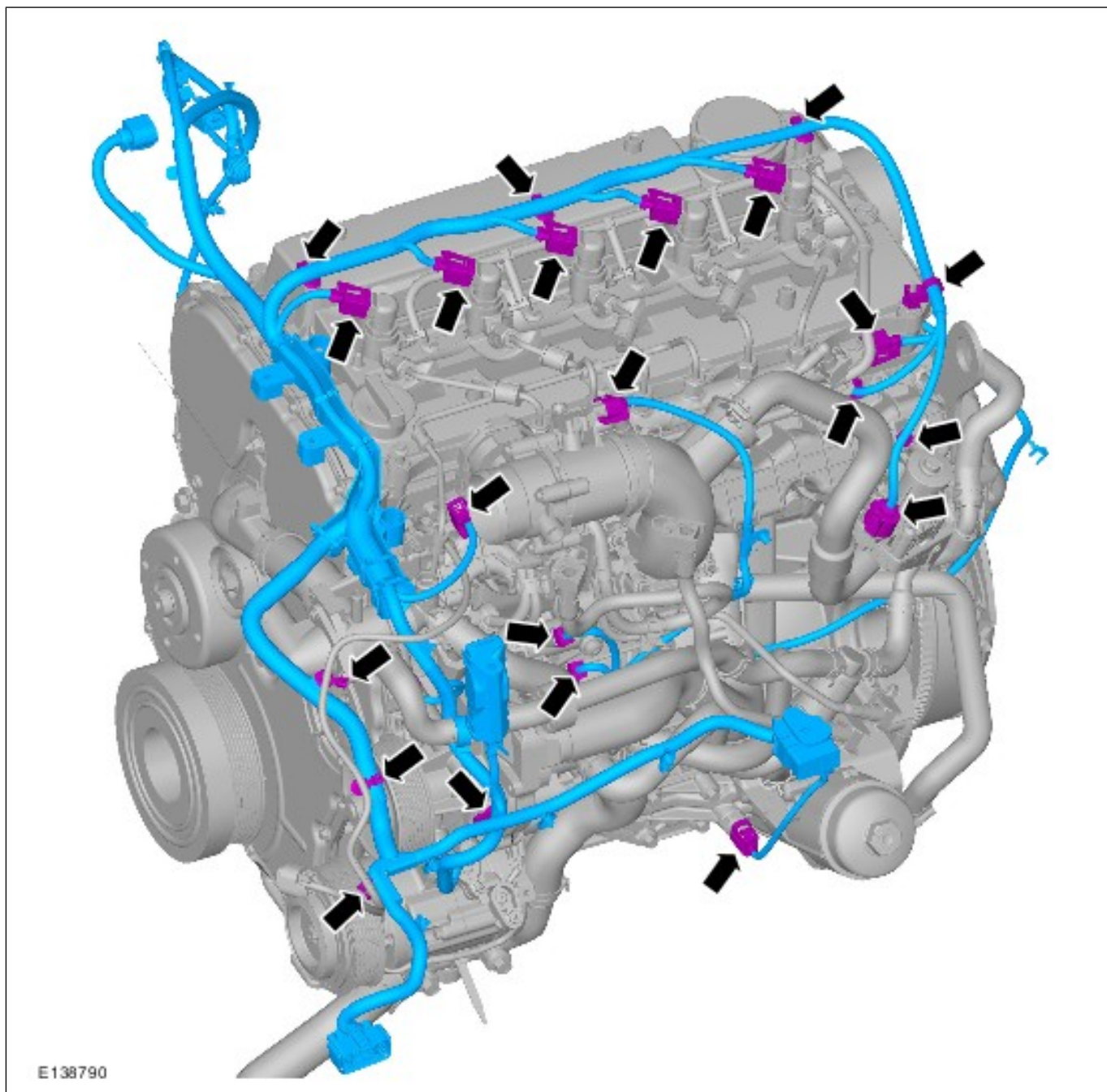
44.



46.



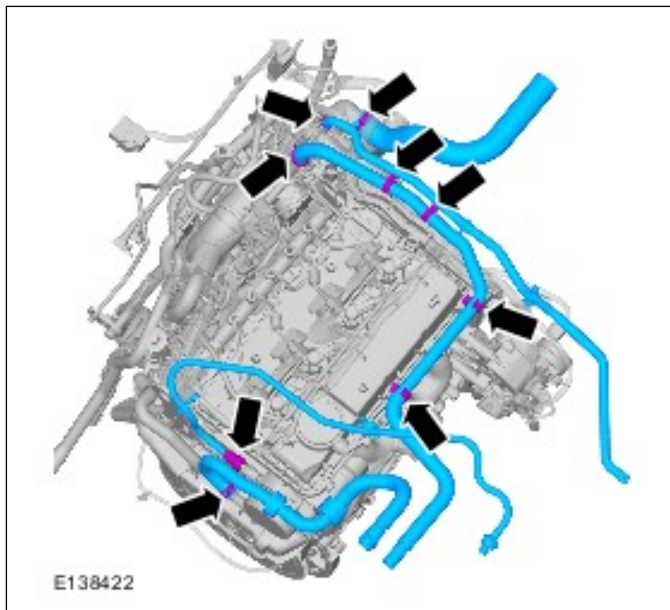
## INSTALLATION





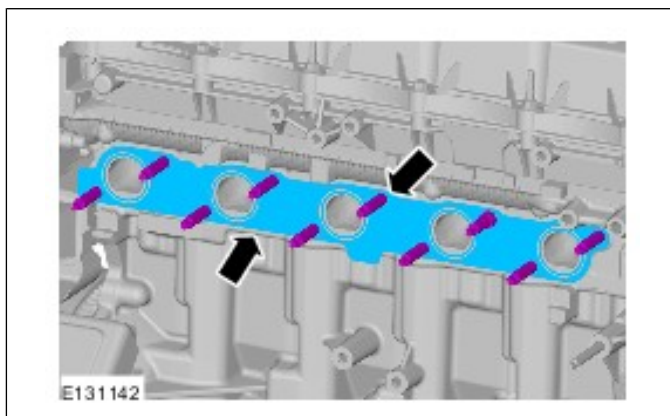
## INSTALLATION

47.

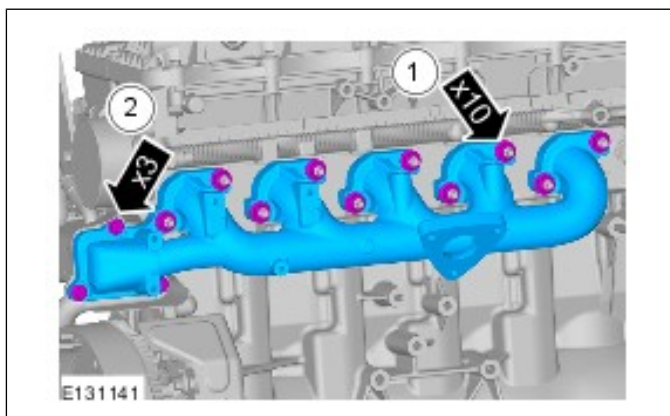


**48. NOTE:** The gasket is to be reused unless damaged.

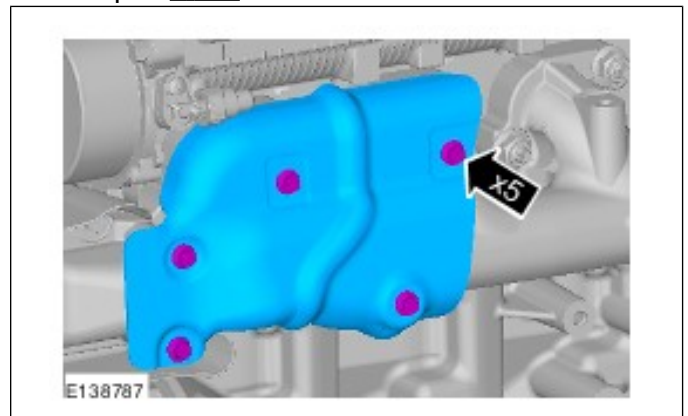
**NOTE:** The studs are to be reused unless damaged.



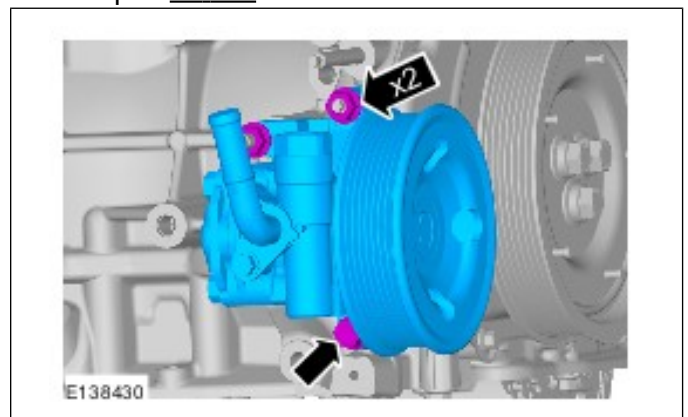
- 49.** 1. Torque: 40 Nm  
2. Torque: 23 Nm



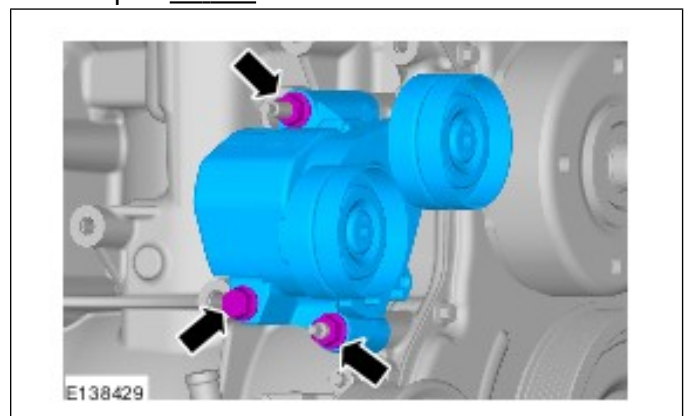
**50.** Torque: 9 Nm



**51.** Torque: 20 Nm

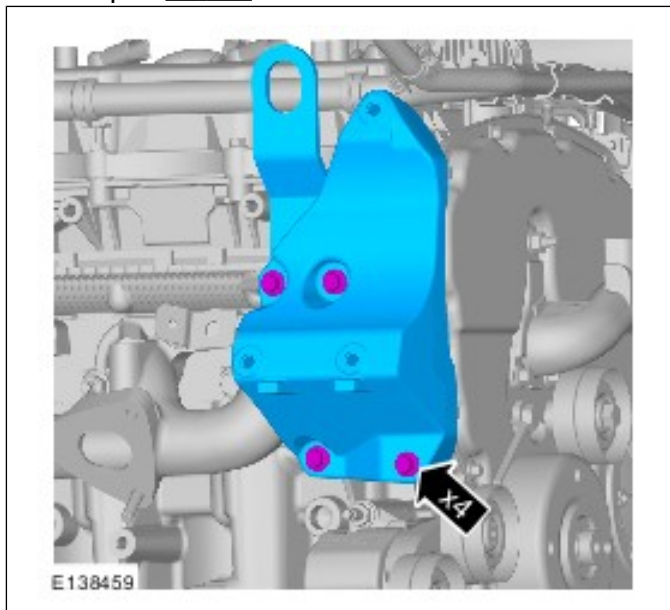


**52.** Torque: 25 Nm



**INSTALLATION**

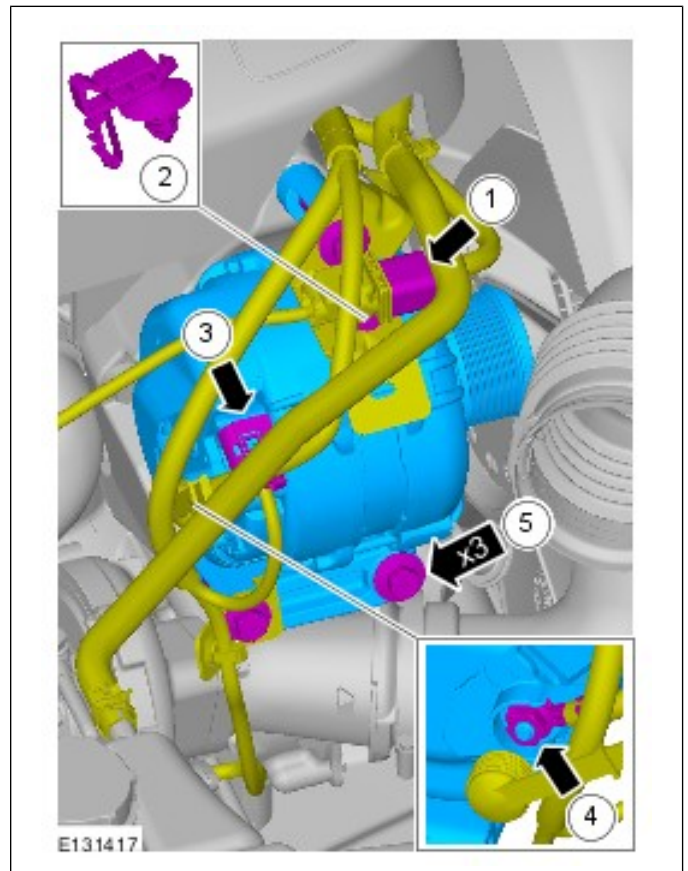
53. Torque: 25 Nm



54. **⚠ CAUTION:** Take extra care not to damage the wiring harnesses.

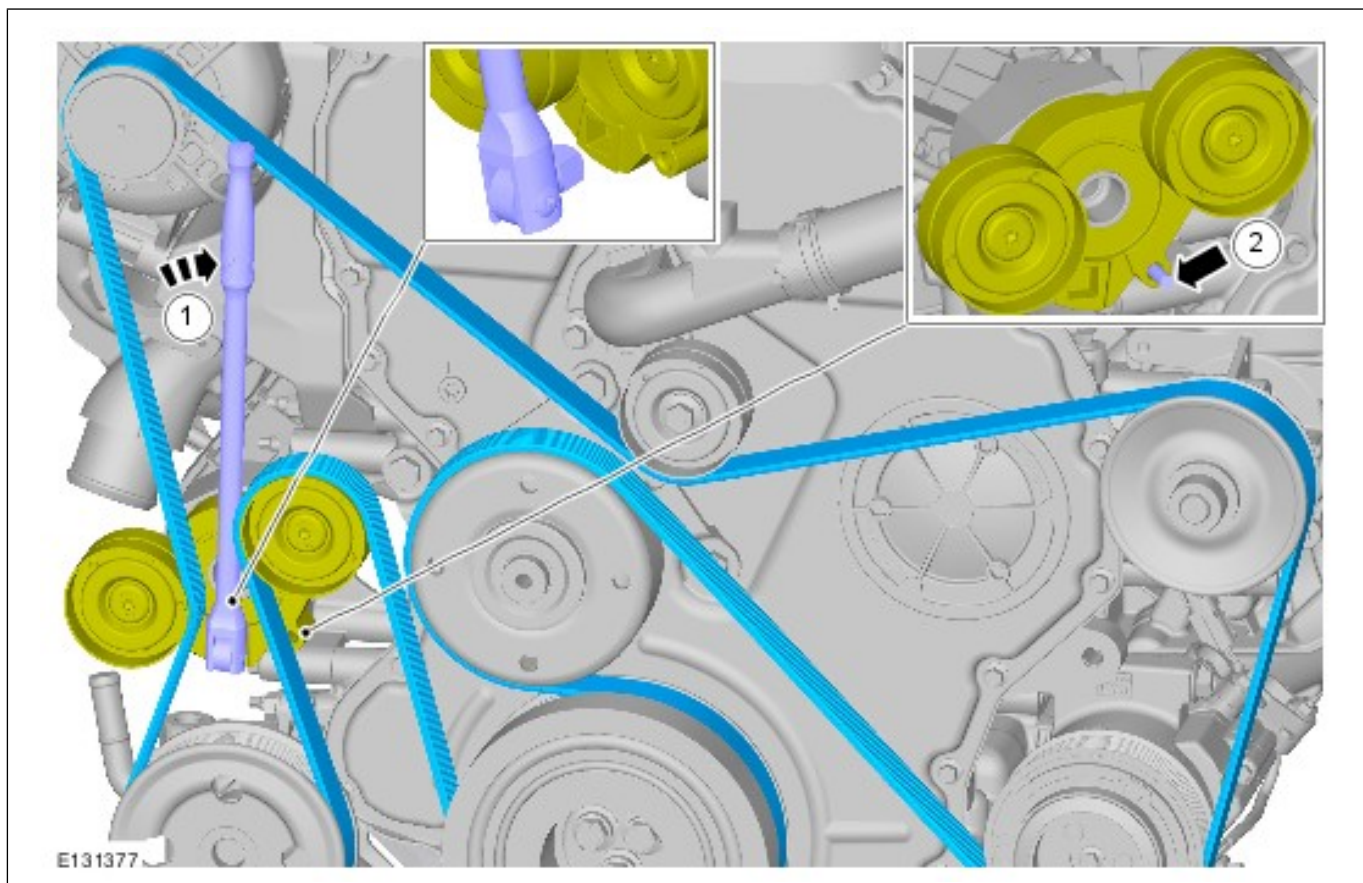
4. Torque: 15 Nm

5. Torque: 48 Nm

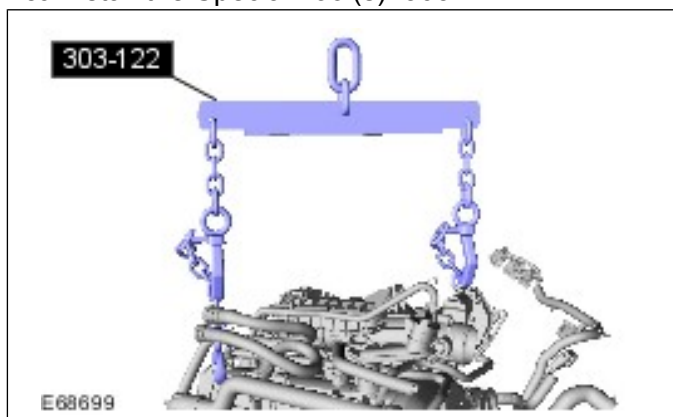


55. General Equipment: 1/2 Inch Square Drive  
Breaker Bar  
General Equipment: Dowel with a Diameter of  
6 mm

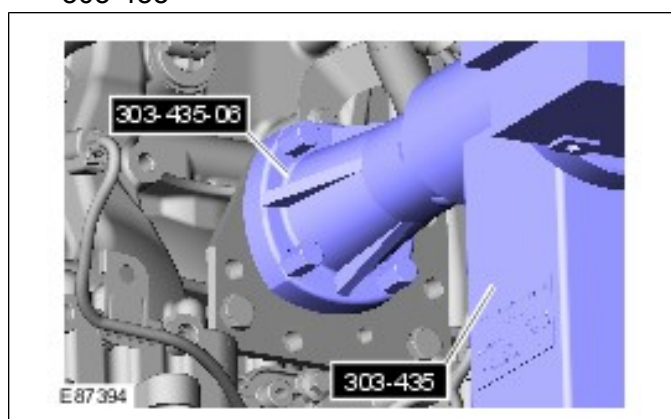
## INSTALLATION



**56.** Install the Special Tool(s): 303-122



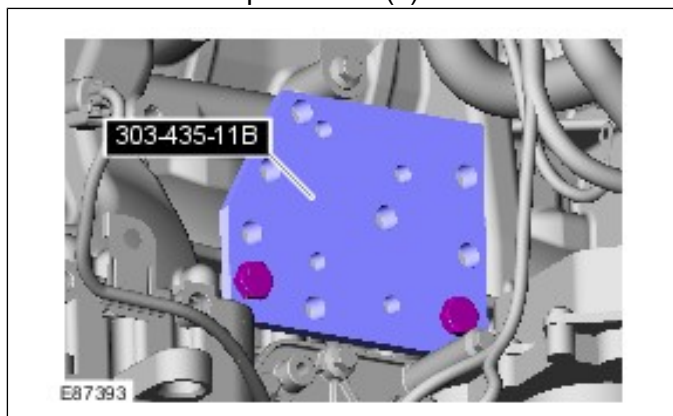
**57.** Remove the Special Tool(s): 303-435-06, 303-435



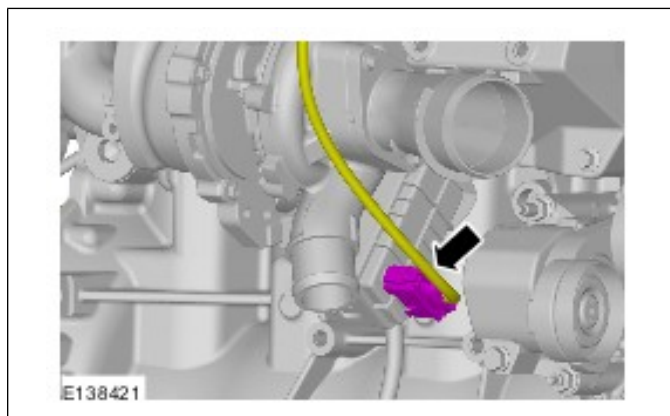


## INSTALLATION

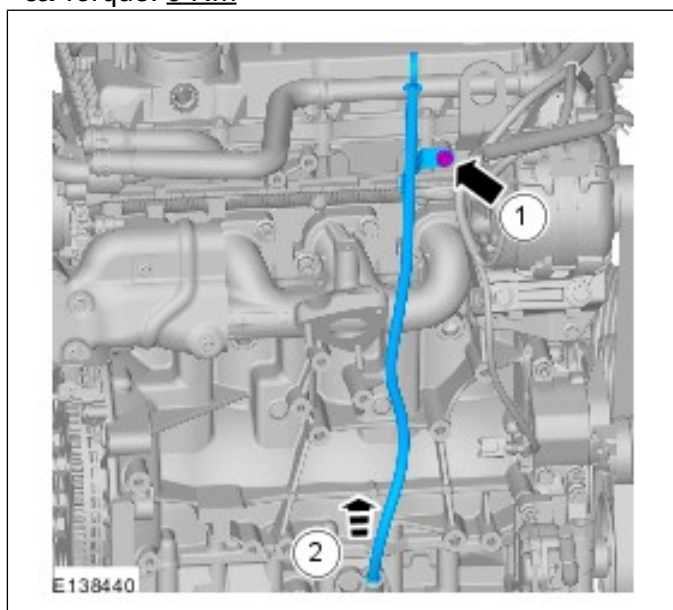
58. Remove the Special Tool(s): 303-435-11B



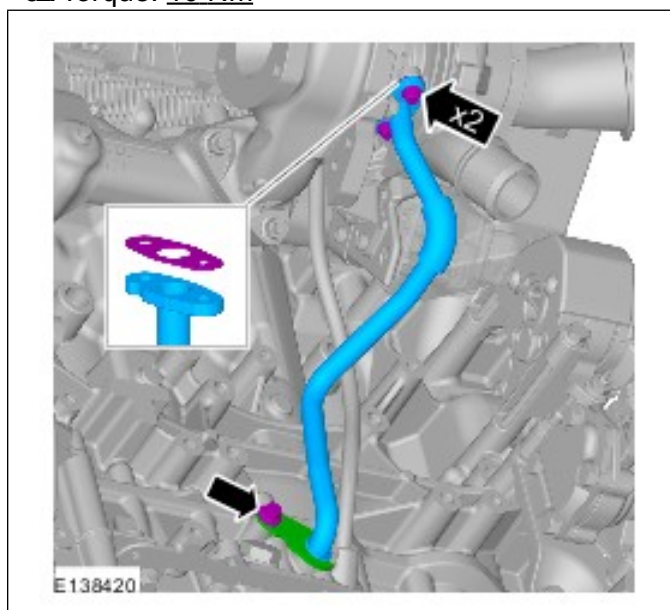
61.



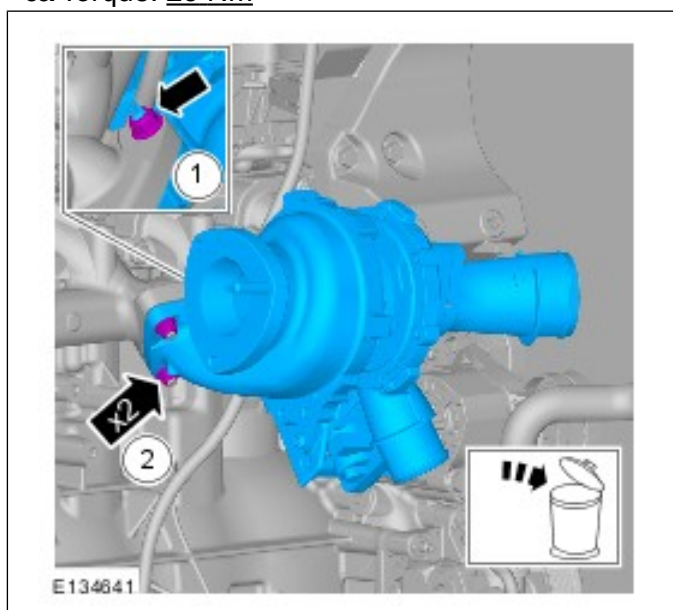
59. Torque: 9 Nm



62 Torque: 10 Nm



60. Torque: 23 Nm



63. 1. Torque: 35 Nm

2. Torque: 32 Nm

