

303-01B-40

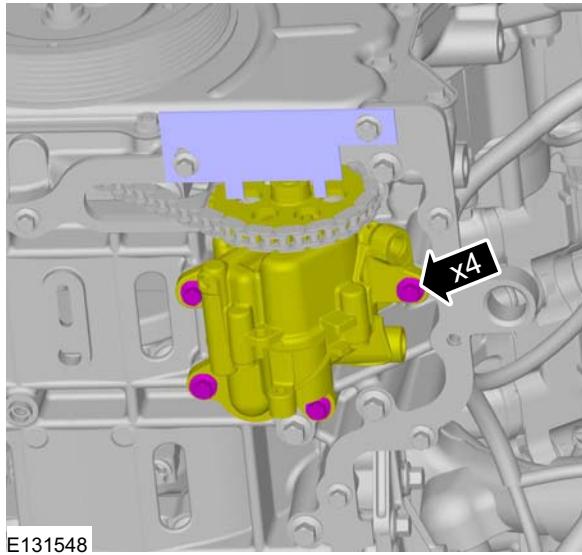
- Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

303-01B-40

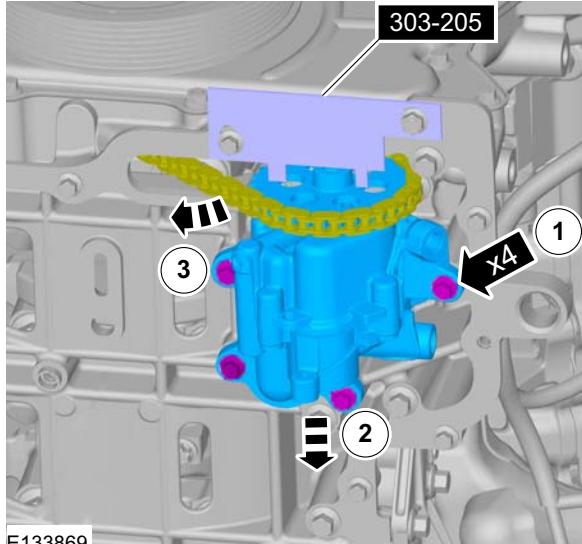
REMOVAL AND INSTALLATION

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

Special Tool(s): 303-705



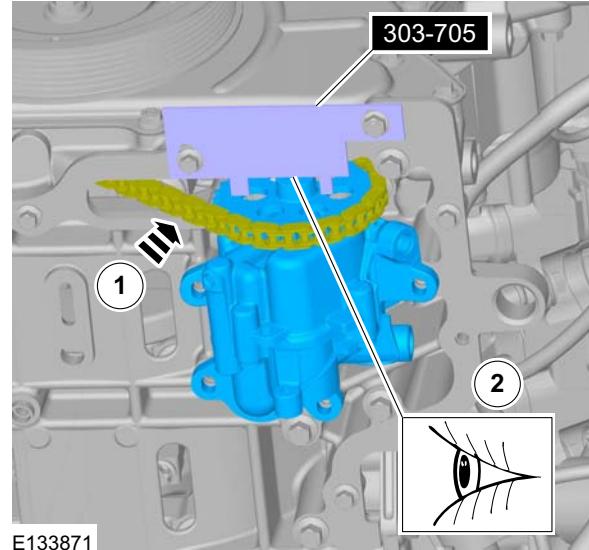
- 6. Special Tool(s): 303-705**



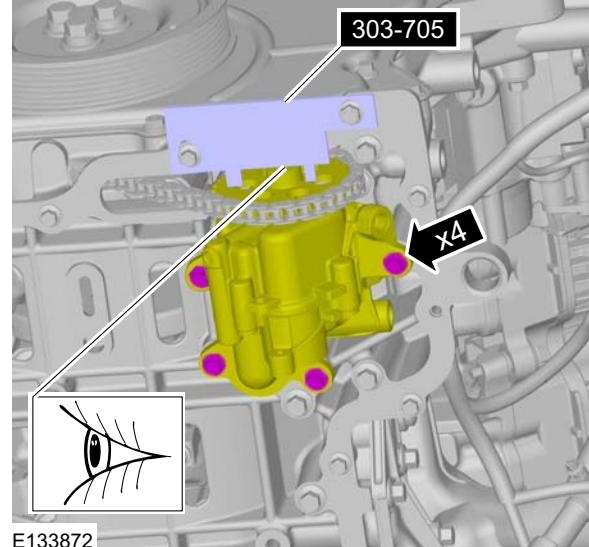
Installation

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

Special Tool(s): 303-705



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



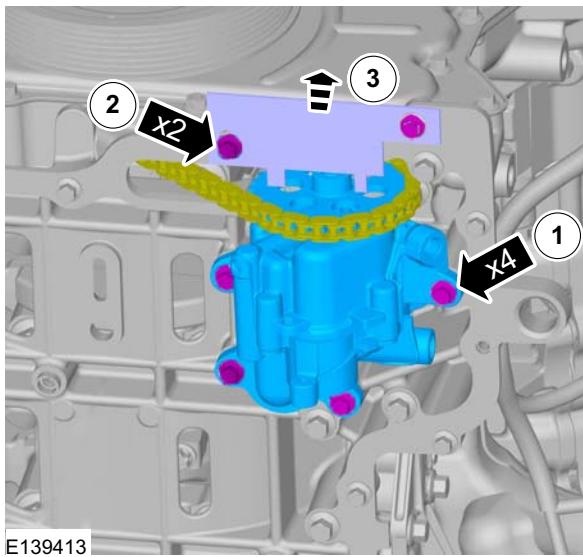
303-01B-41

- Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

303-01B-41

REMOVAL AND INSTALLATION

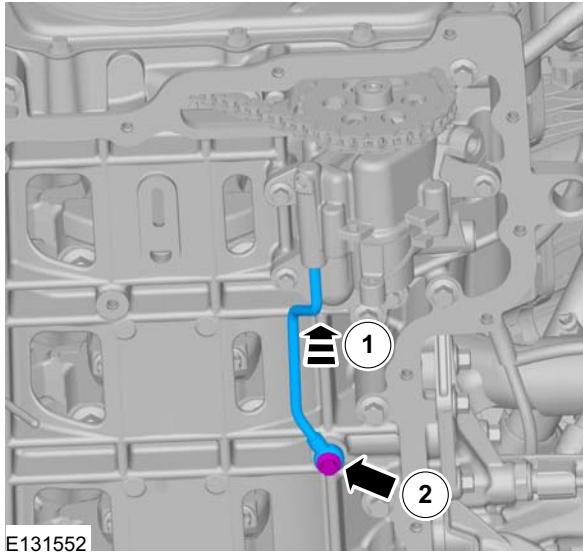
3. 1. Torque: 10 Nm



All vehicles

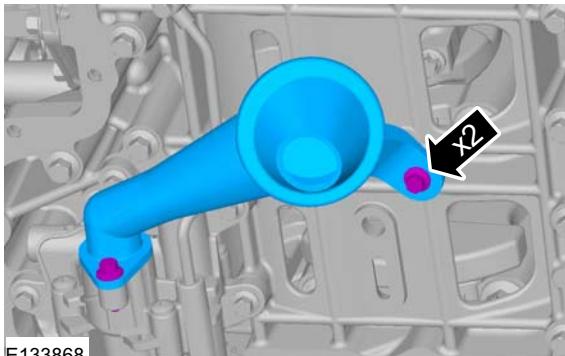
6. Refer to: [Oil Pan \(303-01 Engine - 2.2L Duratorq-TDCi \(88kW/120PS\) - Puma/2.2L Duratorq-TDCi \(96kW/130PS\) - Puma/2.2L Duratorq-TDCi \(110kW/150PS\) - Puma, Removal and Installation\).](#)

4. Torque: 13 Nm



4x2

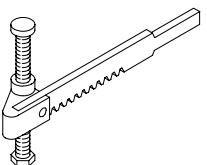
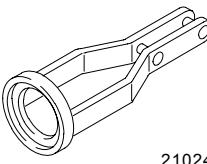
5. Torque: 10 Nm



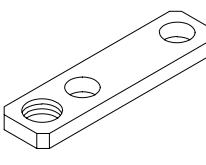
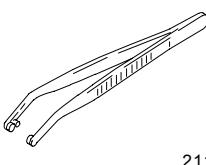
REMOVAL AND INSTALLATION

Valves

Special Tool(s)

	303-060 Compressor, Valve Spring 21024
	303-060-05 Adapter for 303-060 2102405

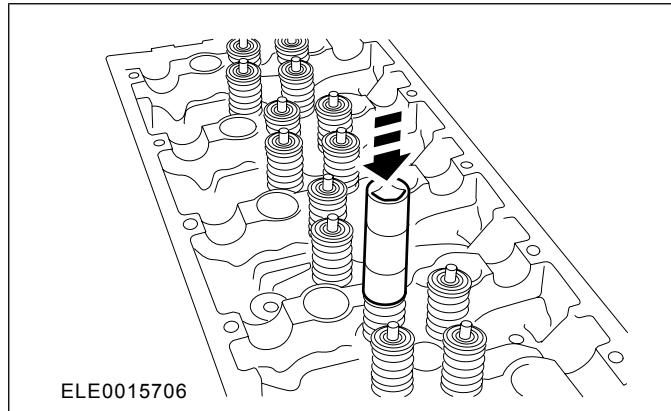
Special Tool(s)

	303-060-07 Adapter for 303-060
	303-362 Installer, Valve Stem Collets 21156

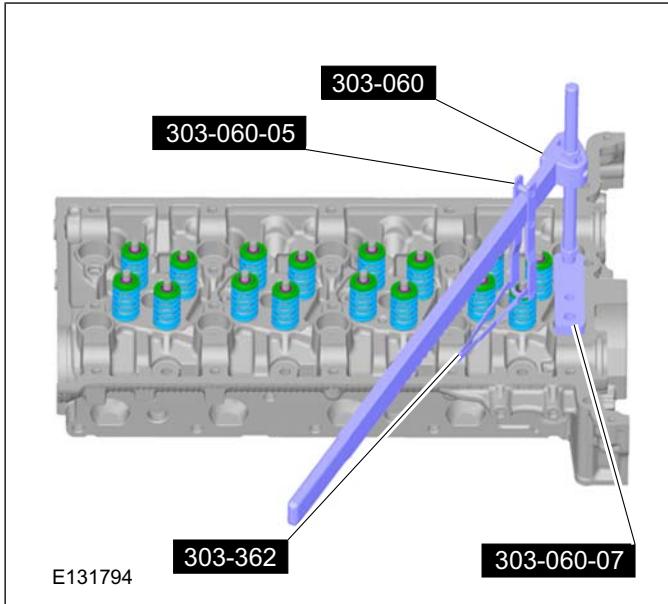
Removal

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

1. Refer to: **Cylinder Head** (303-01 Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. **NOTE:** Position a socket on the valve spring seat and gently strike it with a hammer.

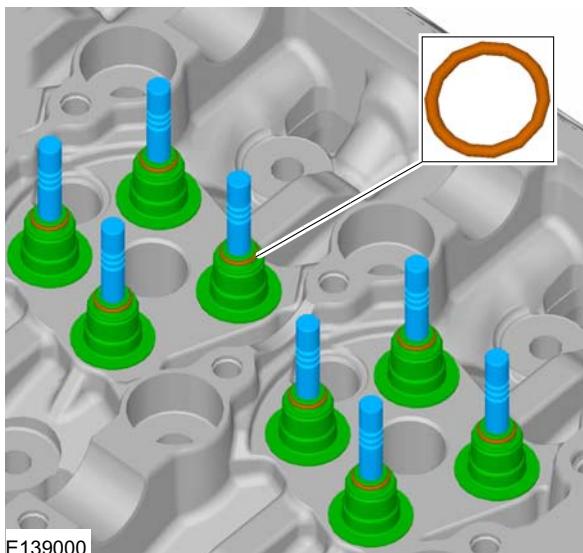


3. Special Tool(s): 303-060, 303-060-05, 303-060-07, 303-362



REMOVAL AND INSTALLATION

4.



Installation

1. To install, reverse the removal procedure.

303-01B-44

- Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

303-01B-44

REMOVAL AND INSTALLATION

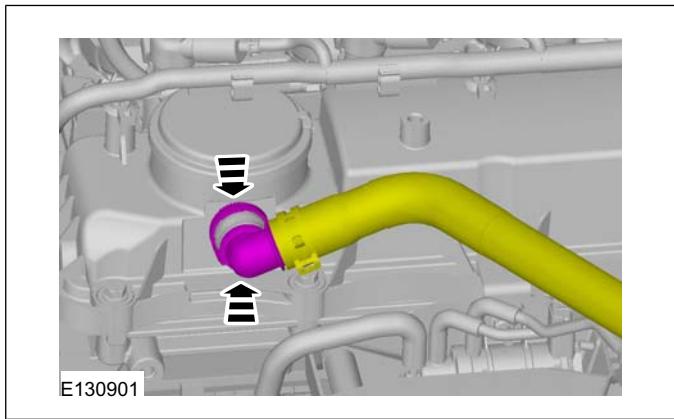
Valve Cover(21 141 0)

Removal

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

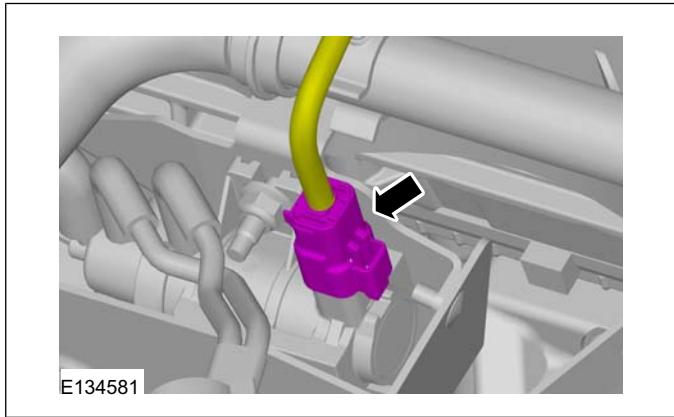
All vehicles

1.

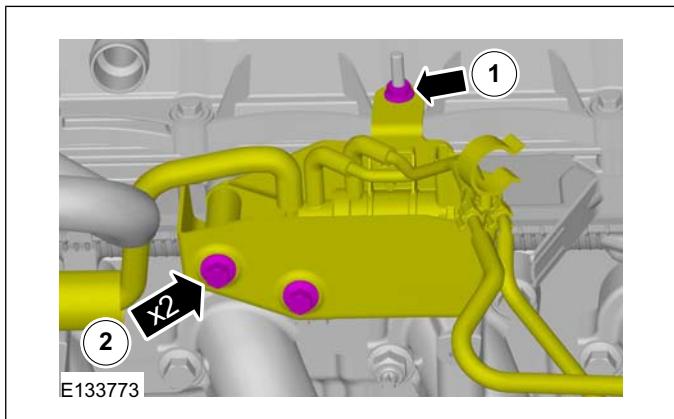


Vehicles with fixed vane turbocharger

2.



3. 1. Torque: 10 Nm
2. Torque: 23 Nm



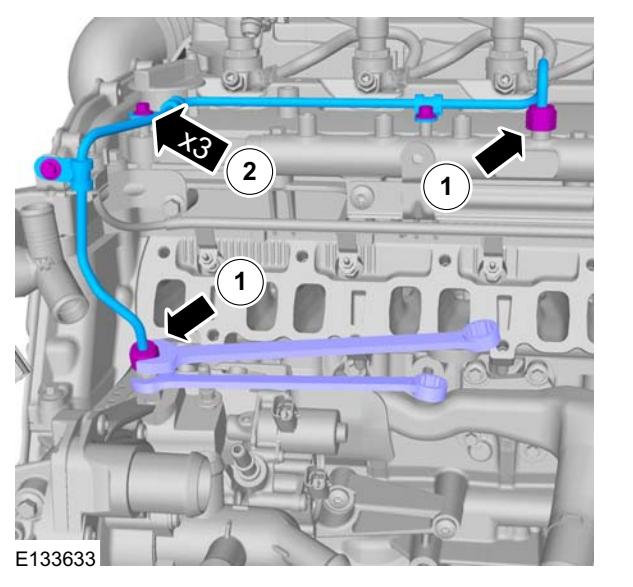
All vehicles

4. Refer to: **Fuel Injectors** (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, Removal and Installation).

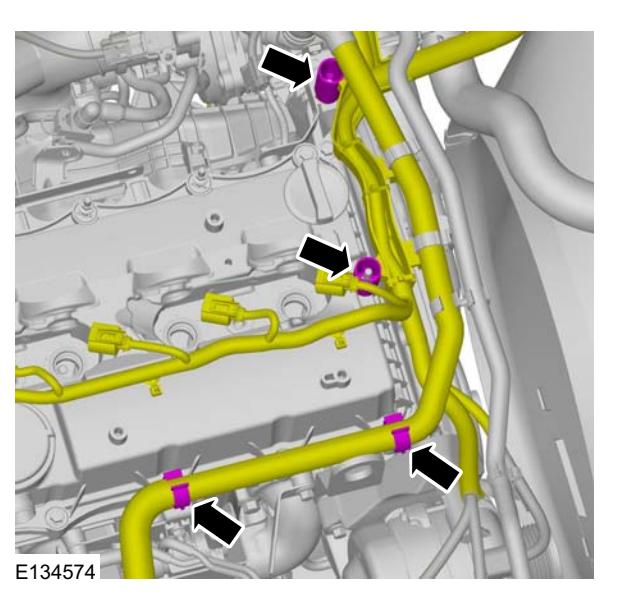
5. 1. Torque:

- Stage 1: 5 Nm
- Stage 2: 35 Nm

2. Torque: 10 Nm

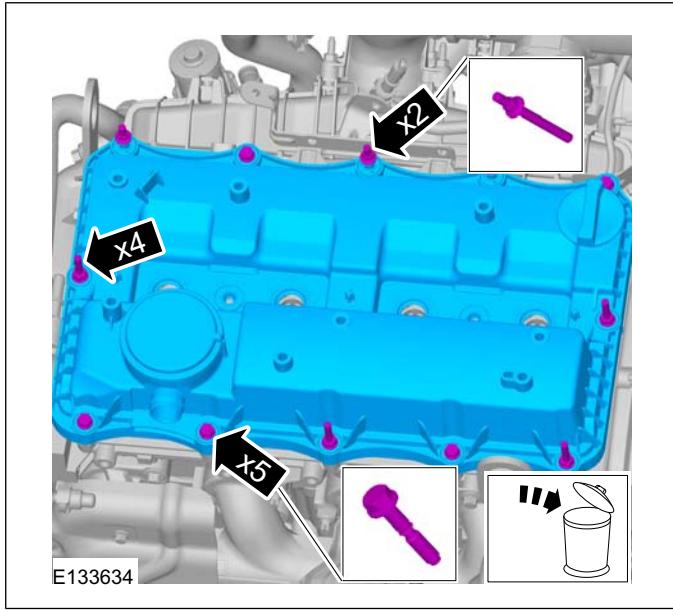


6.

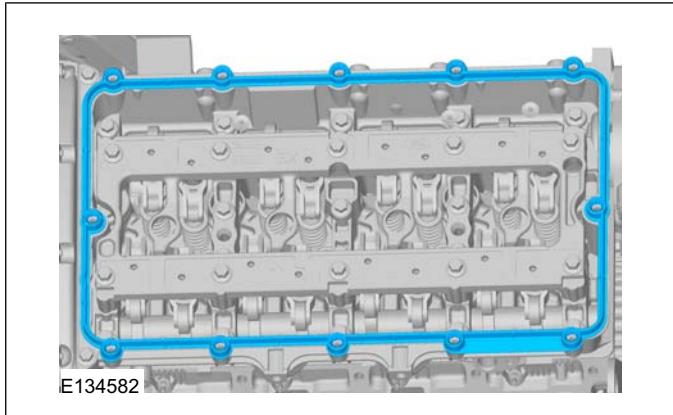


REMOVAL AND INSTALLATION

7. Torque: 10 Nm



8.



Installation

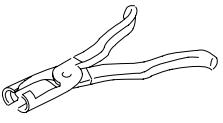
NOTE: Install a new valve cover gasket as necessary.

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

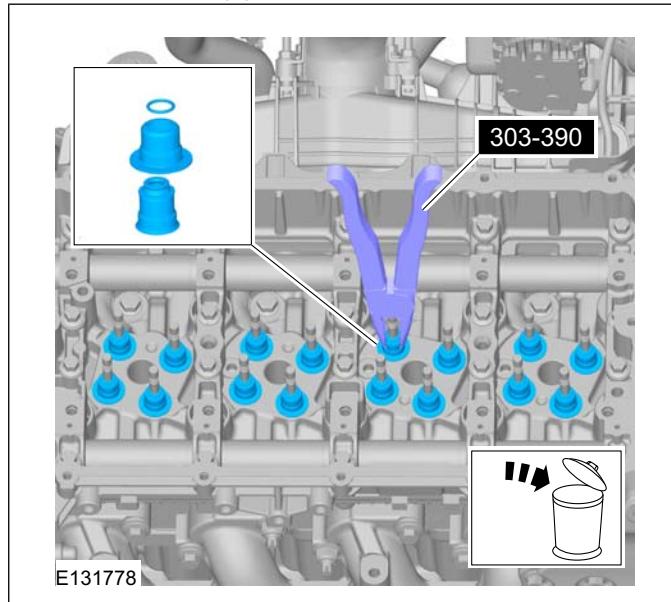
Valve Stem Seals(21 238 0)

Special Tool(s)

	303-390 Pliers, Valve Stem Seal 21165
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Removal

1. Refer to: **Valve Springs** (303-01 Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Special Tool(s): 303-390



Installation

1. To install, reverse the removal procedure.

DESCRIPTION AND OPERATION

- health and safety data sheets can be obtained from manufacturers.
- Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.
 - Do organize work practices and protective clothing to avoid soiling of the skin and eyes; breathing vapors, aerosols, dusts or fumes; inadequate container labeling; fire and explosion hazards.
 - Do wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.
 - Do keep work areas clean, uncluttered and free of spills.
 - Do store chemical materials according to national and local regulations.
 - Do keep chemical materials out of the reach of children.

Chemical Materials - Do Nots

- Do not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals, give off toxic or harmful fumes or become explosive when mixed together.
- Do not spray chemical materials, particularly those based on solvents, in confined spaces, for example when people are inside a vehicle.
- Do not apply heat or flame to chemical materials except under the manufacturers instructions. Some are highly flammable and some may release toxic or harmful fumes.
- Do not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas such as pits.
- Do not transfer chemical materials to unlabelled containers.
- Do not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels, will dry the skin and may cause irritation leading to dermatitis or be absorbed through the skin in toxic or harmful quantities.

- Do not use emptied containers for other materials except when they have been cleaned under supervised conditions.
- Do not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful.

Chlorofluorocarbons (CFC)

There is concern in the scientific community that CFCs and Halons are depleting the upper ozone layer which filters out harmful ultraviolet radiation. Decreased filtration of ultraviolet radiation may result in increases in skin cancer, cataracts and immune system suppression in humans, as well as decreased productivity of crops and aquatic systems.

CFCs are used primarily as refrigerants in vehicle air conditioning systems and as aerosol propellants. Halons are used as fire extinguishants.

Clutch Fluids

See [Brake fluids](#).

Clutch Linings and Pads

See [Asbestos](#).

Corrosion Protection Materials

See also [Solvents, Fire](#).

Highly flammable, flammable – observe No Smoking policy.

These materials are varied and the manufacturers instructions must be followed. They may contain solvents, resins or petroleum products. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

Cutting

See [Welding](#).

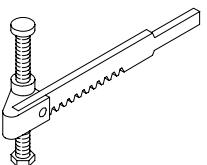
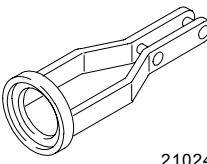
Dewaxing

See [Solvents and Fuels \(Kerosene\)](#).

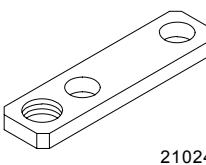
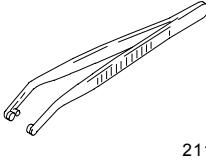
REMOVAL AND INSTALLATION

Valve Springs

Special Tool(s)

	303-060 Compressor, Valve Spring 21024
	303-060-05 Adapter for 303-060 2102405

Special Tool(s)

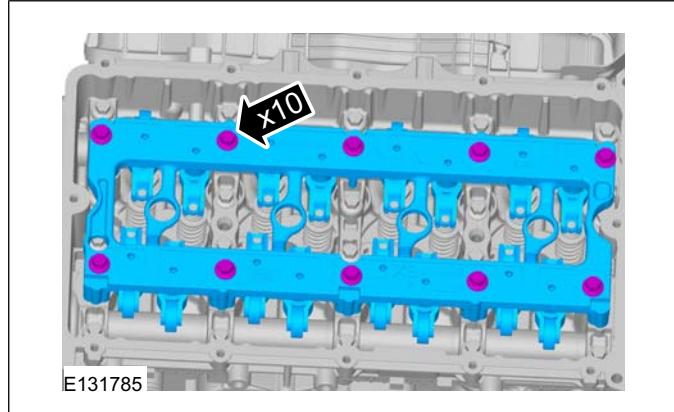
	303-060-07 Adapter for 303-060 2102407
	303-362 Installer, Valve Stem Collets 21156

Removal

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

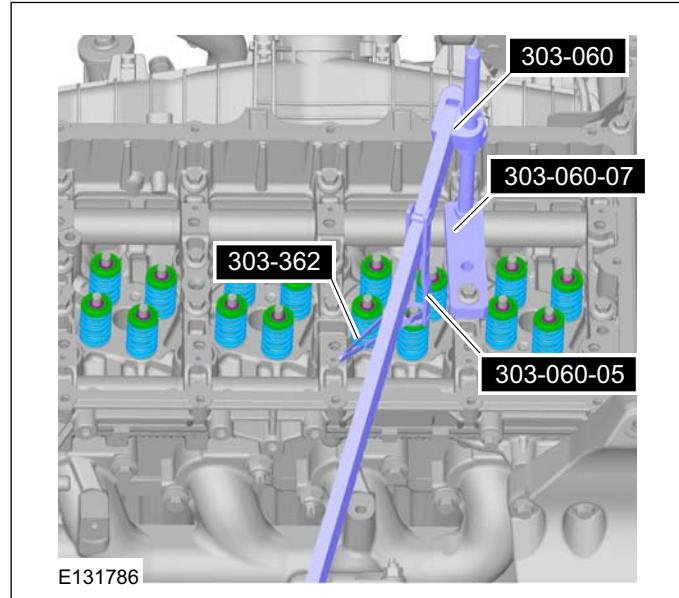
1. Refer to: **Valve Cover** (303-01 Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

2.



4. Using the special tools, remove the valve collets.

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

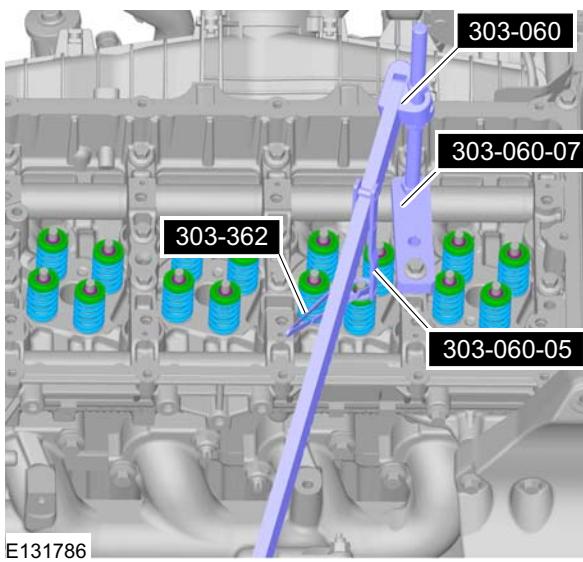


3. Position the appropriate piston at top dead center (TDC).

REMOVAL AND INSTALLATION

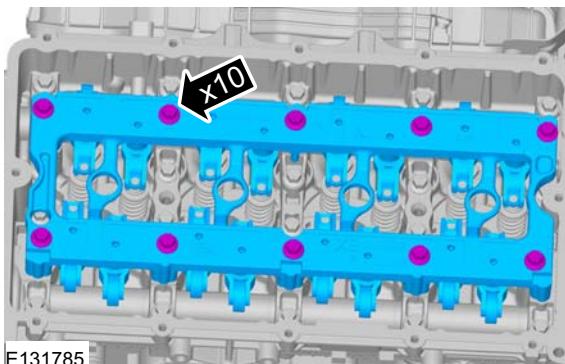
Installation

1.



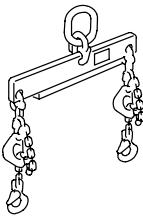
2. Torque:

- Stage 1: 10 Nm
- Stage 2: 30°



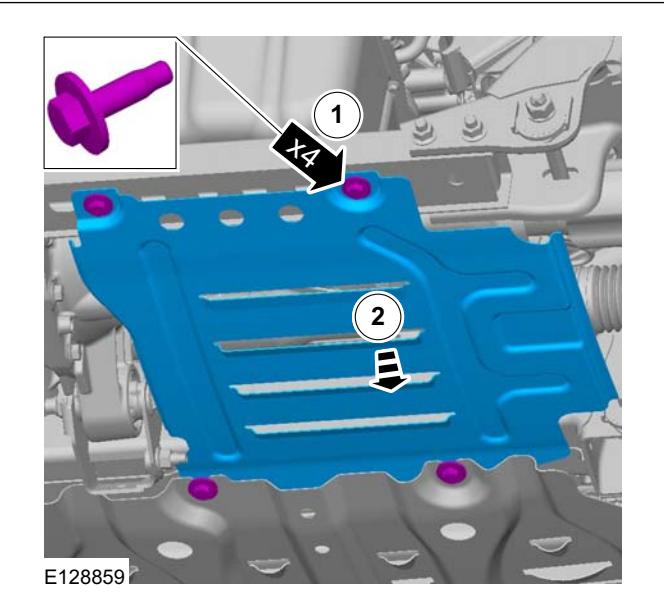
3. Refer to: **Valve Cover (303-01 Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).**

REMOVAL**Engine — Vehicles With: 5-Speed Manual Transmission -
MT75(21 132 0; 21 132 6; 21 132 7)****Removal****Special Tool(s) / General Equipment**

	303-122 Lifting Bracket, Engine 21068A
Transmission Jack	

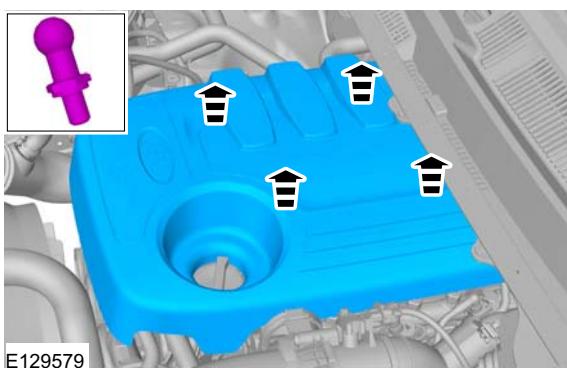
1. Refer to: **Health and Safety Precautions** (100-00 General Information, Description and Operation).
2. Refer to: **Battery Disconnect and Connect** (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: **Cooling System Draining, Filling and Bleeding - 2.2L Duratorq-TDCi (88kW/120PS) - 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.

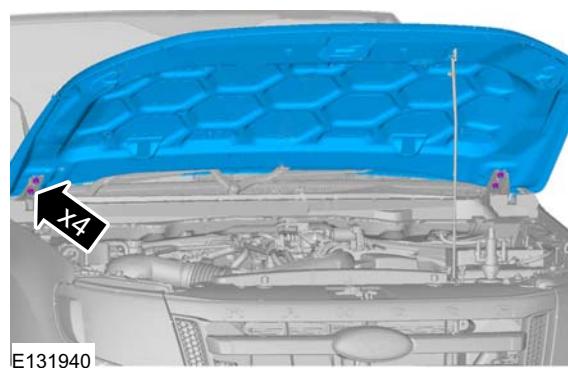


REMOVAL

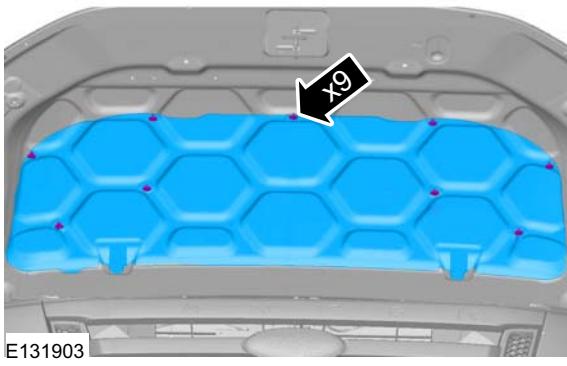
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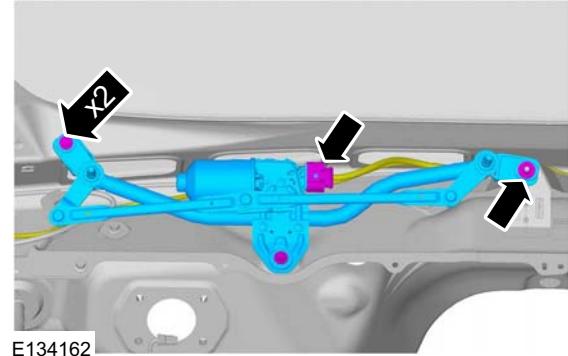
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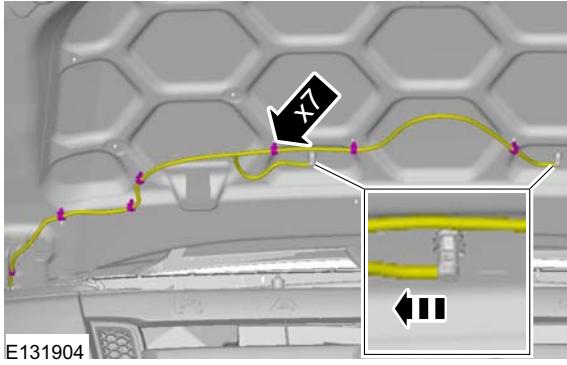
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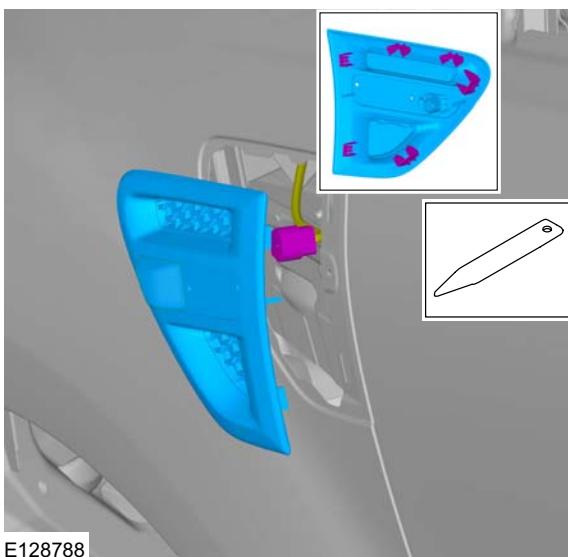
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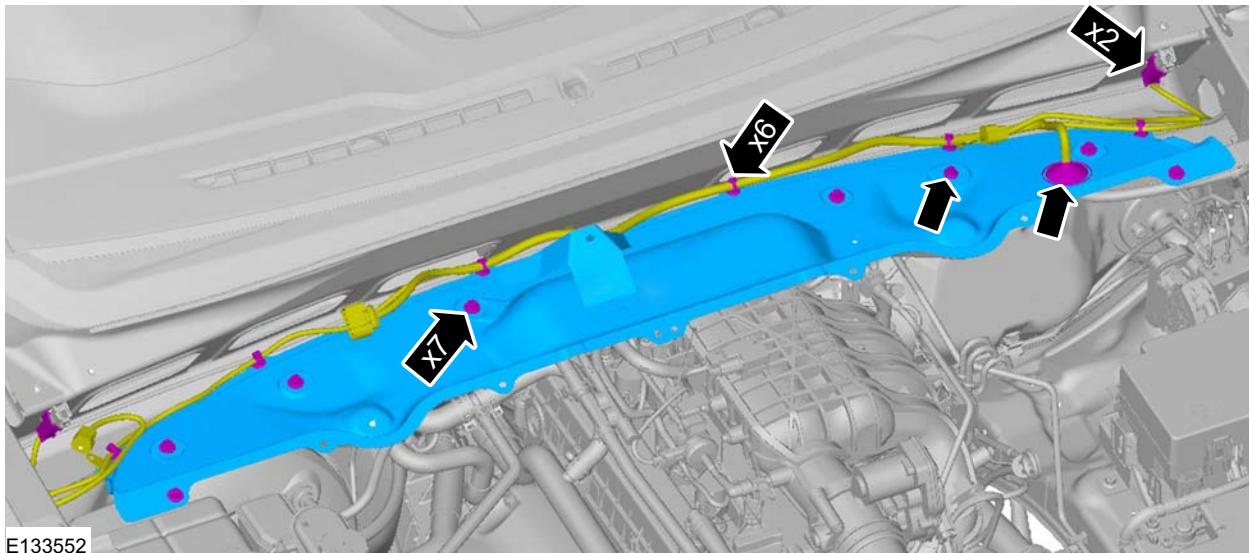
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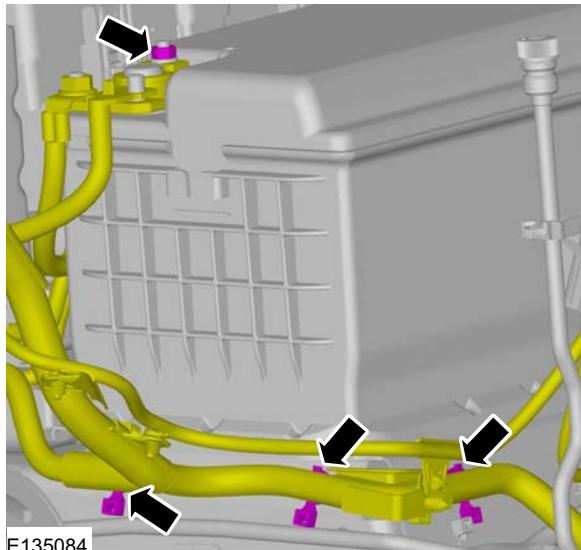
13. On both sides.



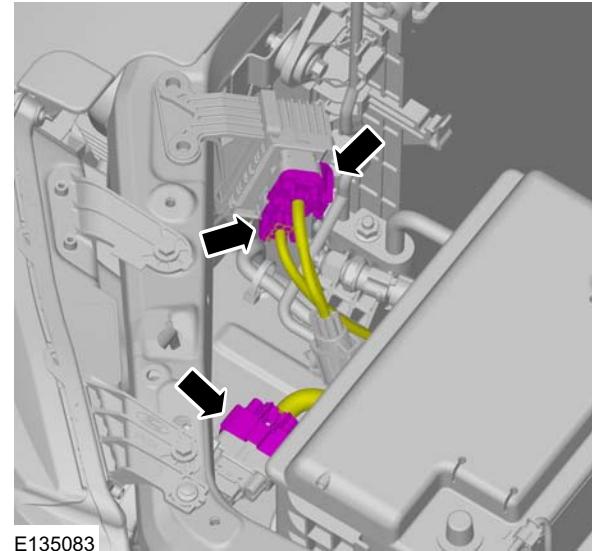
14.

REMOVAL

15.



16.



REMOVAL

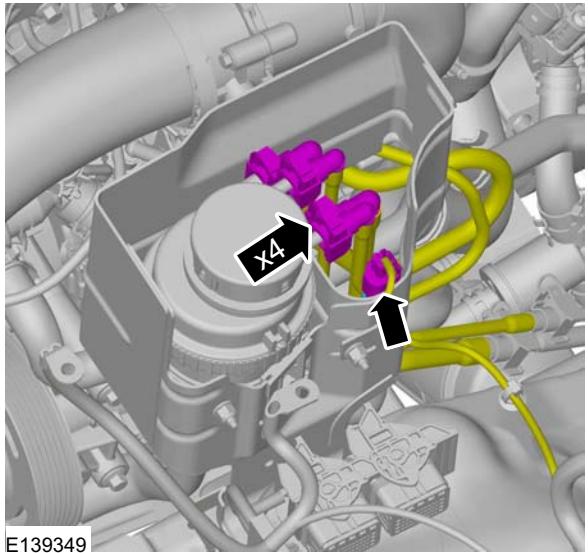
17. Refer to: **Battery** (414-01 Battery, Mounting and Cables, Removal and Installation).

18. Refer to: **Battery Tray** (414-01 Battery, Mounting and Cables, Removal and Installation).

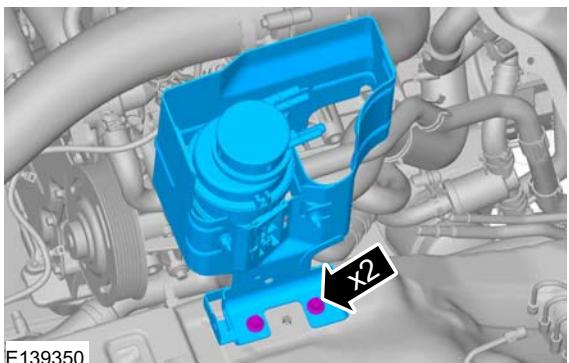
19. Refer to: **Powertrain Control Module (PCM)**
(303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

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).

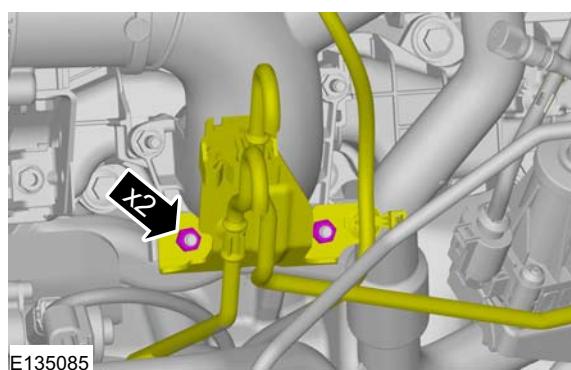
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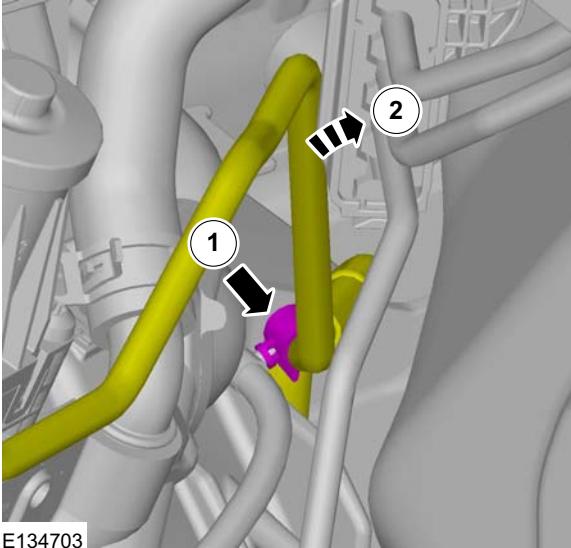
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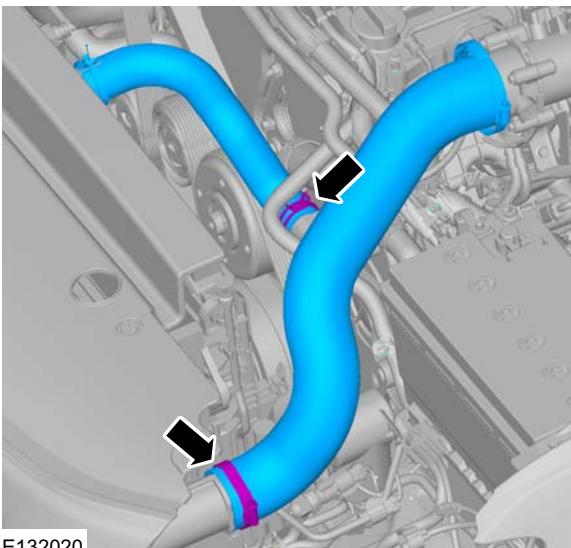
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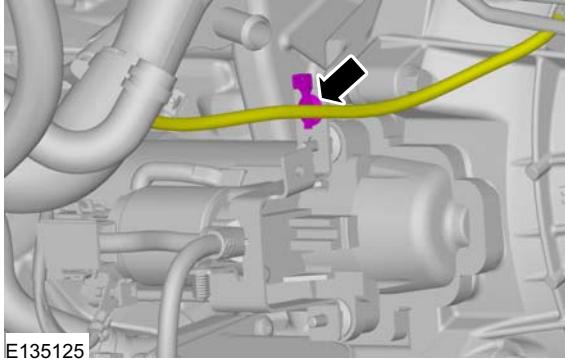


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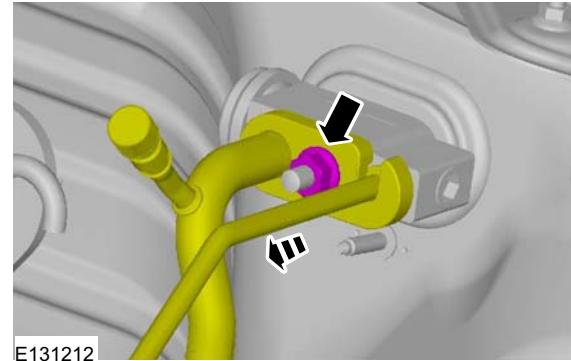
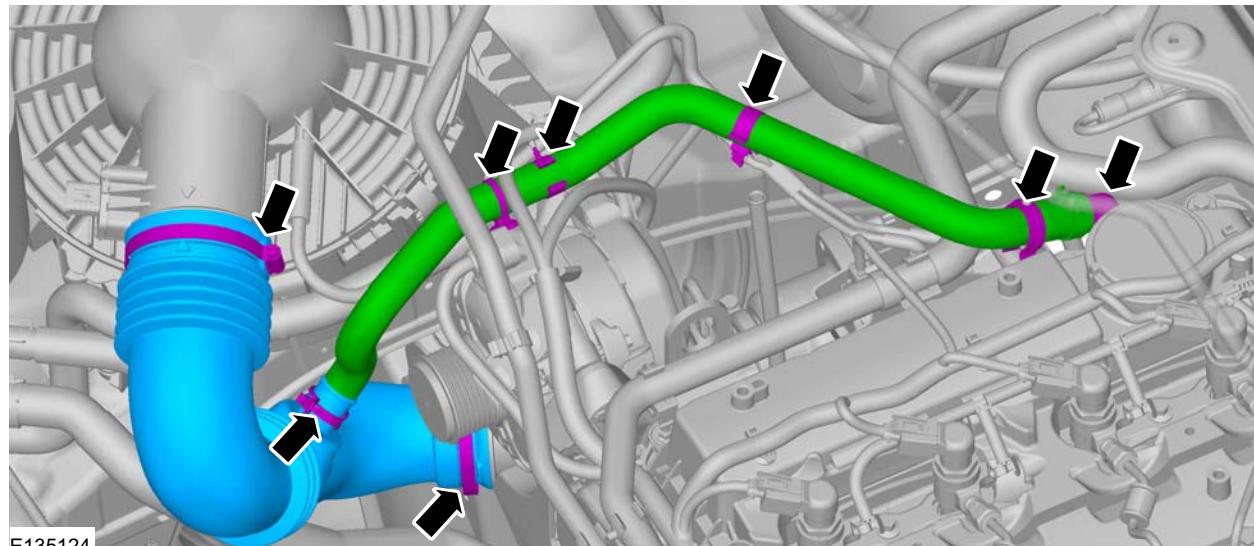


REMOVAL

- 25.** 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).
- 26.** Refer to: **Radiator** (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: **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.

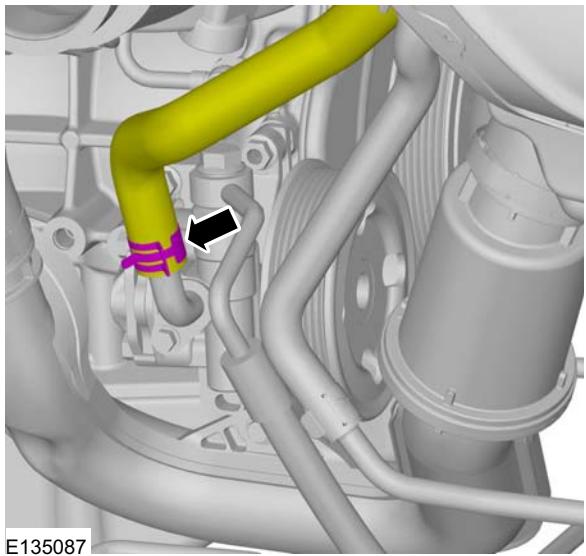
- 29.** Refer to: **Starter Motor - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma** (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L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

30.**31.**

REMOVAL

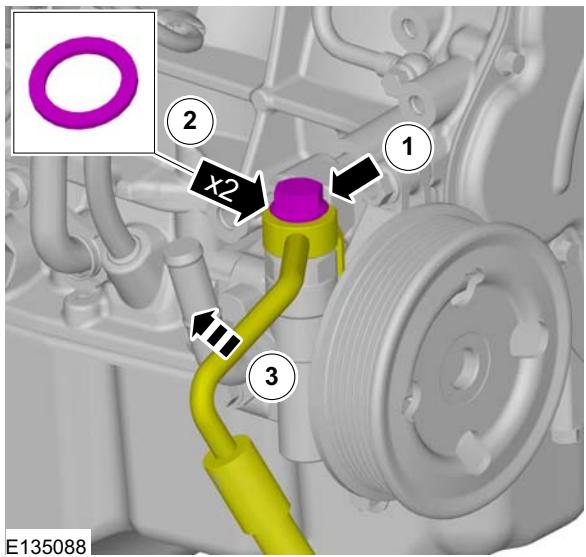
32 Refer to: Air Cleaner - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS)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

33. NOTE: Make sure that all openings are sealed.

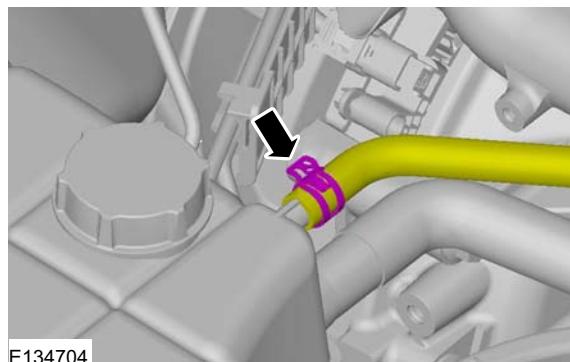


34. ! CAUTION: Cap the power steering line to prevent fluid loss or dirt ingress.

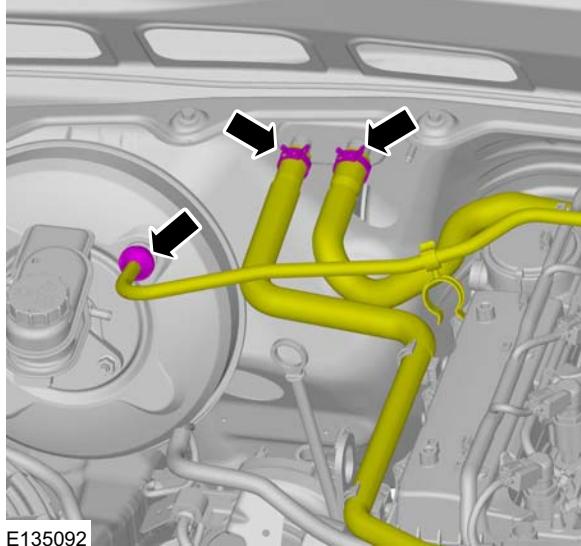
NOTE: The washers can be reused unless damaged.



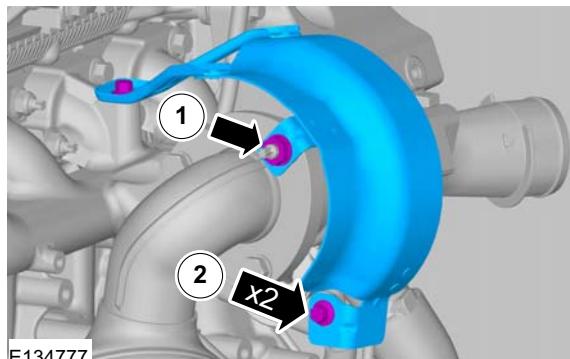
35.



36.

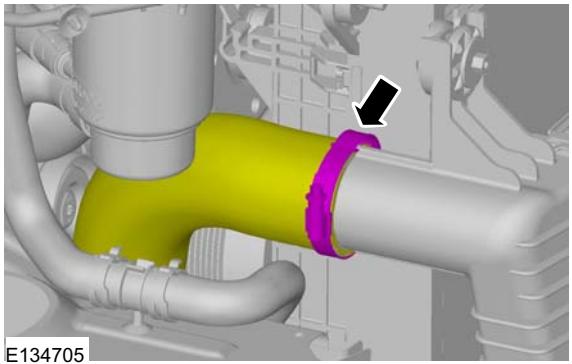
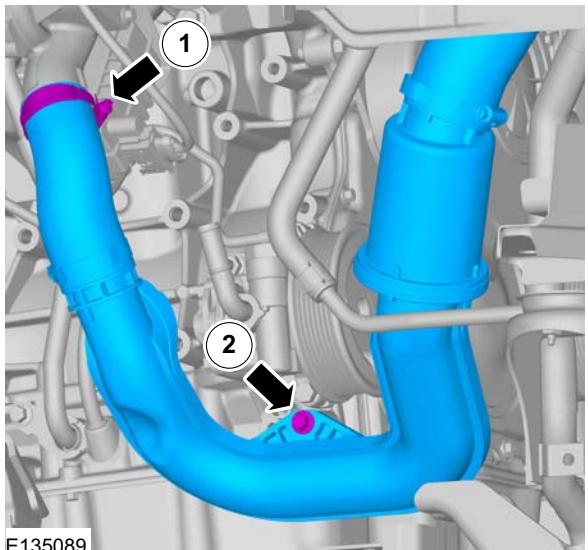
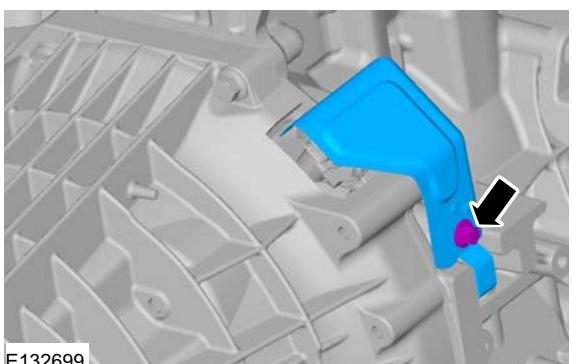
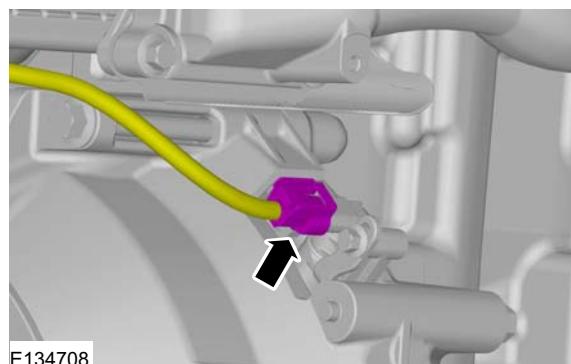
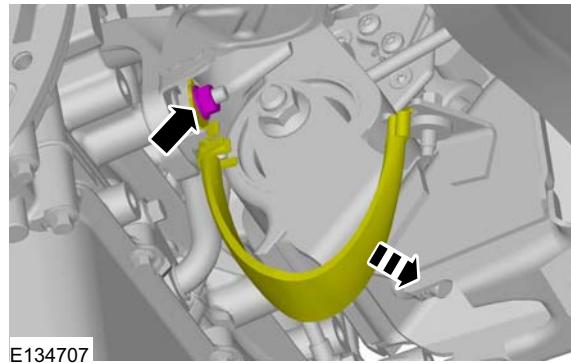


37.



REMOVAL

- 38.** 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).

39.**40.****41.****42****43**

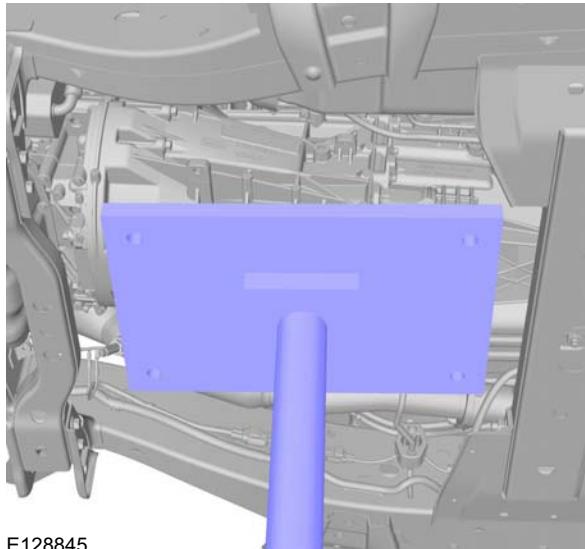
44. **WARNING:** Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.

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

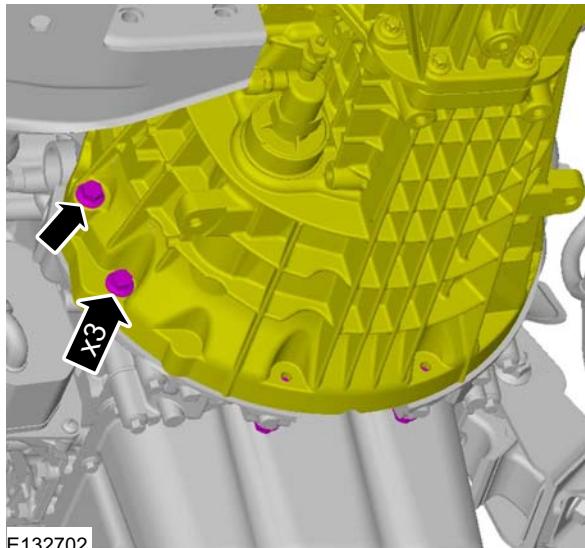
REMOVAL

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

General Equipment: Transmission Jack

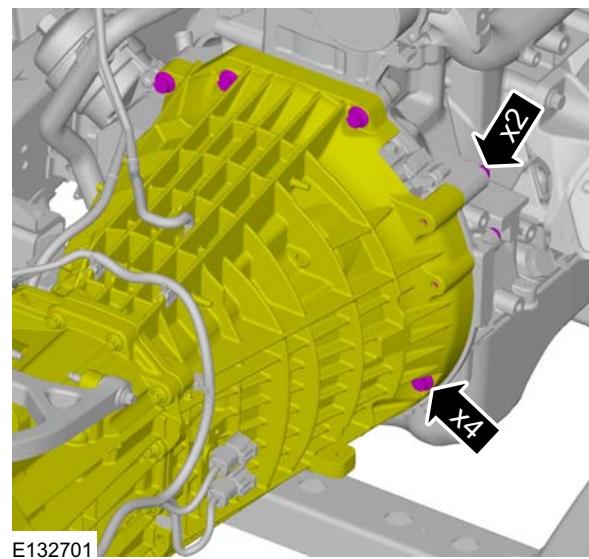


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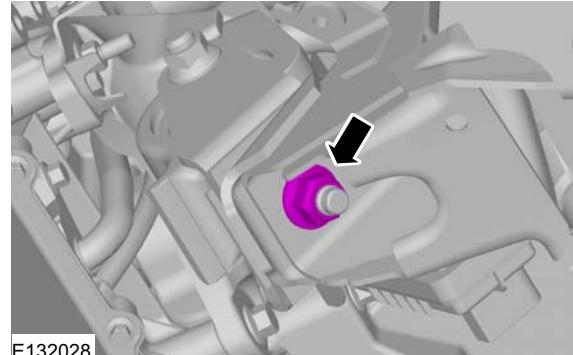
E132702

46.



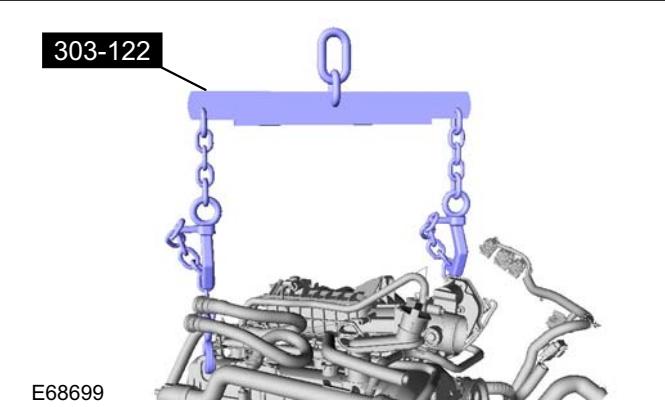
E132701

47. On both sides.



E132028

48. Special Tool(s): 303-122



E68699

DESCRIPTION AND OPERATION

Dusts

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard. Avoid explosive limits and sources of ignition.

Electric Shock

Electric shock can result from the use of faulty electrical equipment or from the misuse of equipment in good condition.

Make sure that electrical equipment is maintained in good condition and frequently tested. Faulty equipment should be labeled and preferably removed from the workstation.

Make sure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Make sure that electrical equipment and flexes do not come into contact with water.

Make sure that electrical equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment that is in any way faulty. The results could be fatal.

Make sure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Make sure that the designated electrical workers are trained in basic First Aid.

In cases of electrocution:

- switch off the power supply before approaching the victim.
- if this is not possible push or drag the victim from the source of electricity using dry non-conductive material.
- commence resuscitation if trained to do so.
- SUMMON MEDICAL ASSISTANCE.

Engine Oils

See [Lubricants and Grease](#).

Exhaust Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

Gasoline (petrol) engine

There may not be adequate warning of odor or of irritation before toxic or harmful effects arise. These may be immediate or delayed.

Diesel engine

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

Fibre Insulation

See also [Dusts](#).

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

Fire

See also [Welding, Foams, Legal Aspects](#).

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

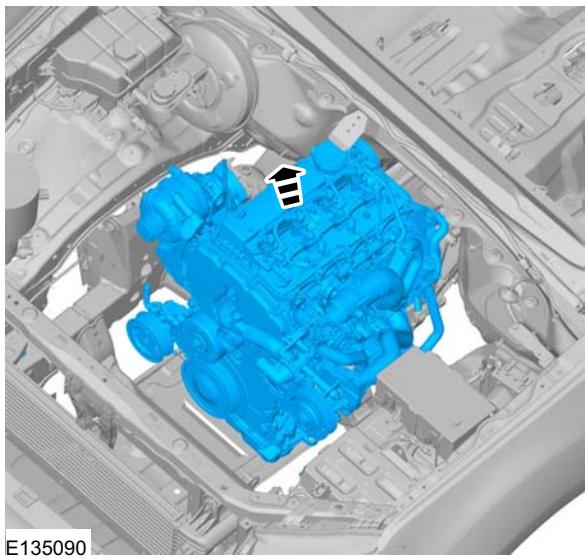
Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Make sure, before using electrical or welding equipment, that there is no fire hazard present.

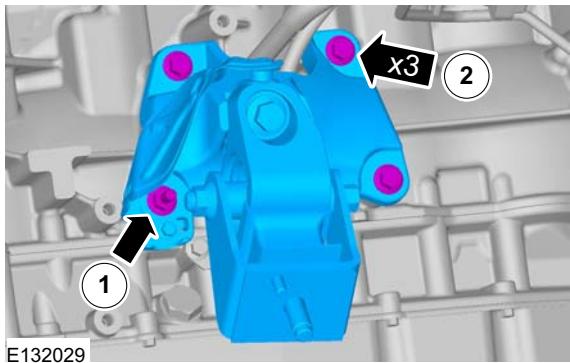
Have a suitable fire extinguisher available when using welding or heating equipment.

REMOVAL

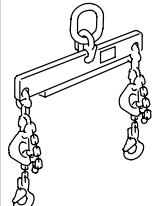
49.



50.

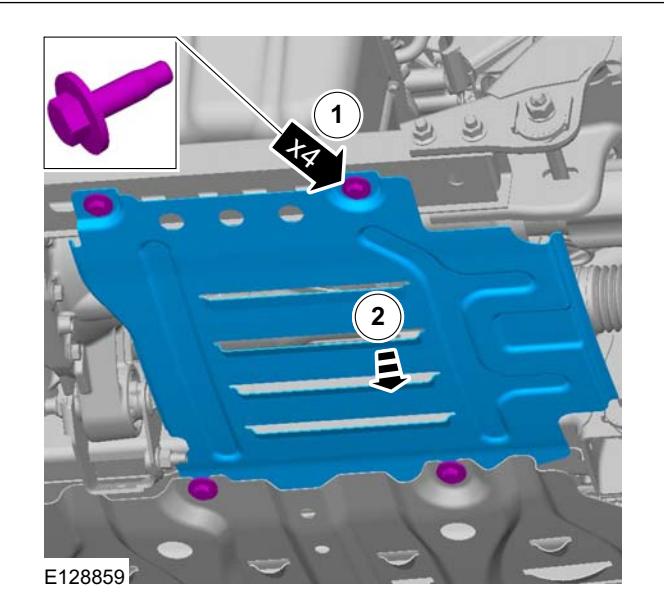


REMOVAL**Engine — Vehicles With: 6-Speed Manual Transmission -
MT82(21 132 0; 21 132 6; 21 132 7)****Removal****Special Tool(s) / General Equipment**

	303-122 Lifting Bracket, Engine 21068A
Transmission Jack	

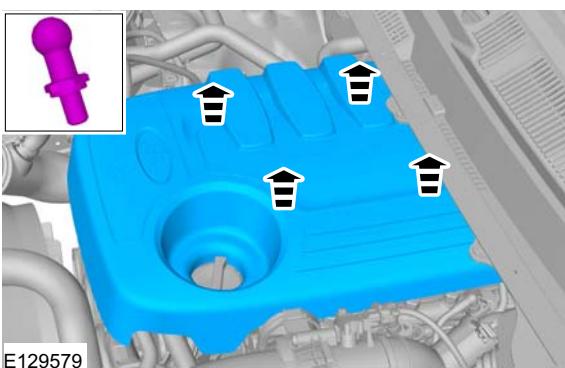
1. Refer to: **Health and Safety Precautions** (100-00 General Information, Description and Operation).
2. Refer to: **Battery Disconnect and Connect** (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: **Cooling System Draining, Filling and Bleeding - 2.2L Duratorq-TDCi (88kW/120PS) - 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.

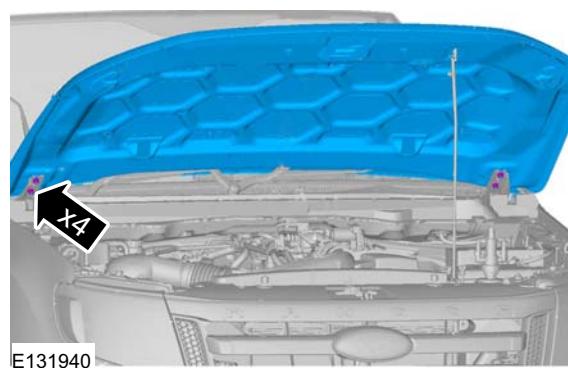


REMOVAL

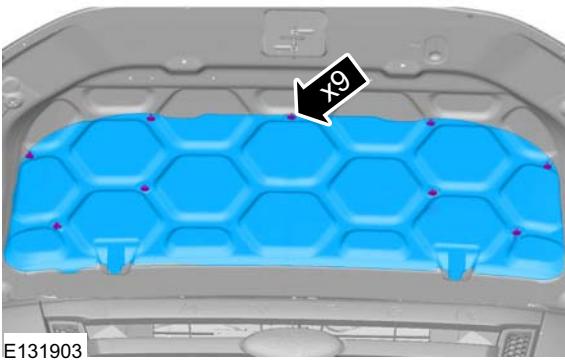
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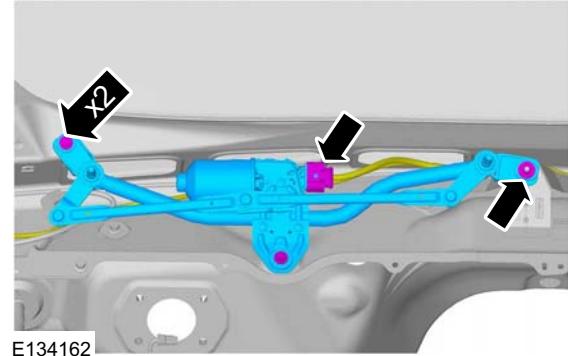
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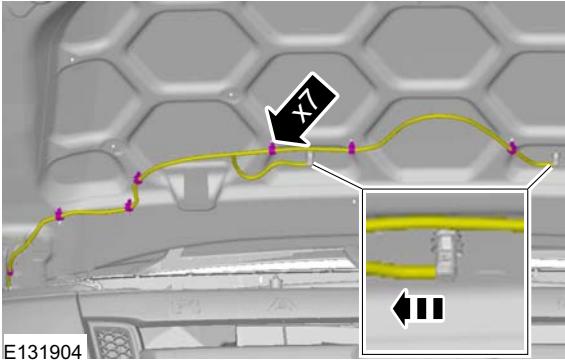
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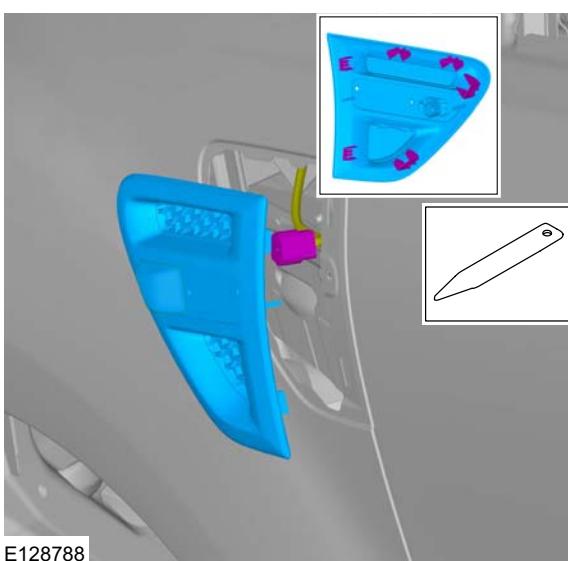
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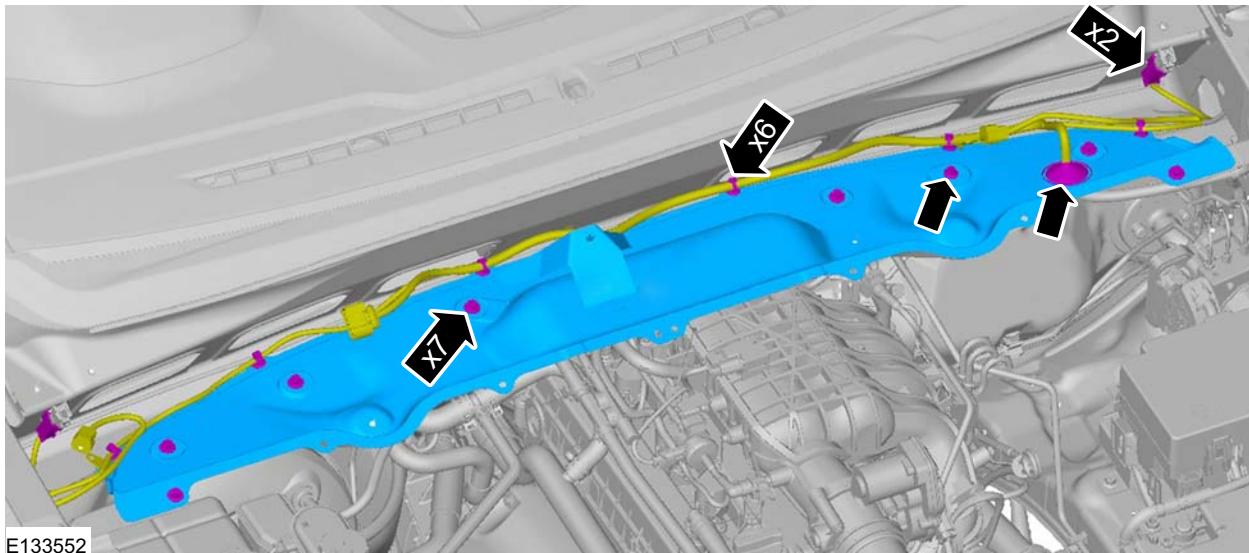
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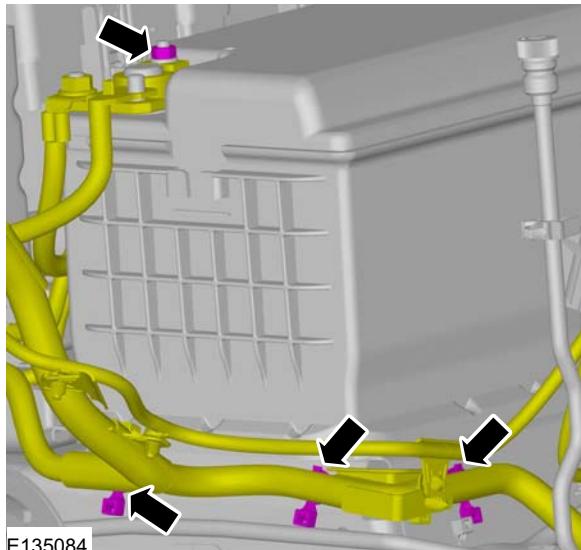
13. On both sides.



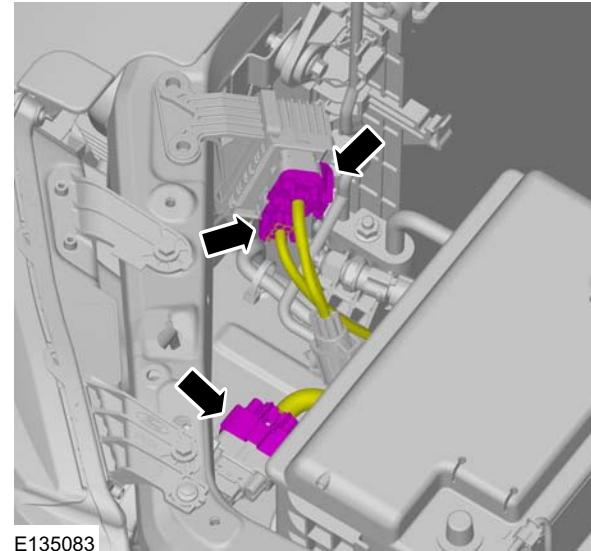
14.

REMOVAL

15.



16.



REMOVAL

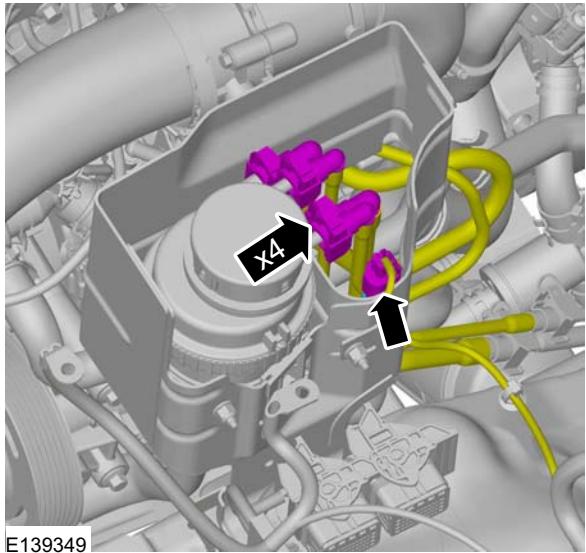
17. Refer to: **Battery** (414-01 Battery, Mounting and Cables, Removal and Installation).

18. Refer to: **Battery Tray** (414-01 Battery, Mounting and Cables, Removal and Installation).

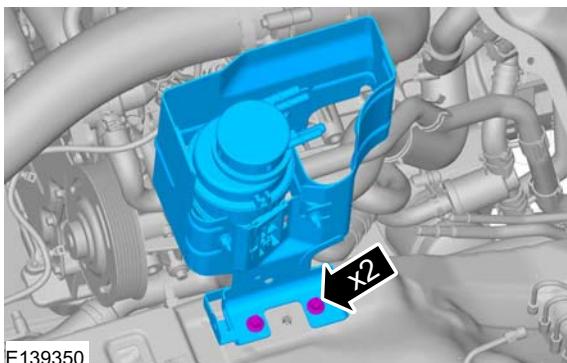
19. Refer to: **Powertrain Control Module (PCM)**
(303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

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).

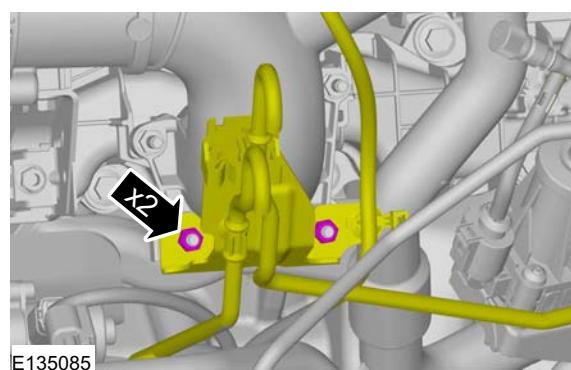
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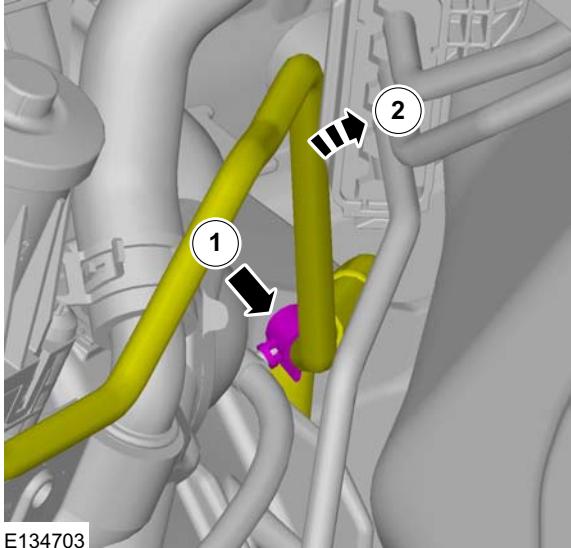
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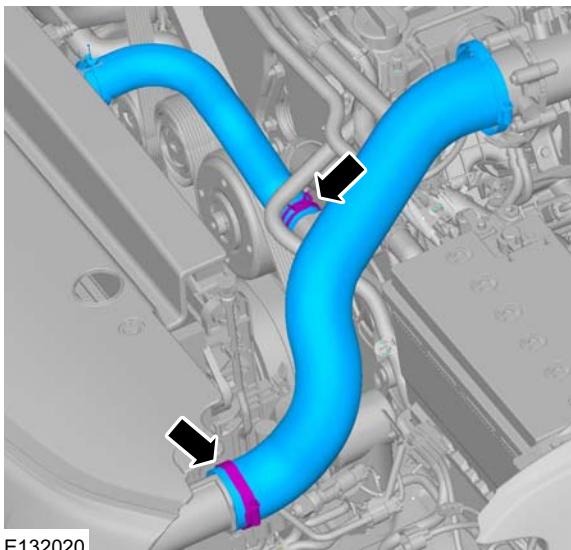
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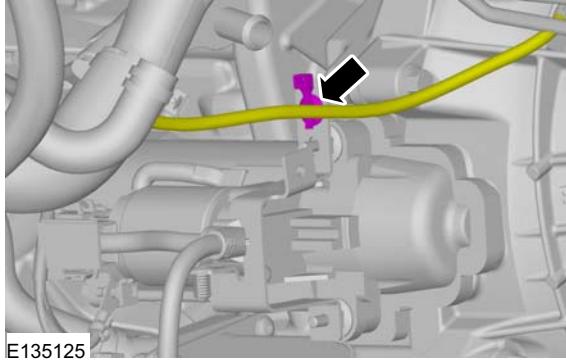


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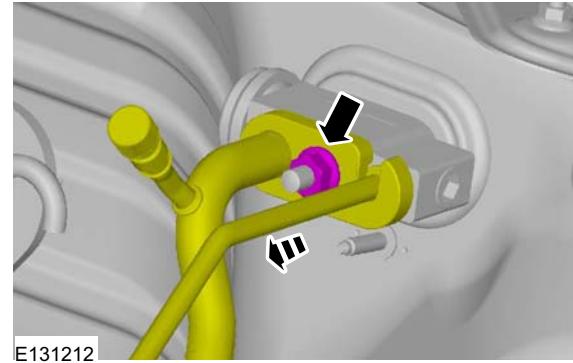
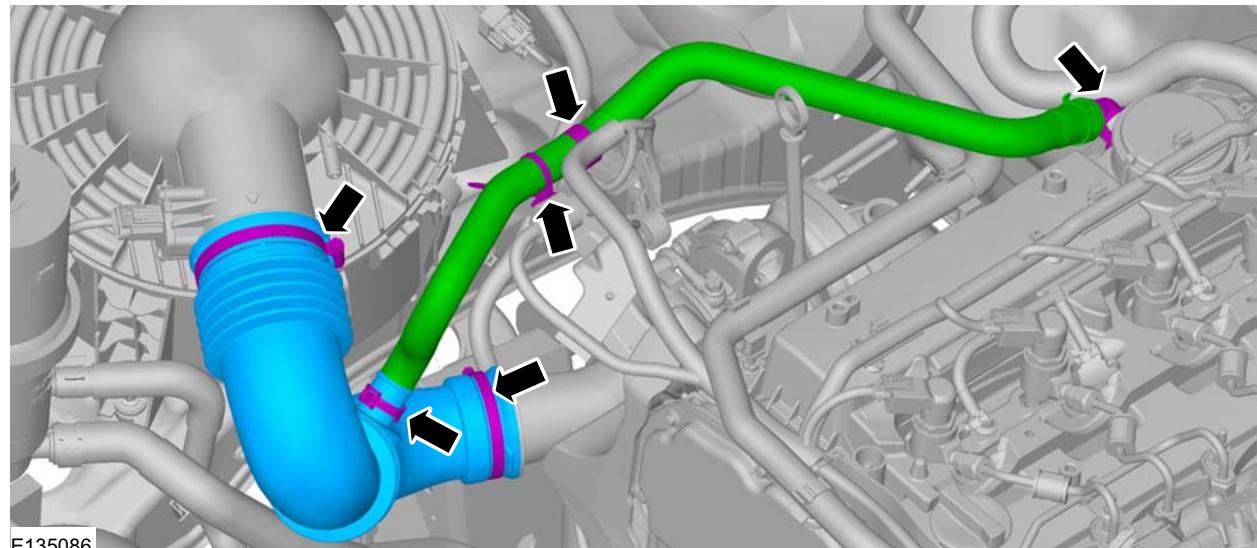


REMOVAL

- 25.** 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).
- 26.** Refer to: **Radiator** (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: **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.

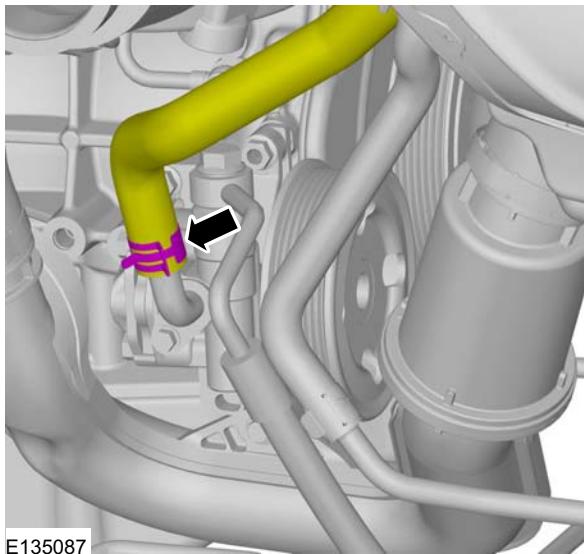
- 29.** Refer to: **Starter Motor - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma** (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L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

30.**31.**

REMOVAL

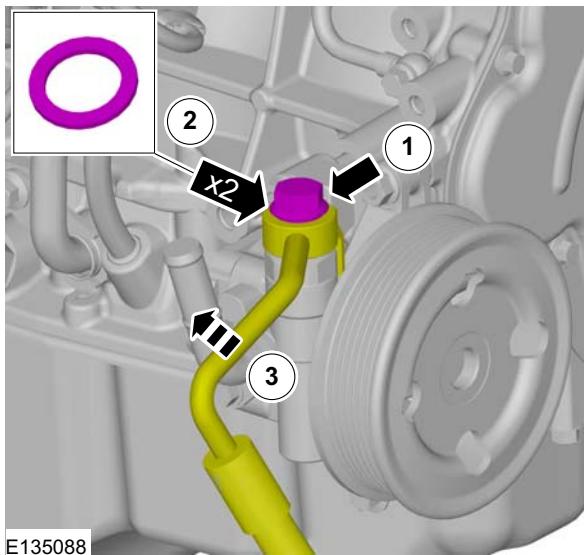
32 Refer to: Air Cleaner - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS)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

33. NOTE: Make sure that all openings are sealed.

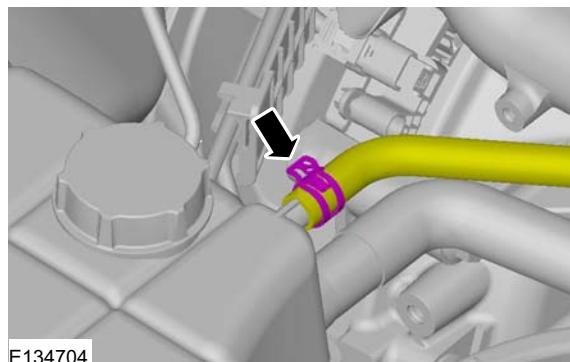


34. ! CAUTION: Cap the power steering line to prevent fluid loss or dirt ingress.

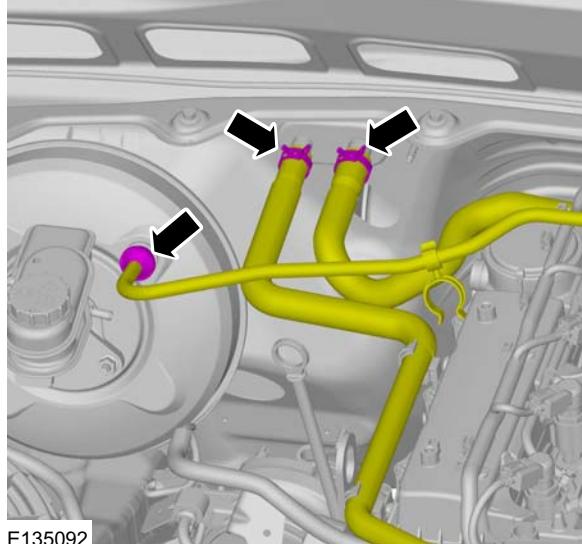
NOTE: The washers can be reused unless damaged.



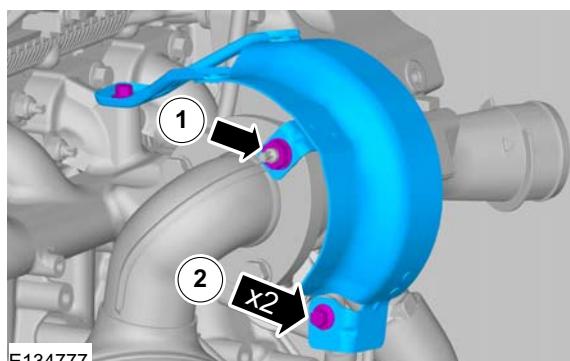
35.



36.

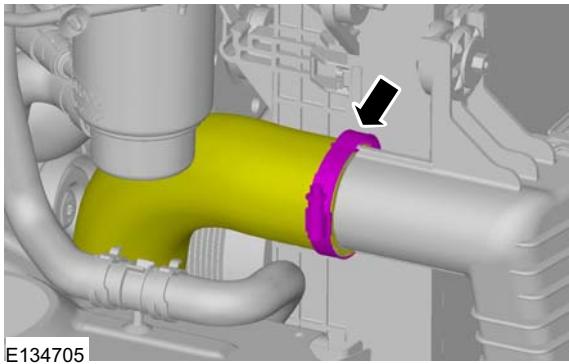
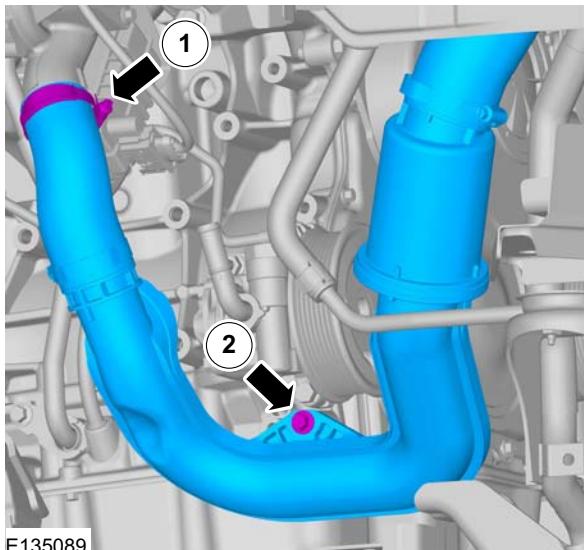
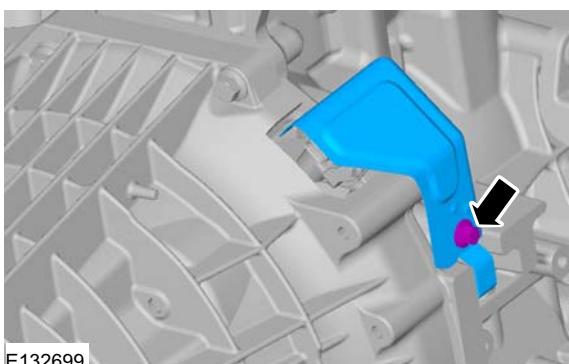
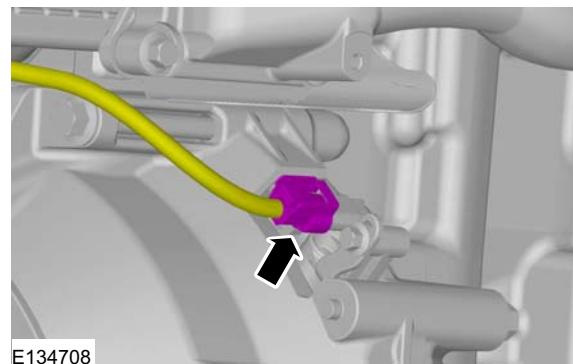
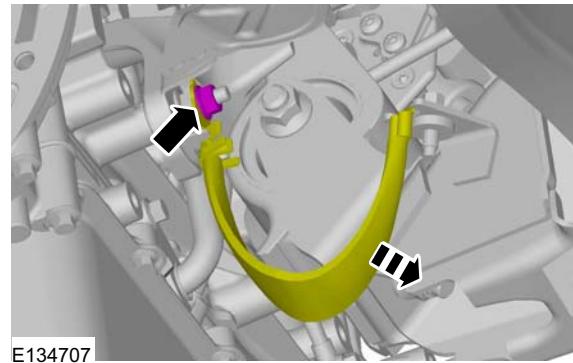


37.



REMOVAL

- 38.** 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).

39.**40.****41.****42****43**

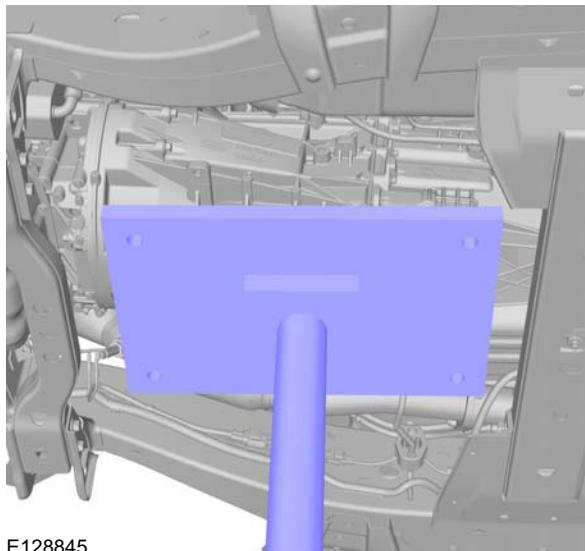
44. **WARNING:** Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.

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

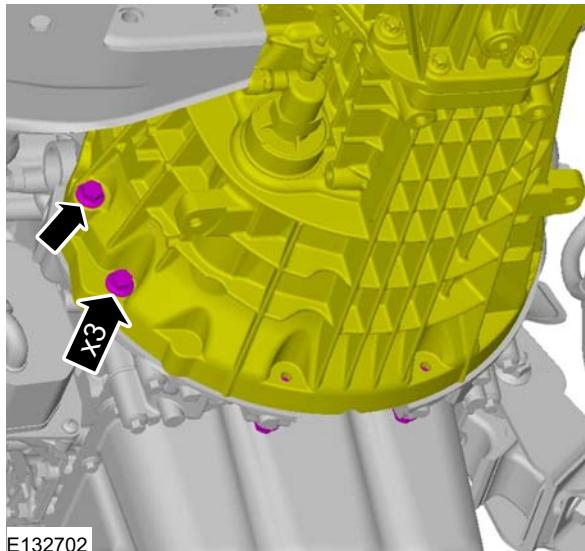
REMOVAL

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

General Equipment: Transmission Jack

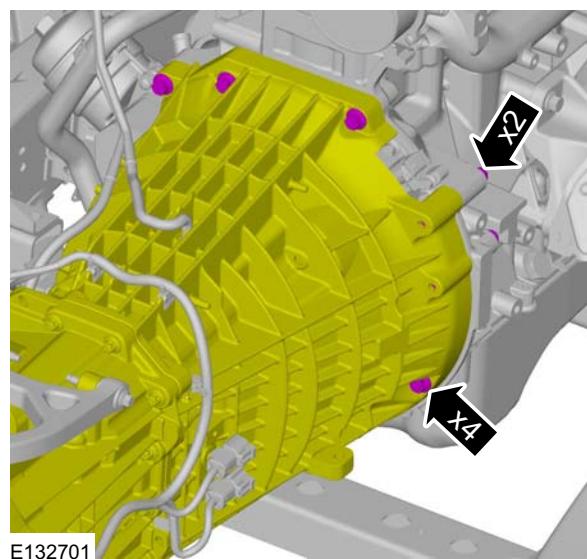


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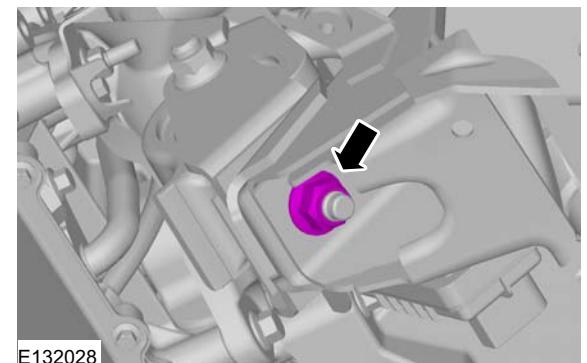


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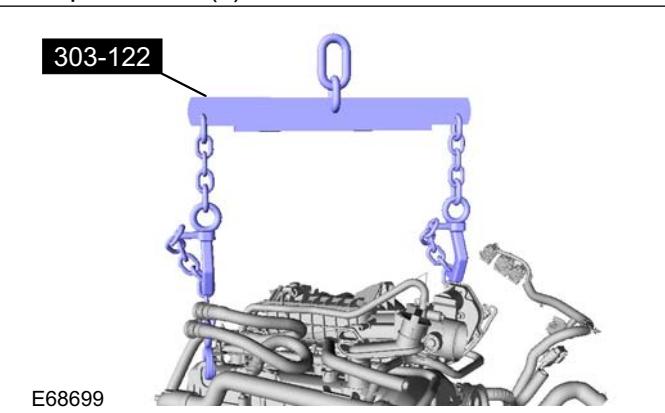
46.



47. On both sides.

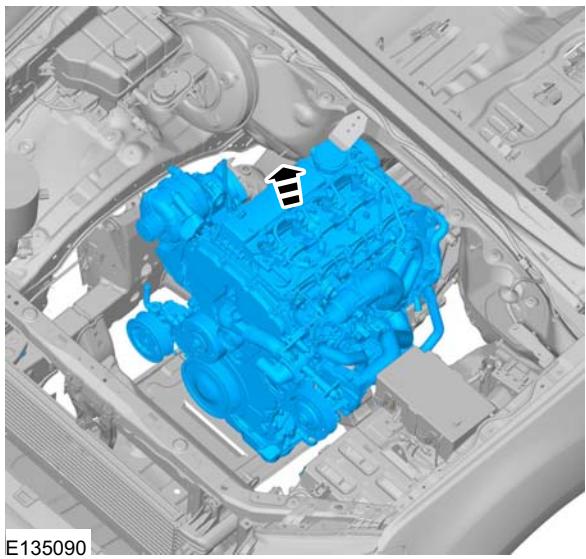


48. Special Tool(s): 303-122

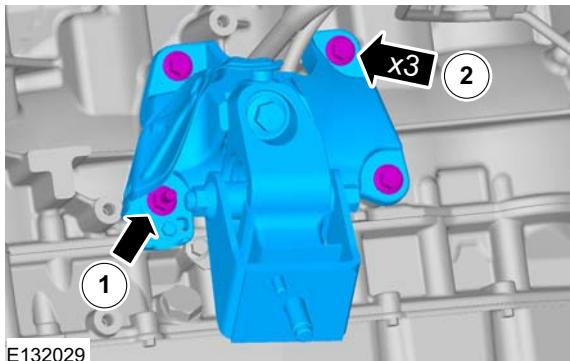


REMOVAL

49.



50.



DESCRIPTION AND OPERATION

First Aid

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in First Aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

In case of cold burns, from alternative fuels, place affected area in cool to cold water.

Individuals affected by inhalation of gases and fumes should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertently, consult a doctor giving him the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

Fluoroelastomer

See [Viton](#).

Foams - Polyurethane

See also [Fire](#).

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Follow manufacturers instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work in or near uncured materials.

The components, vapors or spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapors and spray mists must not be inhaled. These materials must be applied with adequate ventilation and respiratory protection. Do not remove the respirator immediately after spraying; wait until the vapors/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, naked flames or the use of electrical equipment during foaming operations and until vapors/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured

foams should be conducted with extraction ventilation. See also the vehicle Body Repair Manual.

Freon

See [Air Conditioning Refrigerant](#).

Fuels

See also, [Fire](#), [Legal Aspects](#), [Chemicals](#) and [Solvents](#).

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

Gasoline (Petrol)

Highly flammable - observe No Smoking policy.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs, through vomiting, is a very serious hazard.

Gasoline dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe smarting.

Motor gasoline may contain appreciable quantities of benzene, which is toxic upon inhalation, and the concentration of gasoline vapors must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Make sure there is adequate ventilation when handling and using gasoline. Great care must be taken to avoid the serious consequences of inhalation in the event of vapor build up arising from spillages in confined spaces.

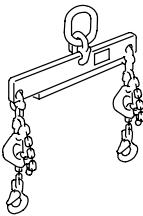
Special precautions apply to cleaning and maintenance operations on gasoline storage tanks.

Gasoline should not be used as a cleaning agent. It must not be siphoned by mouth. See First Aid.

Gas-oil (Diesel Fuel)

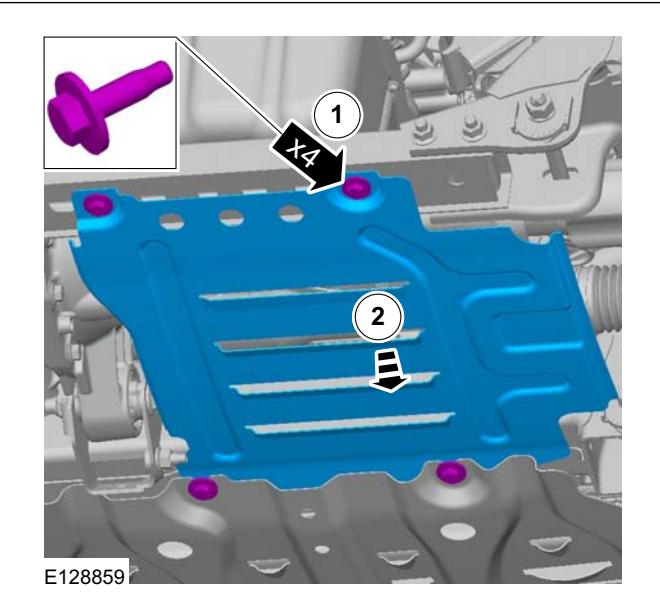
Combustible.

REMOVAL**Engine — Vehicles With: 6-Speed Automatic Transaxle - 6R80(21 132 0; 21 132 6; 21 132 7)****Removal****Special Tool(s) / General Equipment**

	303-122 Lifting Bracket, Engine 21068A
Transmission Jack	

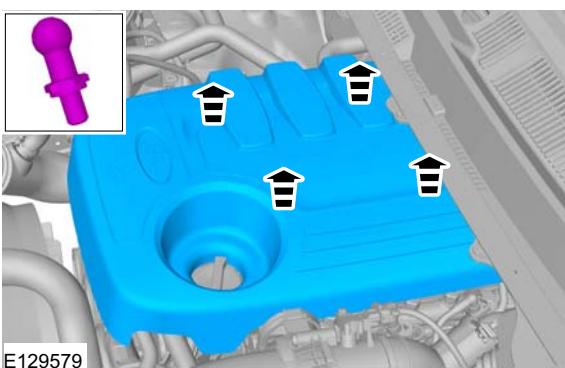
1. Refer to: **Health and Safety Precautions** (100-00 General Information, Description and Operation).
2. Refer to: **Battery Disconnect and Connect** (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: **Cooling System Draining, Filling and Bleeding - 2.2L Duratorq-TDCi (88kW/120PS) - 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.

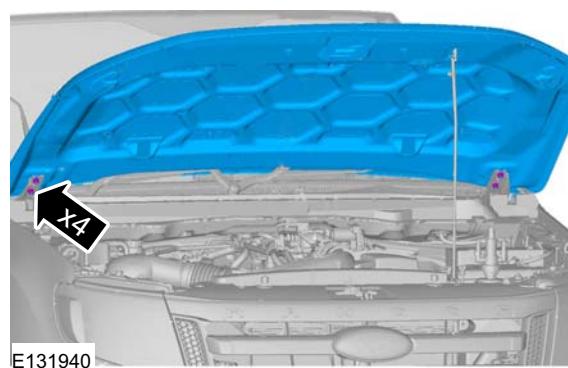


REMOVAL

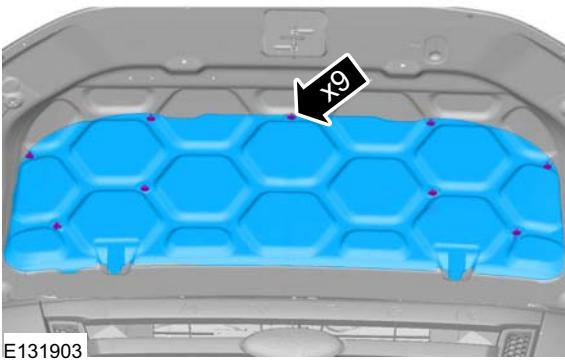
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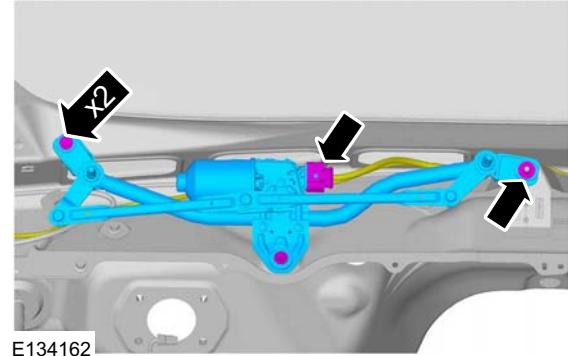
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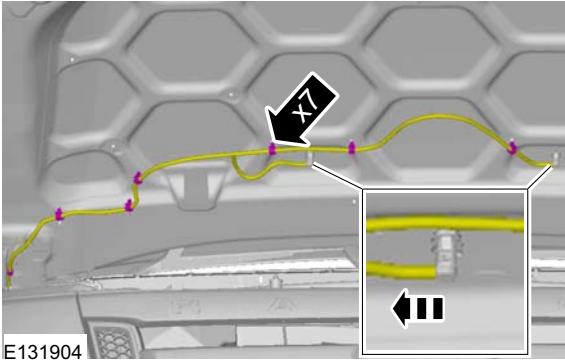
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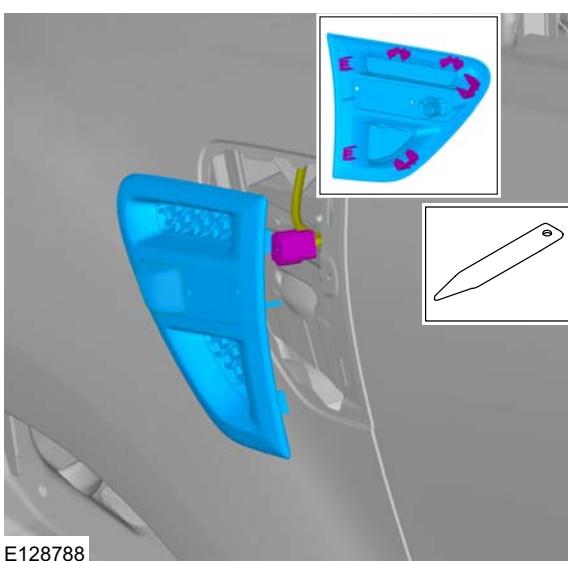
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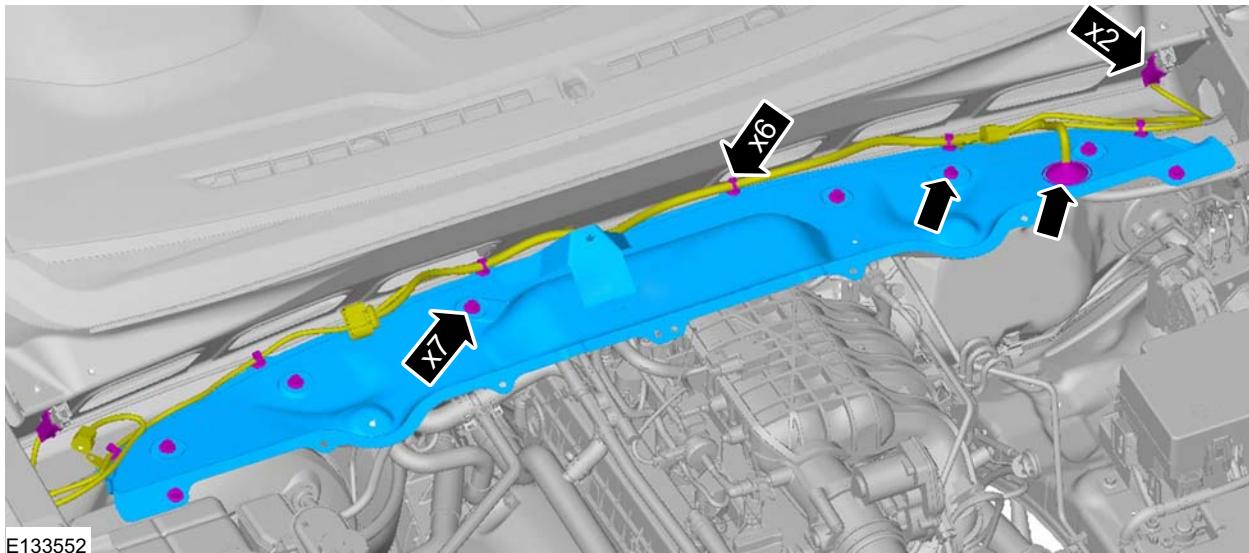
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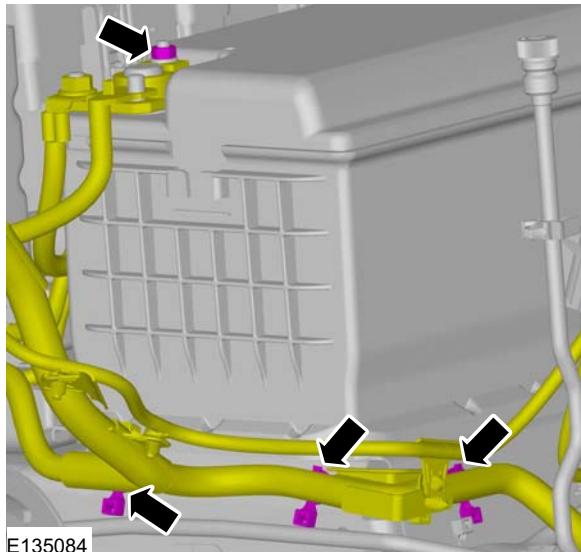
13. On both sides.



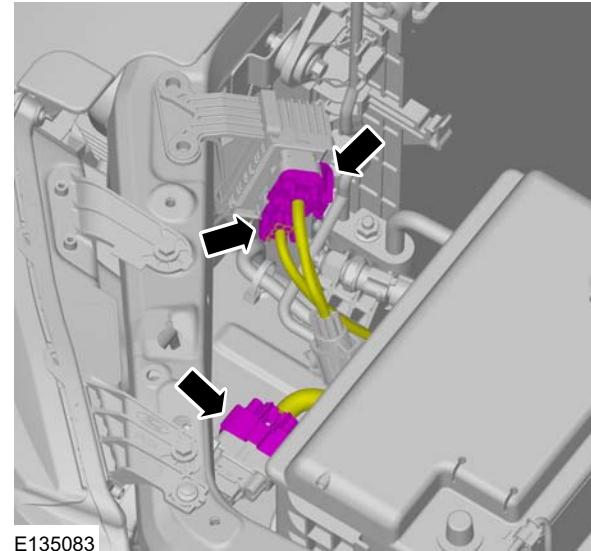
14.

REMOVAL

15.



16.



303-01B-70

- Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

303-01B-70

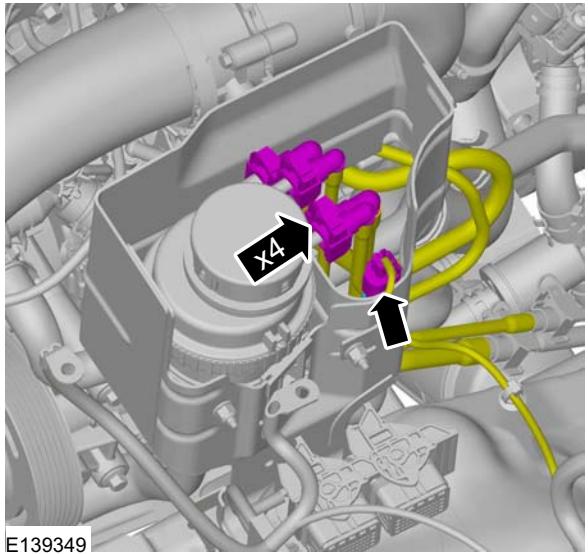
REMOVAL

17. Refer to: **Battery** (414-01 Battery, Mounting and Cables, Removal and Installation).

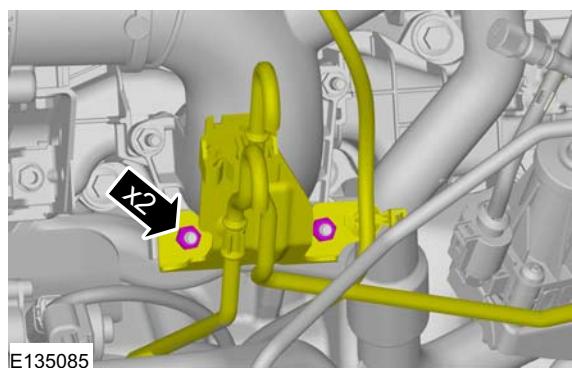
18. Refer to: **Battery Tray** (414-01 Battery, Mounting and Cables, Removal and Installation).

19. 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).

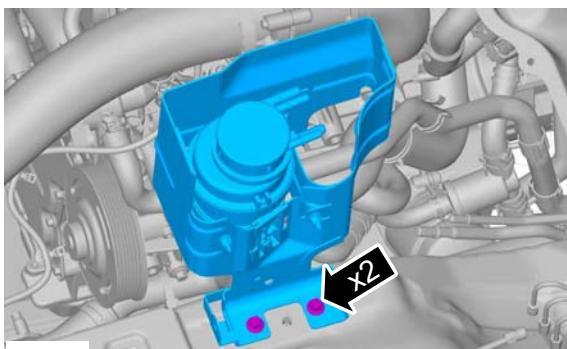
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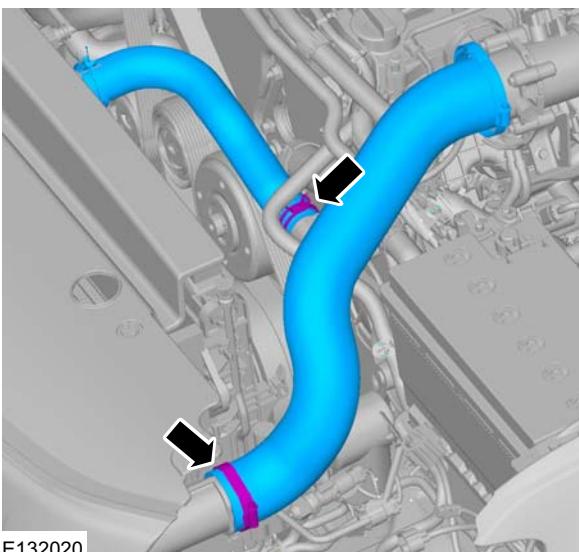
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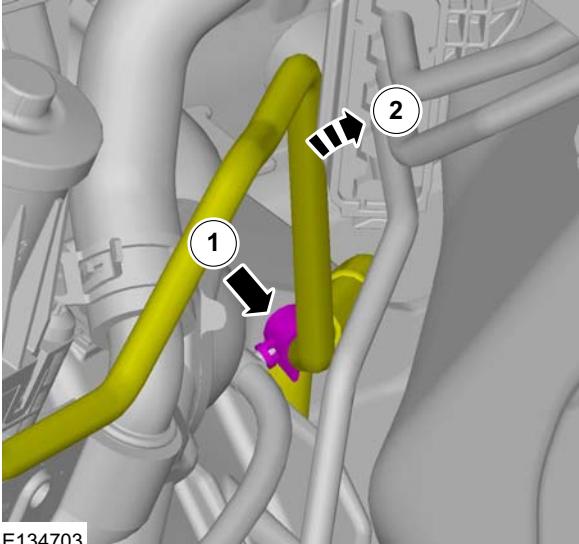
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24

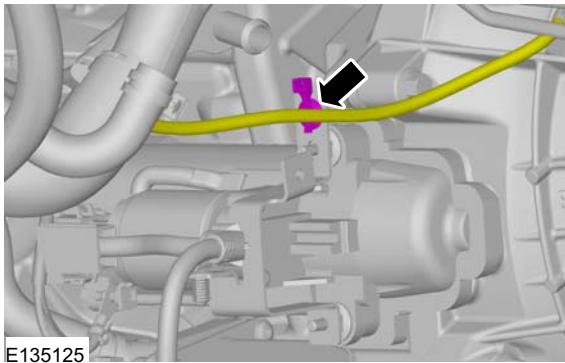


23



REMOVAL

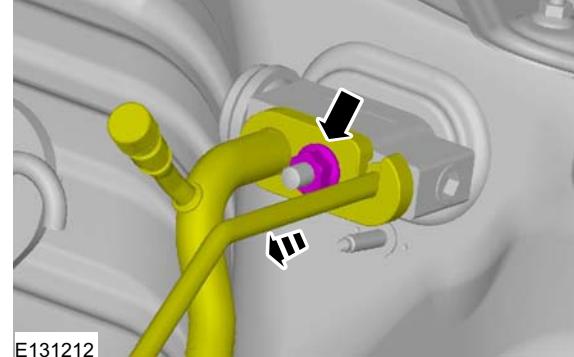
- 25.** Refer to: **Cooling Fan Motor and Shroud** (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
- 26.** Refer to: **Radiator** (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS)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



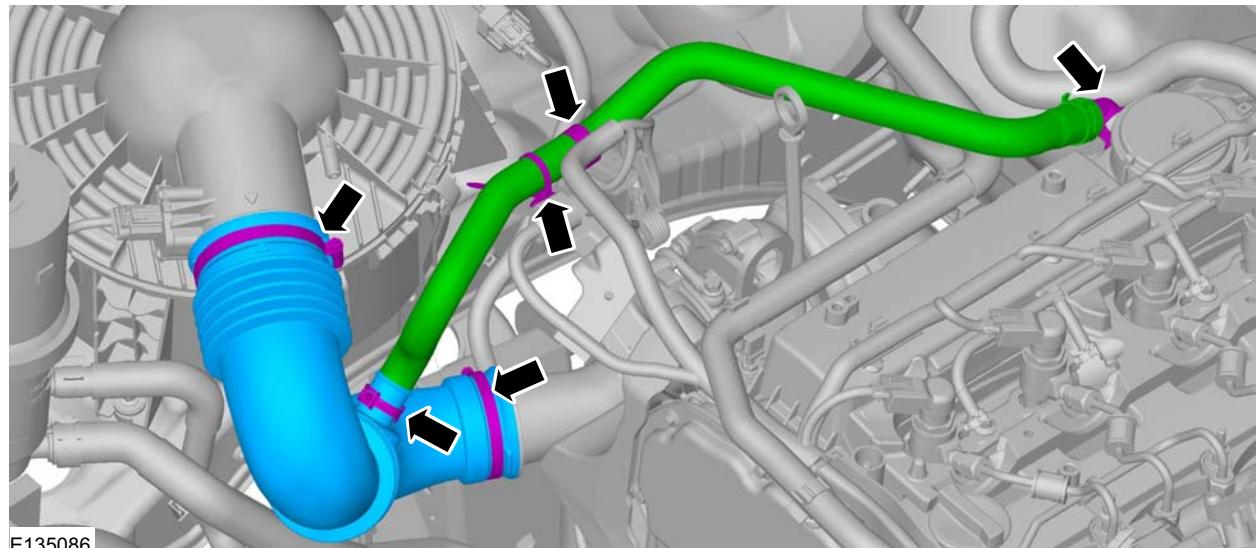
29. Refer to: **Starter Motor - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma** (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L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

30. Refer to: **Transmission Fluid Cooler** (307-02 Transmission/Transaxle Cooling, Removal and Installation).

31.



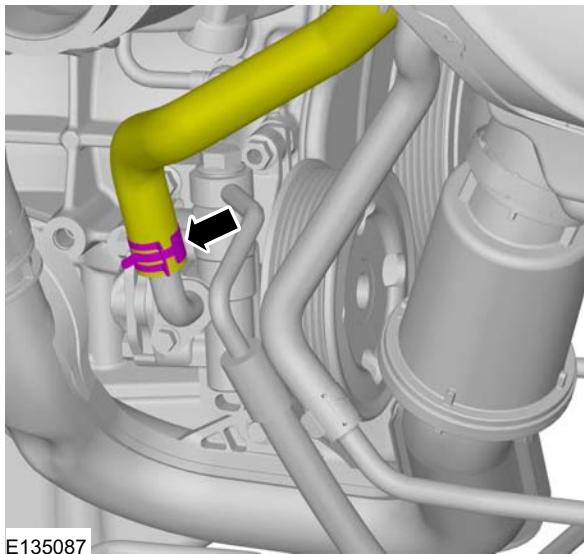
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REMOVAL

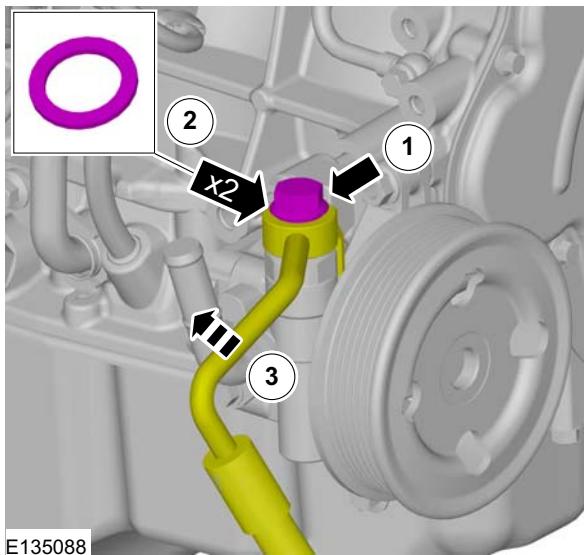
- 33.** Refer to: **Air Cleaner - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma** (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS)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

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

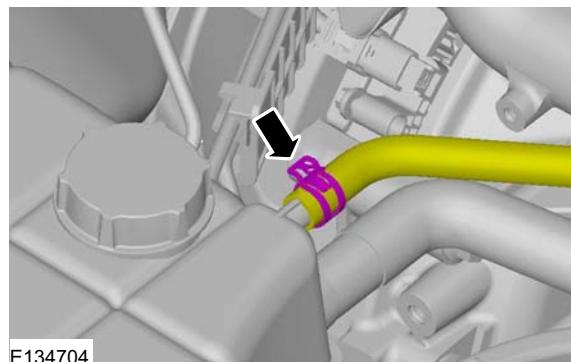


- 35. ! CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.

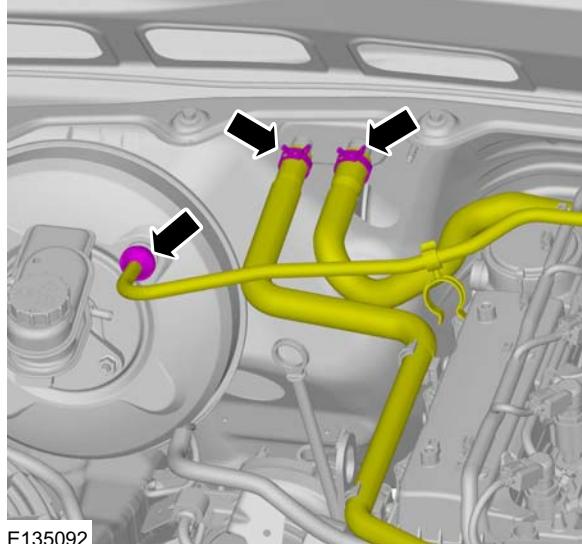
NOTE: The washers can be reused unless damaged.



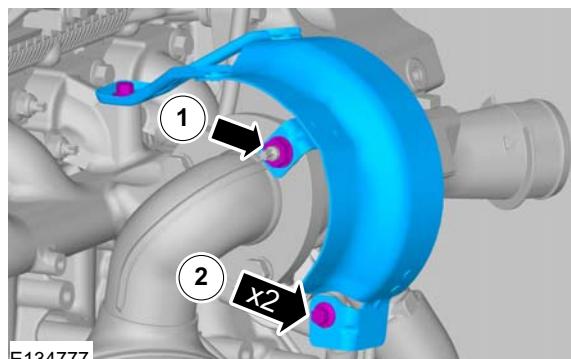
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37.



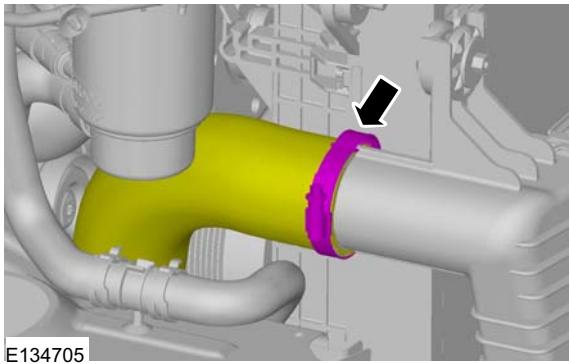
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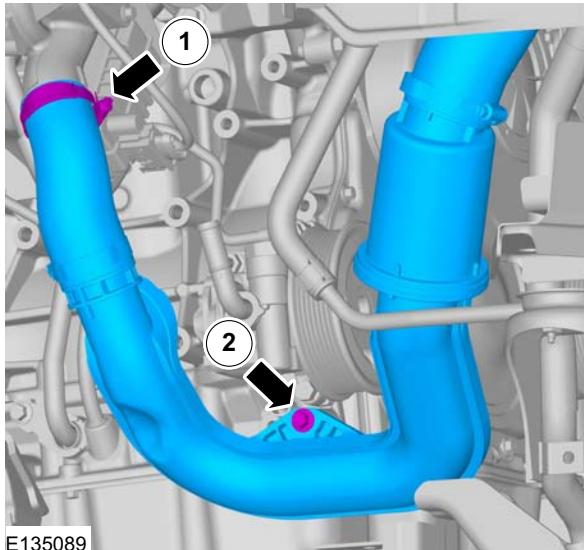
REMOVAL

- 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).

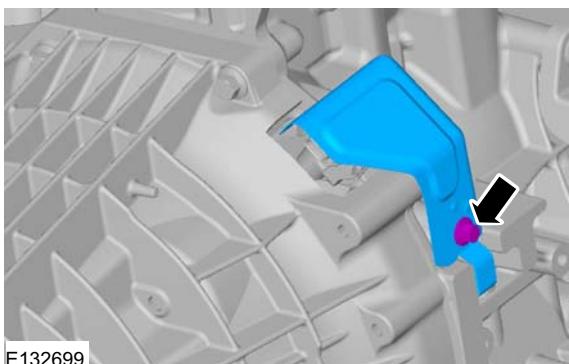
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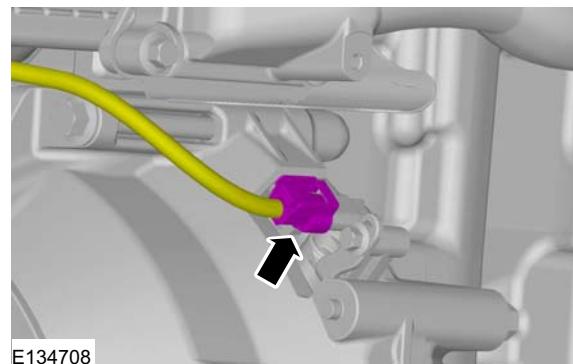
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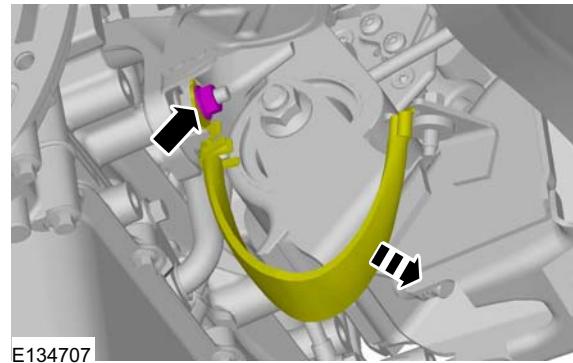
42.



43.



44.

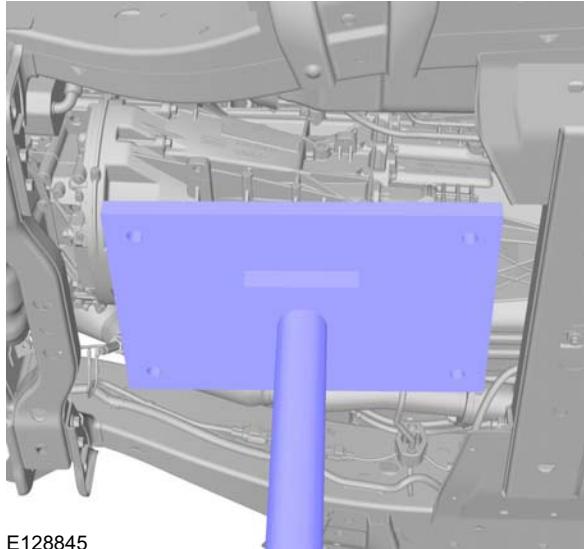


- 45.** **WARNING:** Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.
- CAUTION:** Do not tilt the transmission. This may cause damage to the pilot bearing.

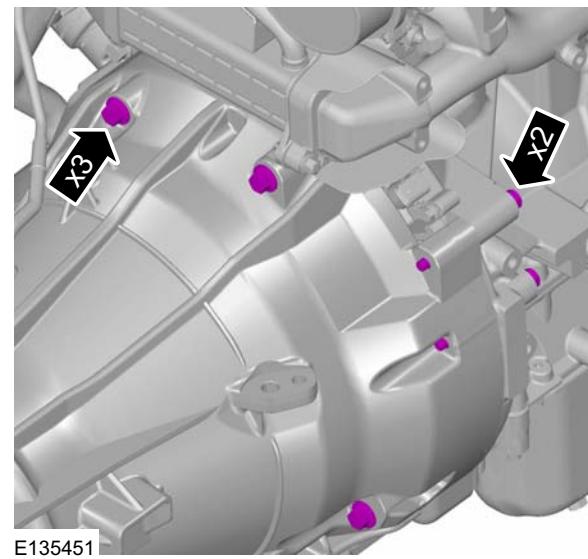
REMOVAL

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

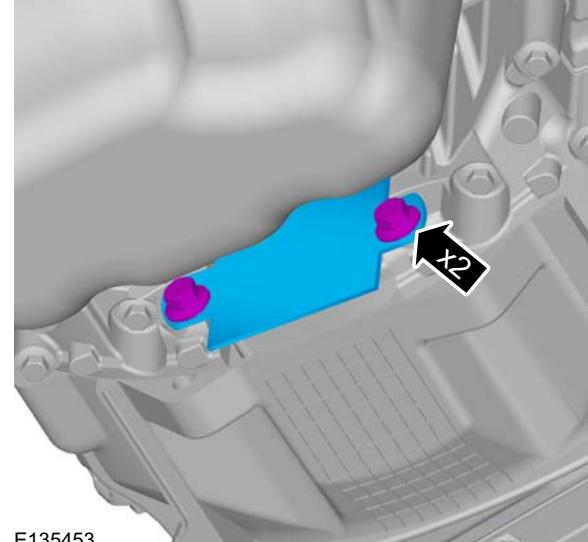
General Equipment: Transmission Jack



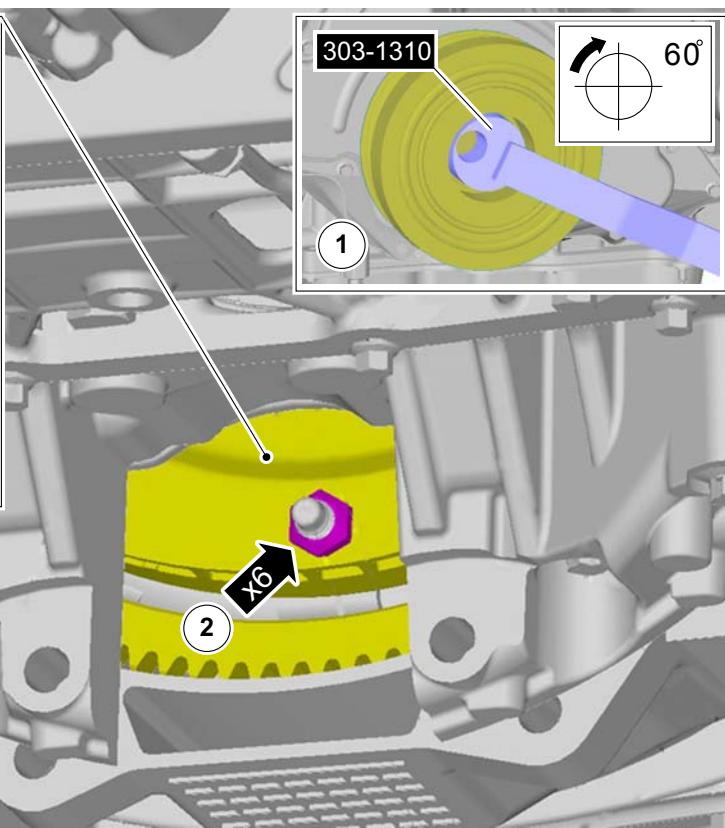
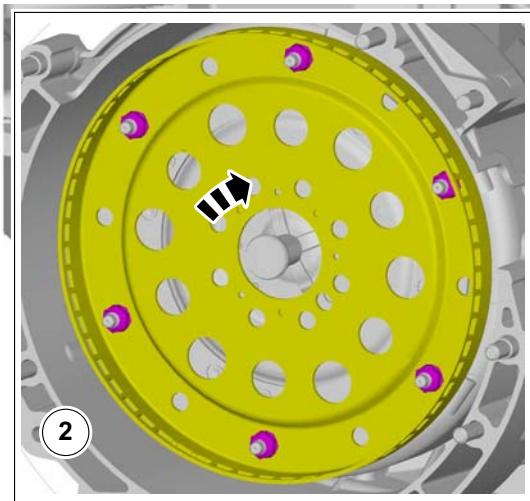
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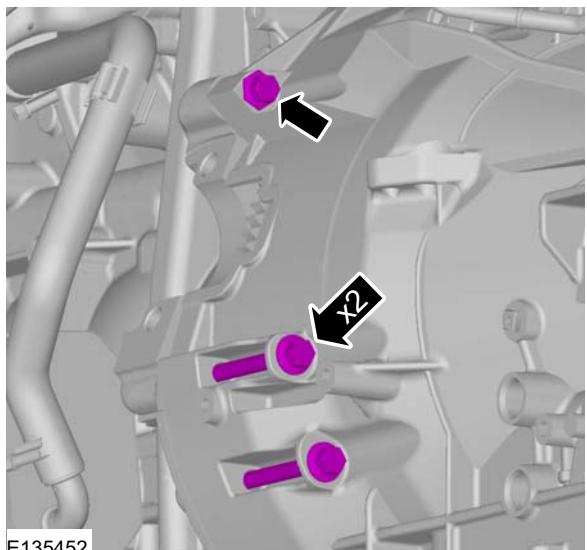
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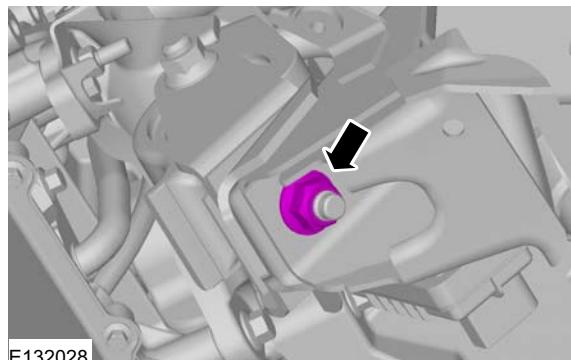
48.

REMOVAL

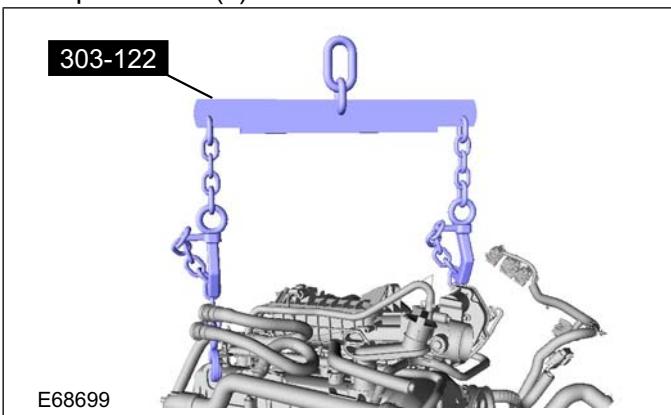
E135454

49.

E135452

50. On both sides.

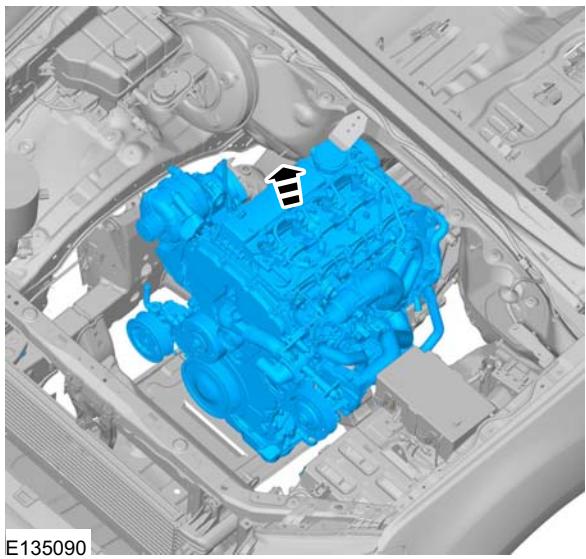
E132028

51. Special Tool(s): 303-122

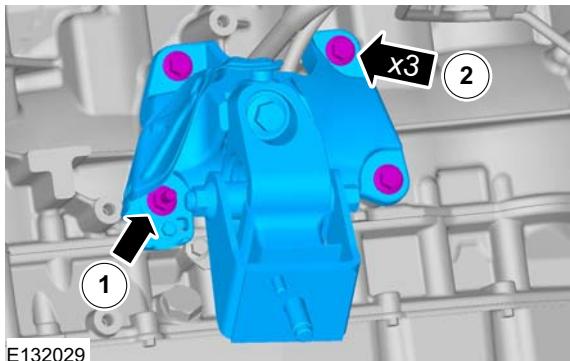
E68699

REMOVAL

52



53.



DESCRIPTION AND OPERATION

Gross or prolonged skin contact with high boiling point gas oils may also cause serious skin disorders including skin cancer.

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable - observe No Smoking policy.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs.

Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapors. Exposure to mists and vapors from kerosene at elevated temperature should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and make sure there is adequate ventilation.

Alternative Fuel

Highly flammable. Observe ``NO SMOKING" signs.

Make sure there is adequate ventilation when working on alternative fuelled vehicles. Great care must be taken to avoid the serious consequences of inhalation in the event of vapor build up in confined spaces.

Inhalation in high concentrations may cause dizziness, headache, nausea and loss of co-ordination. Very high concentrations may result in loss of consciousness.

Contact with liquefied petroleum gas (LPG) or compressed natural gas (CNG) to the skin may cause cold burns and frost bite.

Long sleeved cotton overalls, steel toe capped safety boots and rubber neoprene gloves should be worn during removal and installation of LPG/CNG fuel system components.

LPG/CNG fuel leaks could cause a fire and be a hazard to health that can lead to personal injury, illness or even death.

If a leak is detected, under no circumstances attempt to seal the leak by tightening the union/connection until the fuel in the system or component is depressurized. Once tightened the system should be checked for integrity following the specified procedures.

If the fuel tank is to be removed for service or repair the fuel must be evacuated using dedicated equipment and following the specified procedures.

Gas Cylinders

See also [Fire](#).

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 138 bar (2000 psi) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well-ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases, for example acetylene and propane, should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

Gases

See [Gas Cylinders](#).

Gaskets (Fluoroelastomer)

See [Viton](#).

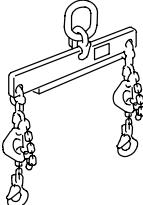
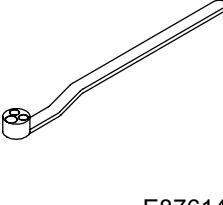
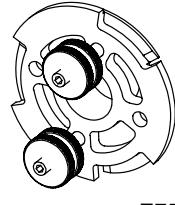
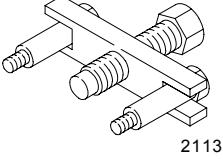
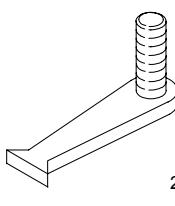
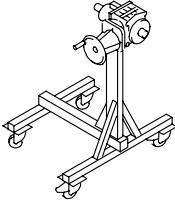
General Workshop Tools and Equipment

It is essential that all tools and equipment are maintained in good condition and that the correct safety equipment is used where required.

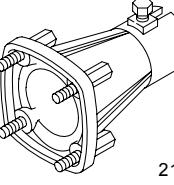
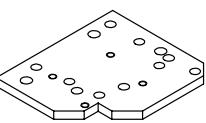
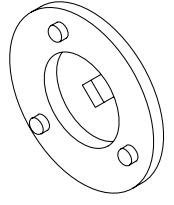
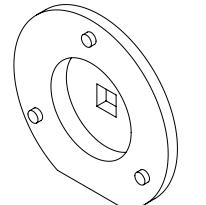
Never use tools or equipment for any purpose other than that for which they were designed. Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

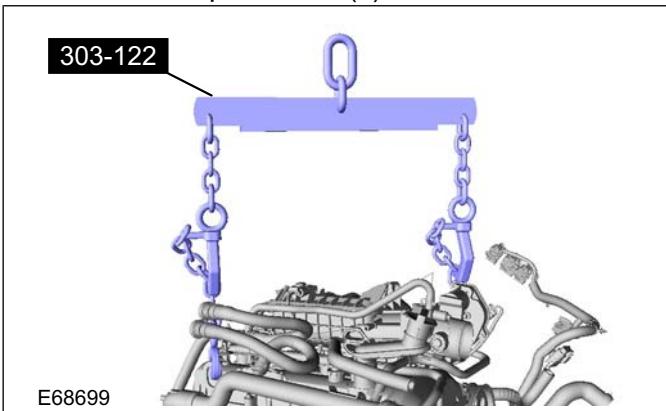
Do not use damaged or defective tools or equipment, particularly high-speed equipment such as grinding wheels. A damaged grinding wheel can

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

	303-122 Lifting Bracket, Engine 21068A
	303-1310 Holding Wrench, Crankshaft E87614
	303-1317 Locking Tool, Fuel Injection Pump Sprocket E75376
	303-249 Remover, Crankshaft Timing Pulley 21132
	303-254 Locking Tool, Flywheel 21135
	303-435 Mounting Stand 21187

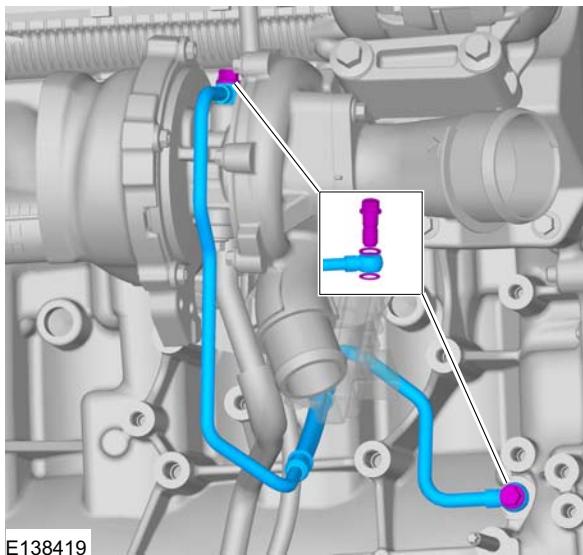
Special Tool(s) / General Equipment

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

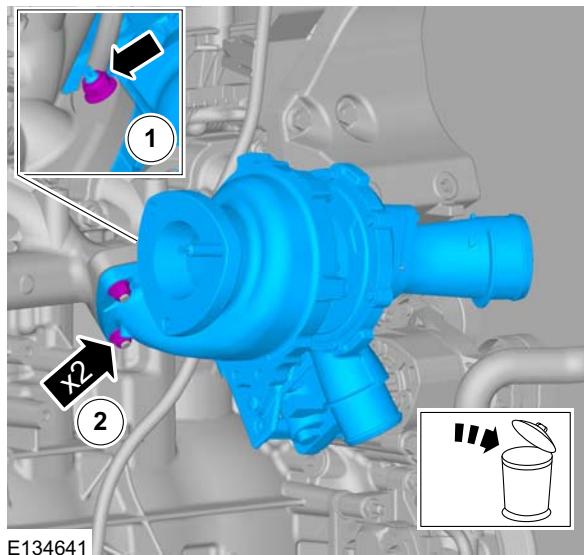
1. Install the Special Tool(s): 303-122

REMOVAL

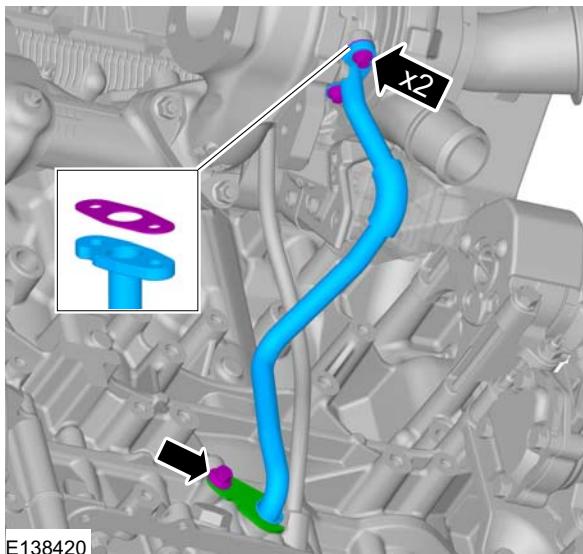
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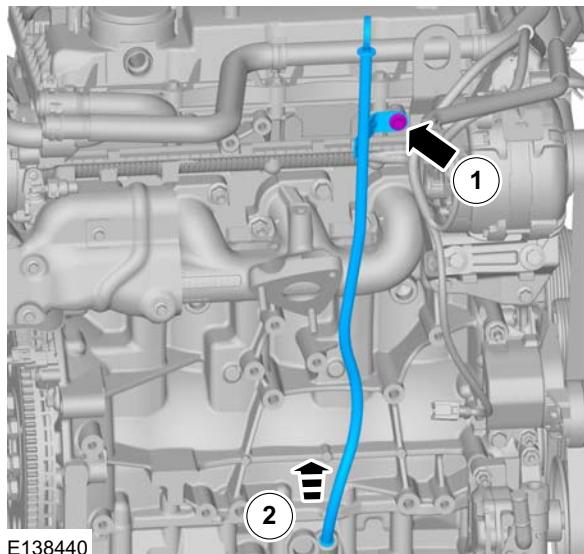
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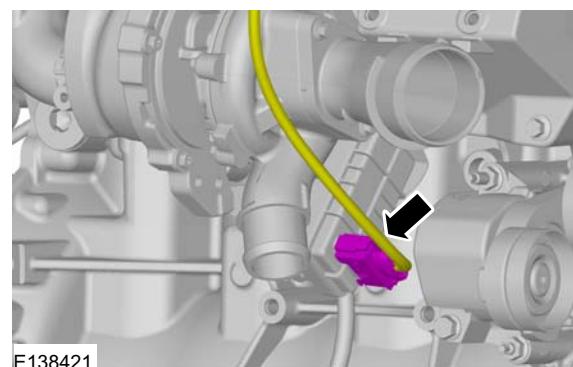
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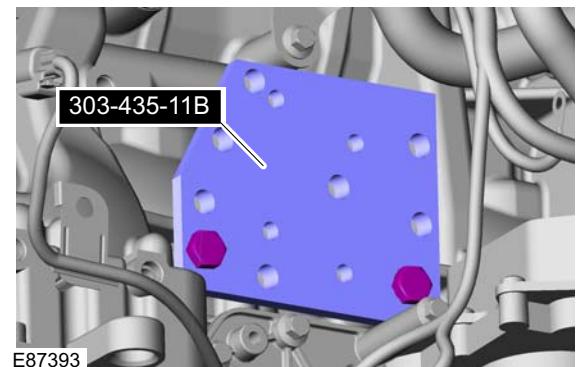
6.



4.

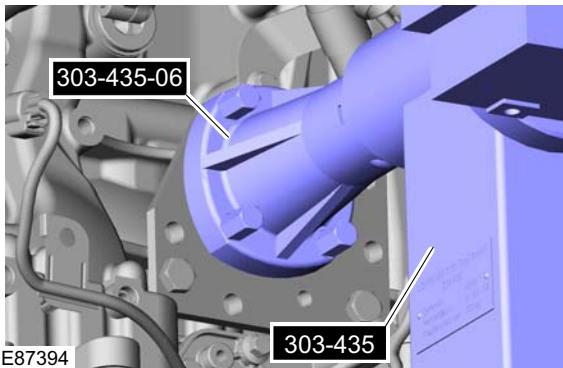


7. Install the Special Tool(s): 303-435-11B

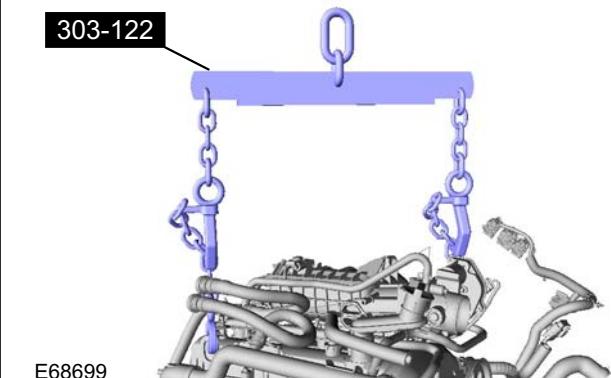


REMOVAL

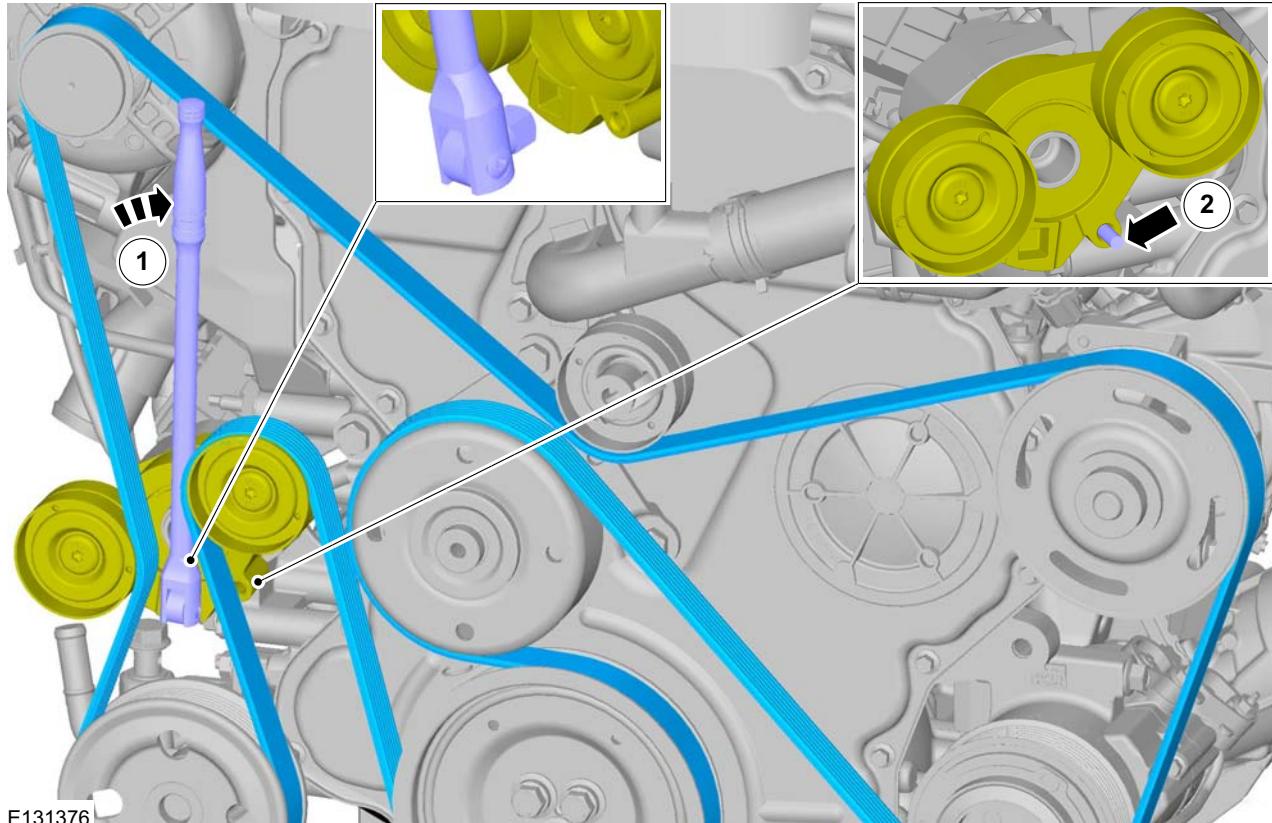
8. Install the Special Tool(s): 303-435, 303-435-06



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

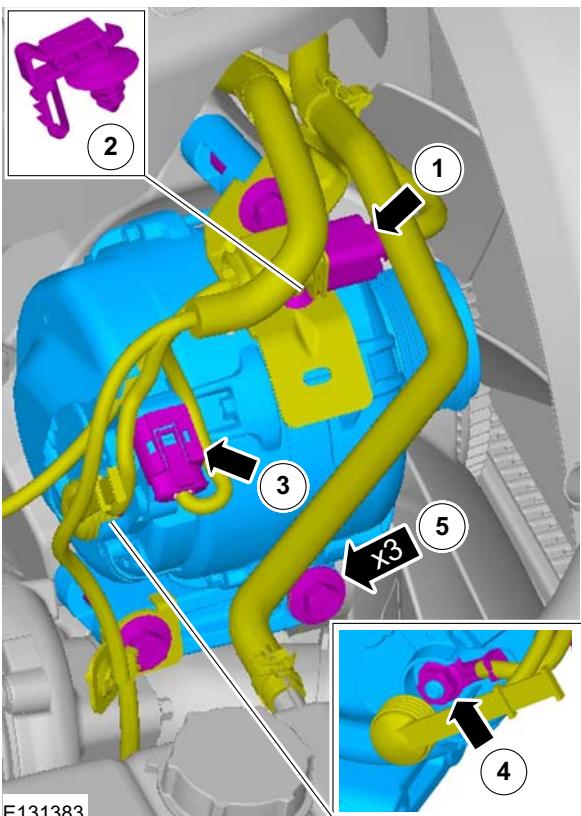
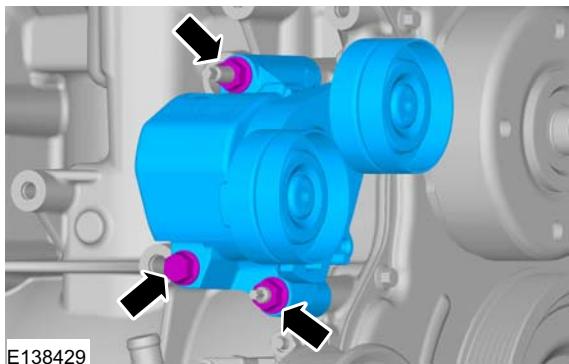
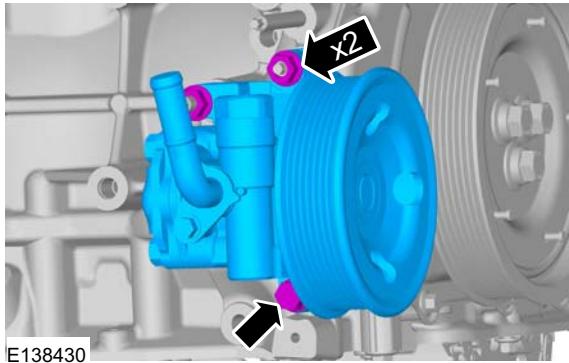
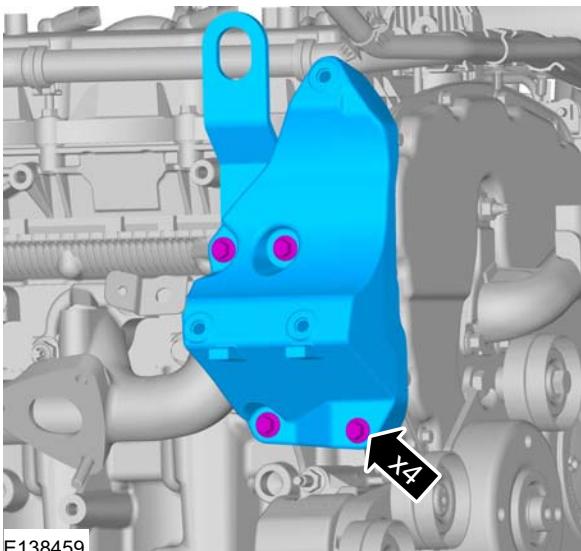
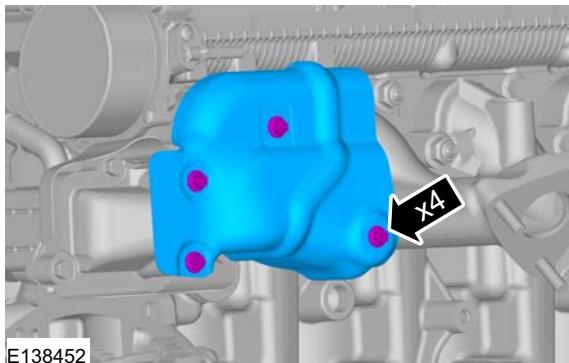


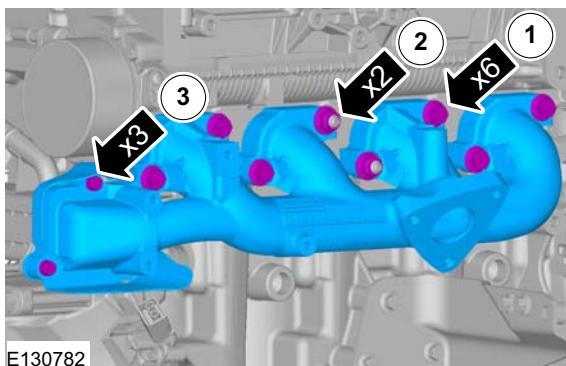
**10. General Equipment: 1/2 Inch Square Drive Breaker Bar
General Equipment: Dowel with a Diameter of 6 mm**



REMOVAL

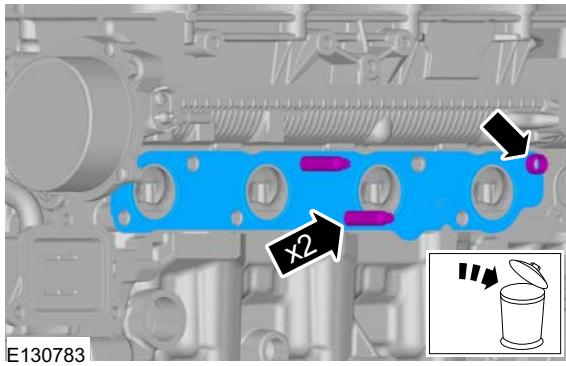
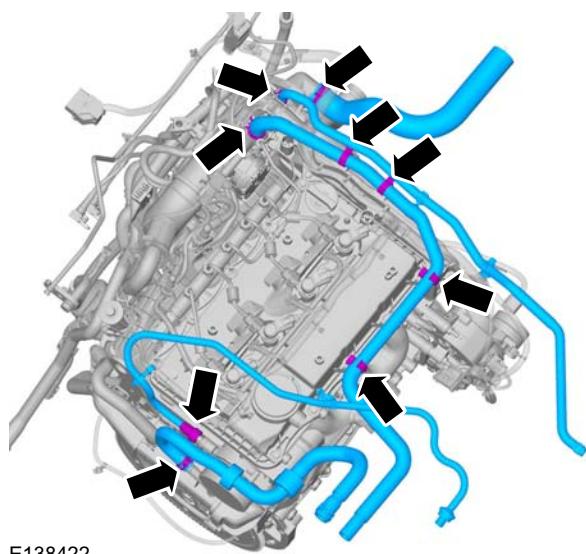
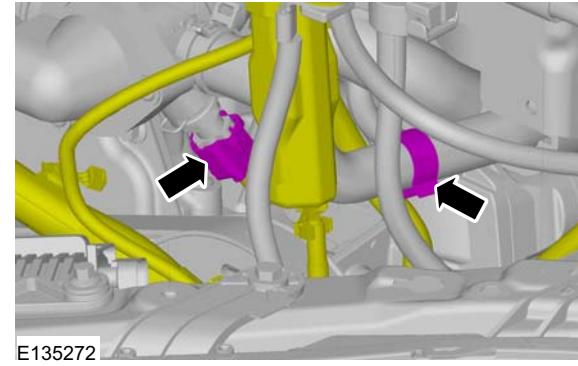
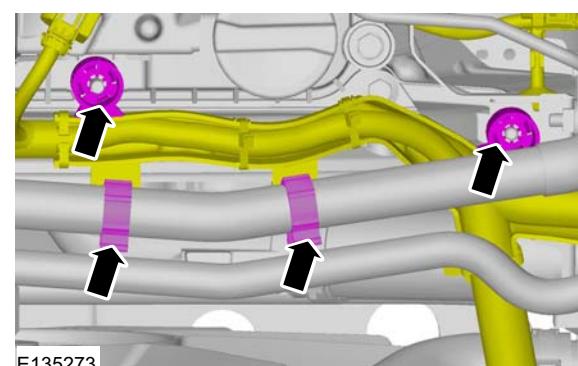
11.  **CAUTION:** Take extra care not to damage the wiring harnesses.

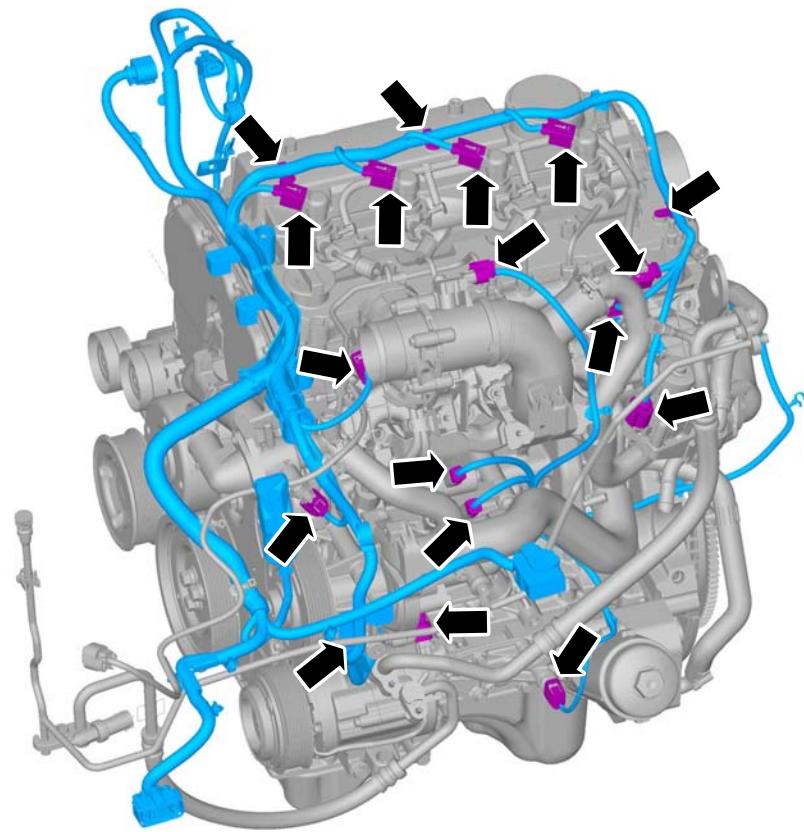
**13.****14.****12.****15.**

REMOVAL**16.**

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

NOTE: The studs are to be reused unless damaged.

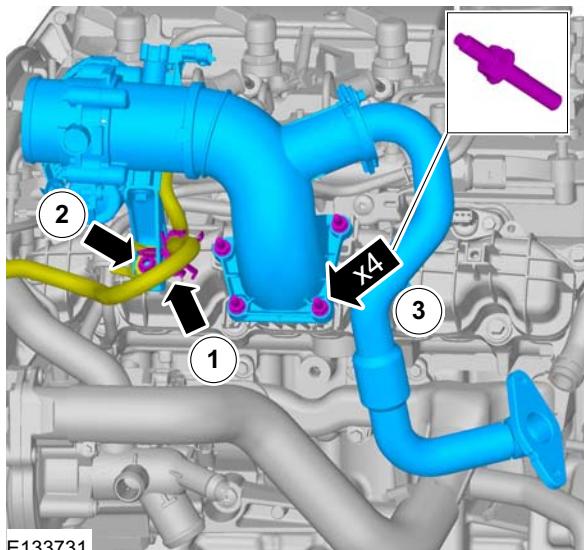
18.**19.****20.****21.**

REMOVAL

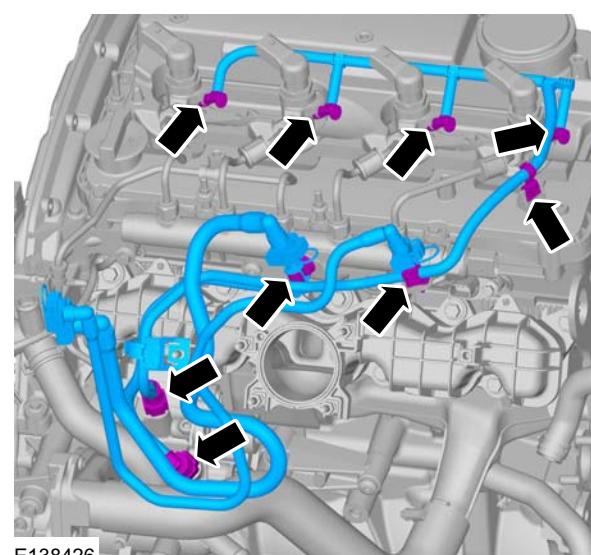
E138423

22

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



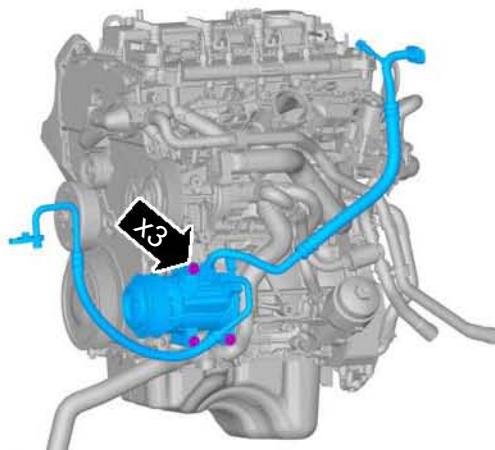
E133731



E138426

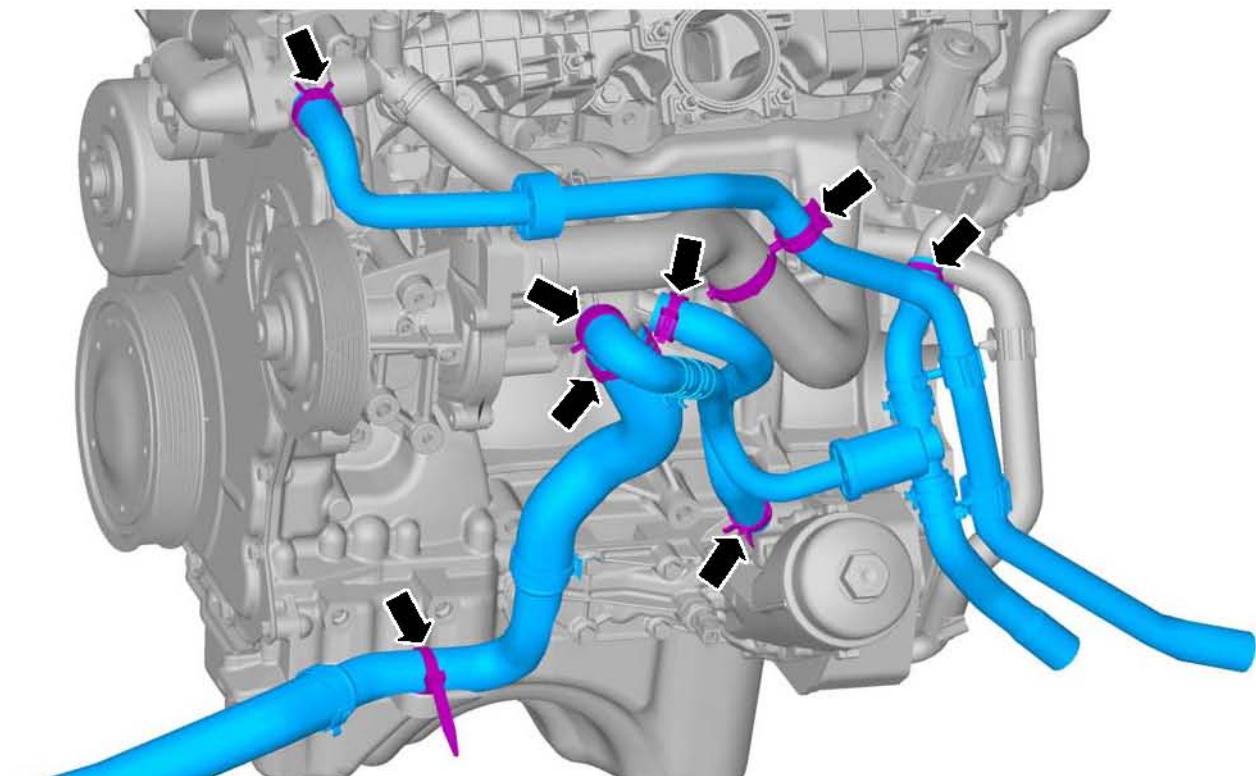
REMOVAL

24.



E138424

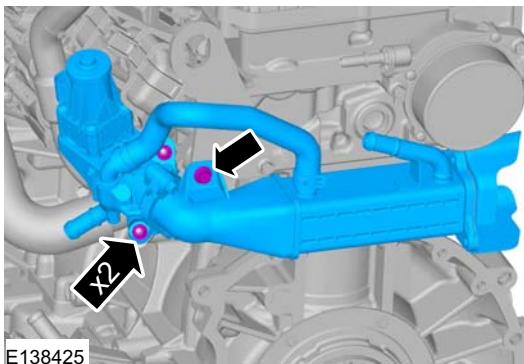
25.



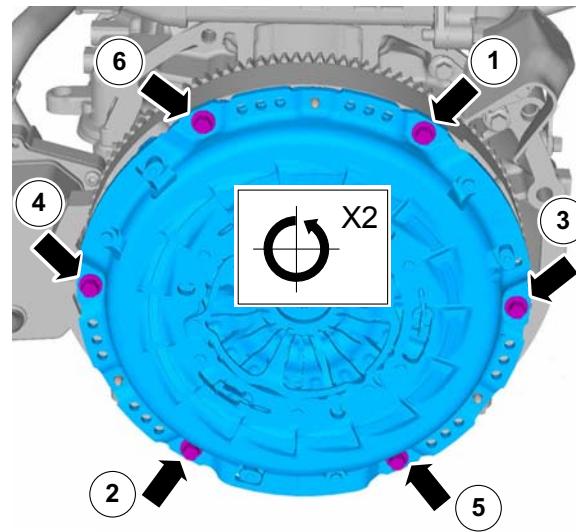
E138534

REMOVAL

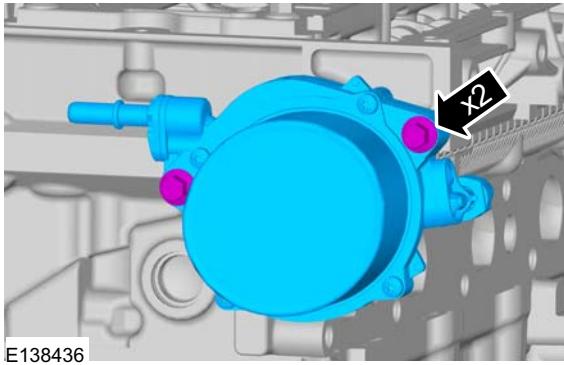
26.



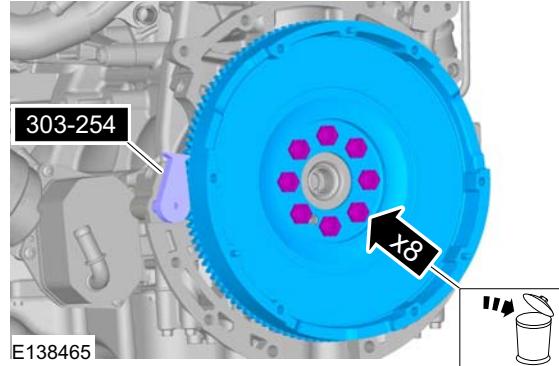
29. NOTE: Do not loosen the bolts more than 2 turns.



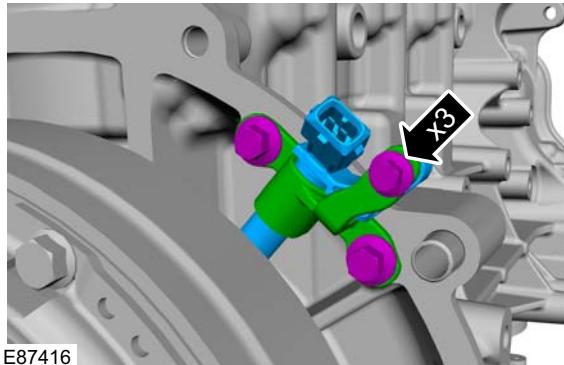
27.



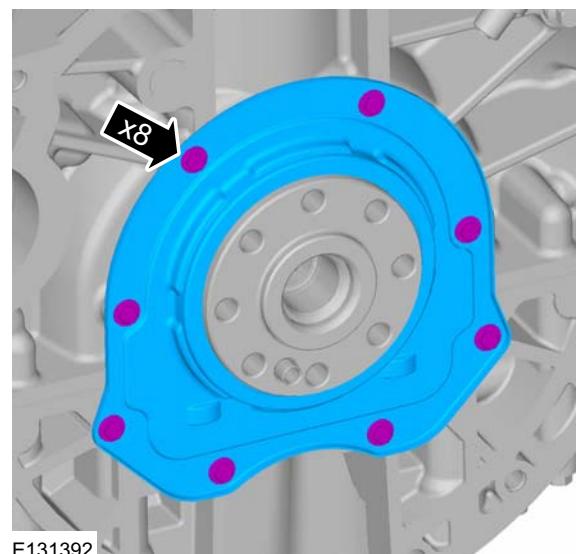
30. Special Tool(s): 303-254



28.

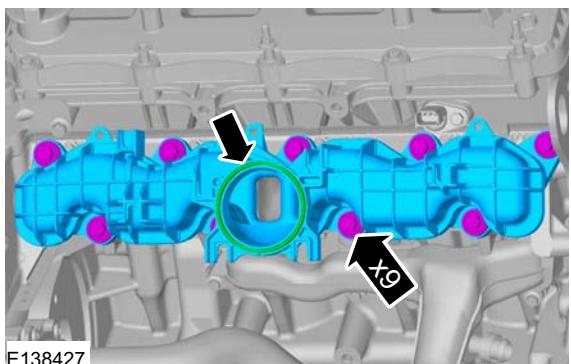


31.

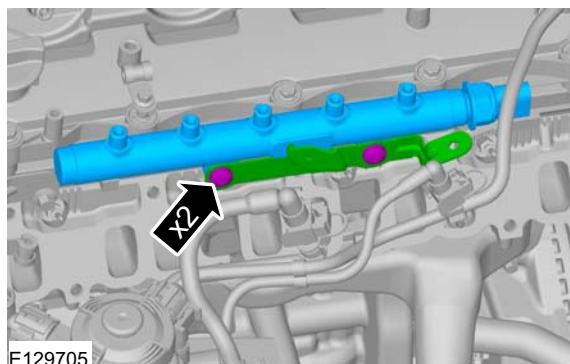


REMOVAL

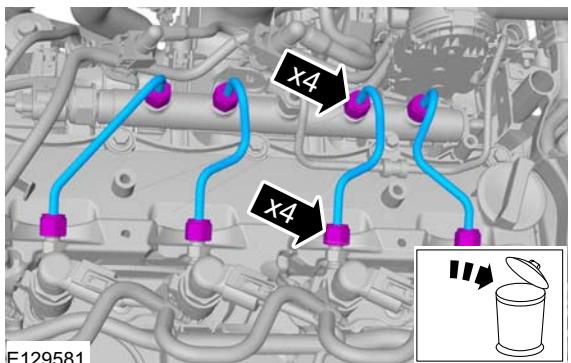
32.



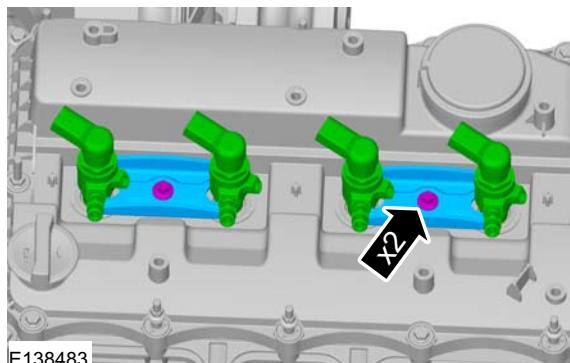
35.



33.

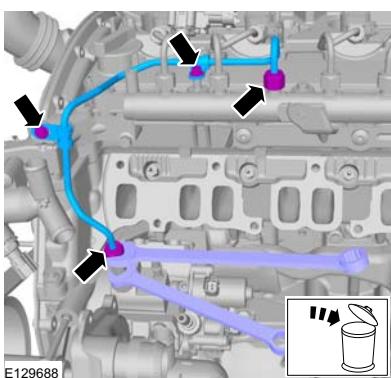
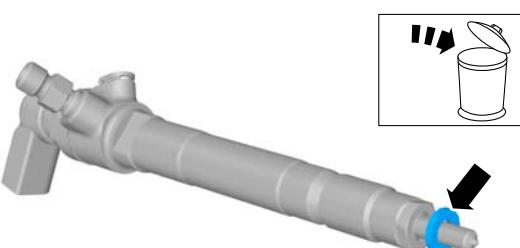


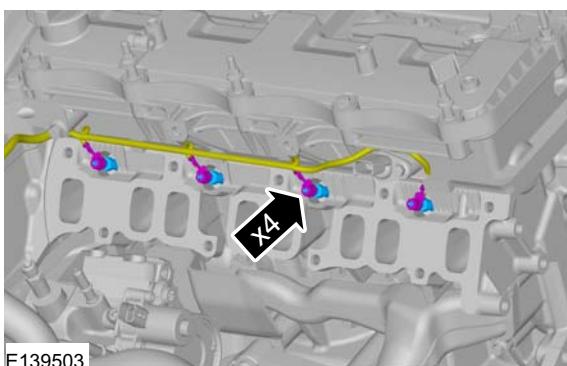
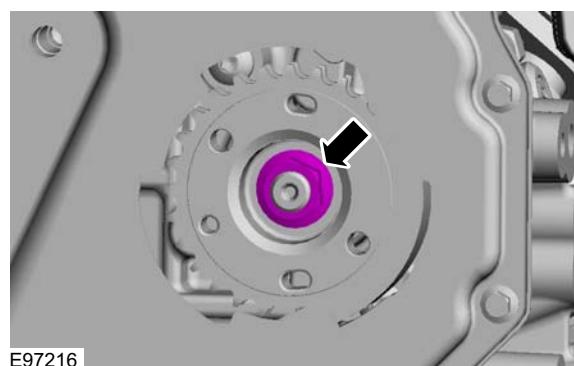
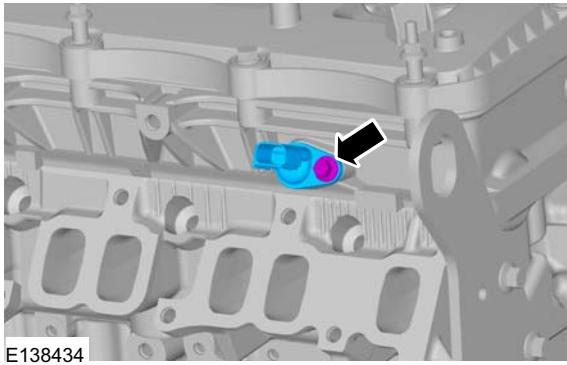
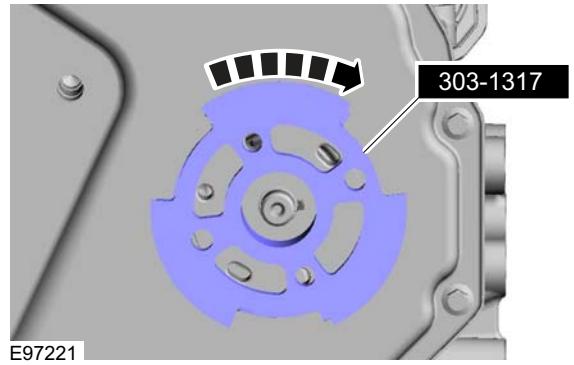
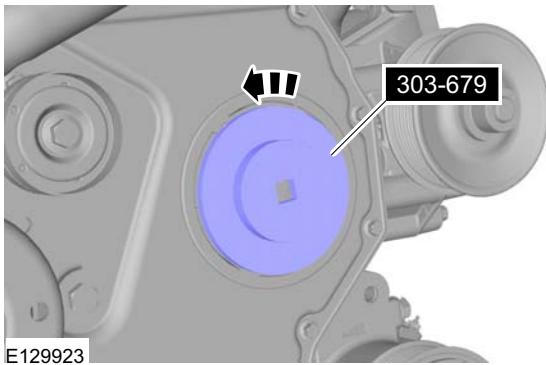
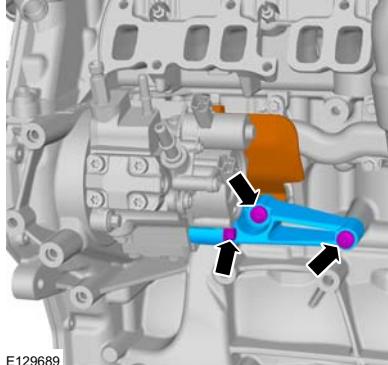
36.

**34. 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 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.**

37.



REMOVAL**38.****41.****39.****42 Install the Special Tool(s): 303-1317****40. Special Tool(s): 303-679****43.**

GROUP**1**

General Information

SECTION TITLE	PAGE
Service Information	
General Information.....	100-00
Identification Codes.....	100-01
Jacking and Lifting.....	100-02
Noise, Vibration and Harshness.....	100-04

DESCRIPTION AND OPERATION

disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiseling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment, working with asbestos-based materials or using spraying equipment.

Make sure there is adequate ventilation to control dusts, mists and fumes.

High Pressure Air, Lubrication and Oil Test Equipment

See also Lubricants and Greases.

Always keep high-pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high-pressure nozzle, for example diesel injector, at the skin as the fluid may penetrate to the underlying tissue, and cause serious injury.

Halon

See CFCs.

Legal Aspects

There are many laws and regulations relating to health and safety in the use and disposal of materials and equipment in a workshop.

For a safe working environment and to avoid environmental pollution, workshops should be familiar, in detail, with the many health and safety laws and regulations within their country, published by both national and local authorities.

Lubricants and Greases

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

Transmission Fluids

Safety instructions

Certain Transmission and Power Steering fluids supplied to Ford may contain additives which have the potential to cause skin disease (dermatitis) to exposed persons. The dermatitis may be irritant or allergic in nature. Risks are higher where prolonged or repeated skin contact with a fluid may occur. These fluids are used for vehicle initial fill and service purposes. This sub-section is to:

- Inform Service personnel who may come into contact with these vehicle fluids (hazard communication).
- Summarise appropriate workplace control measures and personal protective equipment requirements.
- Draw attention to the existence of Material Safety Datasheets (MSDS's) for the fluids (available from Ford Customer Service Division). These MSDS's contain detailed information on hazards and appropriate controls.

Control measures

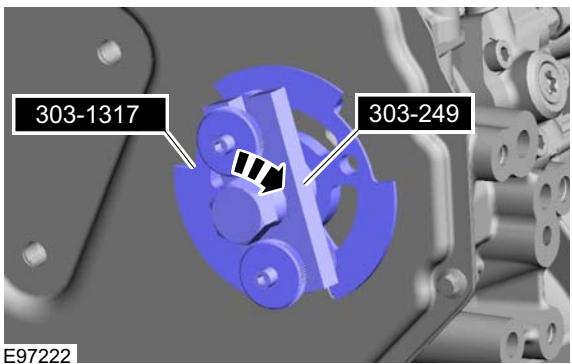
Workplace risk assessments made under national chemical control regulations should identify operations involving the fluids as potentially hazardous and specify workplace control and worker awareness measures. In such circumstances, the relevant Material Safety Datasheet (see the details specified below) which specifies hazards and control measures in detail should be made available for guidance.

Avoid unprotected skin contact with the fluids, and in particular, avoid prolonged or repeated skin contact. Work practices should be organised so as to minimise the potential for skin contact. This may include the use of drip trays, absorbents, correct fluid handling equipment (funnels etc), and workplace housekeeping measures such as the cleaning of contaminated surfaces.

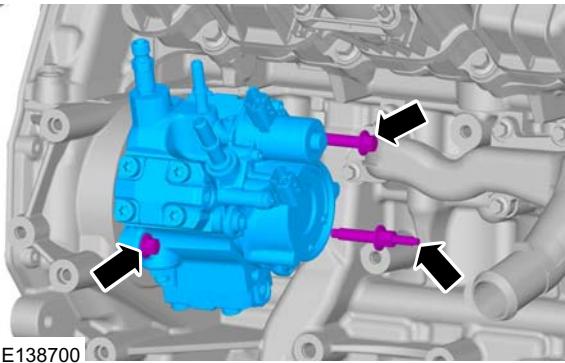
Personnel engaged in operations where skin contact could occur (such as fluid draining or filling) should wear impervious gloves made from nitrile rubber, certified to a chemical protection standard, e.g. Europe Standard EN374. This glove type is widely available from reputable suppliers of gloves for chemical protection [including the manufacturers Ansell-Admont (Solvex Range), North Safety products (North Nitrile Latex Gloves range), and

REMOVAL

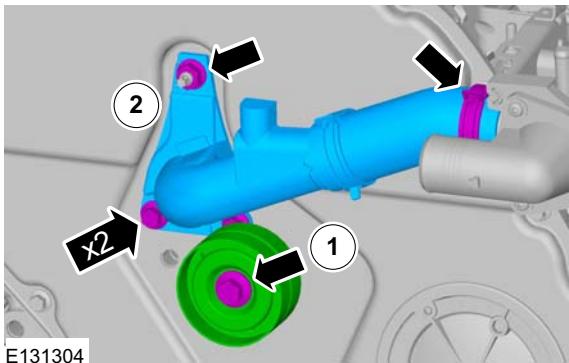
44. Special Tool(s): 303-1317, 303-249



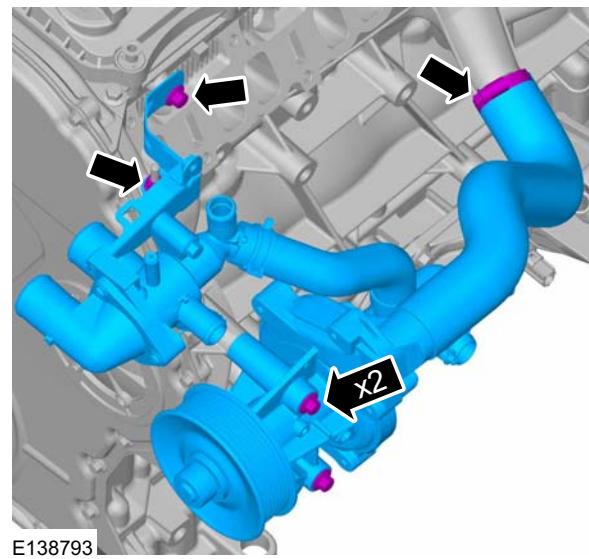
45.



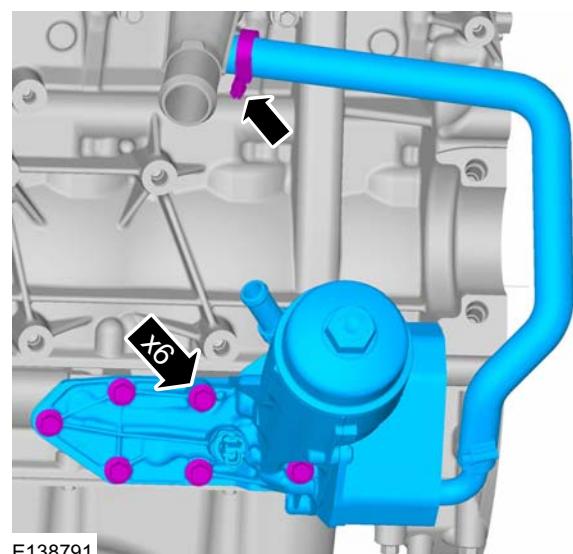
46.



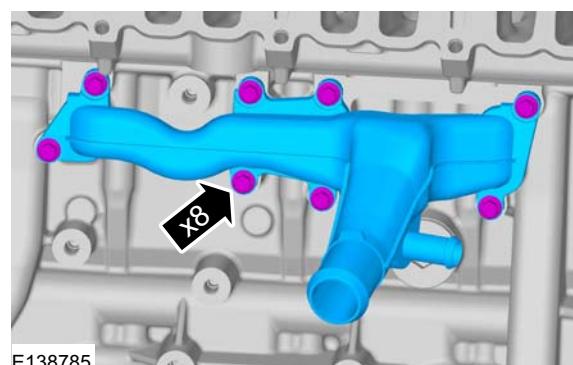
47.



48.



49.



DESCRIPTION AND OPERATION

Marigold Industrial (Blue Nitrile range)]. If gloves become torn or contaminated on the inside they should be replaced. Eye protection with safety glasses is appropriate. Use of an impervious apron and arm protectors may be necessary if more extensive exposure is possible. Use of skin barrier creams suitable for work with mineral oil products may offer some supplementary protection, but such barrier creams should not be used in place of protective clothing.

If accidental skin contact occurs with the fluids, wash the area thoroughly with soap or skin cleanser and water.

Accidental eye contact should be dealt with as per normal first aid practices, by flushing the eyes with an eye wash or clean cool water for 10 minutes, after which medical attention should be obtained.

Remove and launder clothing which becomes contaminated with the fluids. Do not place rags contaminated with fluid in clothing pockets.

Wash thoroughly after completing operations where skin exposure may have occurred.

It is important that personnel do not smoke, eat or drink whilst handling the fluids or affected transmissions. These measures are designed to limit the risk from accidental ingestion.

Label any decanted fluid properly/use an equivalent label to that on original product containers.

Clean up any spills promptly using an inert absorbent and wash down contaminated surfaces with detergent and water.

Dispose of any waste fluids safely as hazardous waste.

Safety Data Sheets

Safety Data Sheets, which detail specific material handling instructions and precautions are available from the respective national sales company, and via internet www.msds.ford.com.

Used Engine Oil

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants, which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

Environmental Precautions

Burning used engine oil in small space heaters or boilers can be recommended only for units of approved design. If in doubt check with the appropriate local authority and manufacturer of approved appliances.

Dispose of used oil and used oil filters through authorized waste disposal contractors or licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the relevant local authority for advice on disposal facilities.

It is illegal to pour used oil on to the ground, down sewers or drains, or into watercourses.

Noise

Some operations may produce high noise levels, which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

Noise Insulation Materials

See [Foams, Fibre Insulation](#).

O-Rings (Fluoroelastomer)

See [Viton](#).

Paints

See also [Solvents, Chemical Materials](#).

Highly flammable, flammable - observe No Smoking policy

One Pack

Can contain harmful or toxic pigments, driers and other components as well as solvents. Spraying should be carried out only with adequate ventilation.

DESCRIPTION AND OPERATION

Two Pack

Can also contain harmful and toxic unreacted resins and resin hardening agents. The manufacturers instructions should be followed. See also Resin-based Adhesives and Isocyanate Adhesives and Sealers under Adhesives and Sealers.

Spraying should preferably be carried out in exhausted ventilated booths removing vapor and spray mists from the breathing zone. Individuals working in booths should wear appropriate respiratory protection. Those doing small-scale repair work in the open workshop should wear air-fed respirators.

Pressurized Equipment

See [High Pressure Air, Lubrication and Oil Test Equipment](#).

Solder

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used.

Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be produced.

Some fumes may be produced by the application of any flame to surfaces coated with grease, and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to make sure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

Solvents

See also [Chemical Materials, Fuels \(Kerosene\), Fire](#).

For example acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning and dewaxing materials, paints, plastics, resins and thinners.

Some may be highly flammable or flammable.

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure of high concentrations of vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapors or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs, for example through vomiting, is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Make sure there is good ventilation when in use, avoid breathing fumes, vapors and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, for example paints, adhesive, coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers instructions.

Sound Insulation

See [Fibre Insulation, Foams](#).

Suspended Loads

 **CAUTION: Never improvise lifting tackle.**

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended or raised load, for example a suspended engine.

Always make sure that lifting equipment such as jacks, hoists, axle stands and slings are adequate and suitable for the job, in good condition and regularly maintained.

DESCRIPTION AND OPERATION

Transmission Brake Bands

See [Asbestos](#).

Underseal

See [Corrosion Protection](#).

Viton

In common with many other manufacturers vehicles, some components have O-rings, seals or gaskets, which contain a material known as 'Viton'.

Viton is a fluoroelastomer, that is a synthetic rubber type material, which contains Fluorine. It is commonly used for O-rings, gaskets and seals of all types. Although Viton is the most well known fluoroelastomer, there are others, including Fluorel and Tecmoflon.

When used under design conditions fluoroelastomers are perfectly safe. If, however, they are exposed to temperatures in excess of 400°C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and may be absorbed directly, through contact, into the general body system.

O-rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT; under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluoroelastomer has been used in the affected O-ring, seal or gasket. If they are of natural rubber or nitrile there is no hazard. If in doubt, be cautious, as the material may be Viton or any fluoroelastomer.

If Viton or any other fluoroelastomers have been used, the affected area should be decontaminated before the commencement of work.

Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralize the acid before disposing of the decomposed Viton residue and final cleaning of the area. After use, the plastic gloves should be discarded carefully and safely.

Welding

See also [Fire](#), [Electric Shock](#), [Gas Cylinders](#).

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at a high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultra-violet radiation, which may cause arc-eye, and skin burns to the operator and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

CONTACT LENS WEARERS ARE ADVISED TO REVERT TO ORDINARY SPECTACLES WHEN ARC WELDING as the arc spectrum is believed to emit microwaves which dry out the fluid between the lens and the eye. This may result in blindness when the lens is removed from the eye.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

Gas Welding (and Cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

DESCRIPTION AND OPERATION

The flame is bright, and eye protection should be used, but the ultra-violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be produced from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

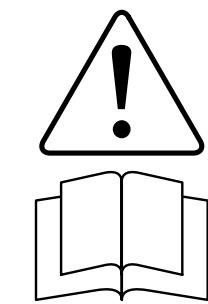
SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS, WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, FOR EXAMPLE BOILING OR STEAMING OUT OF FUEL TANKS.

Warning Symbols on Vehicles

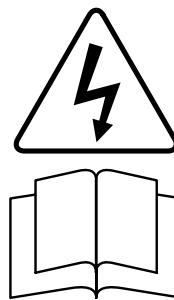
Decals showing warning symbols will be found on various vehicle components.

These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

The most commonly found decals are reproduced below together with an explanation of the warnings.

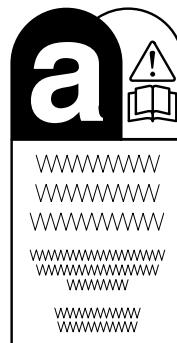


TIM01001



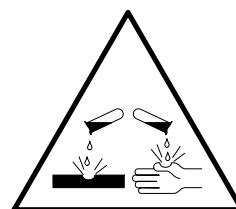
TIM01002

- Components or assemblies displaying the warning triangle with the 'electrified' arrow and open book symbol give warning of inherent high voltages. Never touch these with the engine running or the ignition switched on. See Electric Shock in this subsection.



TIM01003

- Vehicles and replacement components which contain asbestos are identified by this symbol. See Asbestos in this subsection.



TIM01004

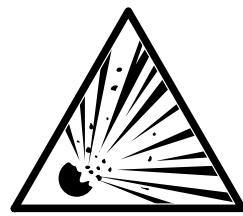
- Components or assemblies displaying the caution triangle and open book symbol advise consultation of the relevant section of the owner literature before touching or attempting adjustments of any kind.

- Components or assemblies displaying this symbol give warning that the component contains a corrosive substance. See Acids and Alkalies in this subsection.

DESCRIPTION AND OPERATION

TIM0101005

5. Displaying the caution circle with a deleted lighted match symbol, caution against the use of naked lights or flames within the immediate vicinity due to the presence of highly flammable or explosive liquids or vapors. See Fire in this subsection.



TIM0101006

6. Displaying this symbol (normally in conjunction with 5 above) warn of the presence of potentially explosive matter within the immediate vicinity.



TI0101008

7. Displaying this symbol warn that children should not be allowed in the immediate vicinity unsupervised.

White Spirit

See Solvents.

DESCRIPTION AND OPERATION

Standard Workshop Practices

Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

- the parking brake is applied or the wheels are securely chocked to prevent the vehicle moving forwards or backwards.
- the key is removed from key operated hood locks before any work is carried out around the front of the vehicle.
- if the engine is to be run, there is adequate ventilation, or an extraction hose to remove exhaust fumes.
- there is adequate room to raise the vehicle and remove the wheels, if necessary.
- fender covers are always fitted if any work is to be carried out in the engine compartment.
- the battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is raised.

 **CAUTION:** When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

- if using welding equipment on the vehicle, a suitable fire extinguisher is readily available.

Towing the Vehicle

 **WARNING:** When the vehicle is being towed, the ignition switch must be in position II (steering lock released and warning lamps illuminated). Only then will the steering, turn signal lamps, horn and stop lamps be operational. Failure to follow these instructions may result in personal injury.

NOTE: The removable towing eye (if equipped), has a left-hand thread and must be fully tightened before towing can commence.

When towing is necessary, the vehicle towing eyes should be used. The rope must be securely fastened to the towing eyes and must also be attached to the other vehicle such that the rope will not foul the bodywork.

When a vehicle with automatic transmission is towed, the gear selector must be in position N

(Neutral). Never tow a vehicle with automatic transmission at a speed greater than 30 mph (50 km/h) or for a distance greater than 30 miles (50 km). If it is necessary to tow the vehicle a greater distance, the drive wheels must be lifted clear off the ground.

Alternatively the vehicle can be transported on a low loader or a trailer.

Connecting a Slave Battery Using Jumper Cables

 **WARNING:** If the slave battery has recently been charged and is gassing, cover the vent plugs or covers with a damp cloth to reduce the risk of explosion should arcing occur when connecting the jumper cables. Failure to follow these instructions may result in personal injury.

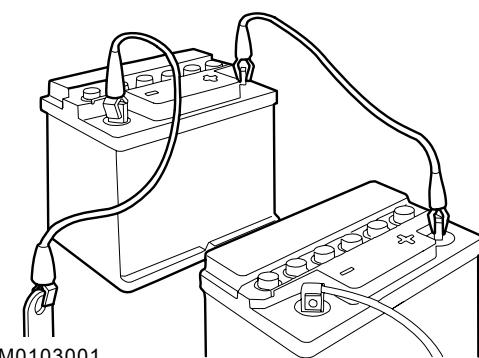
CAUTIONS:

 A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all normal circuits are switched off. This can cause arcing when the jumper cables are connected.

 While it is not recommended that the vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. In such an instance, the discharged battery must be recharged immediately after jump starting to avoid permanent damage.

- Always make sure that the jumper cables are adequate for the task. Heavy duty cables must be used.
- Always make sure that the slave battery is of the same voltage as the vehicle battery. The batteries must be connected in parallel.
- Always make sure that switched electric circuits are switched off before connecting jumper cables. This reduces the risk of arcing occurring when the final connection is made.

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⚠ WARNING: Make sure that the ends of the jumper cables do not touch each other or ground against the vehicle body at any time while the cables are attached to the battery. A fully charged battery, if shorted through jumper cables, can discharge at a rate well above 1000 amps causing violent arcing and very rapid heating of the jumper cables and terminals, and can even cause the battery to explode. Failure to follow these instructions may result in personal injury.

Always connect the jumper cables in the following sequence:

- Slave battery positive first and then vehicle battery positive.
- Slave battery negative next and then vehicle ground at least 12 inches (300 mm) from the battery terminal, for example engine lifting eye.

Always reduce the engine speed to idle before disconnecting the jumper cables.

Before removing the jumper cables from the vehicle that had the discharged battery, switch on the heater blower (high) or the heated rear window, to reduce the voltage peak when the cables are removed.

Always disconnect the jumper cables in the reverse order to the connecting sequence and do not short the ends of the cables.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of eight hours continuous driving with no additional loads placed on the battery.

Component Cleaning

To prevent the ingress of dirt, accumulations of loose dirt and greasy deposits should be removed

before disconnecting or dismantling components or assemblies.

Components should be thoroughly cleaned before inspection prior to reassembly.

Cleaning Methods:

- Dry cleaning.
- Removal of loose dirt with soft or cable brushes.
- Scraping dirt off with a piece of metal or wood.
- Wiping off with a rag.

⚠ WARNING: Wear eye protection when cleaning vehicle components with compressed air, a steam cleaner or a power washer. Failure to follow this instruction may result in personal injury.

CAUTIONS:

⚠ Compressed air is sometimes 'wet' so use with caution, especially on hydraulic systems.

⚠ To prevent damage to the electrical connectors in the engine compartment, do not use a steam cleaner or a power washer to clean the engine compartment.

- Blowing dirt off with compressed air.
- Removal of dry dust using vacuum equipment. This method must always be used to remove friction lining material dust (asbestos particles).
- Steam cleaning.

⚠ WARNING: Most solvents require careful handling and some are harmful. Refer to Health and Safety Precautions and to the manufacturers literature for the relevant safety precautions. Failure to follow these instructions may result in personal injury.

Various solvents are available which are suitable for component cleaning. Some components, such as brake hydraulic parts and electrical assemblies should be cleaned only with recommended solvents — refer to Solvents, Sealers and Adhesives or to the section of the manual relevant to the component.

Calibration of Essential Measuring Equipment

⚠ WARNING: Equipment, which requires regular calibration, must be calibrated in accordance with the manufacturers

DESCRIPTION AND OPERATION

instructions. Failure to follow this instruction may result in personal injury or damage to components.

It is of fundamental importance that certain essential equipment, for example torque wrenches, multimeters, exhaust gas analyzers or rolling roads, are regularly calibrated in accordance with the manufacturers instructions.

DESCRIPTION AND OPERATION**Solvents, Sealants and Adhesives****Introduction**

 **WARNING:** Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.

 **CAUTION:** If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information regarding storage, handling and application.

The Health and Safety Precautions subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken.

SECTION 100-00 General Information

VEHICLE APPLICATION: BT50 & Ranger

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Road/Roller Testing

Road or roller testing may be carried out for various reasons and a procedure detailing pre-test checks, engine starting and stopping, pre-driving checks, on-test checks and final checks to be completed on completion of the test is given below.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system(s) being checked can be extracted.

Pre-Test Checks

 **WARNING:** If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.

It is suggested that pre-test checks and functional tests of those systems and circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or roller test.

With the ignition switched off, check:

- the engine oil level.
- the engine coolant level.
- the tires, for correct pressure, compatible types and tread patterns, and wear within limits.
- that there is sufficient fuel in the tank to complete the test.
- all around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test.

Starting the Engine

NOTE: On initial drive away from cold and within the first 1.5 km (1 mile), do not depress the accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.

With the ignition switched off, check:

- that the parking brake is applied.
- that the gear lever is in the neutral position.
- that all instrument gauges (except fuel gauge) read zero.

With the ignition switched on, check:

- that the ignition controlled warning lamps are illuminated.
- that the engine temperature gauge registers a reading compatible with the engine temperature.
- that the fuel gauge registers a reading appropriate to the fuel level in the tank.
- the operation of the parking brake warning lamp and fluid level warning indicator.

Road or Roller Testing

 **CAUTION:** If road testing, check the brake operation while still traveling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

During the road or roller test, check:

- that the clutch pedal operation is not stiff or heavy.
- that the initial gear engagement is smooth and there is no evidence of clutch drag.
- that the parking brake control operates smoothly and releases quickly and completely.
- that the clutch takes up the drive smoothly, without slip or judder.
- that gear changing is smooth with no abnormal noises or vibrations from the transmission.
- the engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation is not stiff or heavy, and engine speed returns to idle correctly.
- there is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions.
- that steering operation, including power steering (if equipped), is smooth, accurate, not excessively heavy or with excessive free play or vibration.
- that the steering does not pull to one side and self centers smoothly after cornering.

DESCRIPTION AND OPERATION

- that the speedometer, coolant temperature gauge and tachometer (if equipped) register the correct readings and operate correctly.
 - that the switches and controls operate smoothly and positively, warning and indicator lamps operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.
 - that the heating and ventilation systems operate correctly and effectively.
 - the brake operation and efficiency.
- oil, coolant, hydraulic, air and fuel leaks.
 - abnormal temperature of any moving components or assemblies, for example wheel hubs, transmission and axle, which might indicate over tightness or lack of lubrication.

Brake Testing

 **WARNING:** When brake testing, avoid breathing the fumes from hot brakes, this may contain asbestos dust which is hazardous to health. Failure to follow this instruction may result in personal injury.

For additional information, refer to: **Health and Safety Precautions (100-00 General Information, Description and Operation).**

CAUTIONS:

 Avoid brake testing on busy roads where it may cause inconvenience or danger to other road users.

 Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A brake disc or brake drum that feels hot or is appreciably hotter than the others, indicates that the brake is binding.

After completion of the test, check for:

DESCRIPTION AND OPERATION**Air Conditioning (A/C) System Health and Safety Precautions****WARNINGS:**

- ⚠ Only qualified technicians are allowed to work on air conditioning (A/C) systems.
- ⚠ Air conditioning (A/C) system components can become particularly hot or cold.
- ⚠ Make sure that the air conditioning (A/C) system is at ambient temperature before carrying out any repair.
- ⚠ When handling refrigerants, always wear protective goggles and gloves made of fluoroelastomer. Leather or fabric gloves are not suitable.
- ⚠ **SKIN CONTACT:** If liquid refrigerant comes into contact with the skin, it produces severe frostbite. Immediately flush affected areas with plenty of cold running water for 15 minutes. Seek medical attention.
- ⚠ **EYE CONTACT:** If refrigerant comes into contact with the eyes, immediately flush the eyes with plenty of running water for 15 minutes. Seek medical attention.
- ⚠ **INHALED:** Toxic gases generated when refrigerant is heated are hazardous to health. The gases have an irritating smell and can cause lung damage. The symptoms can continue for a long time after having been in contact with the gases. The gases can cause lung damage even if the amount of gas in the air is too small to smell.
- ⚠ Refrigerant is flammable and explosive.
- ⚠ Make sure that refrigerant bottles are not exposed to temperatures greater than 45°C.
- ⚠ Make sure that the local regulations regarding work on air conditioning (A/C) systems are adhered to.
- ⚠ Make sure that refrigerant bottles are closed properly.
- ⚠ Gaseous refrigerant has a higher density than air. There is a danger of suffocation when working close to the ground or in workshop pits.
- ⚠ Provide adequate ventilation when handling refrigerant.
- ⚠ Never release refrigerant into the atmosphere.

- ⚠ Only use special tools, equipment and lubricants that are approved for the type of refrigerant being used.
- ⚠ Always follow the manufacturer's instructions for the correct servicing unit operating procedure.

CAUTIONS:

- ⚠ Do not mix refrigerant oils for different types of refrigerant.
- ⚠ Never mix different types of refrigerant or equipment intended for them.
- ⚠ Only use refrigerant in gas form when filling the system through the low-pressure connection.
- ⚠ Only use refrigerant in liquid form when filling the system through the high-pressure connection.
- ⚠ Refrigerant attacks certain plastics. Only use seals suitable for refrigerant.
- ⚠ If the air conditioning (A/C) compressor is damaged, the fixed orifice tube can become blocked with metal particles.
- ⚠ Any sort of blockage in the refrigerant circuit will damage the air conditioning (A/C) compressor irreparably.
- ⚠ If the air conditioning (A/C) system has been opened for a period greater than 2 hours, a new receiver drier must be installed and the evacuating time to be increased by a minimum of 2 hours.

NOTE: New air conditioning (A/C) compressors are delivered prefilled.

NOTE: Refrigerant oil in new air conditioning (A/C) compressors can contain Teflon, visible as white particles, which will not harm the system.

DESCRIPTION AND OPERATION**Battery and Battery Charging Health and Safety Precautions****WARNINGS:**

-  **Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Wear safety goggles when working near the battery to protect against possible splashing of the acid solution.**
-  **EYE CONTACT:** If acid comes into contact with the eyes, flush immediately with plenty of running water for a minimum of 15 minutes. Seek immediate medical attention.
-  **SKIN CONTACT:** If acid comes into contact with the skin, flush immediately with plenty of running water for a minimum of 15 minutes. Seek immediate medical attention.
-  **SWALLOWED:** If acid is swallowed, rinse the mouth with plenty of water and then drink plenty of water or milk. Do not induce vomiting. Seek immediate medical attention.
-  **Batteries normally produce explosive gases. Do not allow naked flames, sparks or lighted substances to come near the battery.**
-  **When charging the battery shield your face and wear safety goggles. Provide adequate ventilation.**
-  **CAUTION:** Boost charging with excessive current or voltage above 16 volts will damage the battery.

DESCRIPTION AND OPERATION**Brake System Health and Safety Precautions****WARNINGS:**

-  **EYE CONTACT:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid comes into contact with the eyes, flush the eyes with plenty of cold running water for 15 minutes. Seek medical attention for any persistent eye irritation or abnormality.
-  **SWALLOWED:** Brake fluid contains polyglycol ethers and polyglycols. If swallowed, drink plenty of water. Seek immediate medical attention.
-  **INHALED:** Dust from friction materials can be harmful if inhaled.
-  Only use new specified brake fluid from airtight containers.
-  **CAUTION:** If brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

DESCRIPTION AND OPERATION**Steering System Health and Safety Precautions****WARNINGS:**

- ⚠ When handling the power steering fluid, always wear protective goggles and gloves made of nitril.**
- ⚠ EYE CONTACT: Power steering fluid contains long chain alkyl amine thiophosphate. Avoid contact with the eyes. Wash hands thoroughly after handling. If power steering fluid comes into contact with the eyes, flush the eyes with plenty of cold running water for 15 minutes. Seek medical attention for any persistent eye irritation or abnormality.**
- ⚠ SKIN CONTACT: If power steering fluid comes into contact with the skin, remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality.**
- ⚠ INHALED: If oil mist is inhaled, move a victim to fresh air. Keep a victim warm and at rest. Seek immediate medical attention in cases of throat irritation or coughing.**
- ⚠ SWALLOWED: Power steering fluid contains long chain alkyl amine thiophosphate. If swallowed, drink plenty of water. Seek immediate medical attention.**
- ⚠ CAUTION: If the power steering fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.**

DESCRIPTION AND OPERATION**Engine Cooling System Health and Safety Precautions****WARNINGS:**

-  **Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.**
-  **Vapors may be given off from antifreeze when heated. Avoid breathing these vapors.**
-  **SKIN CONTACT:** Antifreeze may be absorbed through the skin in toxic or harmful quantities.
-  **SWALLOWED:** If antifreeze is swallowed, drink plenty of water, induce vomiting. Seek immediate medical attention.
-  **Antifreeze must not be used in any cooling or industrial water system that is connected or linked to general water supplies.**

DESCRIPTION AND OPERATION**Petrol and Petrol-Ethanol Fuel Systems Health and Safety
Precautions****WARNINGS:**

-  **Fuel may not give adequate warning before toxic or harmful effects arise.**
-  **Exposure to fuel can be harmful and can cause severe health damage or death.**
-  **Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.**
-  **Highly flammable mixtures are always present and may ignite when working on fuel systems. Do not allow naked flames, sparks or lighted substances to come near fuel related components.**
-  **Fuel must not be used as a cleaning agent.**
-  **Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.**
-  **SKIN CONTACT: Excessive or prolonged skin contact with diesel fuel may cause serious skin disorders including skin cancer.**
-  **SKIN CONTACT: Fuel is mildly irritating to the skin and may cause dermatitis due to defatting effect. Remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality. Wash contaminated clothing before reuse.**
-  **EYE CONTACT: Fuel is mildly irritating to the eyes. Flush with plenty of running water, blinking as often as possible. Do not force the eyelid open. Seek medical attention for any persistent eye irritation or abnormality.**
-  **SWALLOWED: Fuel is moderately toxic and tends to foam on vomiting. If drawn into the lungs, inflammation may develop. Do not induce vomiting. If spontaneous vomiting occurs place the victim in a forward position to reduce the risk of fuel being drawn into the lungs. Give nothing by mouth. If breathing but unconscious, place in the recovery position. If breathing**

has stopped, apply artificial respiration. Seek immediate medical attention.

-  **INHALED: Fuel is toxic to the respiratory and other body systems. Exposure may result in various symptoms including drowsiness, unconsciousness or severe health damage. Move a victim to fresh air. Keep a victim warm and at rest. If unconscious, place in the recovery position. If not breathing, apply artificial respiration. Give cardiac massage if necessary. Seek immediate medical attention.**

CAUTIONS:

-  **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.**
-  **Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.**

DESCRIPTION AND OPERATION**Diesel Fuel System Health and Safety Precautions****WARNINGS:**

- ⚠ Fuel may not give adequate warning before toxic or harmful effects arise.**
- ⚠ Exposure to fuel can be harmful and can cause severe health damage or death.**
- ⚠ Provide adequate ventilation when working on fuel systems.**
- ⚠ Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.**
- ⚠ Fuel must not be used as a cleaning agent.**
- ⚠ Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.**
- ⚠ SKIN CONTACT: Fuel is mildly irritating to the skin and may cause dermatitis due to defatting effect. Remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality. Wash contaminated clothing before reuse.**
- ⚠ SKIN CONTACT: Excessive or prolonged skin contact with diesel fuel may cause serious skin disorders including skin cancer.**
- ⚠ EYE CONTACT: Fuel is mildly irritating to the eyes. Flush with plenty of running water, blinking as often as possible. Do not force the eyelid open. Seek medical attention for any persistent eye irritation or abnormality.**
- ⚠ SWALLOWED: Fuel is moderately toxic and tends to foam on vomiting. If drawn into the lungs, inflammation may develop. Do not induce vomiting. If spontaneous vomiting occurs place the victim in a forward position to reduce the risk of fuel being drawn into the lungs. Give nothing by mouth. If breathing but unconscious, place in the recovery position. If breathing has stopped, apply artificial respiration. Seek immediate medical attention.**
- ⚠ INHALED: Fuel is toxic to the respiratory and other body systems. Exposure may result in various symptoms including**

drowsiness, unconsciousness or severe health damage. Move a victim to fresh air. Keep a victim warm and at rest. If unconscious, place in the recovery position. If not breathing, apply artificial respiration. Give cardiac massage if necessary. Seek immediate medical attention.

CAUTIONS:

- ⚠ Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.**
- ⚠ Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.**
- ⚠ Make sure that non-plated tools are used.**
- ⚠ Tools must be cleaned using a new brush and fresh suitable evaporative cleaning agent.**
- ⚠ Make sure to use a steel topped workbench covered with clean, lint-free, non-flocking material.**
- ⚠ Make sure that all parts removed from the vehicle are placed on the lint-free, non-flocking material.**
- ⚠ Make sure that any protective clothing worn is clean and made from lint-free, non-flocking material.**
- ⚠ Make sure to wear non-powdered latex type gloves.**
- ⚠ Make sure to protect all electrical components and connectors with lint-free non-flocking material before using the suitable evaporative cleaning agent.**

NOTE: Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

DESCRIPTION AND OPERATION**Liquefied Petroleum Gas (LPG) Fuel Systems Health and Safety Precautions**

 **WARNING:** Only fully trained technicians, who are conversant with local regulations, are to work on gas fuel systems.

Make sure that all components of the liquefied petroleum gas (LPG) fuel system are labeled with the ECE R 67.01 approval label.

Highly flammable. Observe "NO SMOKING" signs.

Fuel may not give adequate warning before toxic or harmful effects arise.

Exposure to fuel can be harmful and can cause severe health damage or death.

Only work on a vehicle in a designated area, that is well ventilated and with access restricted to authorized personnel.

If the smell of gas fuel is present, immediately advise all persons in the area to take preventative actions to prevent explosion or fire and evacuate the area.

Make sure that the area is ventilated and that no smell of gas fuel is present before returning to the area.

Long sleeved cotton overalls and rubber neoprene gloves must be worn during removal and installation of gas fuel system components.

EYE CONTACT: If liquefied petroleum gas (LPG) comes into contact with the eyes, immediately flush the eyes with plenty of running water for 15 minutes. Seek immediate medical attention.

INHALED: If liquefied petroleum gas (LPG) is inhaled, move a victim to fresh air. Keep a victim warm and at rest. If breathing stops, provide artificial respiration. Seek immediate medical attention.

SKIN CONTACT: If liquefied petroleum gas (LPG) comes into contact with the skin, it produces severe frostbite. Immediately flush affected areas with plenty of cold running water. Seek immediate medical attention.

If possible always close the gas fuel tank valve and run the engine on gas fuel until it automatically switches to petrol prior to taking the vehicle into the workshop area.

Make sure that the gas fuel system pressure has been released before starting work on the gas fuel circuit.

Do not use compressed air to force gas fuel out of the fuel tank.

Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.

The gas fuel tank must be removed prior to moving the vehicle into paint drying ovens above 40°C.

Situations, such as extremely hot days, may cause the gas fuel system to vent off.

Install new warning labels to the original locations.

 **CAUTION:** Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.

Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.

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DESCRIPTION AND OPERATION**Compressed Natural Gas (CNG) Fuel Systems Health and Safety Precautions****WARNINGS:**

-  **Highly flammable and explosive mixtures are always present and may ignite when working on fuel systems. Do not allow naked flames, sparks or lighted substances to come near fuel related components.**
-  **Only qualified technicians are allowed to work on CNG (compressed natural gas) systems.**

Make sure that all components of the CNG fuel system are labeled with the ECE R 110 approval label.

Fuel may not give adequate warning before toxic or harmful effects arise.

Exposure to fuel can be harmful and can cause severe health damage or death.

EYE CONTACT: If CNG comes into contact with the eyes, immediately flush the eyes with plenty of running water for 15 minutes. Seek immediate medical attention.

INHALED: If CNG is inhaled, move a victim to fresh air. Keep a victim warm and at rest. If breathing stops, provide artificial respiration. Seek immediate medical attention.

SKIN CONTACT: If CNG comes into contact with the skin, it produces severe frostbite. Immediately flush affected areas with plenty of cold running water. Seek immediate medical attention.

Provide adequate ventilation when working on fuel systems.

Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.

DESCRIPTION AND OPERATION**Supplemental Restraint System (SRS) Health and Safety Precautions****WARNINGS:**

- ⚠ Only qualified technicians are allowed to work on pyrotechnic components.
- ⚠ INHALED: Exposure to pyrotechnic residue may cause low blood pressure, severe headache, irritation of mucous membranes, fainting, shortness of breath or rapid pulse. Move a victim to fresh air. Seek immediate medical attention.
- ⚠ EYE CONTACT: Exposure to unburned pyrotechnic residue may cause irritation, burning and etching of the eyes. Flush immediately with plenty of cold running water for at least 15 minutes. Seek immediate medical attention.
- ⚠ EYE CONTACT: Exposure to burned pyrotechnic residue may cause irritation, burning and etching of the eyes. Flush immediately with diluted boric acid solution. Seek immediate medical attention.
- ⚠ SKIN CONTACT: Unburned pyrotechnic residue may be rapidly absorbed through the skin in toxic quantities. Wash immediately with plenty of soap and water. Seek medical attention.
- ⚠ SKIN CONTACT: Burned pyrotechnic residue may be rapidly absorbed through the skin in toxic quantities. Wash with plenty of water. Do not use soap. Seek medical attention.
- ⚠ SWALLOWED: Unburned pyrotechnic residue is extremely toxic. If conscious drink plenty of water then induce vomiting. Seek immediate medical attention. If unconscious, or in convulsions do not attempt to induce vomiting or give anything by mouth. Seek immediate medical attention.
- ⚠ SWALLOWED: Burned pyrotechnic residue is extremely toxic. Drink plenty of water and seek immediate medical attention.
- ⚠ The deployment key must only be accessible to authorized personnel.
- ⚠ Make sure that the deployment key remains removed from the deployment equipment except during deployment.

- ⚠ If permanently disabling or enabling the passenger air bag a new seat belt for vehicles without or with a passenger air bag must be installed.
- ⚠ Undeployed pyrotechnic components must not be deployed in the vehicle.
- ⚠ Pyrotechnic components must be deployed following local regulations.
- ⚠ Check thoroughly that no loose objects can be spread during the deployment of pyrotechnic components.
- ⚠ Pyrotechnic components must be transported following local regulations.
- ⚠ Never carry out any electrical measurement on disconnected, undeployed pyrotechnic components.
- ⚠ Pyrotechnic components must not be disassembled.
- ⚠ Pyrotechnic components are not interchangeable between vehicles.
- ⚠ Always carry a live air bag module away from the body with the air bag or trim cover pointing upwards.
- ⚠ Live air bag modules must be placed in a suitable cage when removed from the vehicle. The air bag or trim cover must be facing upwards.
- ⚠ Do not install a rearward facing child safety seat to the passenger seat with an activated passenger air bag.

CAUTIONS:

- ⚠ Pyrotechnic components must not be subjected to temperatures higher than 110°C.
- ⚠ Never install aftermarket accessories to the vehicle on or adjacent to the supplemental restraint system module.

DESCRIPTION AND OPERATION**Window Glass Health and Safety Precautions****WARNINGS:**

- ⚠ Cured polyurethane (PU) adhesive can degrade if subjected to high temperatures. Isocyanide compounds can be released when grinding or welding in close proximity to cured PU adhesive.
- ⚠ SKIN CONTACT: Prolonged exposure to polyurethane (PU) adhesive may cause skin irritation. If PU adhesive comes into contact with the skin, remove any contaminated clothing. Immediately wash the skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality.
- ⚠ EYE CONTACT: Polyurethane (PU) adhesive may cause severe irritation or damage. If PU adhesive comes into contact with the eyes, immediately flush eyes with plenty of running water for at least 15 minutes. Seek immediate medical attention.
- ⚠ SWALLOWED: If polyurethane (PU) adhesive is swallowed, flush the mouth thoroughly. Do not induce vomiting. Provide rest, warmth and fresh air. Seek immediate medical attention.
- ⚠ INHALED: Persons having a respiratory allergy may have an allergic reaction when handling polyurethane (PU) adhesive.
- ⚠ INHALED: Polyurethane (PU) adhesive can cause asthma like symptoms. Isocyanate vapor from primer or PU adhesive can cause allergies in the respiratory tract.
- ⚠ INHALED: If polyurethane (PU) adhesive fumes are inhaled, move victim to fresh air. Provide oxygen if necessary. If breathing stops, provide artificial respiration. Keep a victim warm and at rest. Seek immediate medical attention.

CAUTIONS:

- ⚠ Make sure that the direct glazing for bonded glass cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.
- ⚠ During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are opened and closed.

SECTION 100-01 Identification Codes

VEHICLE APPLICATION:BT50 & Ranger

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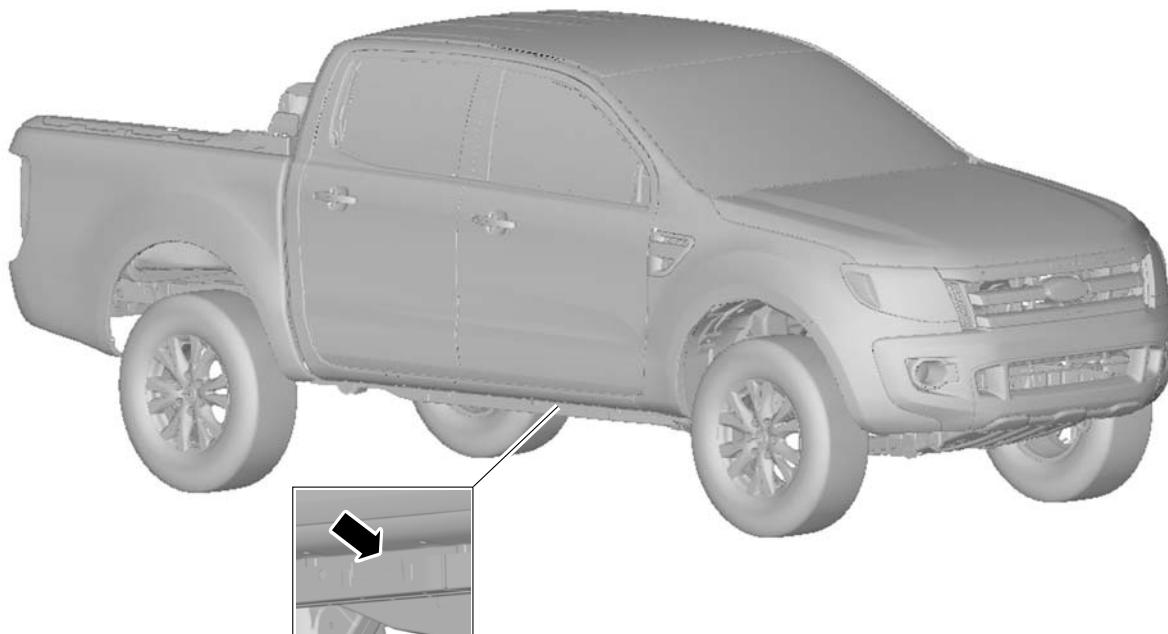
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DESCRIPTION AND OPERATION**Identification Codes**

NOTE: The vehicle identification number (VIN) can be identified by an asterisk (*) at its start and finish.

The vehicle identification number (VIN) is stamped on RH side of ladder frame of the vehicle . The VIN

plate is located on the inside of the LH fender body panel, near to PCM (powertrain control module). The code is stamped during production to enable the precise details of the vehicle build specification to be established.



E140118

Unique VIN - Manufactured in FMSA

- Market List for VIN Structure 'A'

Afghanistan, Albania, Algeria, Andorra, Angola, Cape Verde Islands, Anguilla, Antigua, Armenia, Aruba, Austria, Azerbaijan, Bahamas, Barbados, Belarus, Belgium, Luxembourg, Belize, Benin, Bonaire, Bosnia & Herzegovina, Botswana, British Virgin Isl, Bulgaria, Burkina Faso, Burundi, Cameroon, Cayman Islands, Costa Rica, Croatia, Curacao, Cyprus, Czech Republic, Democratic Republic of Congo, Denmark , Iceland, Faroe Islands, Dominica islands, Dominica Rep, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Finland, Estonia, Latvia, Lithuania, France, Monaco, Martinique, French Guiana, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar, Greece, Grenada, Guadeloupe, Guinea-Bissau,

Guyana, Haiti, Honduras, HungaryIreland, Italy, San Marino, Vatican City, Ivory Coast, Kazakhstan, Kenya, Kyrgyzstan, Liberia, Libya, Macedonia, Madagascar, Malawi, Mali, Malta, Mauritania, Mauritius, Moldova, Montenegro, Morocco, Mozambique, N. Antilles, Namibia, Netherlands, Nicaragua, Nigeria, Norway, Pakistan, Panama, Poland, Portugal, Rep. of Rwanda Republic of Congo, Republic of Guinea, Romania, Reunion Isl, Russia, Senegal, Serbia, Seychelles, Sierra Leone, Slovakia, Slovenia, Spain, Canary Island, St. Kitts, St. Lucia, St. Maarten, St. Vincent, Sudan, Suriname, Sweden, Switzerland, Liechtenstein, Tajikistan, Tanzania, Togo, Trinidad & Tobago, Tunisia, Turkey, Northern Cyprus, Turkmenistan, Uganda, Ukraine, United Kingdom, Uzbekistan, Zambia, Zimbabwe.

DESCRIPTION AND OPERATION

Vehicle Identification Number

*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	*
Start Marking	World Mfr. Index			Body Type	Constant Figure	Constant Figure	Product Source	Assembly Plant	Model Line	Body Type	Year of Manufacture	Month of Manufacture	Vehicle Sequence Number					End Marking
*	6	F	P	N/G/P/4/6/5	X	X	M	J	P	N/G/P/4/6/5	B/C/D/E/F	#	1	2	3	4	5	*

Variable

Vehicle Identification Number: Character 1 to 17

E139898

Item	Description
1-3	VIN Positions 1, 2 and 3 — World Manufacturer Identifier
4	VIN Position 4 — Body type
5	VIN Positions 5 — Constant figure
6	VIN Position 6 — Constant figure
7	VIN Position 7 — Product source

Item	Description
8	VIN Position 8 — Assembly plant
9	VIN Position 9 — Model line
10	VIN Position 10 — Body type
11	VIN Position 11 — Year of Manufacture
12	VIN Position 12 — Month of Manufacture
13-17	VIN Positions 13-17 — Vehicle Sequence Number

VIN Positions 1, 2 and 3 — World Manufacturer Identifier

Code	World Manufacturer
6FP	Ranger

VIN Positions 4 — Body Type

Code	Body Type
N	Regular cab
G	RAP cab
P	Double cab
4	Regular cab - chassis
6	RAP cab - chassis
5	Double cab - chassis

VIN Positions 5 — Constant Figure

Code	Constant Figure
X	

DESCRIPTION AND OPERATION**VIN Positions 6 — Constant Figure**

Code	Constant Figure
X	

VIN Position 7— Product Source

Code	Product Source
M	Ford Motor Company of Southern Africa

VIN Position 8 — Assembly Plant

Code	Assembly Plant
J	Silverton Assembly Plant

VIN Position 9 — Model Line

Code	Check Digit
P	Ranger

VIN Position 10 — Body Type

Code	Body Type
N	Regular cab
G	RAP cab
P	Double cab
4	Regular cab - chassis
6	RAP cab - chassis
5	Double cab - chassis

VIN Position 11 — Year of Manufacture

Code	Year of Manufacture
B	2011
C	2012
D	2013
E	2014
F	2015

VIN Position 12 — Month of Manufacture

Month	2011	2012	2013	2014	2015
Jan	C	B	J	L	C
Feb	K	R	U	Y	K
Mar	D	A	M	S	D
Apr	E	G	P	T	E
May	L	C	B	J	L
Jun	Y	K	R	U	Y
July	S	D	A	M	S

DESCRIPTION AND OPERATION

Month	2011	2012	2013	2014	2015
Aug	T	E	G	P	T
Sep	J	L	C	B	J
Oct	U	Y	K	R	U
Nov	M	S	D	A	M
Dec	P	T	E	G	P

VIN Positions 13 to 17 — Vehicle Sequence Number

Five digit number.

NOTE: The vehicle identification number (VIN) can be identified by an asterisk (*) at its start and finish.

Vehicle Identification Number

- Market List for VIN Structure 'B'

Bahrain, Guatemala, Iraq, Jamaica, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, UAE, Yemen.

*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	*
Start Marking	World Mfr. Index			Brake, Gross Weight Rating	Model Line	Series	Engine Type	Body Type	Check Digit	Model Year	Assembly Plant	Month of Manufacture	Vehicle Sequence Number					End Marking
*	A	F	A	P	#	L/A/E/R/M	N/G/P/4/6/5	#	B/C/D/E/F	J	#	1	2	3	4	5	*	

Variable

Vehicle Identification Number: Character 1 to 17

E139899

Item	Description
1-3	VIN Positions 1, 2 and 3 — World Manufacturer Identifier
4	VIN Position 4 — Brake, Gross Weight Rating
5	VIN Positions 5 — Model line
6	VIN Position 6 — Series
7	VIN Position 7 — Engine Type

Item	Description
8	VIN Position 8 — Body Type
9	VIN Position 9 — Check Digit
10	VIN Position 10 — Model Year
11	VIN Position 11 — Year of Manufacture
12	VIN Position 12 — Month of Manufacture
13-17	VIN Positions 13-17 — Vehicle Sequence Number

VIN Positions 1, 2 and 3 — World Manufacturer Identifier

Code	World Manufacturer
AFA	Ranger

DESCRIPTION AND OPERATION

VIN Positions 4 — Brake, Gross Weight Rating

Code	Brake, Gross Weight Rating
E	Hydraulic brake, GVM 2722-3175 kg
F	Hydraulic brake, GVM 3176-3629 kg

VIN Positions 5 — Model line

Code	Model line
P	Ranger

VIN Positions 6 — Series

Code	Series
1	Base
2	XL
3	XLS
4	XLТ
5	Wildtrak
6	Titanium
7	Limited

VIN Position 7— Engine Type

Code	Engine Type
L	I4 2.5L Petrol
A	I4 2.2L Diesel low power
E	I4 2.2L Diesel mid power
R	I4 2.2L Diesel High power
M	I4 3.2L Diesel

VIN Position 8 — Body Type

Code	Body Type
N	Regular cab
G	RAP cab
P	Double cab
4	Regular cab - chassis
6	RAP cab - chassis
5	Double cab - chassis

VIN Position 9 — Check Digit

Code	Check Digit
#	

DESCRIPTION AND OPERATION

VIN Position 10 — Model Year

Code	Body Type
N	Regular cab
G	RAP cab
P	Double cab
4	Regular cab - chassis
6	RAP cab - chassis
5	Double cab - chassis

VIN Position 11 — Assembly Plant

Code	Assembly Plant
J	Silverton Assembly Plant

VIN Position 12 — Month of Manufacture

Month	2011	2012	2013	2014	2015
Jan	C	B	J	L	C
Feb	K	R	U	Y	K
Mar	D	A	M	S	D
Apr	E	G	P	T	E
May	L	C	B	J	L
Jun	Y	K	R	U	Y
July	S	D	A	M	S
Aug	T	E	G	P	T
Sep	J	L	C	B	J
Oct	U	Y	K	R	U
Nov	M	S	D	A	M
Dec	P	T	E	G	P

VIN Positions 13 to 17 — Vehicle Sequence Number

Five digit number.

The vehicle identification number (VIN) is stamped in to the floor panel below the driver side front seat. The code is stamped during production to enable

the precise details of the vehicle build specification to be established.

NOTE: The vehicle identification number (VIN) can be identified by an asterisk (*) at its start and finish.

- Market List for VIN Structure 'C'
South Africa only.

DESCRIPTION AND OPERATION

About This Manual

Introduction

This manual covers diagnosis and testing and repair procedures.

This manual is structured into groups and sections, with specific system sections collected together under their relevant group.

A group covers a specific portion of the vehicle. The manual is divided into five groups, General Information, Chassis, Powertrain, Electrical and Body and Paint. The number of the group is the first number of a section number.

Within Etis, the navigation tree will list the groups. After selecting a group the navigation tree will then list the sections within that group. Each section has a contents list detailing Specifications, Description and Operation, Diagnosis and Testing, General Procedures, Disassembly and Assembly, Removal and Installation.

If components need to be removed or disassembled in sequence, the sequence will be identified numerically in a graphic and the corresponding text will be numbered accordingly.

All left-hand and right-hand references to the vehicle are taken from a position sitting in the driver seat looking forward.

All left-hand and right-hand references to the engine are taken from a position at the flywheel looking towards the front camshaft pulley.

How to Use This Manual - Repair Procedures

This manual has been written in a format that is designed to meet the needs of technicians worldwide. The objective is to use common formats and include similar content in each manual.

This manual provides general descriptions for accomplishing diagnosis and testing, service and repair work with tested, effective techniques. Following them will help assure reliability.

Special Tools

The special tool(s) table provided at the beginning of each procedure shows all special tools required to carry out a repair. Where possible, illustrations

are provided to assist in identifying the special tool required.

Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual carrying out the work.

This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or components.

Warnings, Cautions and Notes in This Manual

 **WARNING:** Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.

 **CAUTION:** Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.

NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory repair.

A warning, caution or note is placed at the beginning of a series of steps if it applies to multiple steps. If the warning, caution or note only applies to one step, it is placed at the beginning of the specific step (after the step number).

Overview Procedures

Overview procedures contain an exploded view illustration(s). The numbered sequence within the illustration(s) indicate the order to be followed when removing/disassembling or when installing/assembling a component. Additional information, symbol(s) or a torque figure, may also be shown alongside the component.

There are ten symbols used to give additional information when removing/disassembling or when installing/assembling a component.

DESCRIPTION AND OPERATION

Vehicle Identification Number

*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	*
Start Marking	World Mfr. Index			Body Type	Constant Figure	Constant Figure	Product Source	Assembly Plant	Model Line	Body Type	Year of Manufacture	Month of Manufacture	Vehicle Sequence Number				End Marking	
*	A	F	A	N/G/P/4/6/5	X	X	M	J	P	N/G/P/4/6/5	B/C/D/E/F	#	1	2	3	4	5	*

Variable

Vehicle Identification Number: Character 1 to 17

E139900

Item	Description
1-3	VIN Positions 1, 2 and 3 — World Manufacturer Identifier
4	VIN Position 4 — Body type
5	VIN Positions 5 — Constant figure
6	VIN Position 6 — Constant figure
7	VIN Position 7 — Product source

Item	Description
8	VIN Position 8 — Assembly plant
9	VIN Position 9 — Model line
10	VIN Position 10 — Body type
11	VIN Position 11 — Year of Manufacture
12	VIN Position 12 — Month of Manufacture
13-17	VIN Positions 13-17 — Vehicle Sequence Number

VIN Positions 1, 2 and 3 — World Manufacturer Identifier

Code	World Manufacturer
AFA	Ranger

VIN Positions 4 — Body Type

Code	Body Type
N	Regular cab
G	RAP cab
P	Double cab
4	Regular cab - chassis
6	RAP cab - chassis
5	Double cab - chassis

VIN Positions 5 — Constant Figure

Code	Constant Figure
X	

DESCRIPTION AND OPERATION**VIN Positions 6 — Constant Figure**

Code	Constant Figure
X	

VIN Position 7— Product Source

Code	Product Source
M	Ford Motor Company of Southern Africa

VIN Position 8 — Assembly Plant

Code	Assembly Plant
J	Silverton Assembly Plant

VIN Position 9 — Model Line

Code	Check Digit
P	Ranger

VIN Position 10 — Body Type

Code	Body Type
N	Regular cab
G	RAP cab
P	Double cab
4	Regular cab - chassis
6	RAP cab - chassis
5	Double cab - chassis

VIN Position 11 — Year of Manufacture

Code	Year of Manufacture
B	2011
C	2012
D	2013
E	2014
F	2015

VIN Position 12 — Month of Manufacture

Month	2011	2012	2013	2014	2015
Jan	C	B	J	L	C
Feb	K	R	U	Y	K
Mar	D	A	M	S	D
Apr	E	G	P	T	E
May	L	C	B	J	L
Jun	Y	K	R	U	Y
July	S	D	A	M	S

DESCRIPTION AND OPERATION

Month	2011	2012	2013	2014	2015
Aug	T	E	G	P	T
Sep	J	L	C	B	J
Oct	U	Y	K	R	U
Nov	M	S	D	A	M
Dec	P	T	E	G	P

VIN Positions 13 to 17 — Vehicle Sequence Number

Five digit number.

Unique VIN - Manufactured in AutoAlliance Thailand (AAT)

Vehicle Identification Number

*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	*
Start Marking	World Mfr. Index			Body Type	Constant Figure	Constant Figure	Product Source	Assembly Plant	Model Line	Body Type	Year of Manufacture	Month of Manufacture	Vehicle Sequence Number					End Marking
*	A	F	A	N/G/P/4/6/5	X	X	M	J	P	N/G/P/4/6/5	B/C/D/E/F	#	1	2	3	4	5	*

Variable

Vehicle Identification Number: Character 1 to 17

E139900

Item	Description
1-3	VIN Positions 1, 2 and 3 — World Manufacturer Identifier
4	VIN Position 4 — Air bag
5	VIN Positions 5 — Production source
6	VIN Position 6 — Body style
7	VIN Position 7 — GVM

Item	Description
8	VIN Position 8 — Engine type
9	VIN Position 9 — Constant Value
10	VIN Position 10 — Production Year / Model year
11	VIN Position 11 — Plant
12-17	VIN Positions 12-17 — Serial Number

VIN Positions 1, 2 and 3 — World Manufacturer Identifier

Code	World Manufacturer
MNA	Australia(RHD), New Zealand(RHD)
MNB	Thailand (RHD), RHD Markets - Indonesia, Malaysia, Bangladesh, Brunei, Fiji, Singapore, Sri Lanka, Papua New Guinea, Hong Kong, Samoa
MNC	LHD Markets - Philippines, Vietnam, Cambodia, New Caledonia, Wallis & Vanuatu, Palau, Micronesia, French Polynesia, Mongolia, Laos

DESCRIPTION AND OPERATION

VIN Positions 4 — Air bag

Code	Air bag
B	Seat belts only
D	Driver air bag
L	Driver airbag + passenger airbag
U	Driver airbag + passenger airbag + Side airbags + Side Curtain Airbags
W	Driver airbag + passenger airbag+ Side Curtain Airbags

VIN Positions 5 — Production source

Code	Production source
M	Thailand

VIN Positions 6 — Body style

Code	Body style
A	Regular cab-chassis
B	Regular cab
E	Double cab-chassis
F	Double cab
1	RAP cab-chassis
2	RAP cab

VIN Position 7— GVM

Code	GVM
E	2722 to \leq 3175 kg
F	E >3175 to 3629 kg

VIN Position 8 — Engine type

Code	Engine type
3	I4 2.5l Petrol
0	I4 2.2l Diesel low power
2	I4 2.2l Diesel mid power
8	I4 2.2l Diesel high power
5	I5 3.2l Diesel

VIN Position 9 — Constant Value

Code	Constant Value
0	0

DESCRIPTION AND OPERATION

VIN Position 10 — Production Year/Model year

Code	Year	Production year for markets	Model year for markets
B	2011	RHD: Indonesia, Thailand, Australia, New Zealand LHD: Philippines	RHD: Malaysia, Bangladesh, Brunei, Fiji, Singapore, Sri Lanka, Papua New Guinea, Hong Kong, Samoa LHD: Vietnam, Cambodia, New Caledonia, Wallis & Vanuatu, Palau, Micronesia, French Polynesia, Mongolia, Laos
C	2012		
D	2013		
E	2014		
F	2015		

VIN Position 11 — Plant

Code	Plant
W	AutoAlliance Thailand

VIN Positions 12 to 17 — Serial Number

Six digit number (Last four must be numerical)

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

VEHICLE APPLICATION:BT50 & Ranger

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ASSEMBLY

Engine.....	(21 134 8)	303-01C-90
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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	17.5:1
Power output at 3500 rpm	147 kW (200 PS)
Torque between 2000 to 2500 rpm	470 Nm
Idle speed	800 +/- 50 rpm
Maximum oil consumption	0.1L / 1000 Km

Engine Oil Capacity

Description	Liters
Initial fill including oil filter	12,6
Service fill including oil filter	11,4
Service fill without oil filter	11,0

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	WSS-M2C913-B
Sealer — oil pan, camshaft carrier and engine front cover	WSE-M4G323-A4

DESCRIPTION AND OPERATION

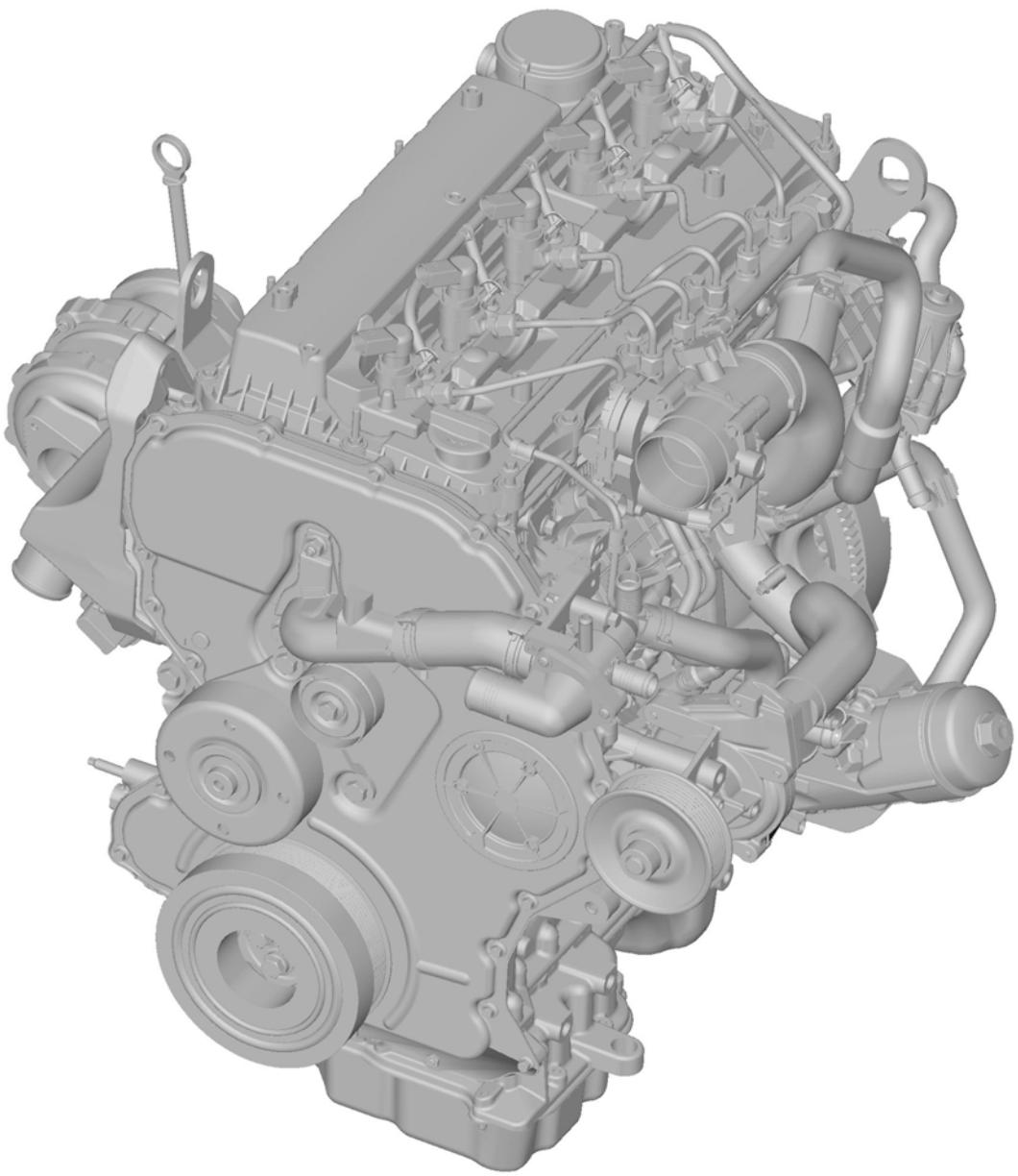
Engine – Overview

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.

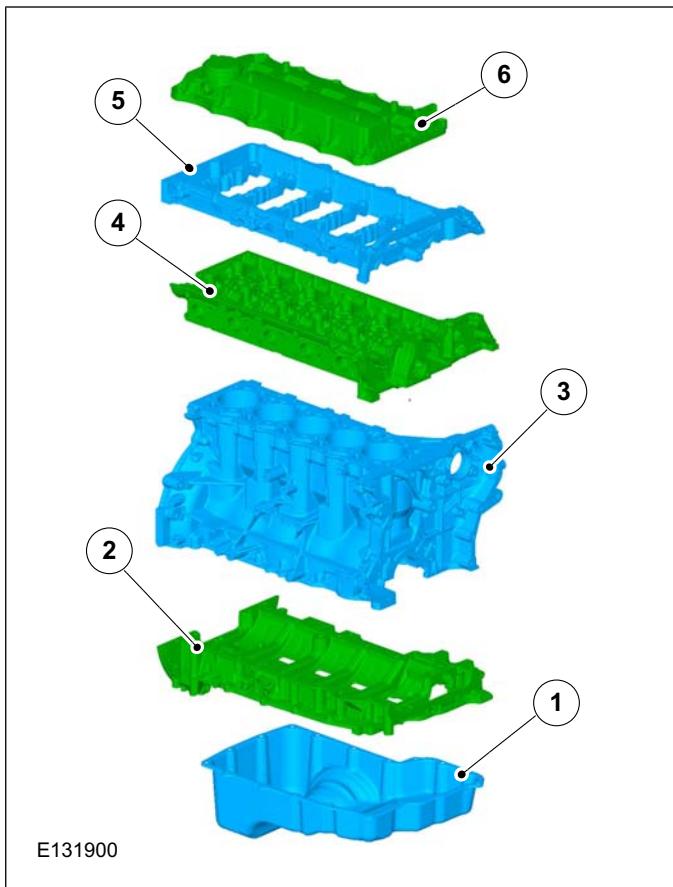
NOTE: Cylinder 1 is located on the timing chain end.

DESCRIPTION AND OPERATION

E131231

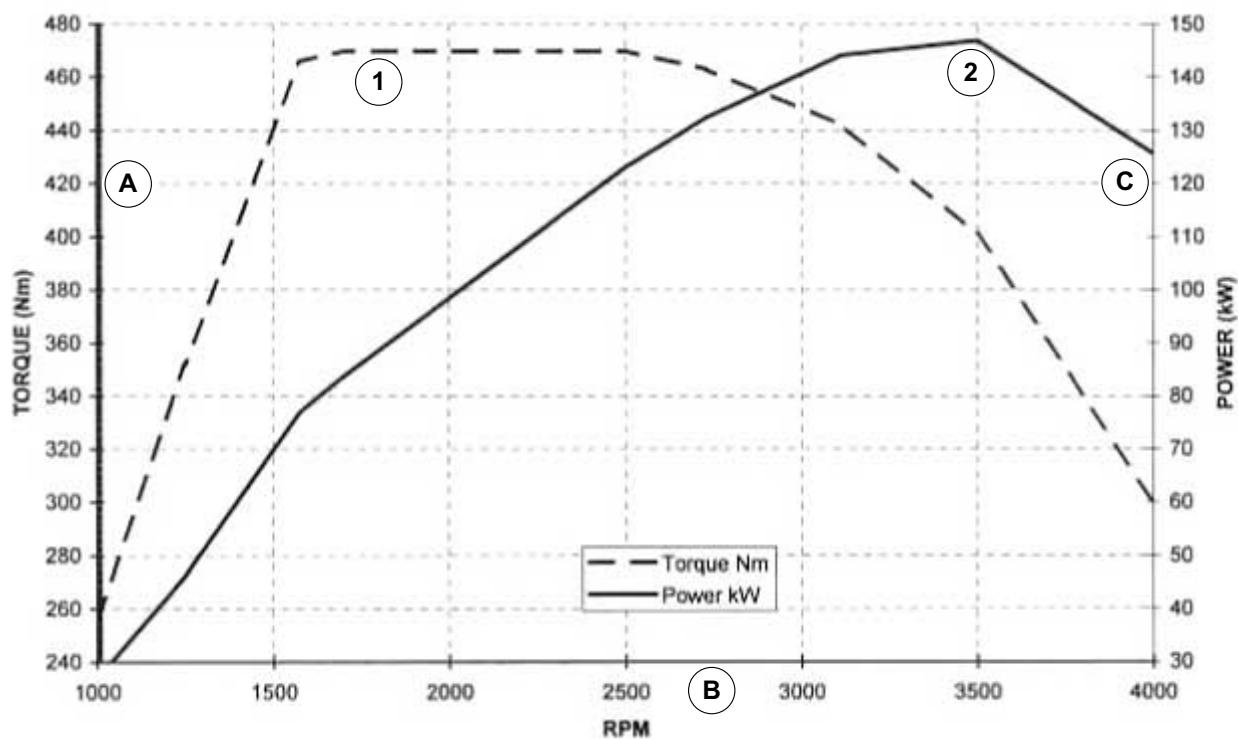
DESCRIPTION AND OPERATION

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

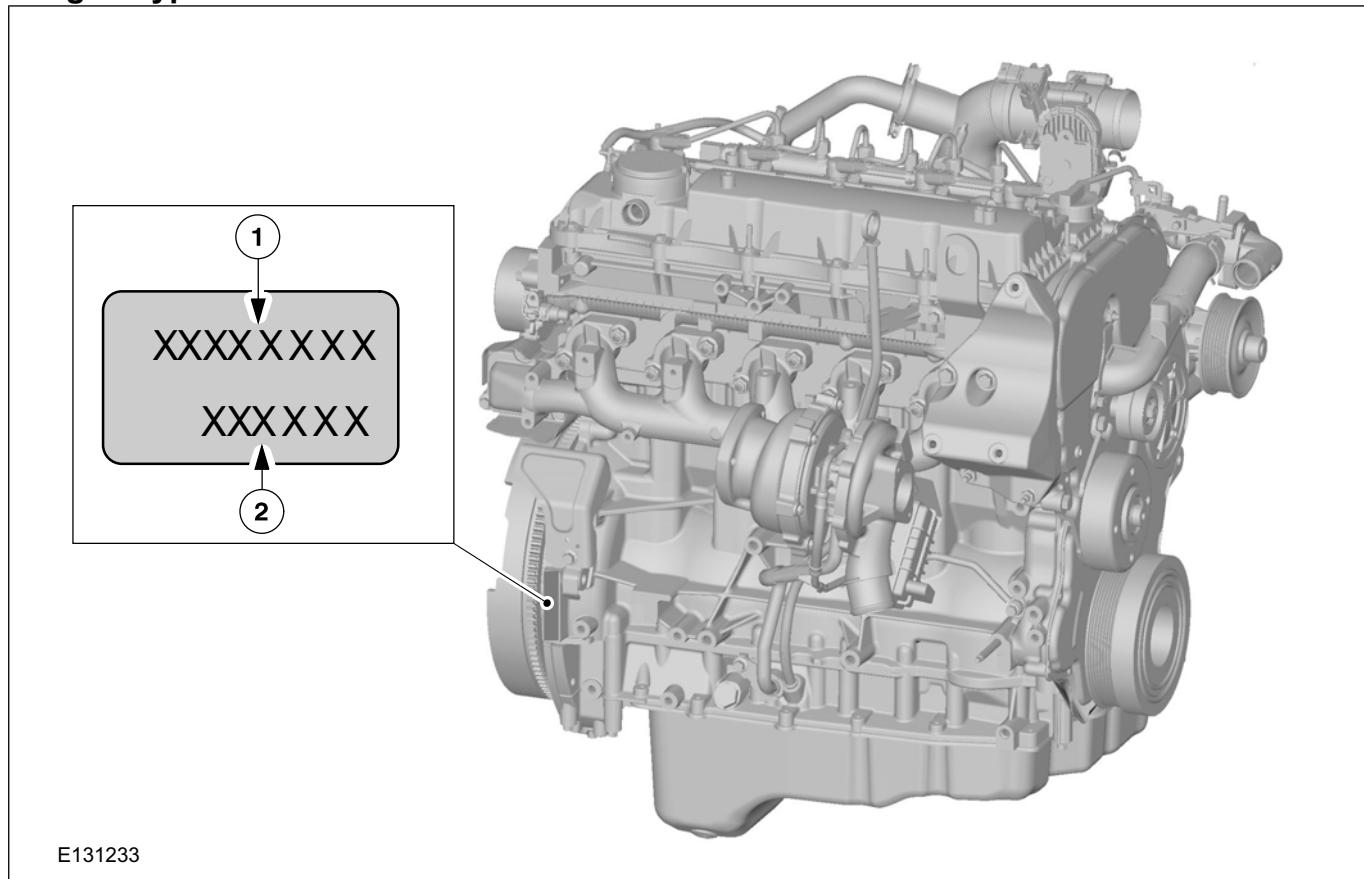


DESCRIPTION AND OPERATION

Item	Description
A	Torque (Nm)
B	Engine speed (rpm)
C	Power (kW)

Item	Description
1	Torque curve for the 147 kW engine (200 PS)
2	Power curve for the 147 kW engine (200 PS)

Engine type identification



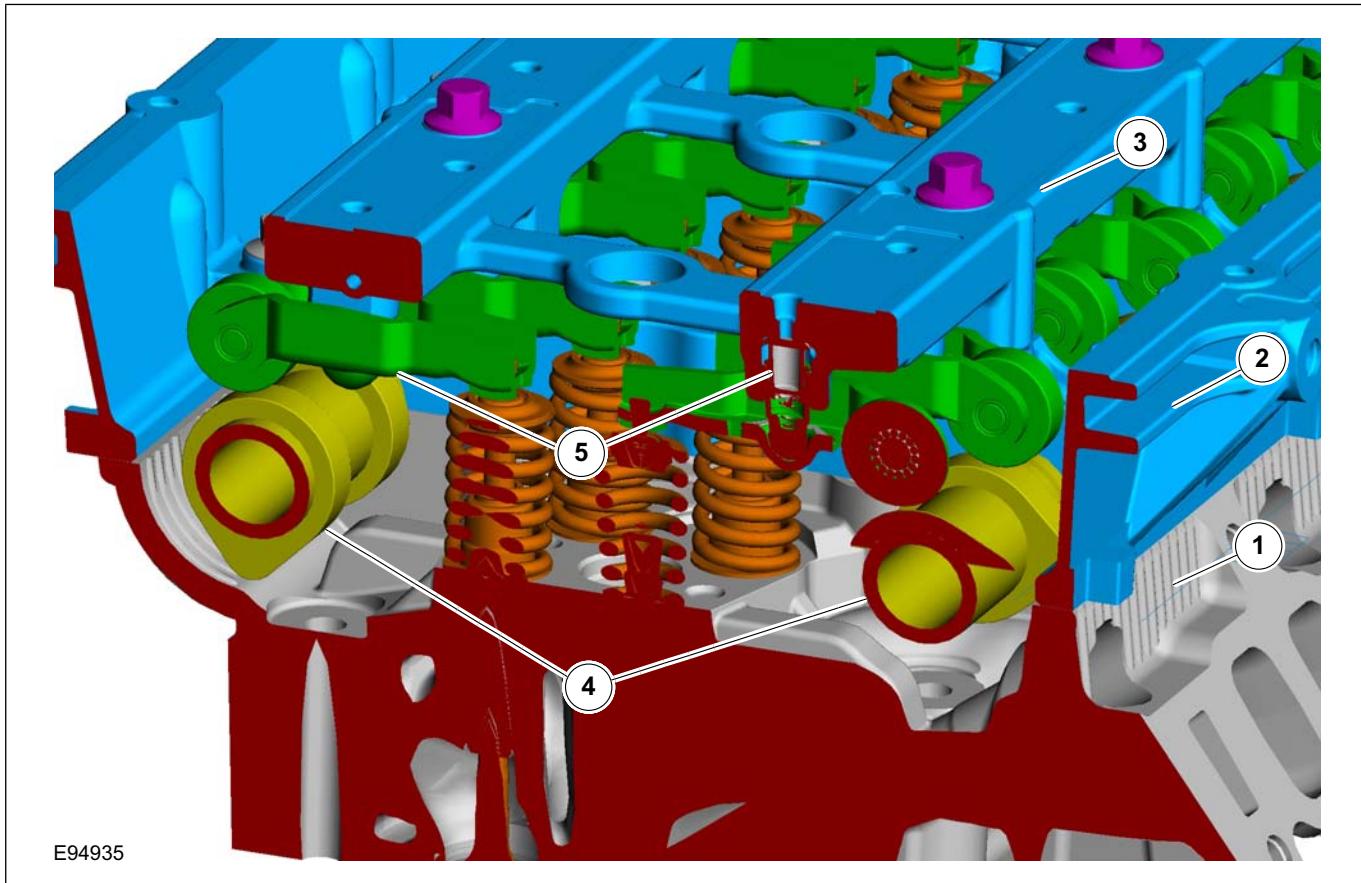
Item	Description
1	Engine code
2	Engine serial number

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

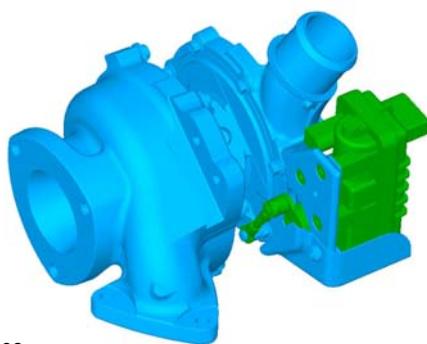


Item	Description
1	Cylinder head lower part
2	Cylinder head upper part
3	Rocker arm frame

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

DESCRIPTION AND OPERATION

Electronic turbocharger guide vane adjustment



E131898

Item	Description
1	Electric actuator for turbocharger guide vane adjustment

operating conditions) and displays it in the instrument panel.

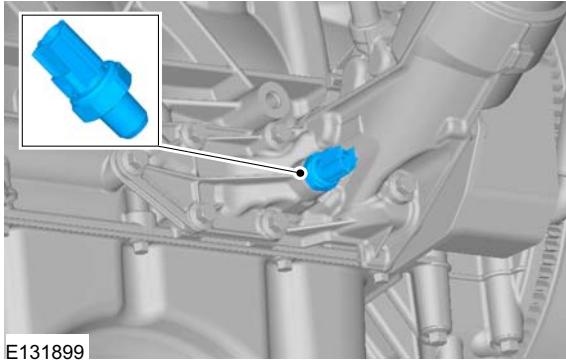
In addition, a separate indicator in conjunction with a corresponding message in the instrument cluster display warns the driver when the oil quantity falls below the minimum level.

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



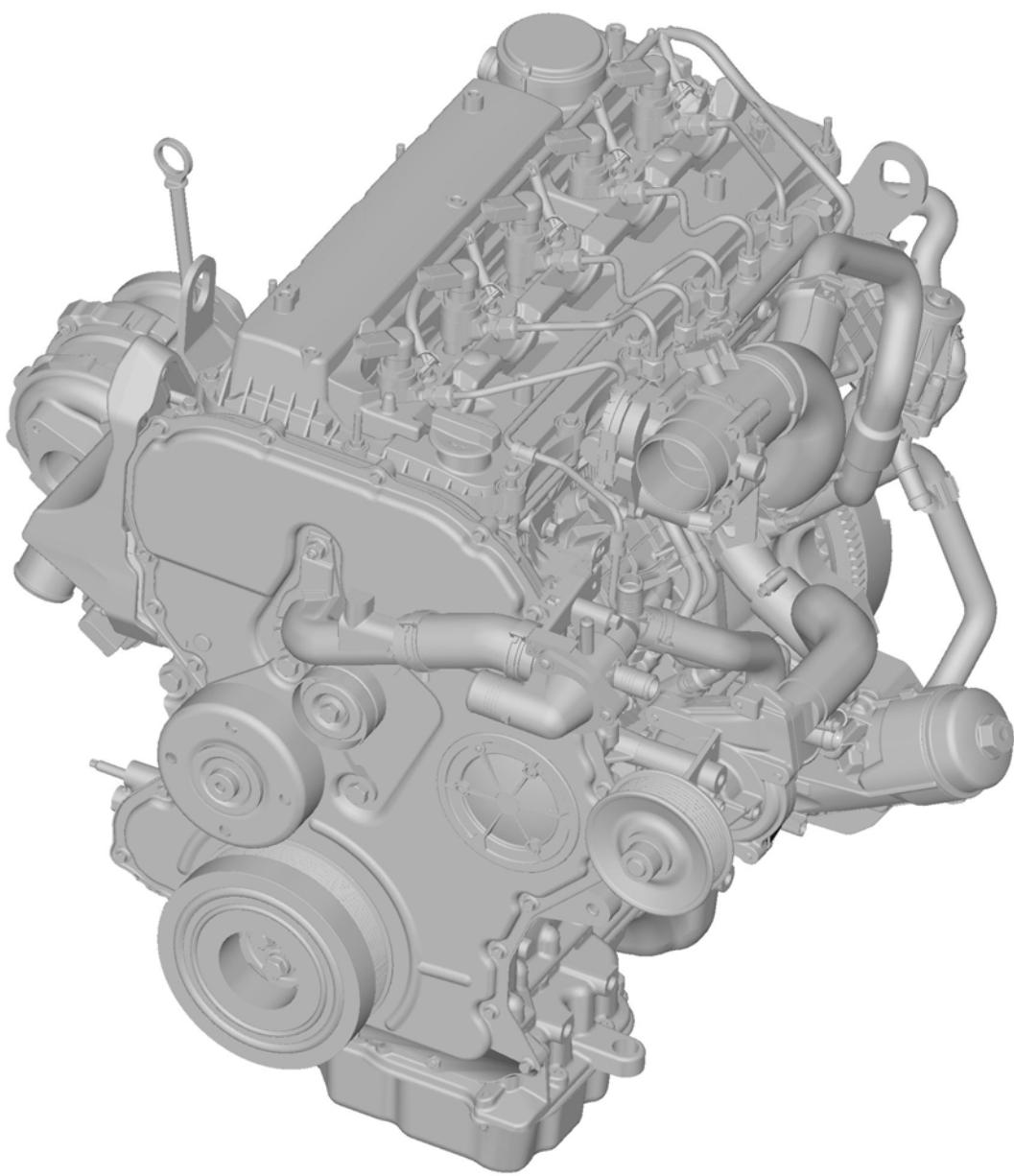
An oil level/temperature sensor located on the front of the engine directly beside the engine oil dipstick is provided for the service interval indicator.

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).

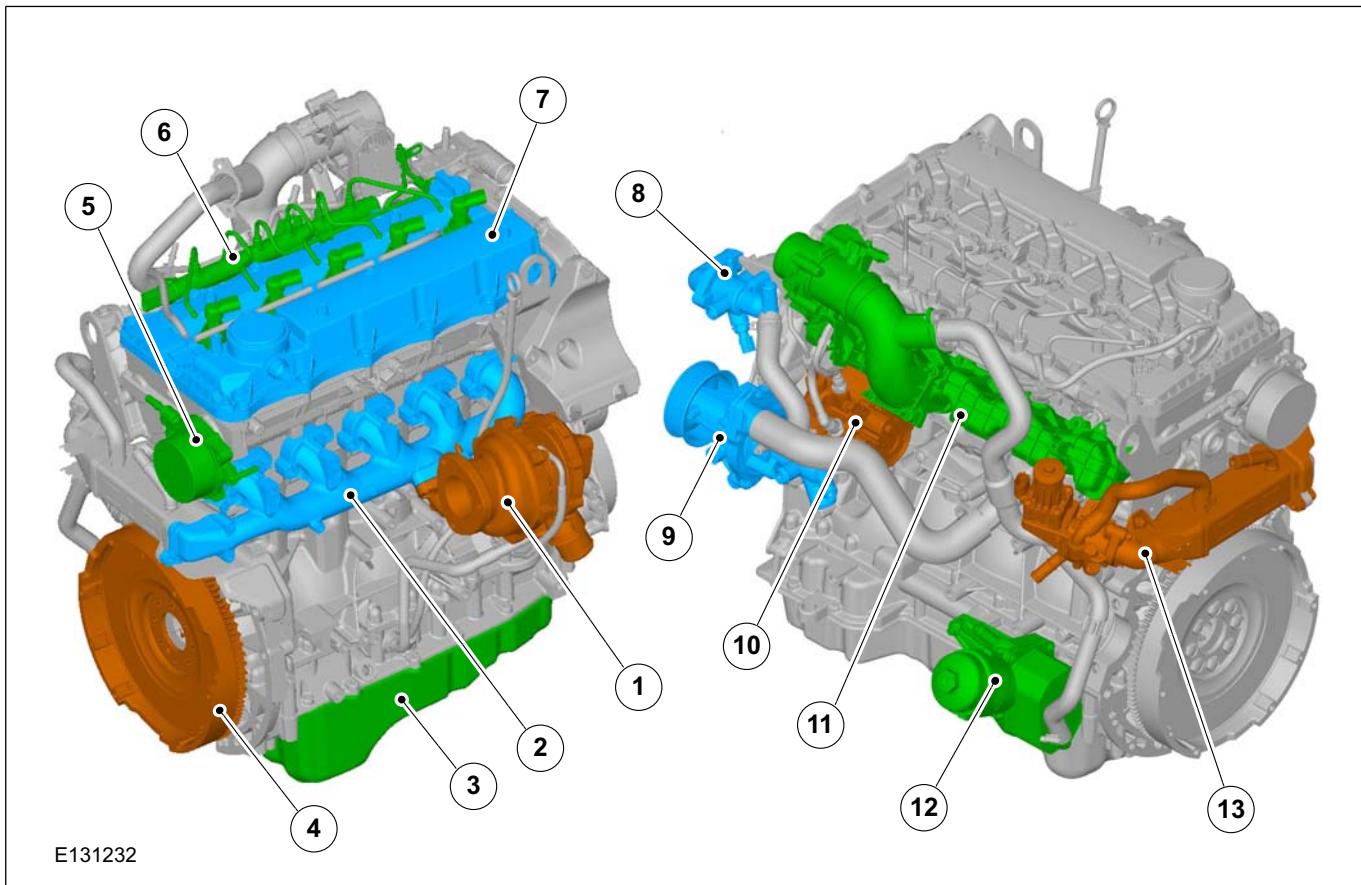
The change in the voltage drop serves as an input variable for calculating the oil level. The oil temperature is sensed simultaneously via the integrated temperature sensor. The temperature is used as a corrective factor in the calculation.

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**

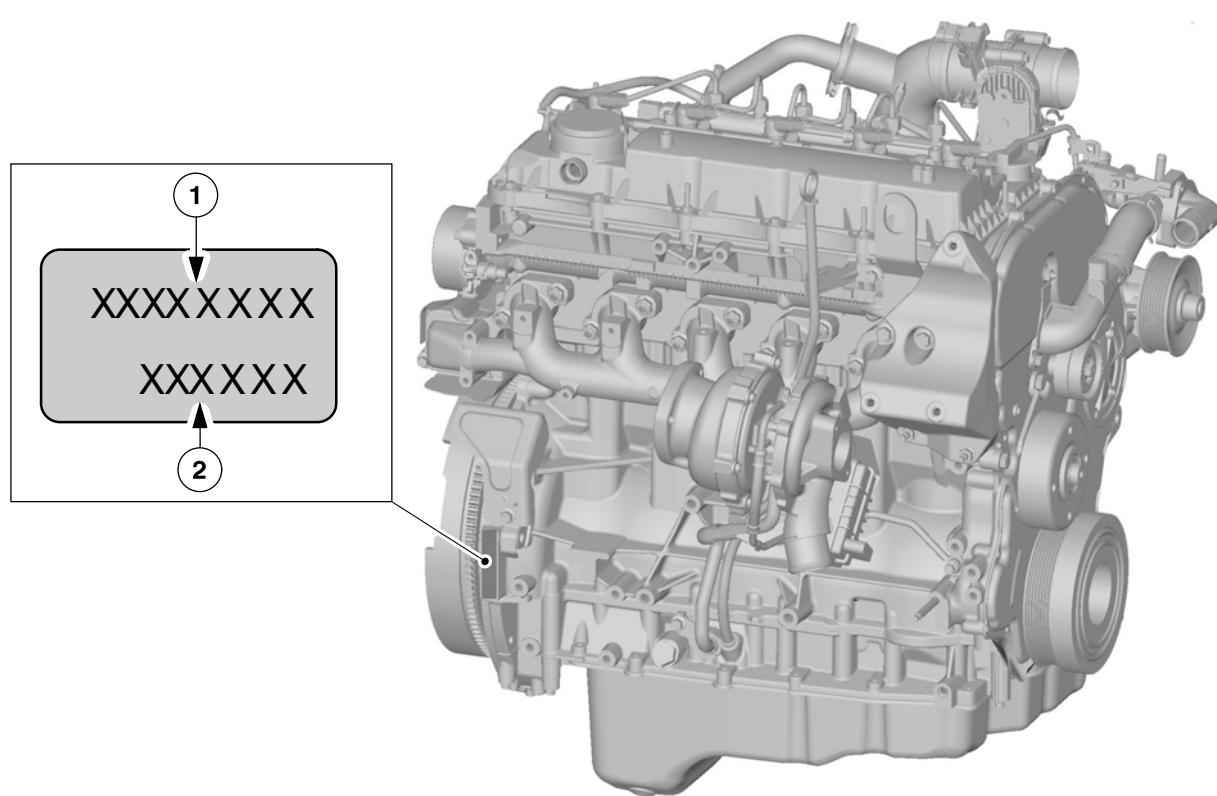
E131231

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

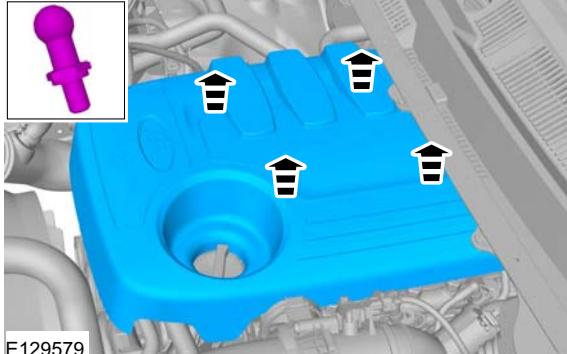
WARNINGS:

- ⚠ 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.

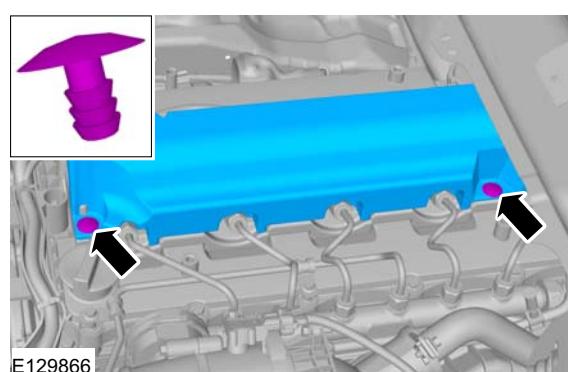
NOTE: Removal steps in this procedure may contain installation details.

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).

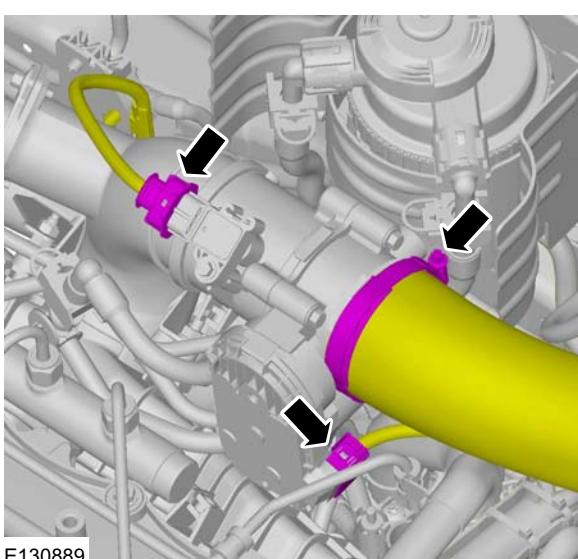
3.



4.

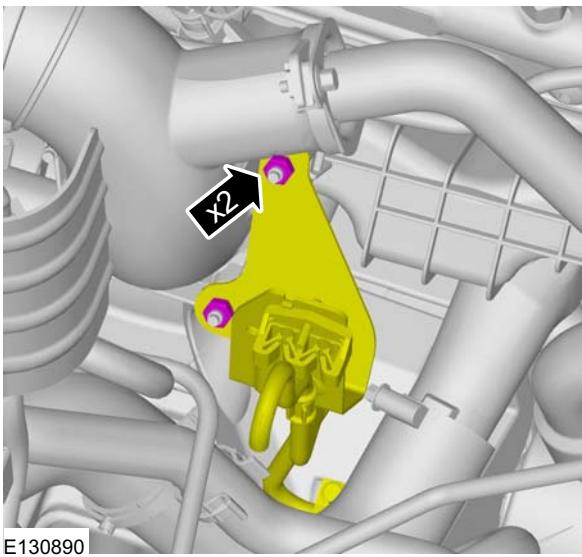


5.

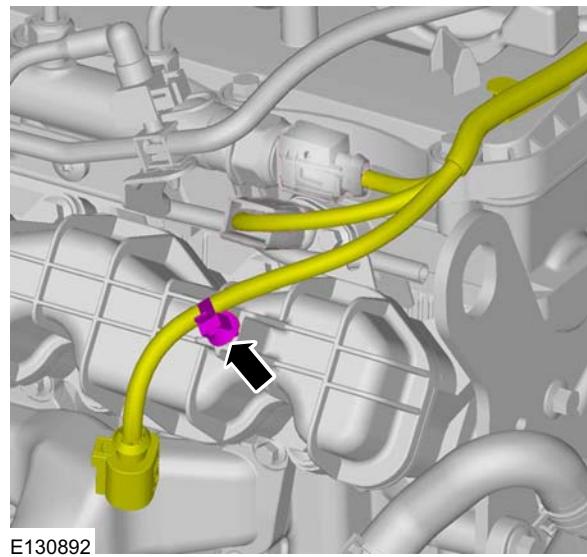


REMOVAL AND INSTALLATION

6. Torque: 11 Nm



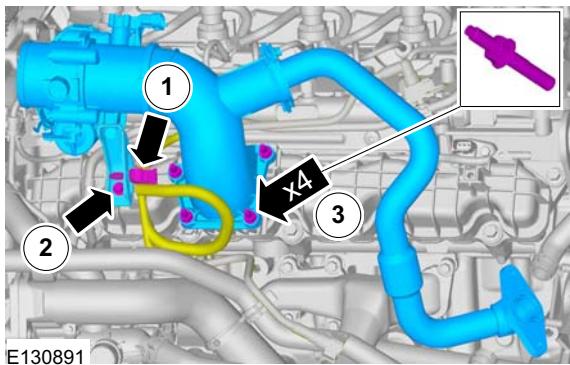
9.



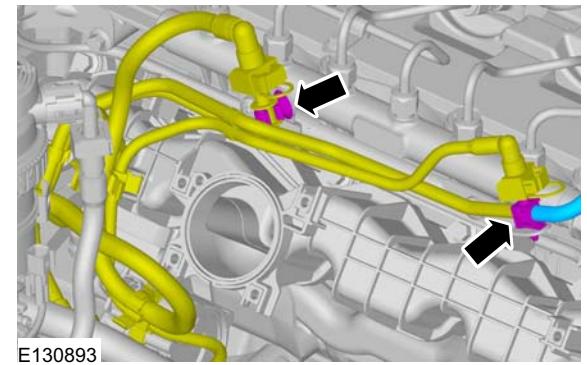
7. Refer to: **Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (148kW/200PS) - Puma** (303-08 Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and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

8. 2. Torque: 10 Nm

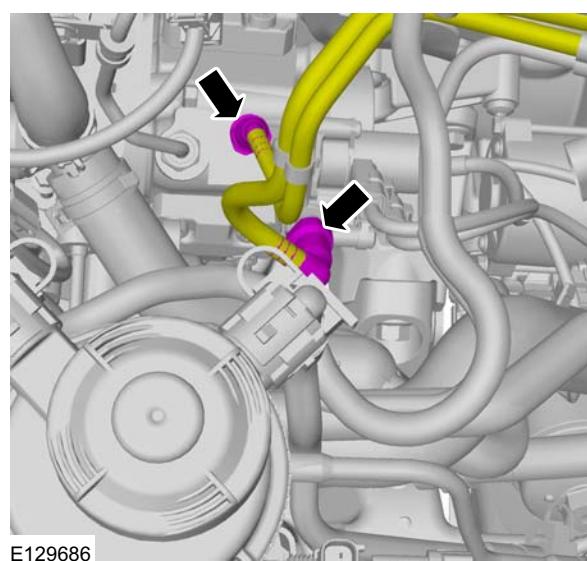
3. Torque: 15 Nm



10.



11.

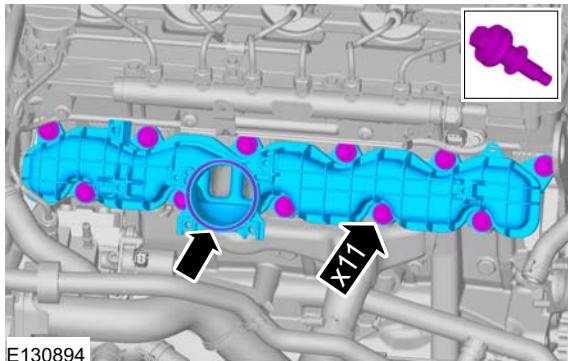


REMOVAL AND INSTALLATION

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.

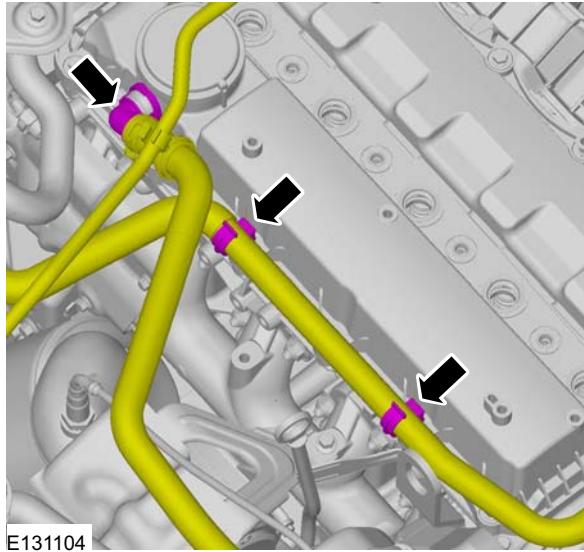
REMOVAL AND INSTALLATION

Exhaust Manifold(21 187 0)

Removal

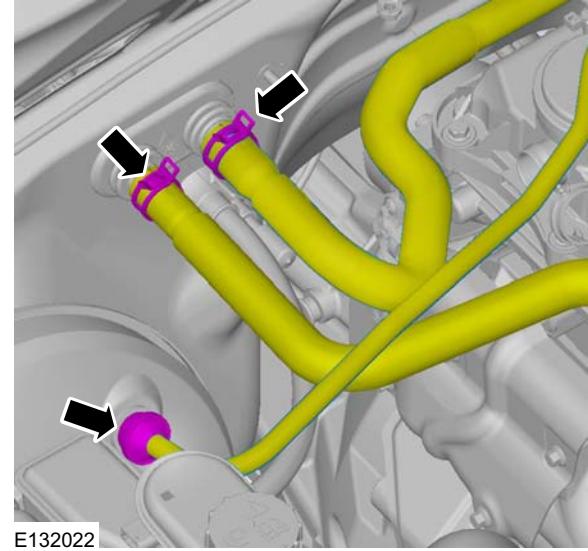
NOTE: Removal steps in this procedure may contain installation details.

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.

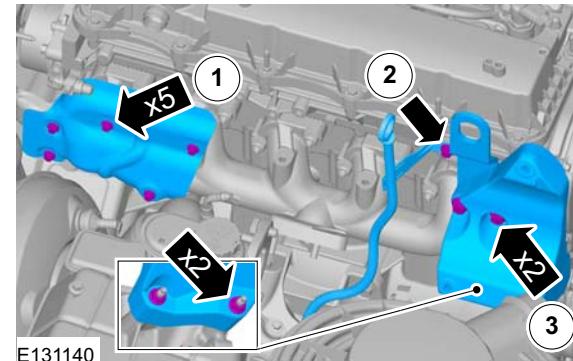


4. Refer to: **Turbocharger - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, LHD 4WD/LHD RWD (303-04 Fuel Charging and Controls - Turbocharger, Removal and Installation).**
Refer to: **Turbocharger - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, RHD 4WD/RHD RWD (303-04 Fuel Charging and Controls - Turbocharger,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

- 5.

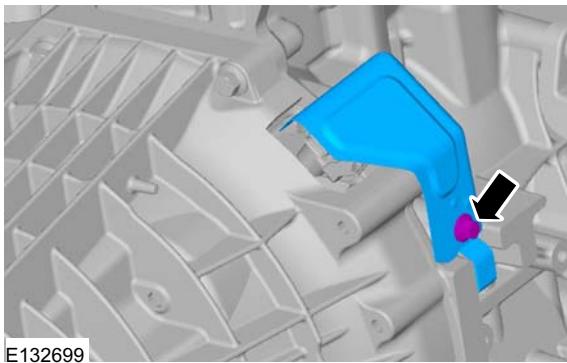


6. 1. Torque: 9 Nm
2. Torque: 22 Nm
3. Torque: 25 Nm

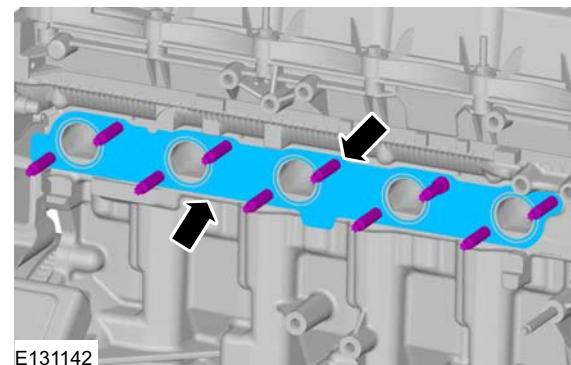


REMOVAL AND INSTALLATION

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



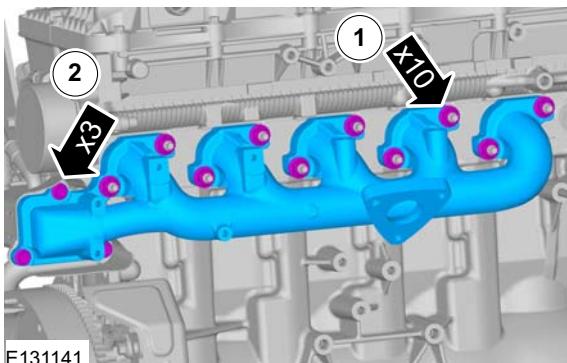
NOTE: The gasket is to be reused unless damaged.



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)

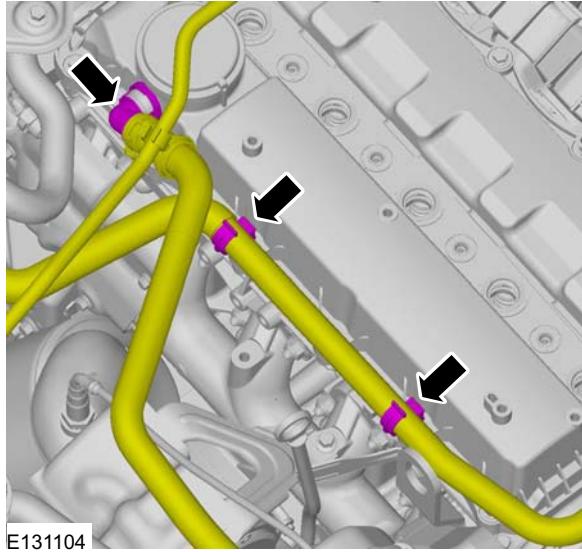
Removal

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

- 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.

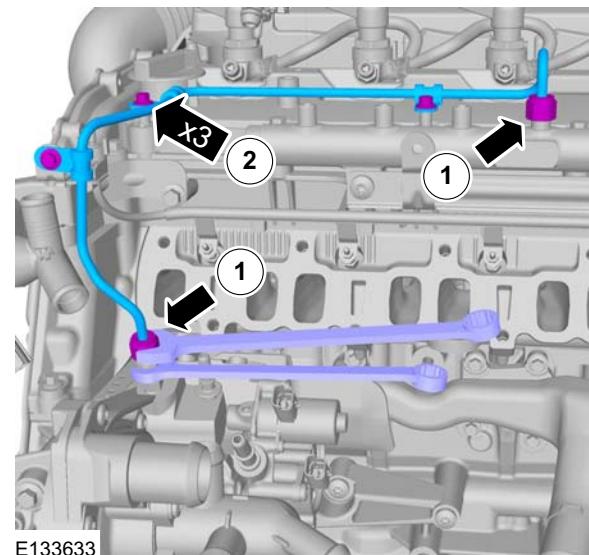


- Refer to: **Fuel Injectors** (303-04 Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

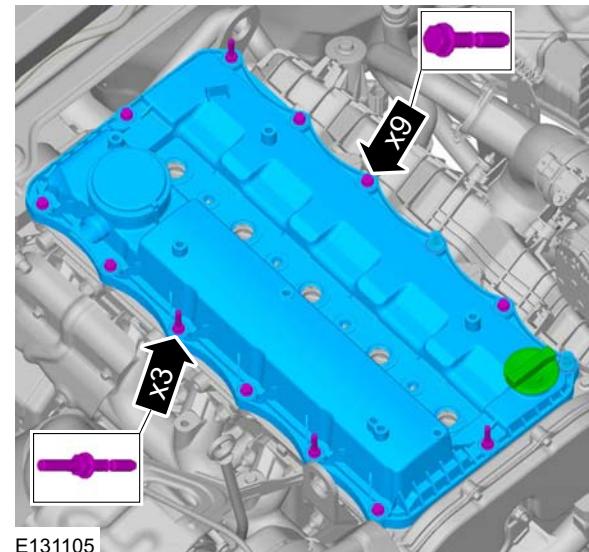
1. Torque:

- Stage 1: 5 Nm
- Stage 2: 35 Nm

2. Torque: 10 Nm

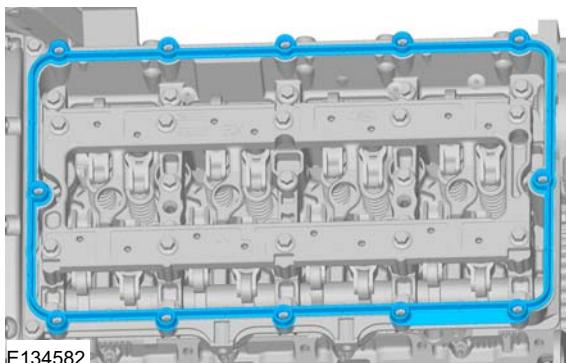


- Torque: 10 Nm



REMOVAL AND INSTALLATION

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



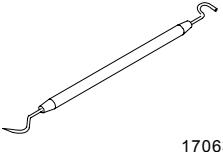
Installation

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Camshafts(21 284 0)

Special Tool(s) / General Equipment

	17063 100-010 Remover, O-Ring Seal
	E131853 303-1562 Timing Tool
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.

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

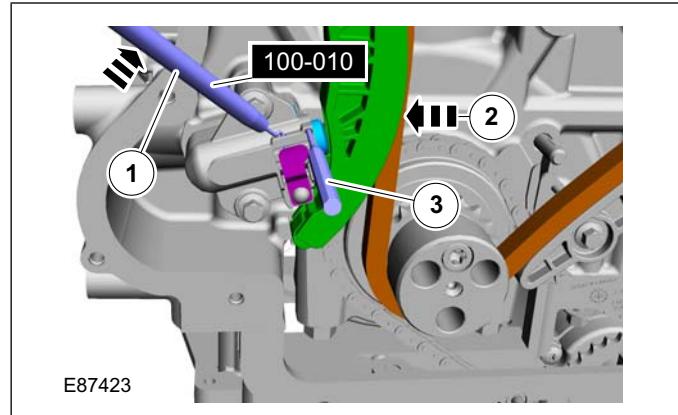
Refer to: **Valve Cover** (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

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

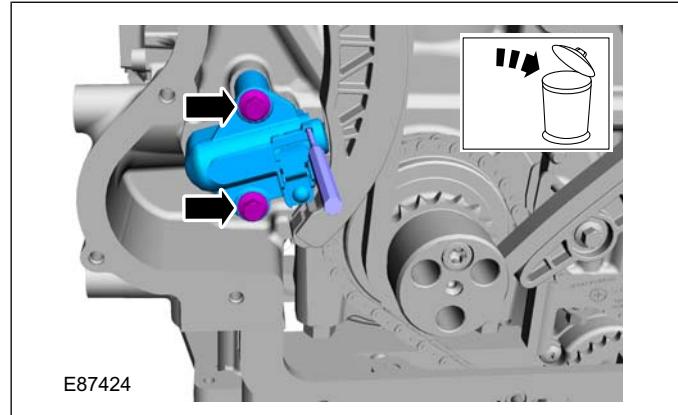
Refer to: **Brake Vacuum Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma** (206-07 Power Brake Actuation, Removal and Installation).

- Special Tool(s): 100-010

General Equipment: 2 mm Punch

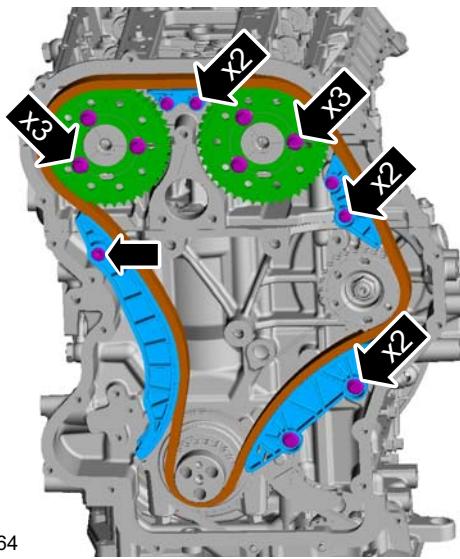


- General Equipment: 2 mm Punch

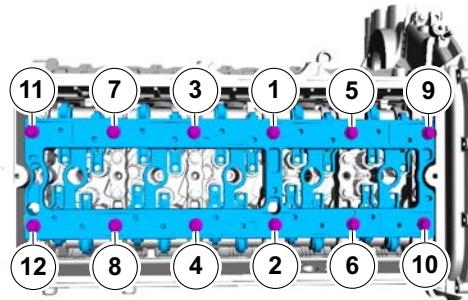


REMOVAL AND INSTALLATION

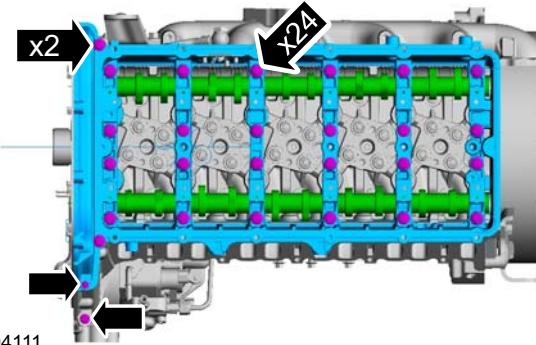
4.



5.



6.

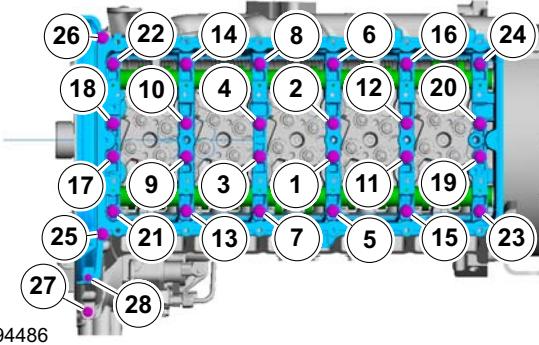


Installation

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

Torque:

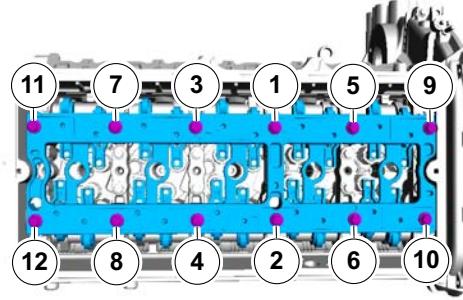
- Bolts 1 to 26
 - Stage 1: 3,5 Nm
 - Stage 2: 15 Nm
 - Stage 3: 23 Nm
- Bolts 27 and 28
 - Stage 1: 3,5 Nm
 - Stage 2: 7,5 Nm
 - Stage 3: 10 Nm



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

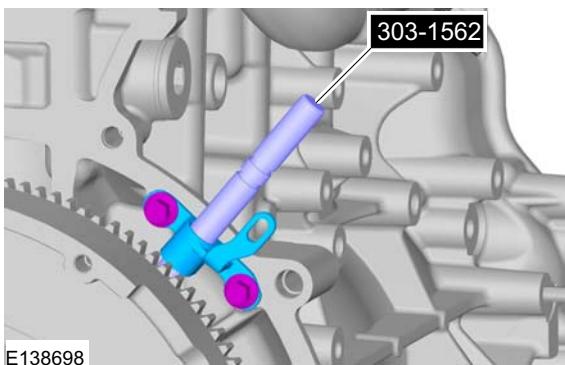
Torque:

- Stage 1: 10 Nm
- Stage 2: 30°



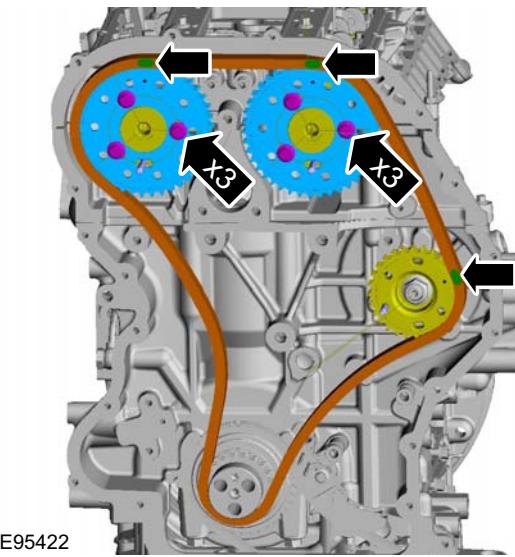
REMOVAL AND INSTALLATION

3. Special Tool(s): 303-1562



4. NOTE: Make sure that the installation marks are aligned.

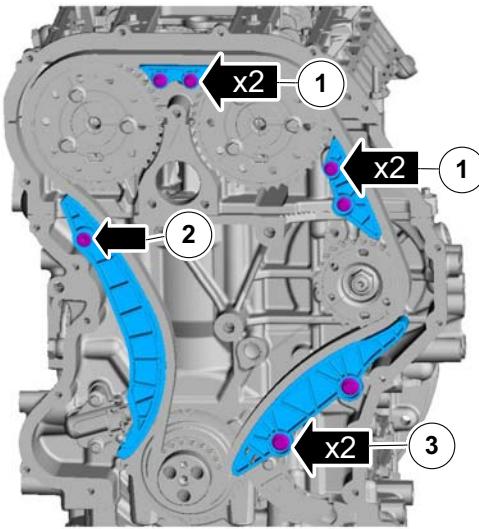
General Equipment: 6 mm Drill Bit
Torque: 33 Nm



5. Remove the 6 mm drill bit.

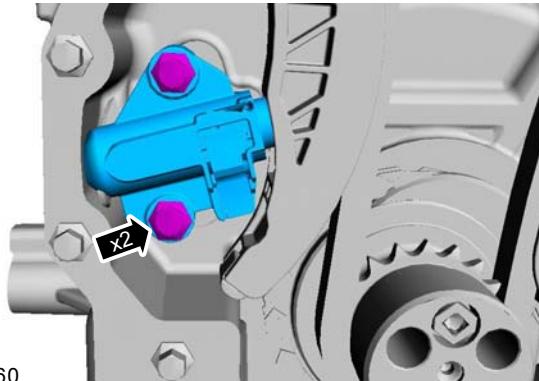
6. Torque:

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

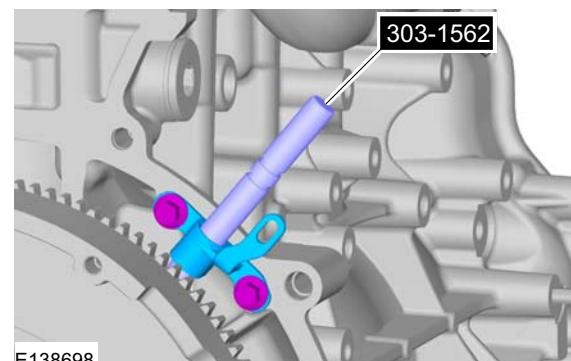


7. NOTE: Make sure that a new component is installed.

Torque: 15 Nm



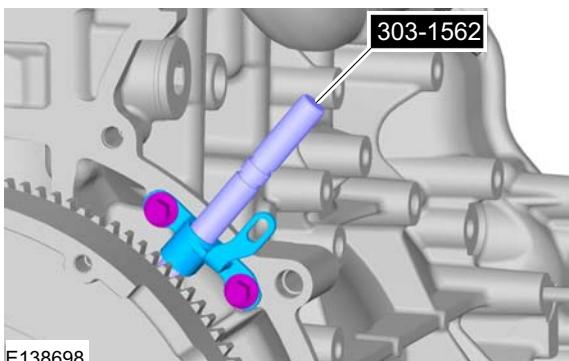
8. Remove the Special Tool(s): 303-1562



9. Rotate the engine two revolutions.

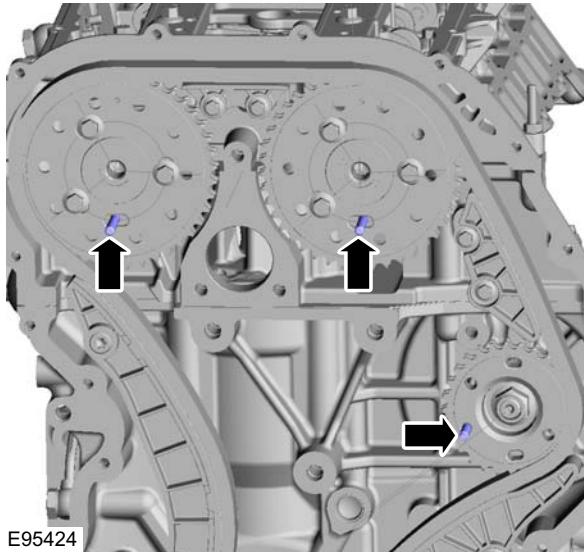
REMOVAL AND INSTALLATION

10. Special Tool(s): 303-1562



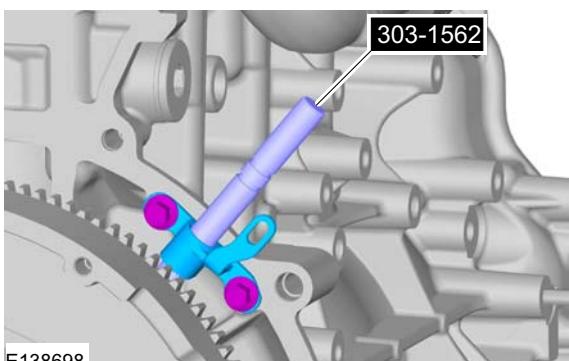
11. Check the valve timing by inserting the drill bits.
If the drill bits cannot be inserted repeat the timing steps.

General Equipment: 6 mm Drill Bit



12 Remove the 6 mm drill bits.

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



14. 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\).](#)

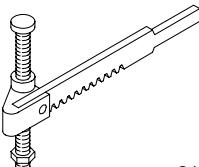
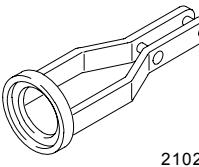
Refer to: [Valve Cover \(303-01 Engine - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma, Removal and Installation\).](#)

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

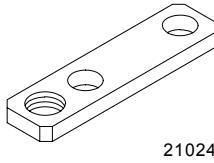
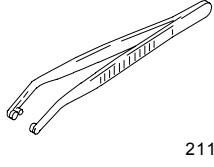
REMOVAL AND INSTALLATION

Valves

Special Tool(s)

	303-060 Compressor, Valve Spring 21024
	303-060-05 Adapter for 303-060 2102405

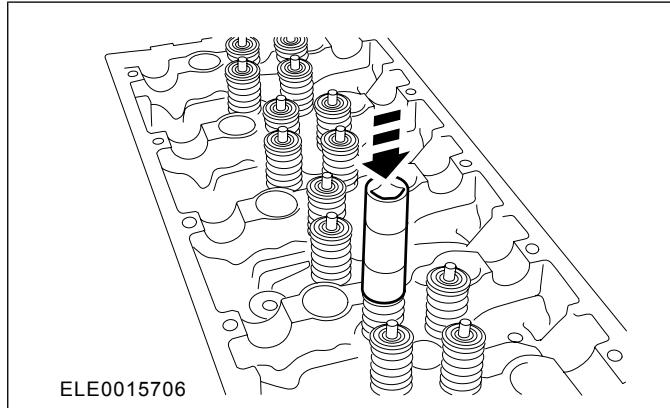
Special Tool(s)

	303-060-07 Adapter for 303-060 2102407
	303-362 Installer, Valve Stem Collets 21156

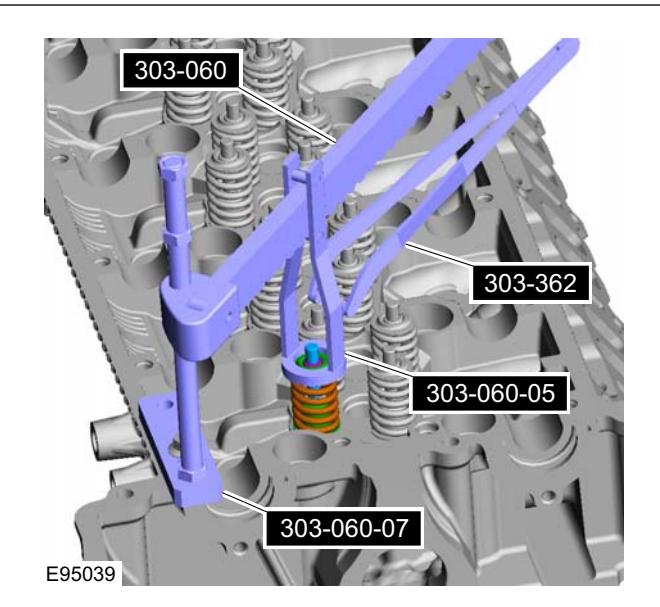
Removal

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.

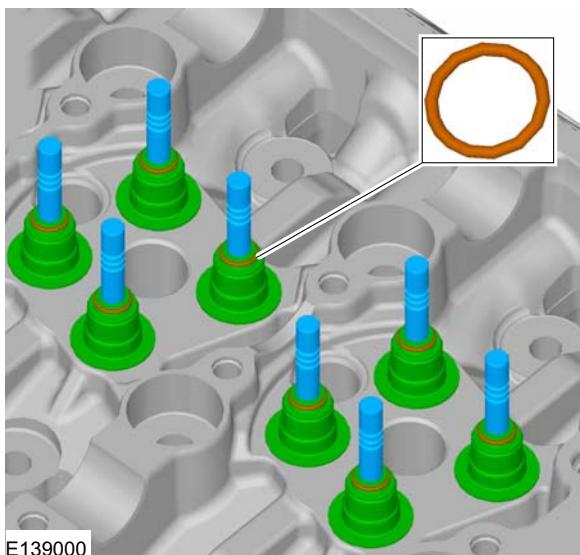


3. Special Tool(s): 303-060, 303-060-05, 303-060-07, 303-362



REMOVAL AND INSTALLATION

4.



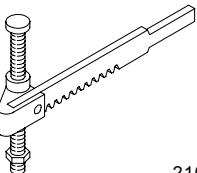
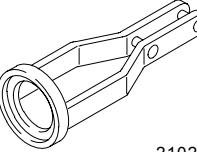
Installation

1. To install, reverse the removal procedure.

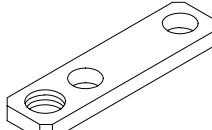
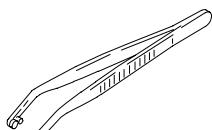
REMOVAL AND INSTALLATION

Valve Springs

Special Tool(s)

	303-060 Compressor, Valve Spring 21024
	303-060-05 Adapter for 303-060 2102405

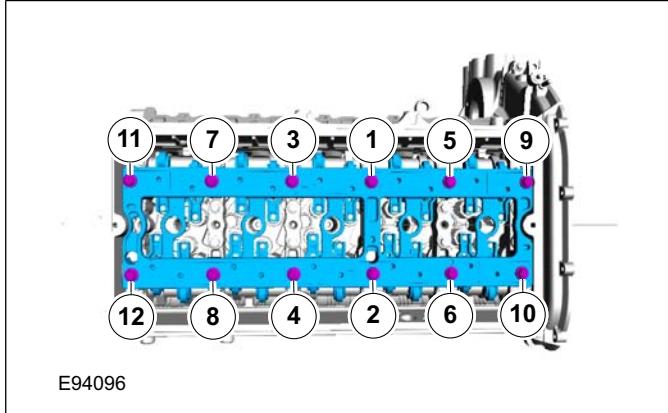
Special Tool(s)

	303-060-07 Adapter for 303-060 2102407
	303-362 Installer, Valve Stem Collets 21156

Removal

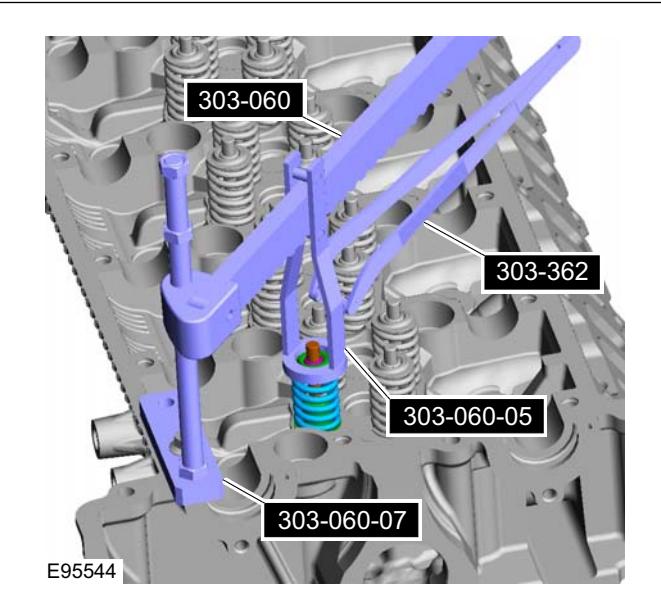
1. Refer to: **Valve Cover** (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

2.



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

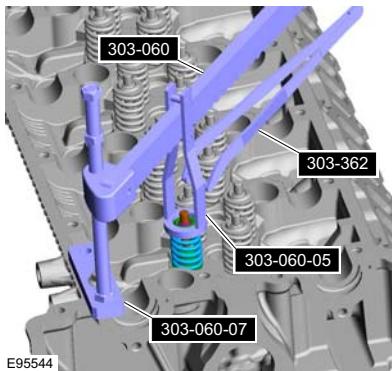
4. Special Tool(s): 303-060, 303-060-05, 303-060-07, 303-362



REMOVAL AND INSTALLATION

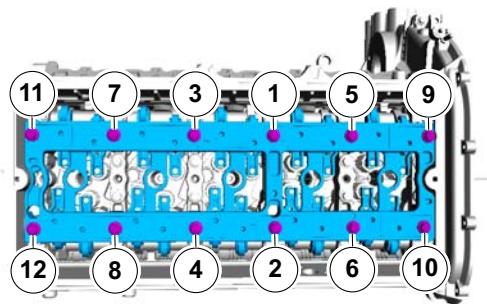
Installation

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



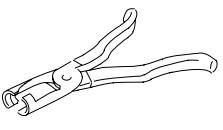
2. Torque:

- 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).**

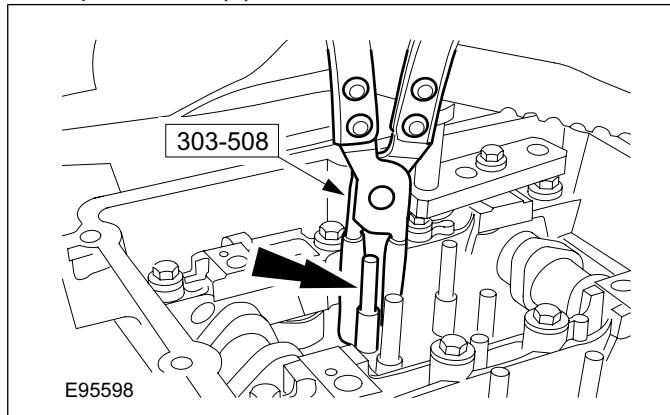
REMOVAL AND INSTALLATION**Valve Stem Seals(21 238 0)****Special Tool(s)**

 21211	303-508 Pliers, Valve Stem Seal
--	------------------------------------

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

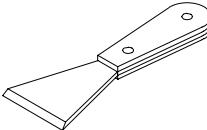
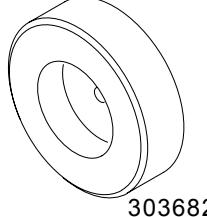
**Installation**

1. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Timing Cover(21 146 0)

Special Tool(s)

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

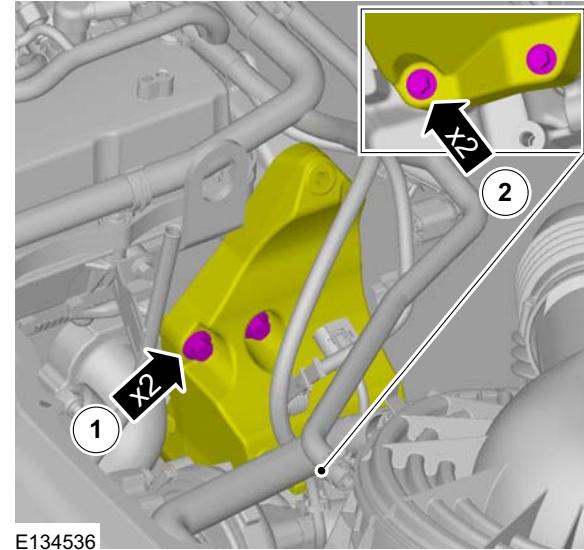
Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

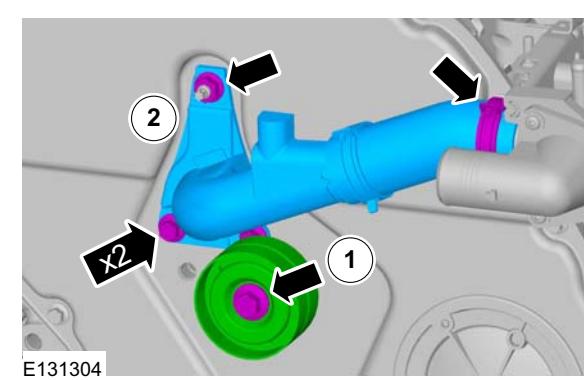
Removal

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

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



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



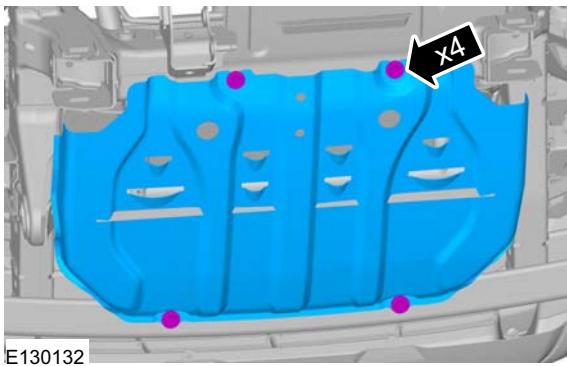
REMOVAL AND INSTALLATION

6. Torque: 48 Nm



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

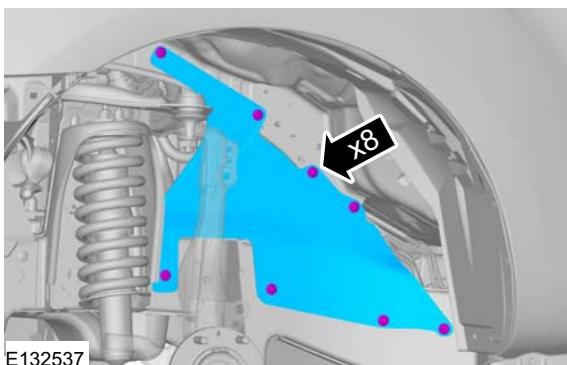
8. Torque: 30 Nm



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

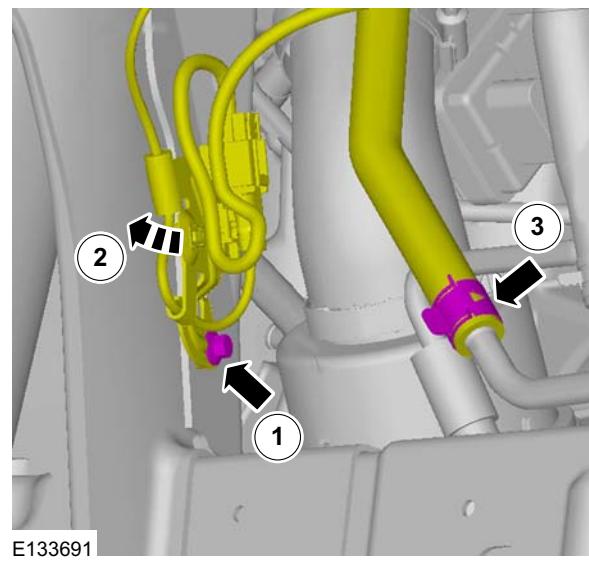
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

10.

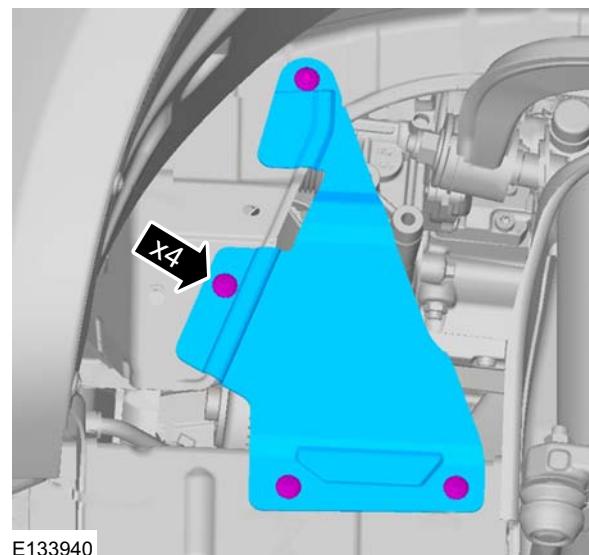


11. **CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.

Torque: 7 Nm



12

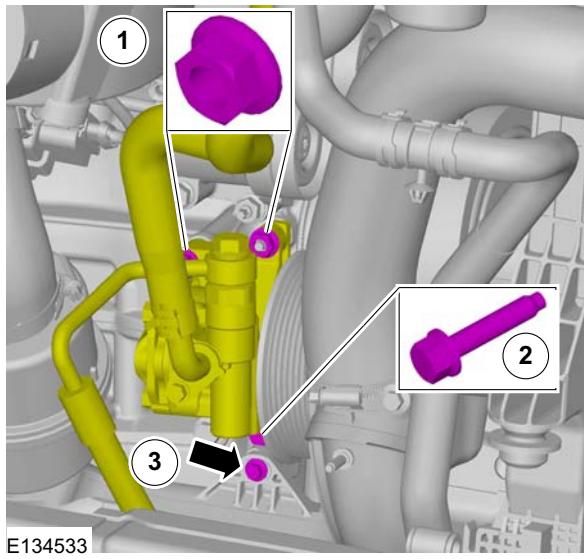


REMOVAL AND INSTALLATION

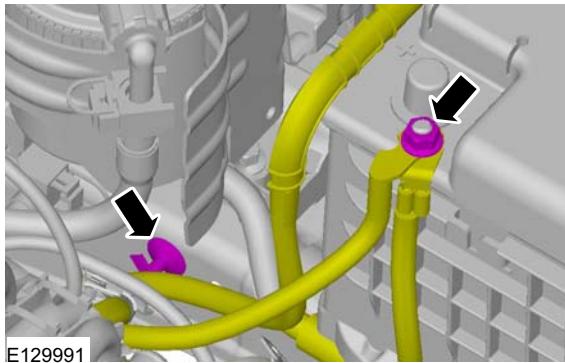
13. 1. Torque: 20 Nm

2. Torque: 20 Nm

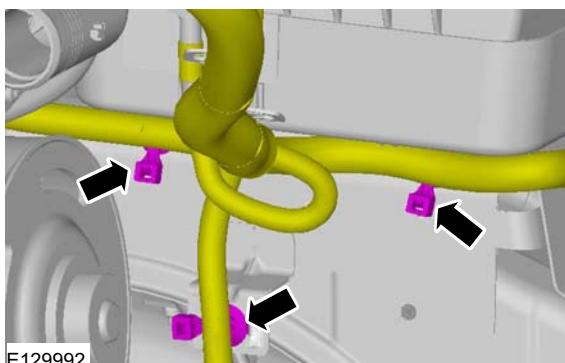
3. Torque: 18 Nm



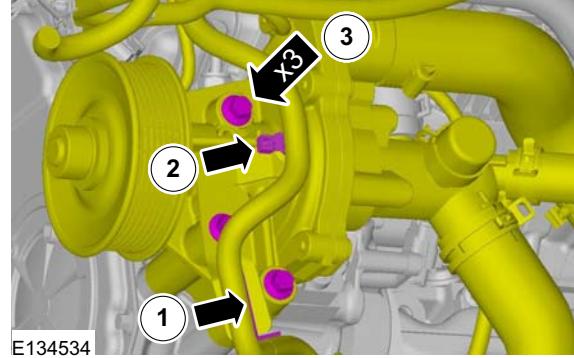
14. Torque: 10 Nm



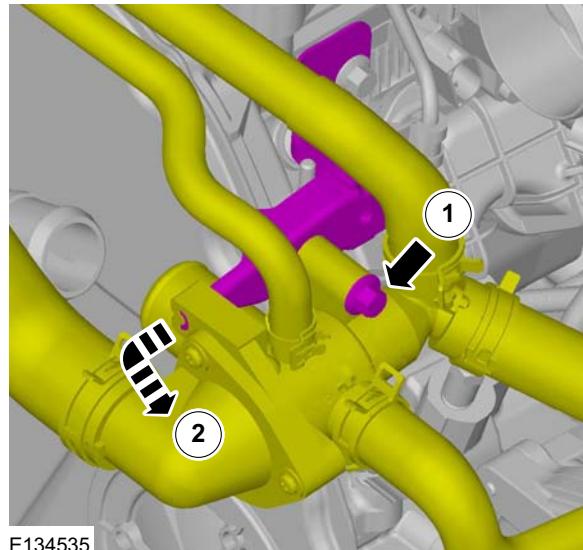
15.



16. 3. Torque: 23 Nm



17. Torque: 23 Nm

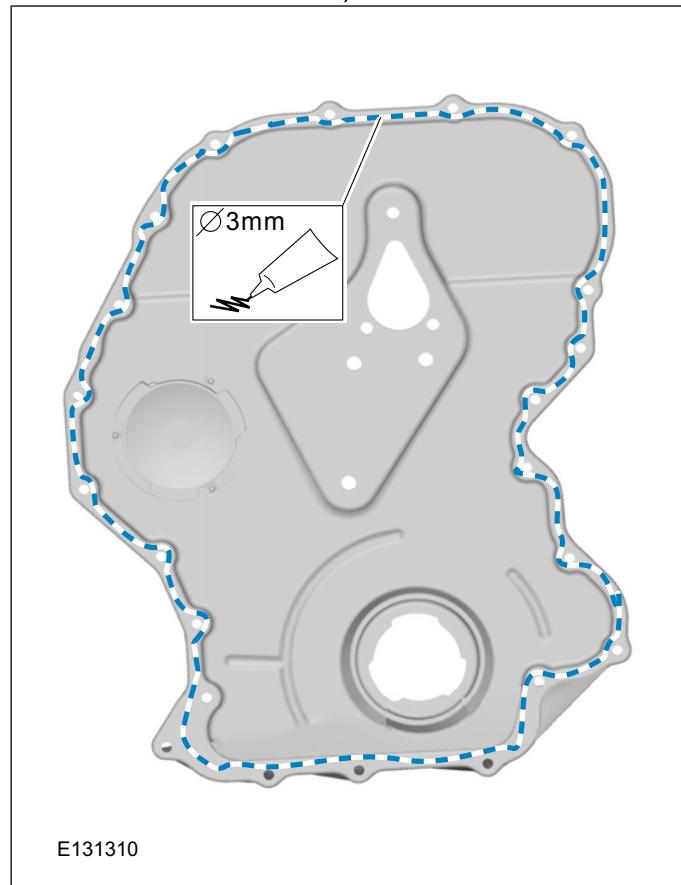


REMOVAL AND INSTALLATION

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

NOTE: Do not damage the mating faces.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant



Installation

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

REMOVAL AND INSTALLATION

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

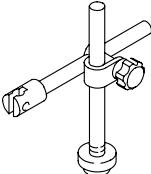
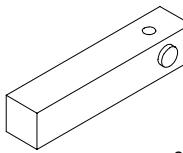


3. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

Cylinder Head(21 163 0)

Special Tool(s)

	205-069 Dial Indicator Gauge (Metric) 15046
	205-070 Holding Fixture, Dial Indicator Gauge 15022A
	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion) 21183

Removal

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

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

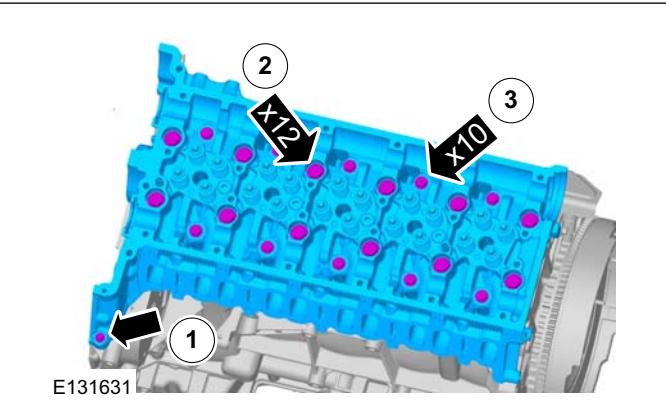
Refer to: [Brake Vacuum Pump - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma \(206-07 Power Brake Actuation, Removal and Installation\).](#)

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.



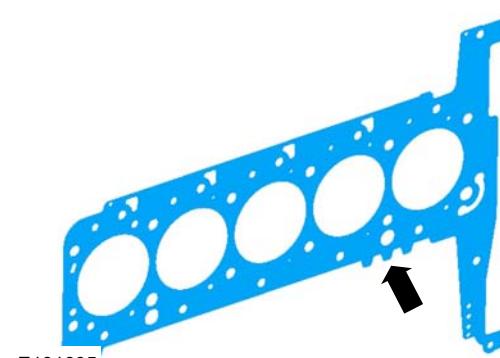
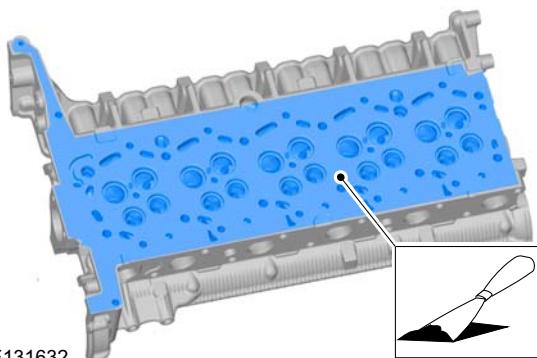
Installation

- 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

REMOVAL AND INSTALLATION

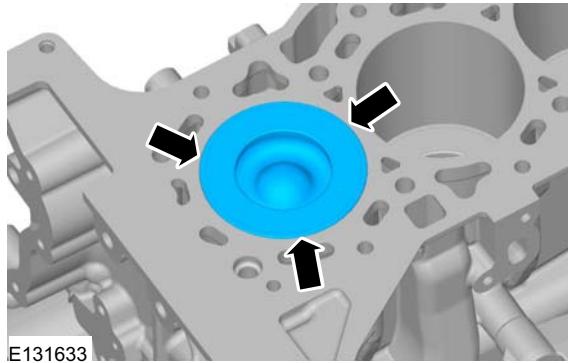
paths. Use a plastic scraping tool to remove all traces of the head gasket.

NOTE: Make sure that a new component is installed.



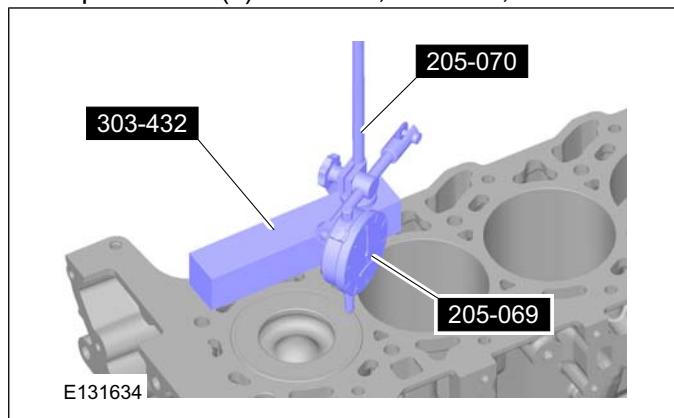
2. NOTE: Measure the piston protrusion of each cylinder at top dead center (TDC).

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



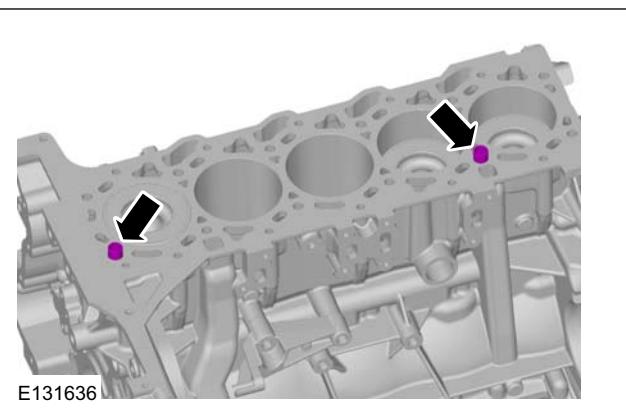
3. NOTE: The largest measurement determines the choice of the cylinder head gasket.

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



4. NOTE: Note the thickness of the gasket.

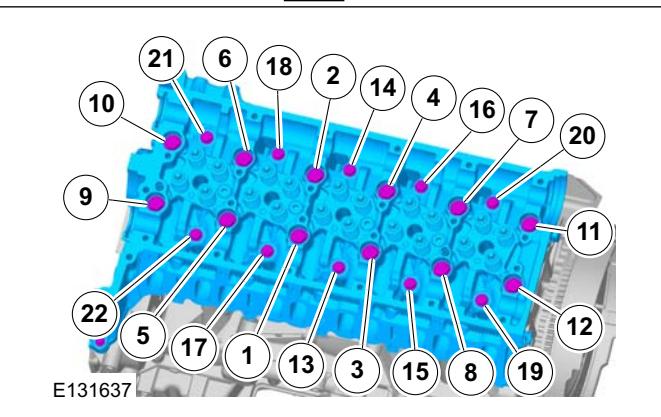
5.



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°



REMOVAL AND INSTALLATION

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).

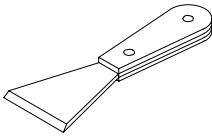
Refer to: **Brake Vacuum Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma** (206-07 Power Brake Actuation, Removal and Installation).

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
21179	

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

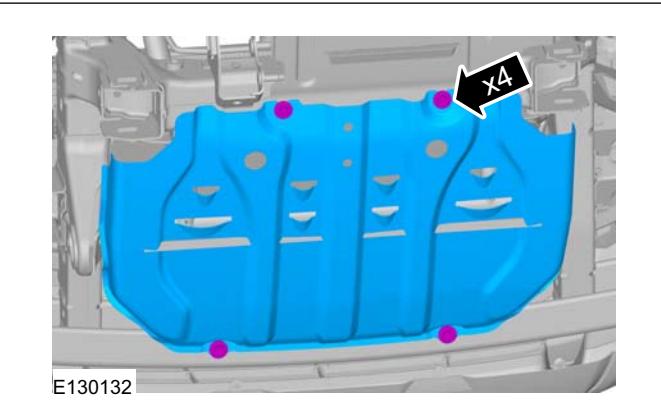
Removal

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

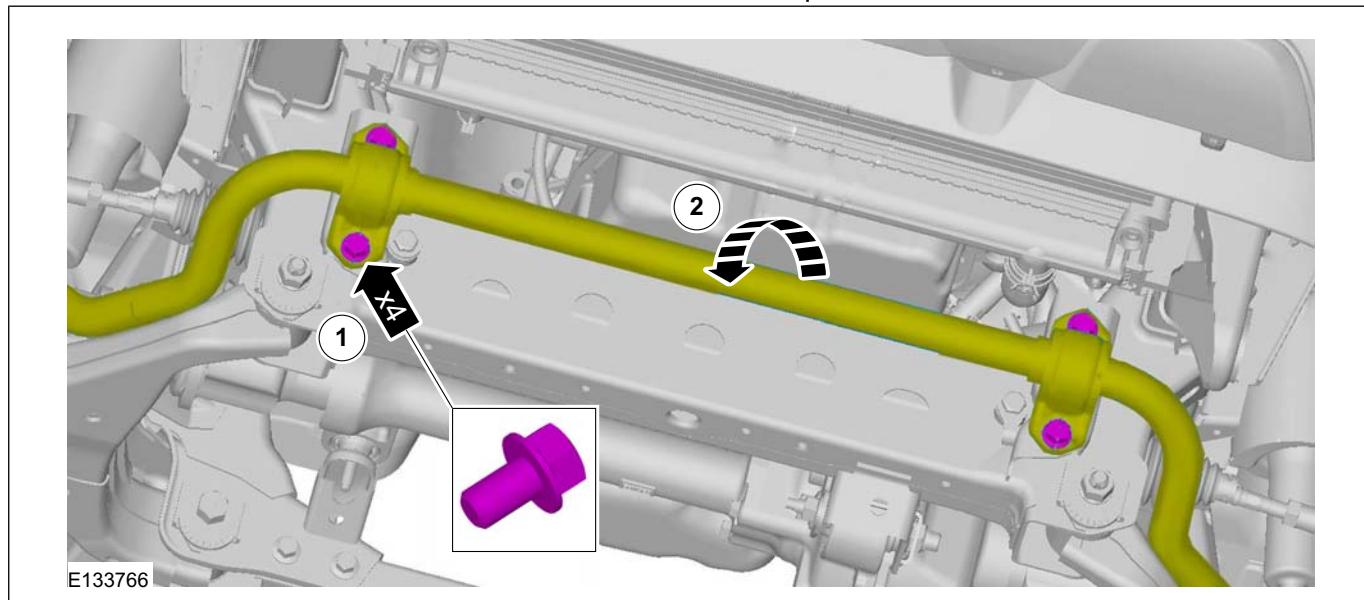
- Refer to: **Engine Cooling System Health and Safety Precautions** (100-00 General Information, Description and Operation).
- Refer to: **Battery Disconnect and Connect** (414-01 Battery, Mounting and Cables, General Procedures).
- Refer to: **Lifting** (100-02 Jacking and Lifting, Description and Operation).

4x4

- Torque: 30 Nm



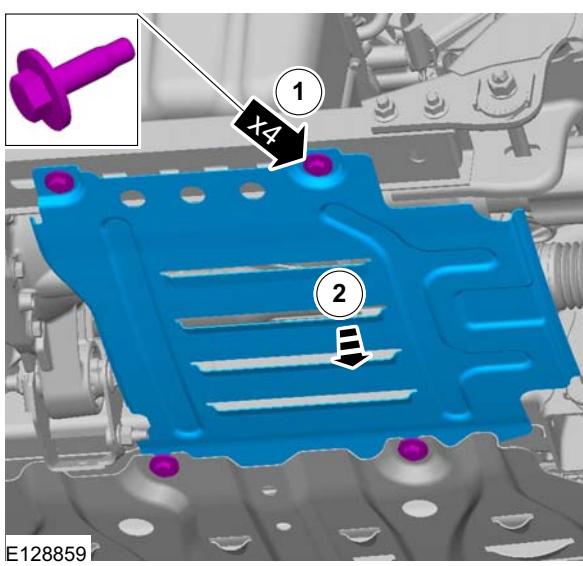
- Torque: 30 Nm



REMOVAL AND INSTALLATION

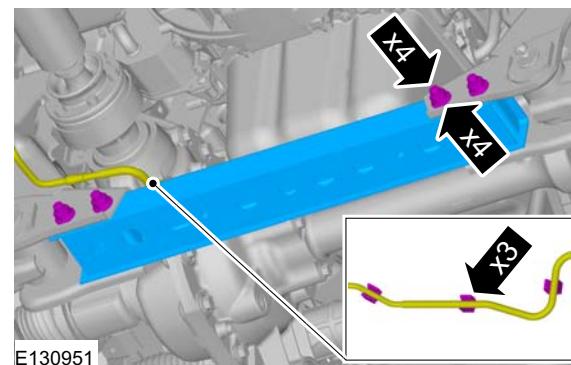
All vehicles

6. Torque: 30 Nm



E128859

7. Torque: 35 Nm

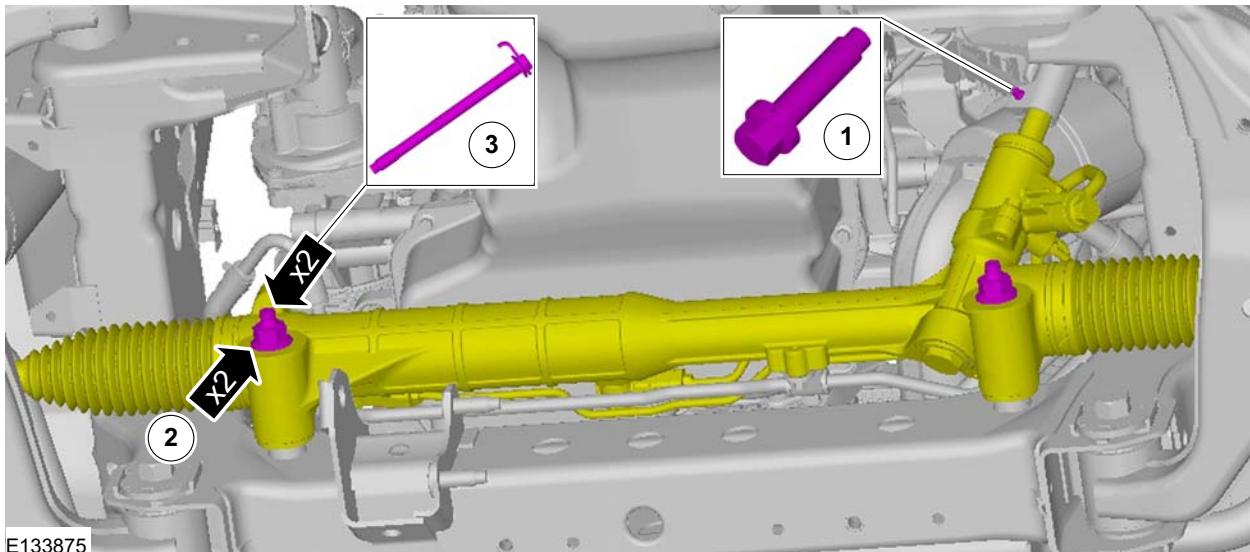


E130951

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

1. Torque: 23 Nm

2. Torque: 150 Nm



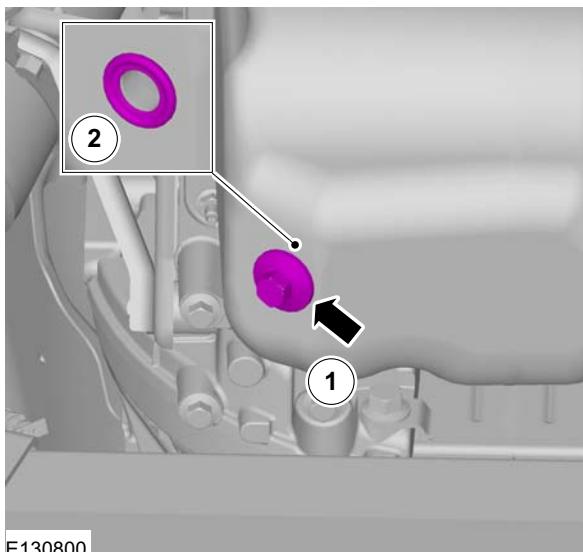
E133875

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

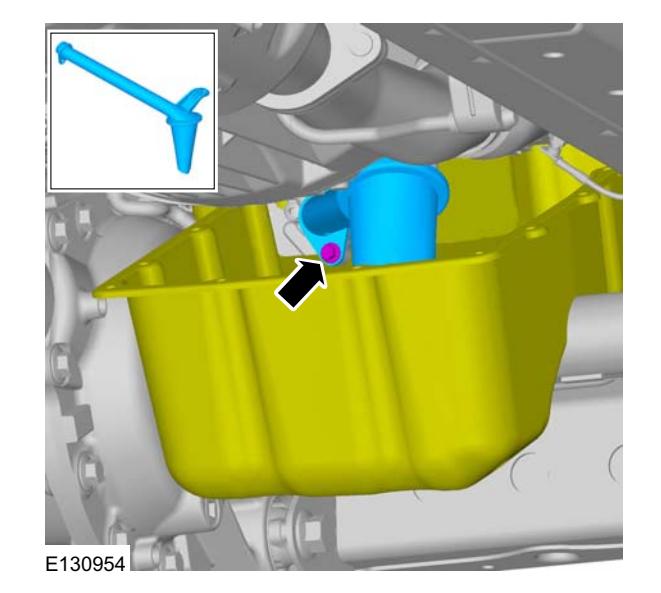
REMOVAL AND INSTALLATION

Drain the oil pan into a suitable container.

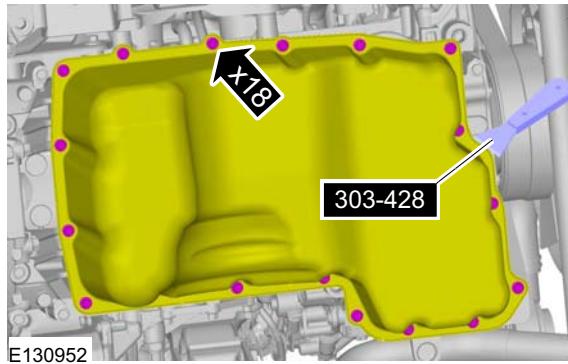
Torque: 39 Nm



12 Torque: 10 Nm

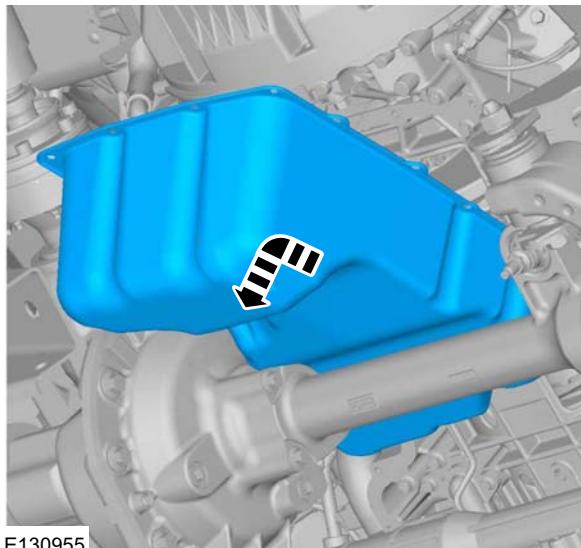


10. Special Tool(s): 303-428

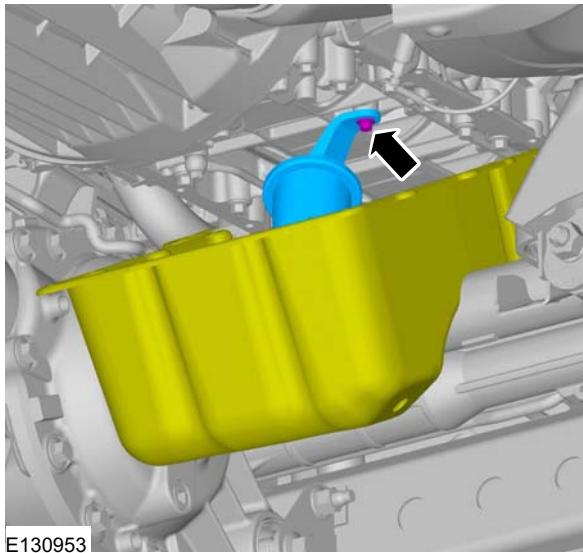


4x4

13.



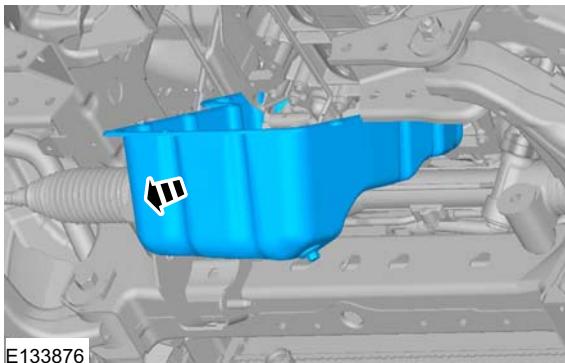
11. Torque: 10 Nm



REMOVAL AND INSTALLATION

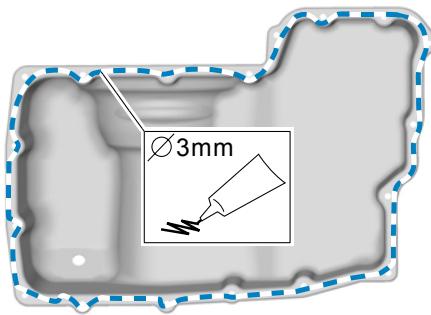
4x2

14.



NOTE: Do not damage the mating faces.

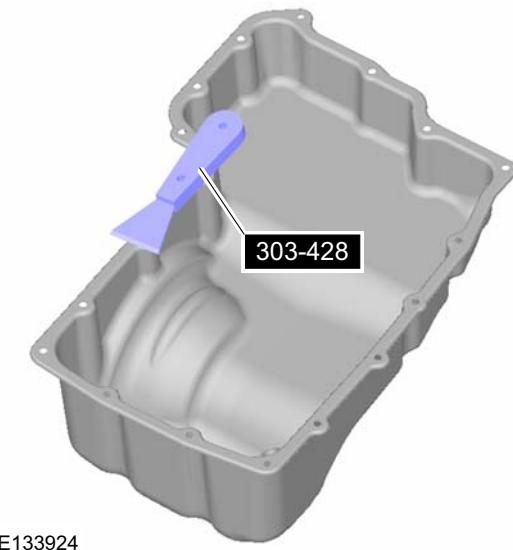
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant



Installation

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

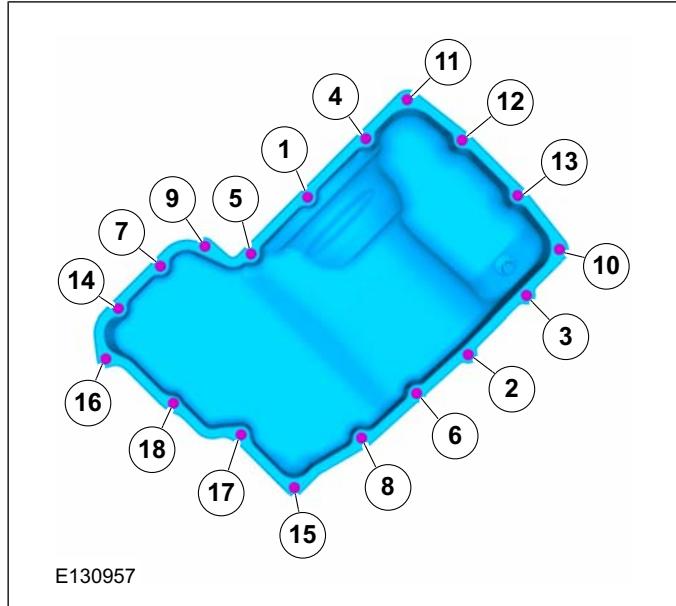
Special Tool(s): 303-428



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

3. Torque:

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



4. To install, reverse the removal procedure.

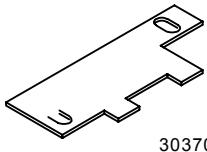
5. Fill the oil pan with clean engine oil.

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)

	303-705 Aligner, Oil Pump
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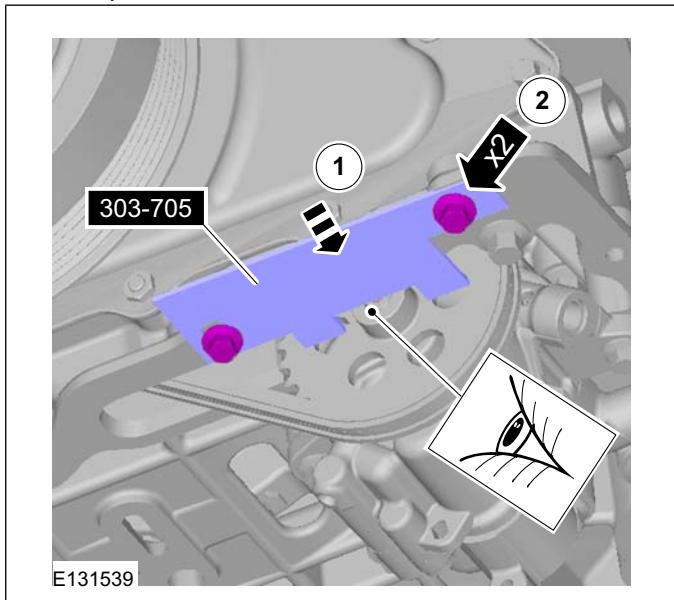
Removal

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

- 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).
- Refer to: **Oil Pan** (303-01 Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
- Hand tighten the bolts at this stage.

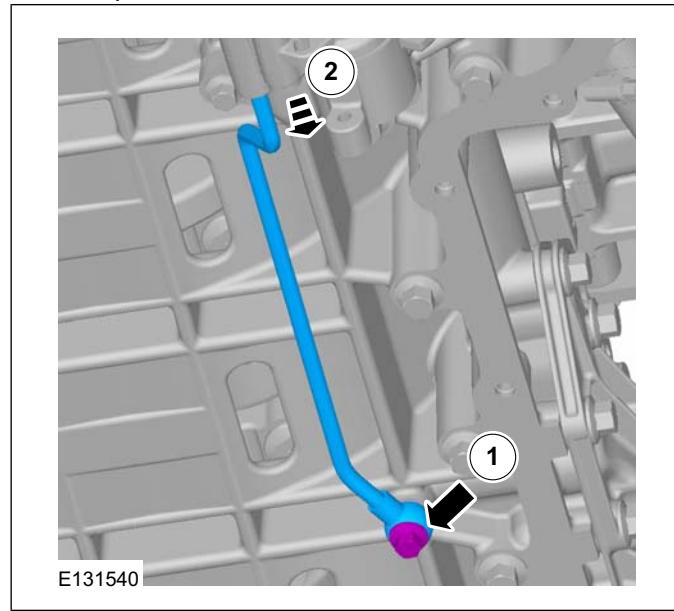
Special Tool(s): 303-705

Torque: 15 Nm



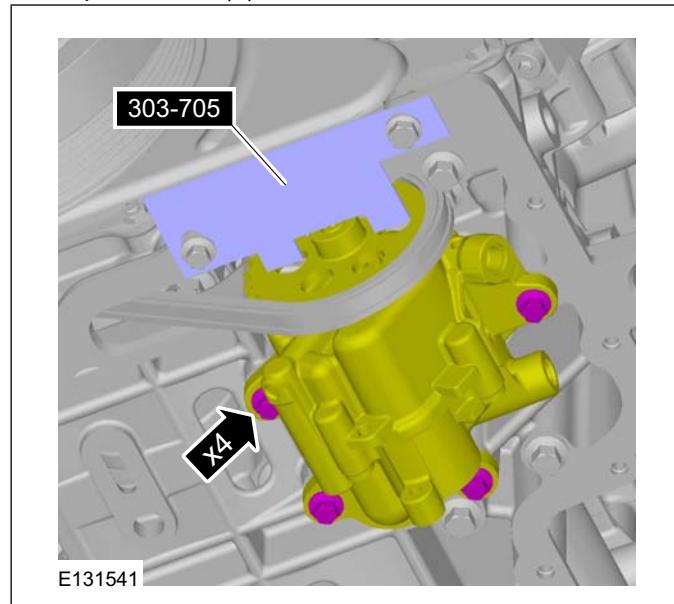
- WARNING:** Be prepared to collect escaping fluids.

Torque: 13 Nm



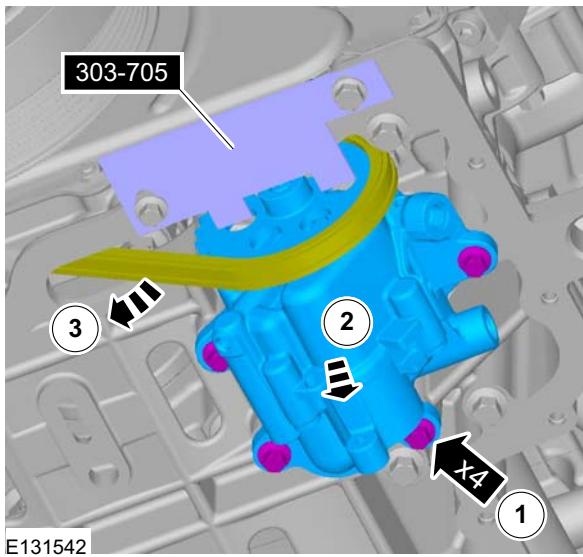
- NOTE:** Do not completely loosen the bolts at this stage.

Special Tool(s): 303-705



REMOVAL AND INSTALLATION

6. Special Tool(s): 303-705



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

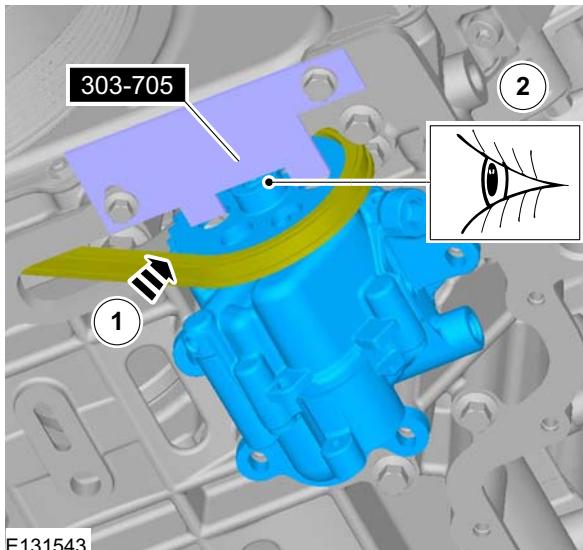
Special Tool(s): 303-705



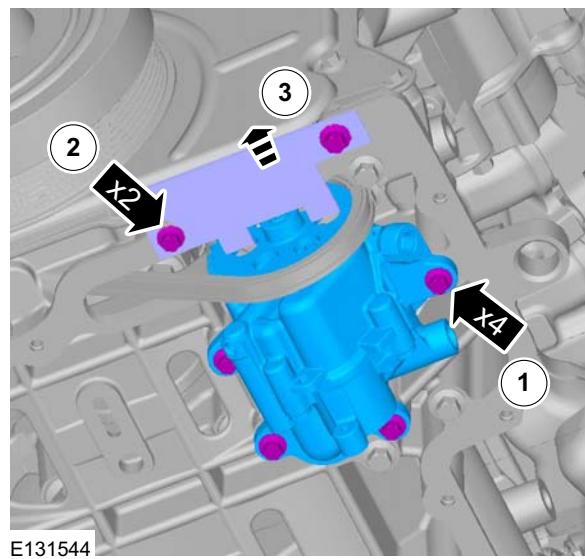
Installation

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

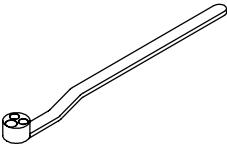


4. Refer to: [Oil Pan \(303-01 Engine - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma, Removal and Installation\).](#)

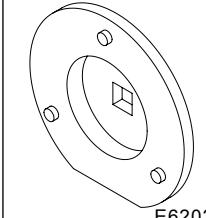
REMOVAL AND INSTALLATION

Engine Front Seal

Special Tool(s)

	303-1310 Holding Wrench, Crankshaft E87614
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Special Tool(s)

	303-679A Remover/Installer, Engine Front Cover Inspection Plate E62024
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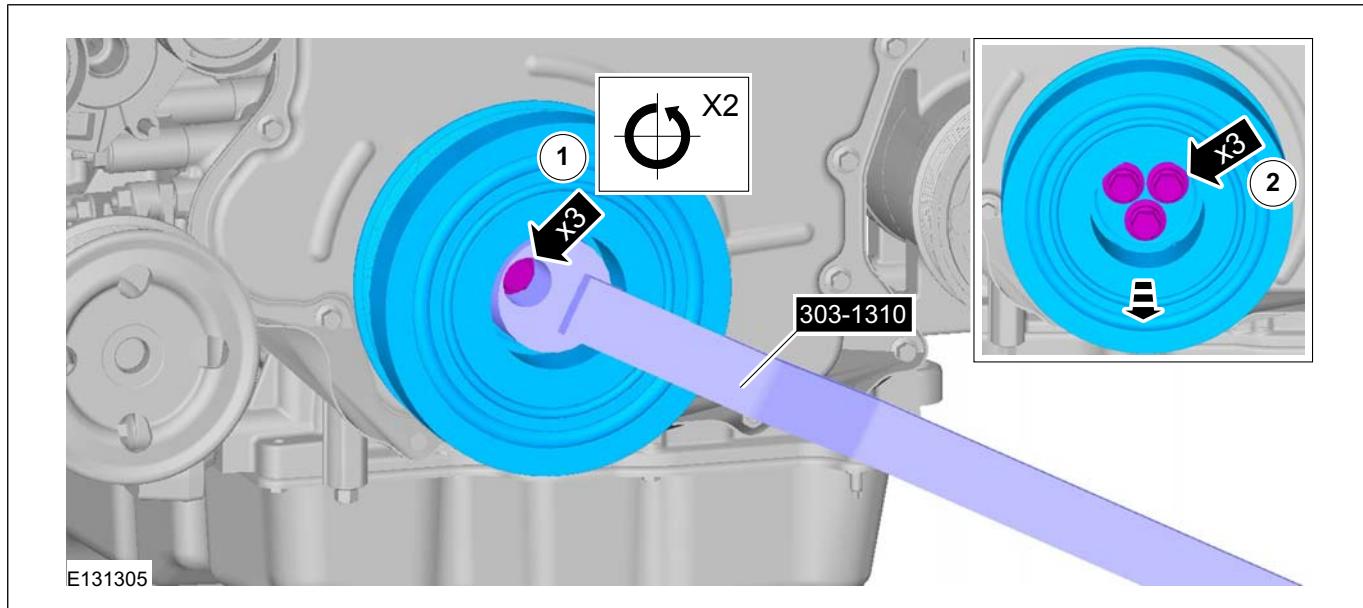
Removal

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

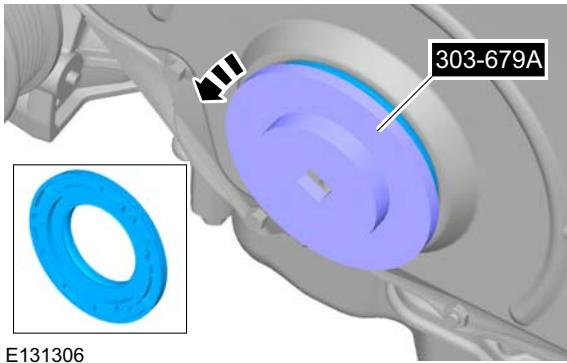


3. **⚠ CAUTION: Rotate the seal assembly until it releases. Failure to follow this**

REMOVAL AND INSTALLATION

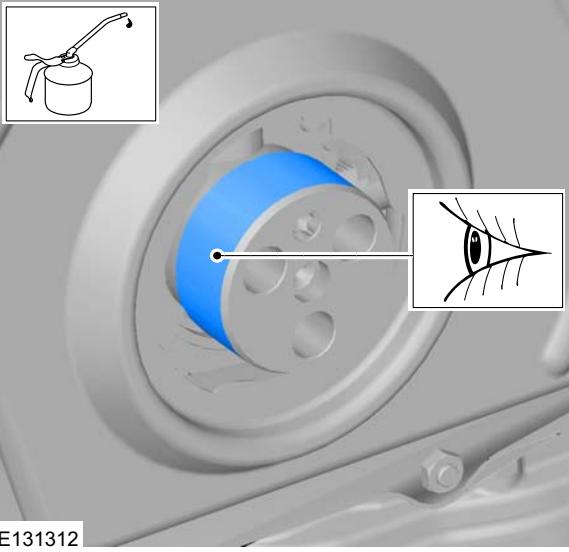
instruction may result in damage to the seal assembly.

Special Tool(s): 303-679A



Installation

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

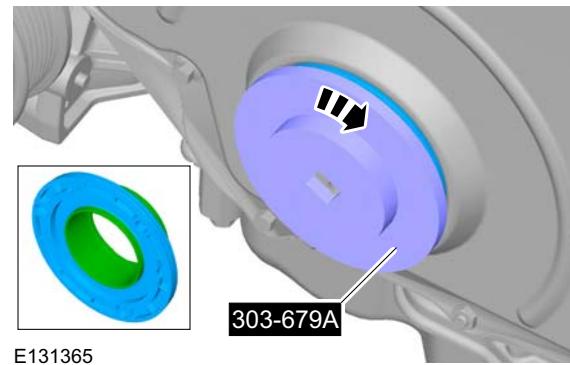


- CAUTION:** Rotate the seal assembly until it locks. Failure to follow this

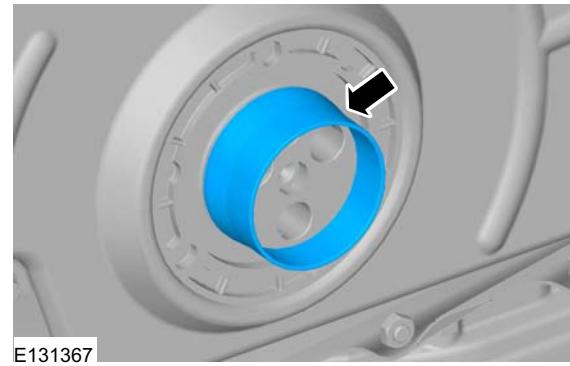
instruction may result in damage to the seal assembly.

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



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



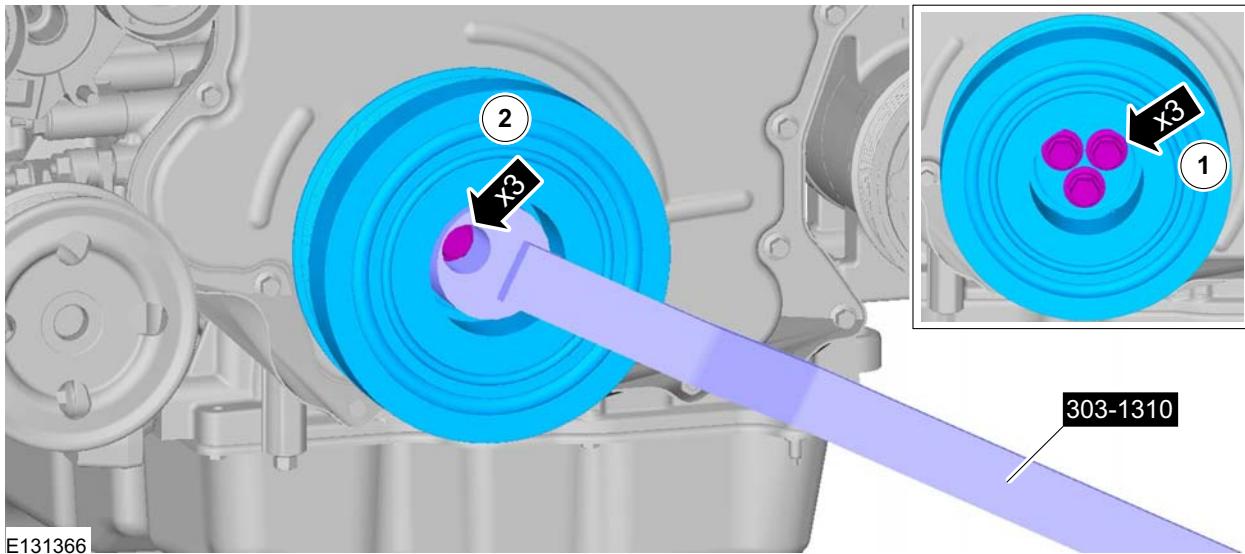
- CAUTION:** The crankshaft pulley bolts must not be used more than 3 times.

Special Tool(s): 303-1310

Torque:

- Stage 1: 45 Nm
- Stage 2: 120°

REMOVAL AND INSTALLATION

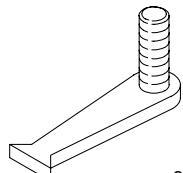


5. Refer to: [Cooling Fan Motor and Shroud \(303-03 Engine Cooling - 3.2L Duratorq-TDCi \(148kW/200PS\) - Puma, Removal and Installation\).](#)

REMOVAL AND INSTALLATION

Crankshaft Rear Seal(21 468 4)

Special Tool(s)

	303-254 Locking Tool, Flywheel 21135
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Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal

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

Vehicles with automatic transmission

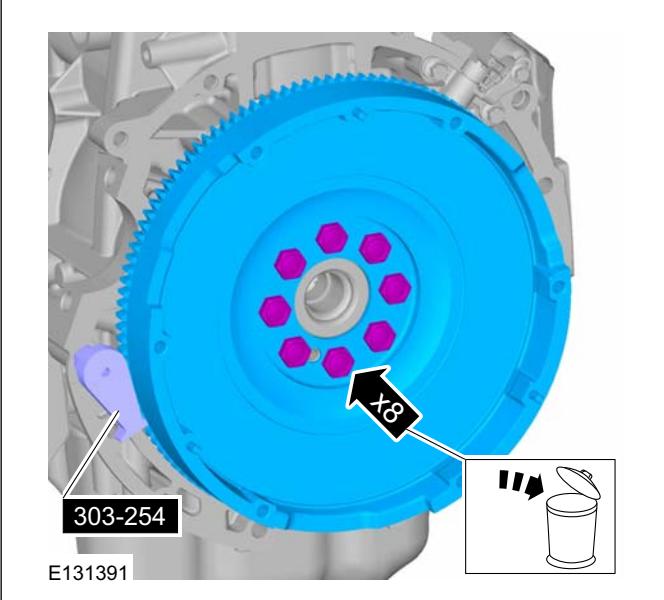
- Refer to: [Transmission - 2WD \(307-01\)](#)
Automatic Transmission/Transaxle - Vehicles
With: 6-Speed Automatic Transaxle - 6R80,
Removal).
- Refer to: [Transmission - 4WD \(307-01\)](#)
Automatic Transmission/Transaxle - Vehicles
With: 6-Speed Automatic Transaxle - 6R80,
Removal).

Vehicles with manual transmission

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

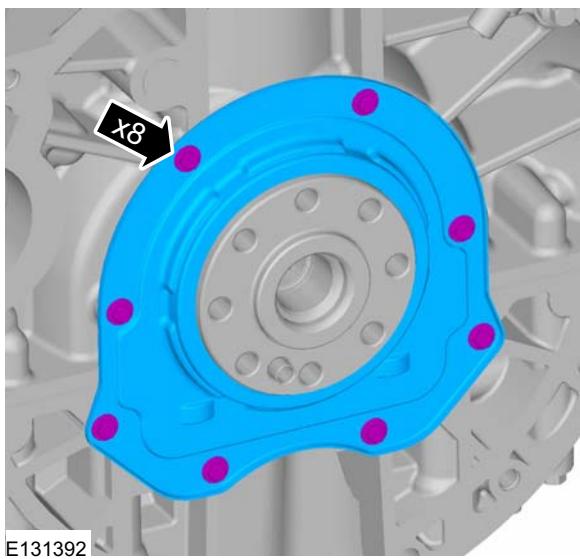
All vehicles

- Special Tool(s): 303-254



REMOVAL AND INSTALLATION

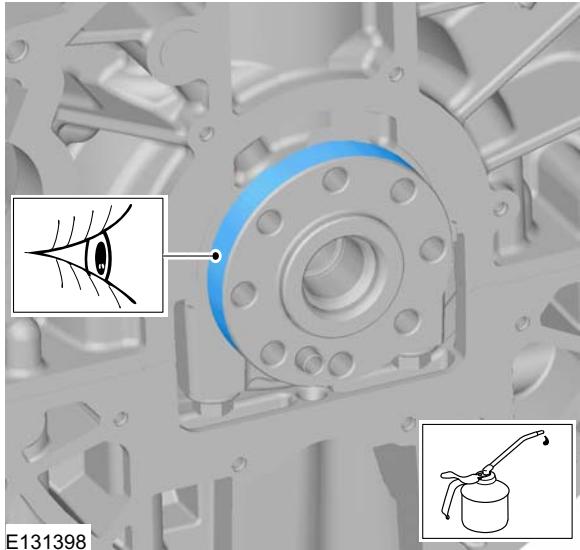
4.



Installation

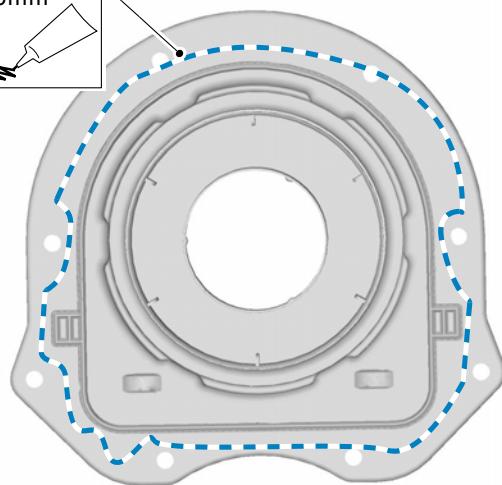
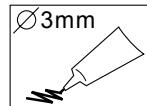
All vehicles

1.



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

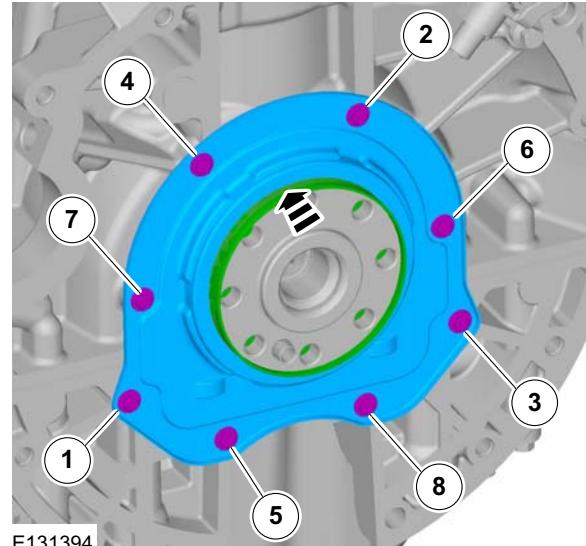
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant



E131393

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.

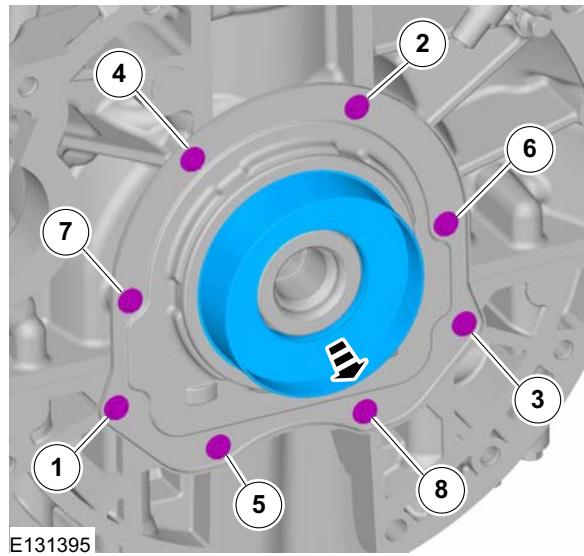
Hand tighten the bolts at this stage.



REMOVAL AND INSTALLATION

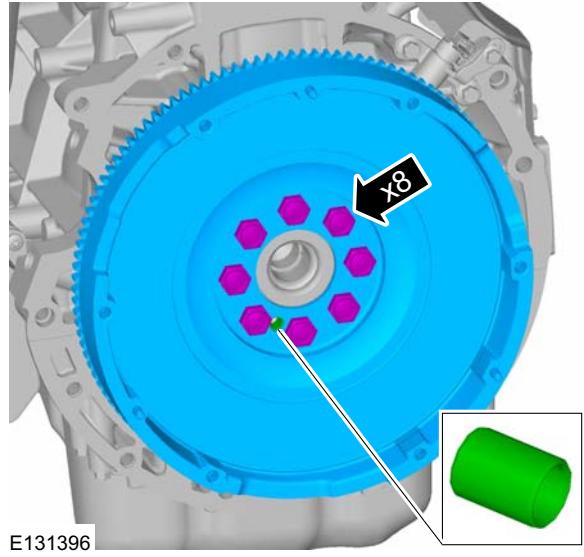
4. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

Torque: 10 Nm



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

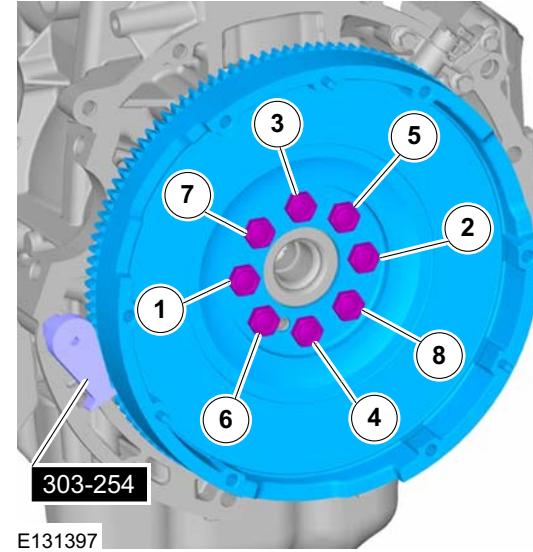
Hand tighten the bolts at this stage.



6. Special Tool(s): 303-254

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

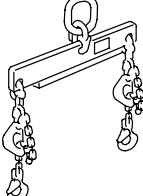
8. Refer to: **Transmission - 2WD** (307-01

Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - 6R80, Installation).

Refer to: **Transmission - 4WD** (307-01

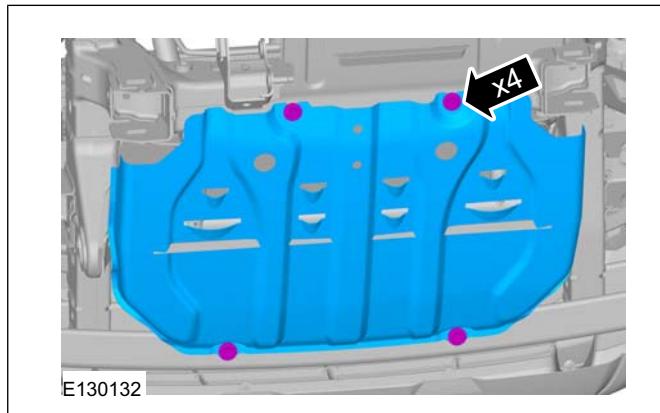
Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - 6R80, Installation).

REMOVAL**Engine — Vehicles With: 6-Speed Manual Transmission - MT82(21 132 0; 21 132 6; 21 132 7)****Removal****Special Tool(s) / General Equipment**

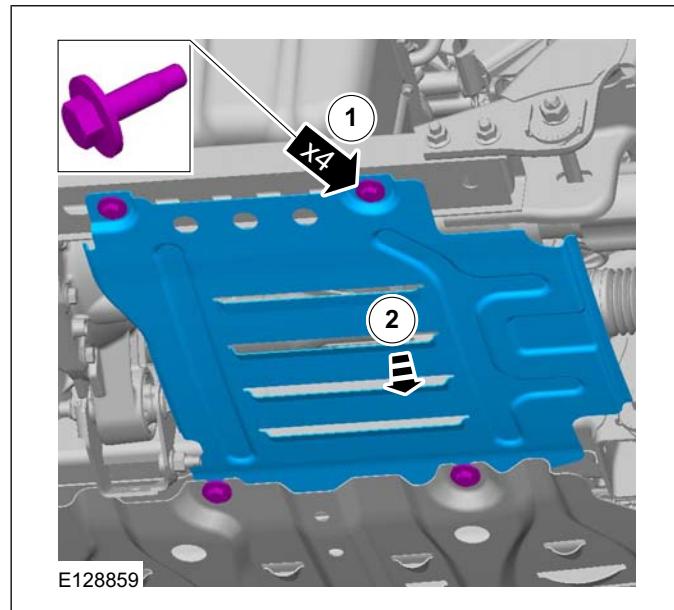
	303-122 Lifting Bracket, Engine
21068A	Transmission Jack

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).

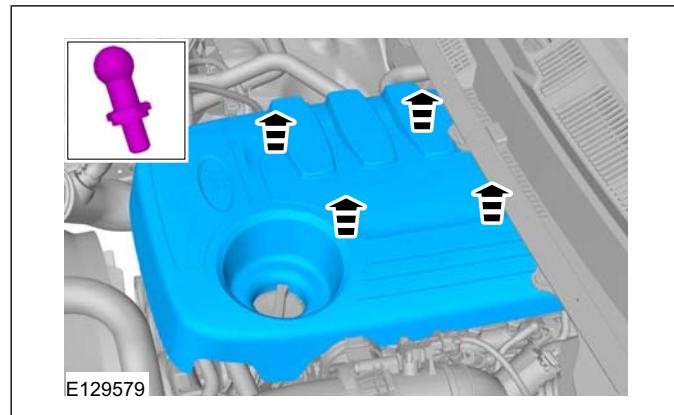
6.



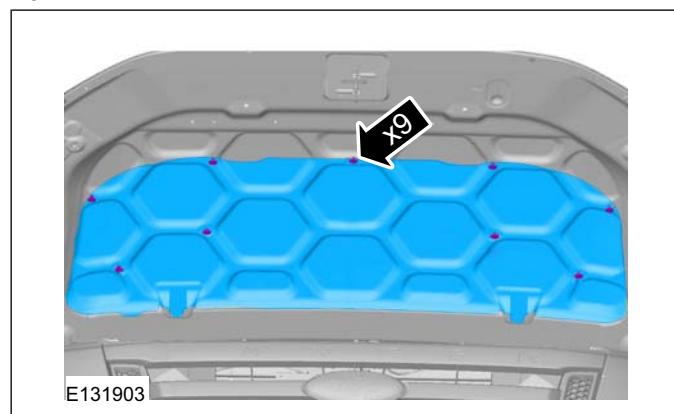
7.

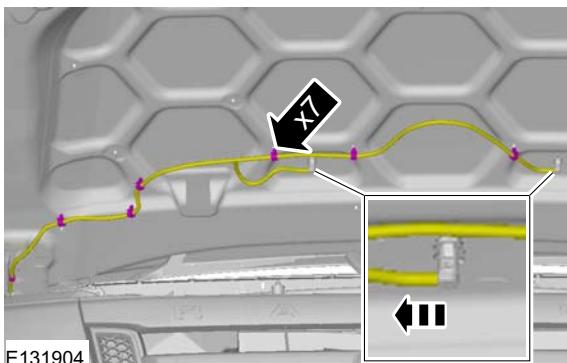
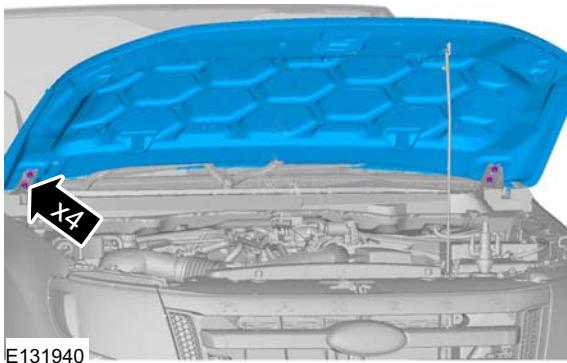
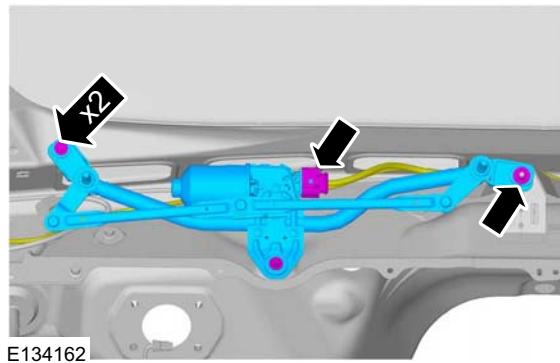
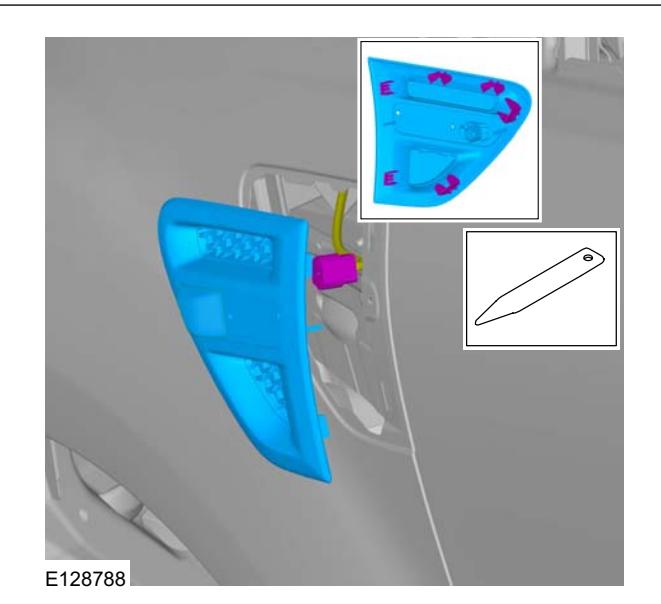


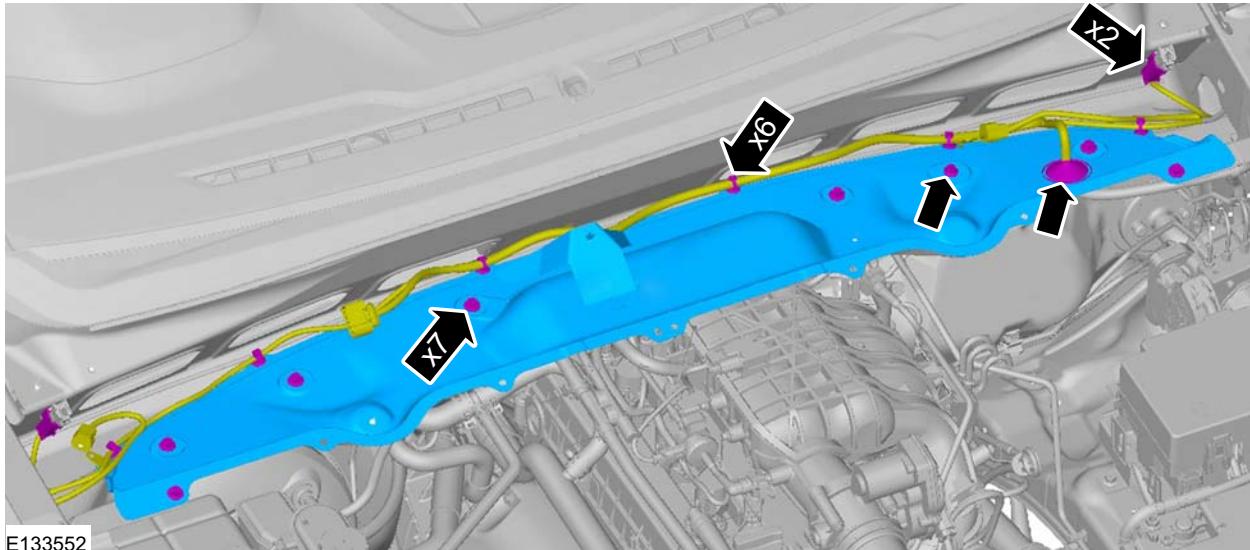
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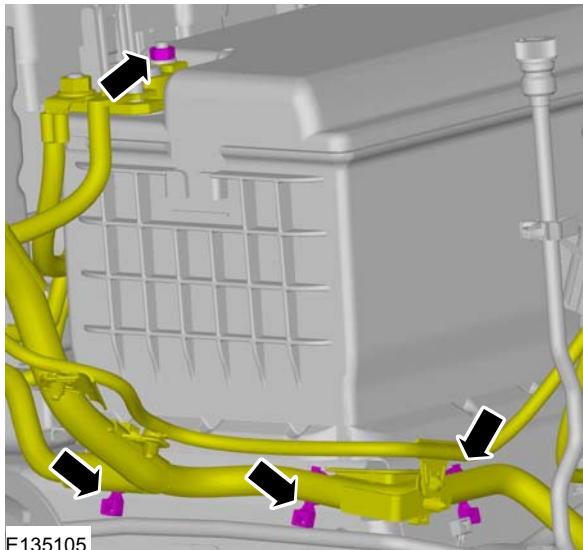
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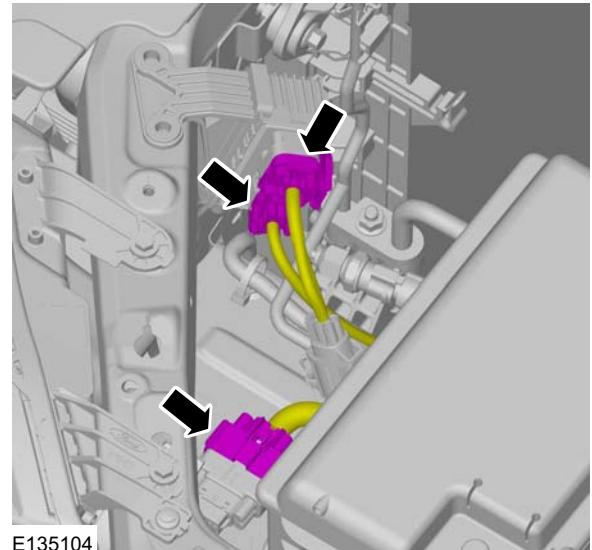
REMOVAL**10.****11.****12** Refer to: **Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).****13.****14.** On both sides.**15.**

REMOVAL

16.



17.



REMOVAL

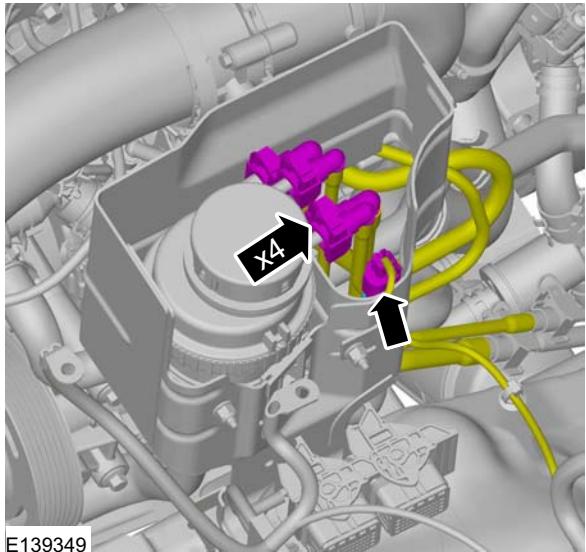
18. Refer to: **Battery** (414-01 Battery, Mounting and Cables, Removal and Installation).

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

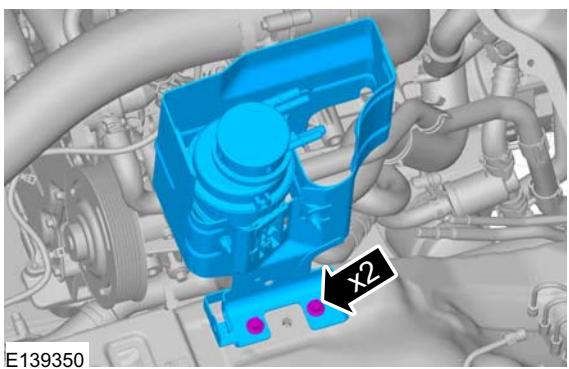
20. Refer to: **Powertrain Control Module (PCM)** (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

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).

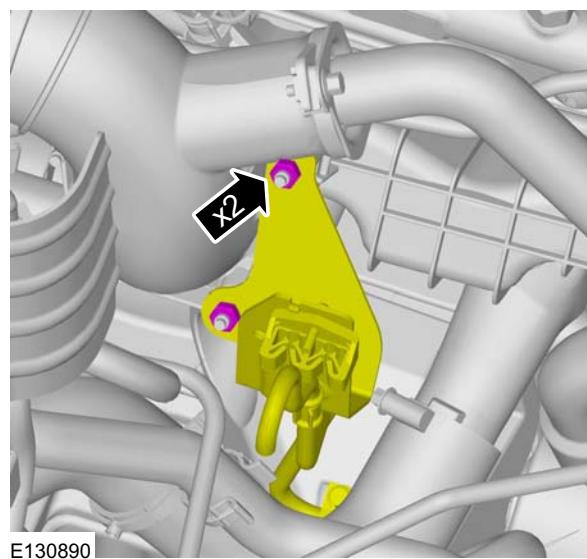
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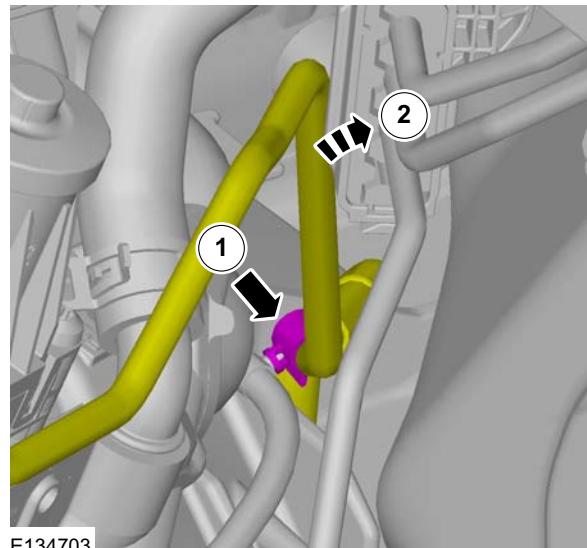
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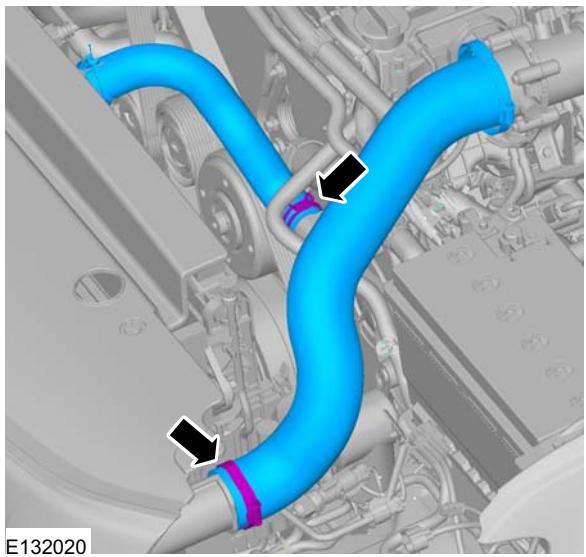


23.



24.

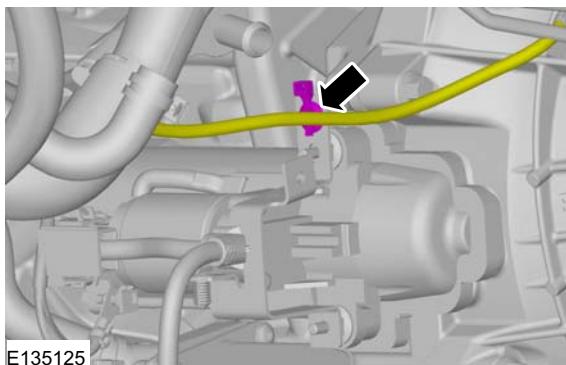


REMOVAL**25.**

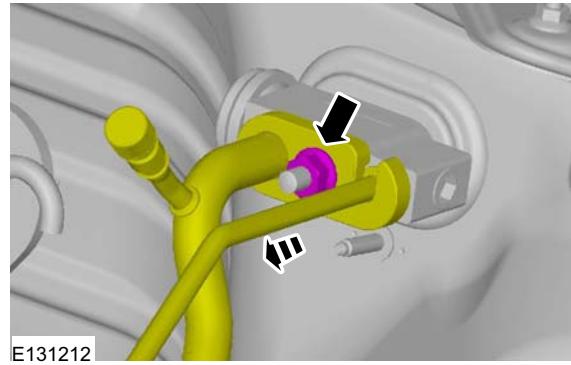
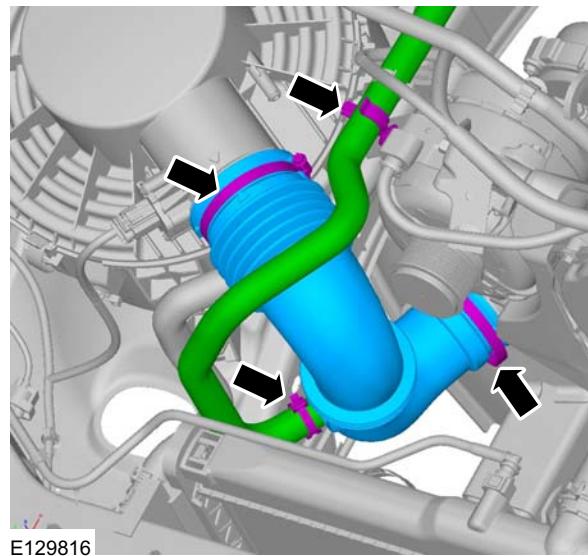
26. Refer to: **Cooling Fan Motor and Shroud** (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

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.

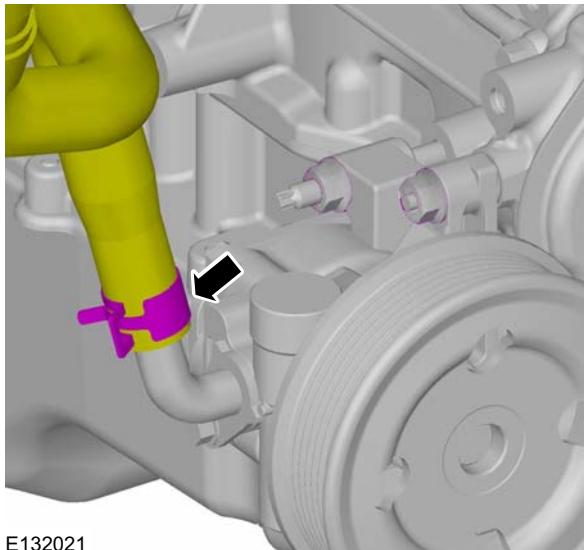
30. Refer to: **Starter Motor - 3.2L Duratorq-TDCi (148kW/200PS) - Puma** (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

31.**32.**

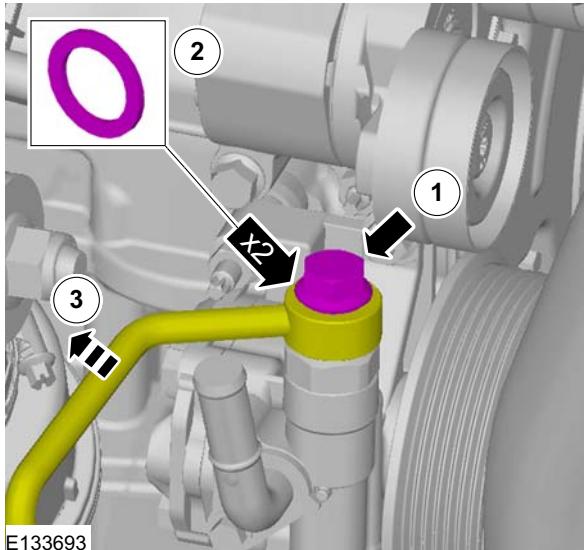
REMOVAL

- 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\).](#)

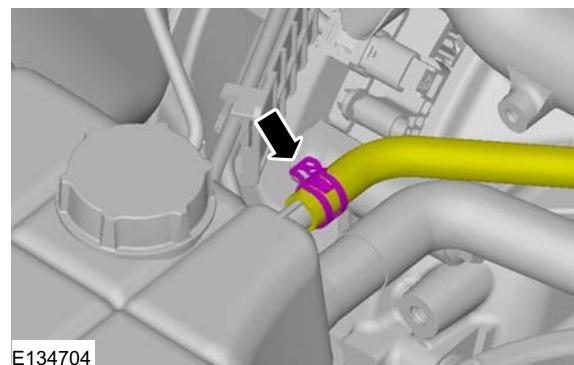
34. NOTE: Make sure that all openings are sealed.



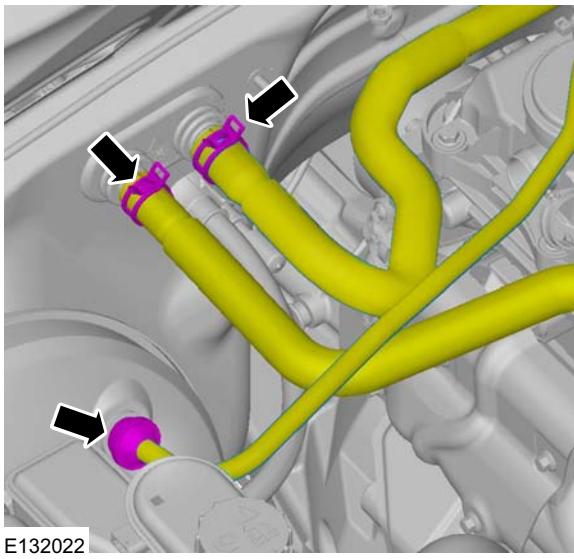
- 35.** **CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.



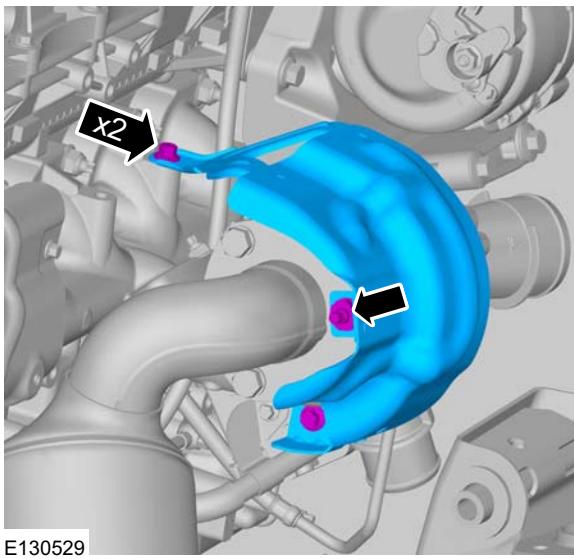
36.



37.



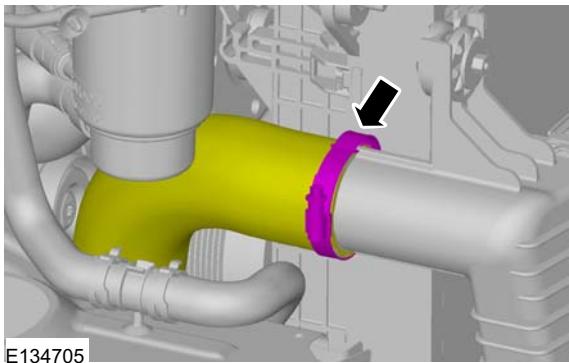
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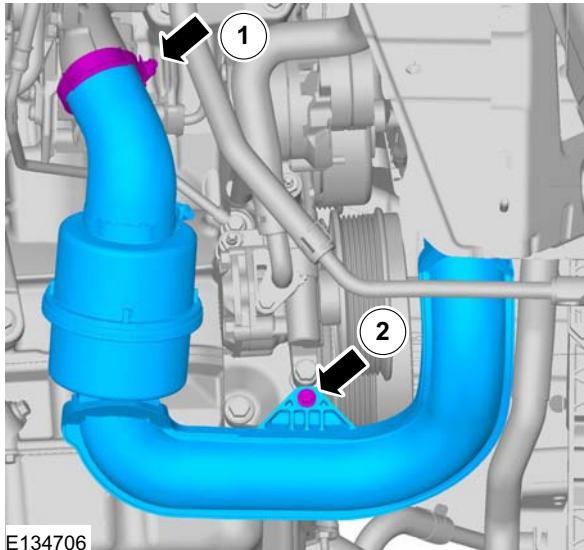
REMOVAL

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).

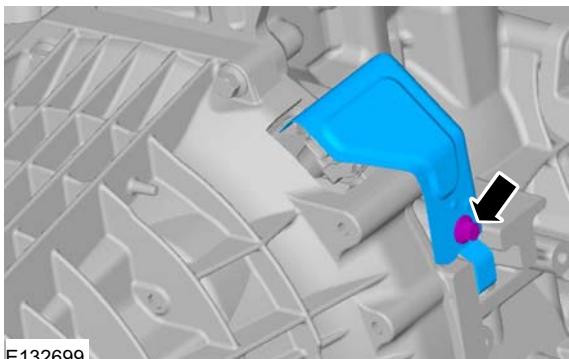
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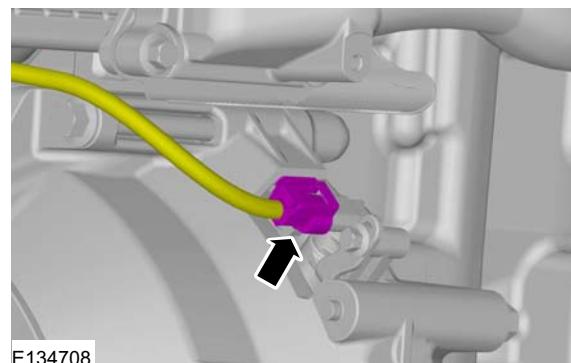
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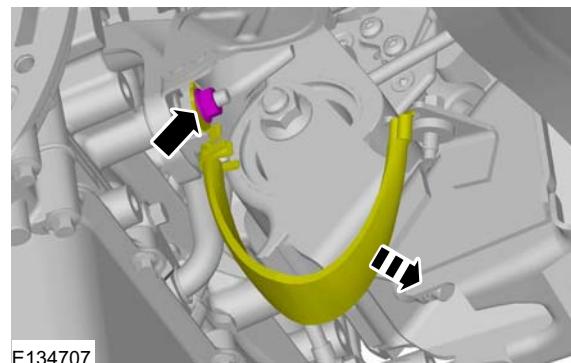
42.



43.



44.



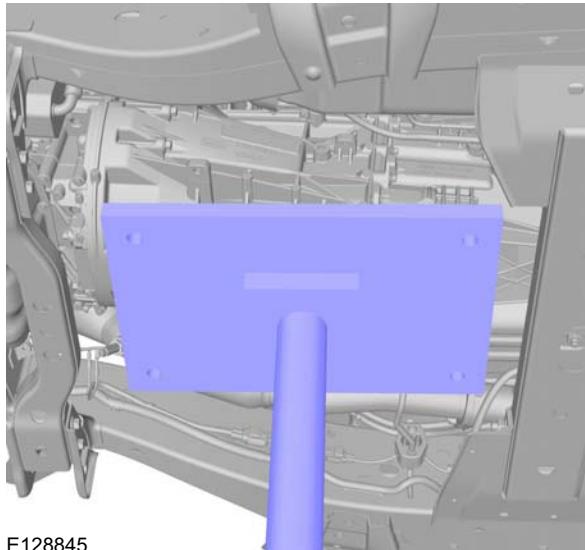
45. **WARNING:** Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.

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

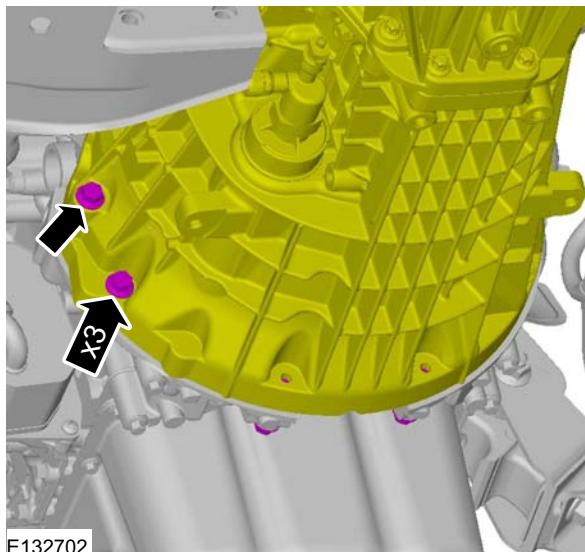
REMOVAL

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

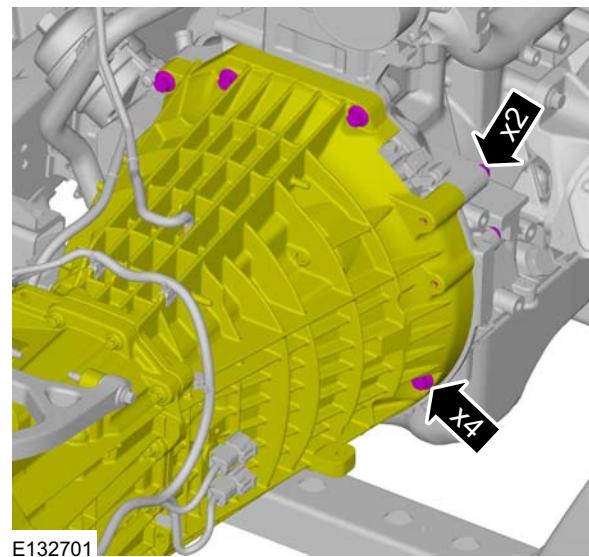
General Equipment: Transmission Jack



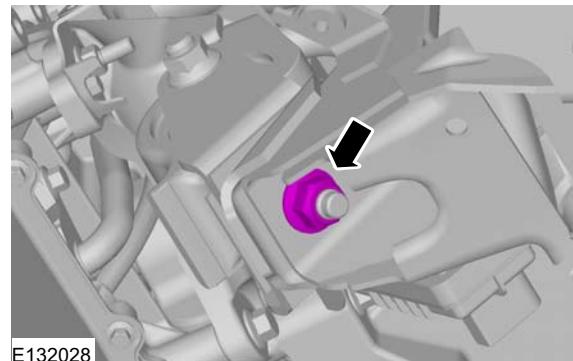
46.



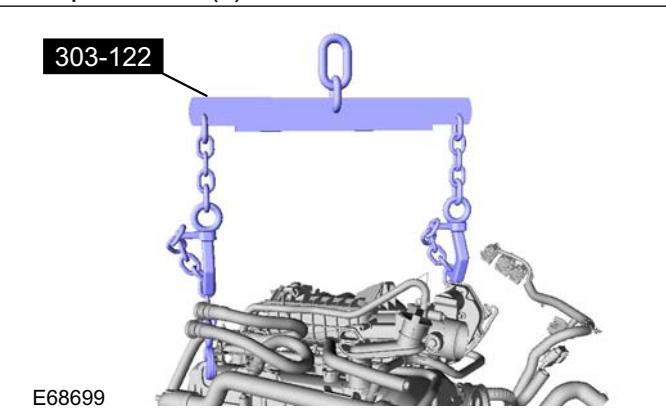
47.



48. On both sides.

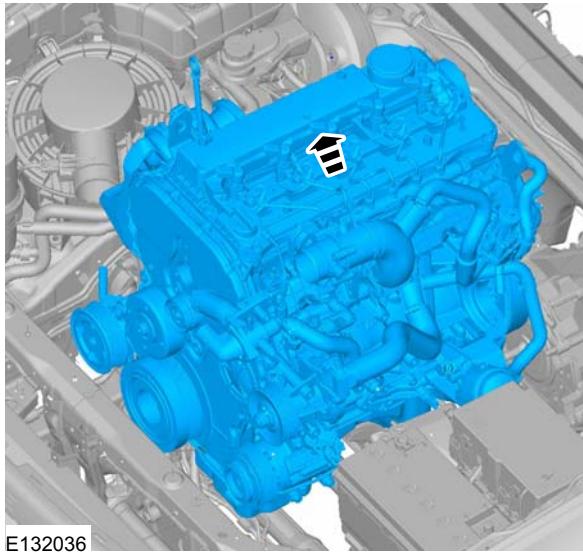


49. Special Tool(s): 303-122

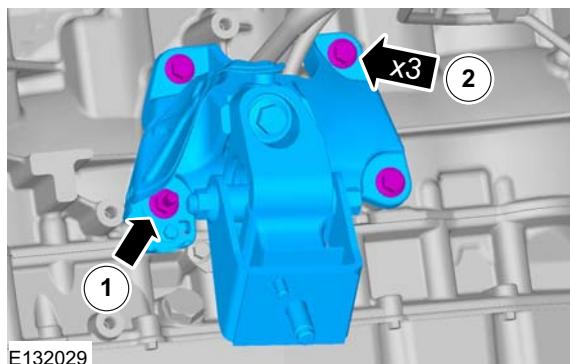


REMOVAL

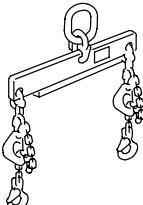
50.



51.

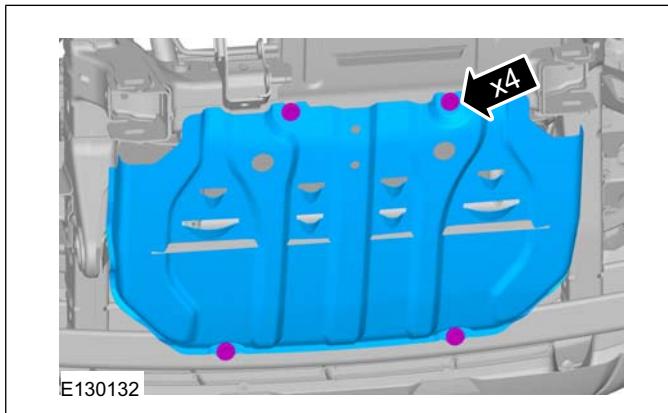


REMOVAL**Engine — Vehicles With: 6-Speed Automatic Transaxle - 6R80(21 132 0; 21 132 6; 21 132 7)****Removal****Special Tool(s) / General Equipment**

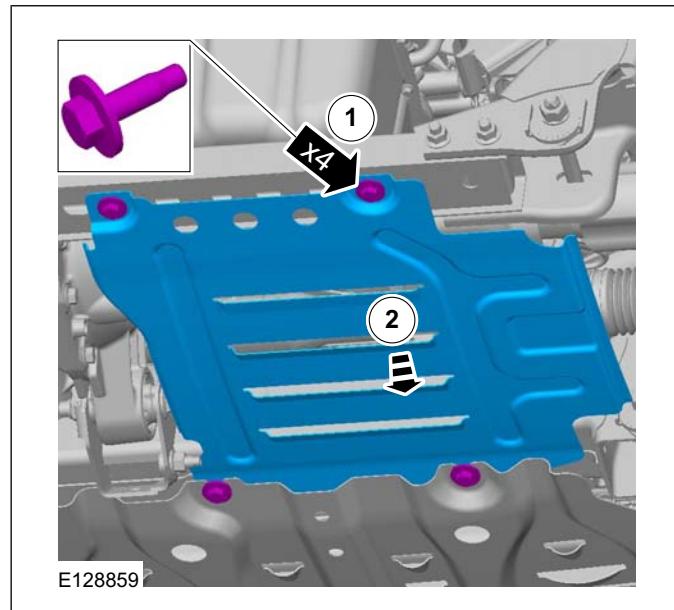
	303-122 Lifting Bracket, Engine
21068A	Transmission Jack

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).

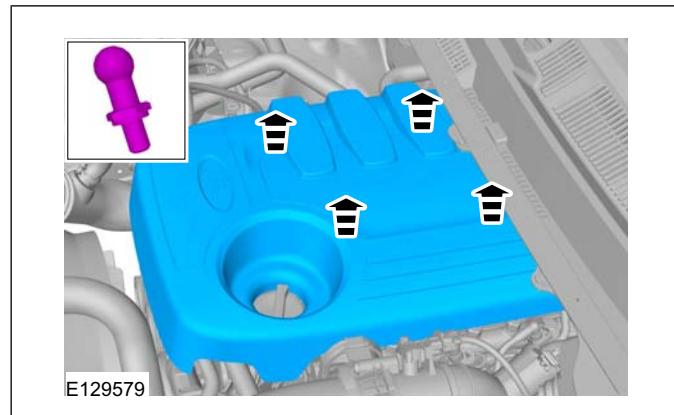
6.



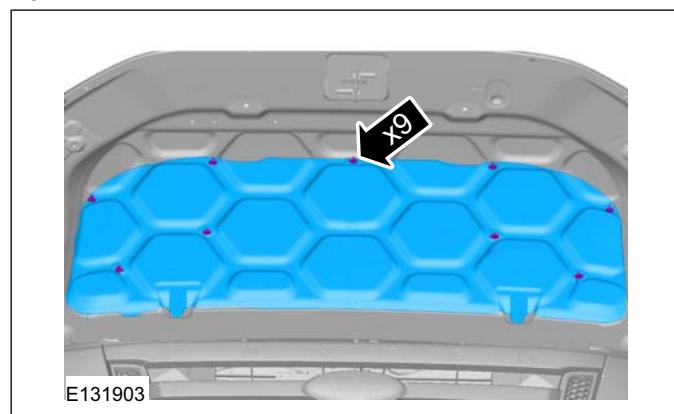
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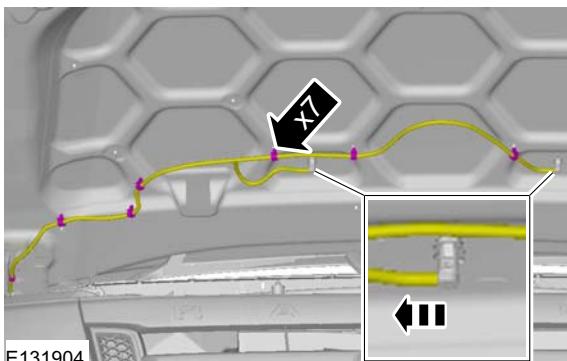
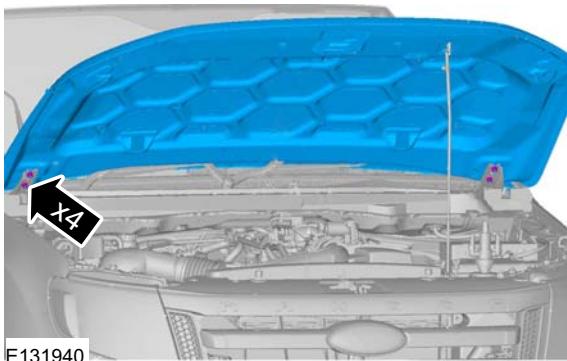


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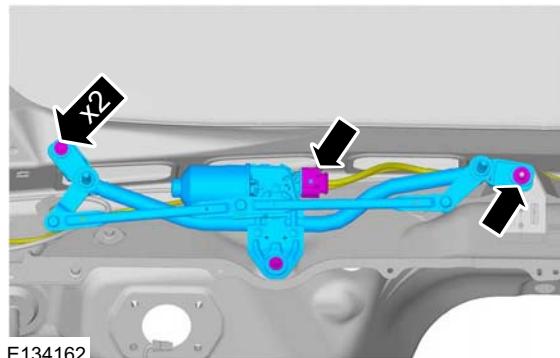


9.

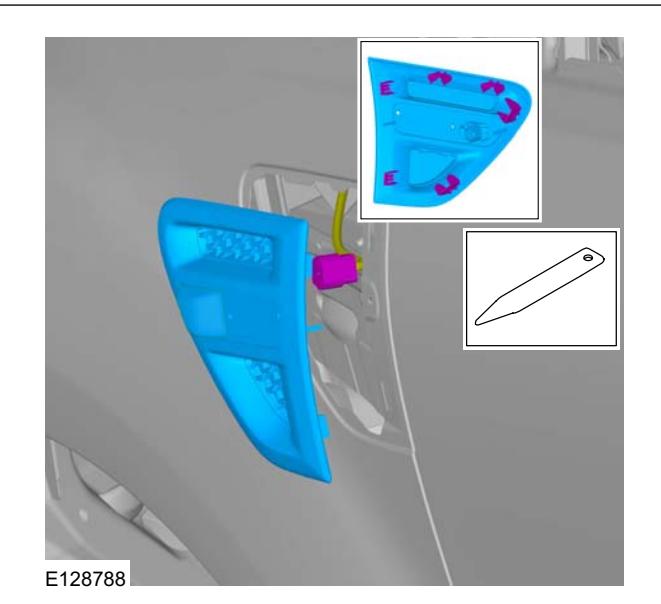


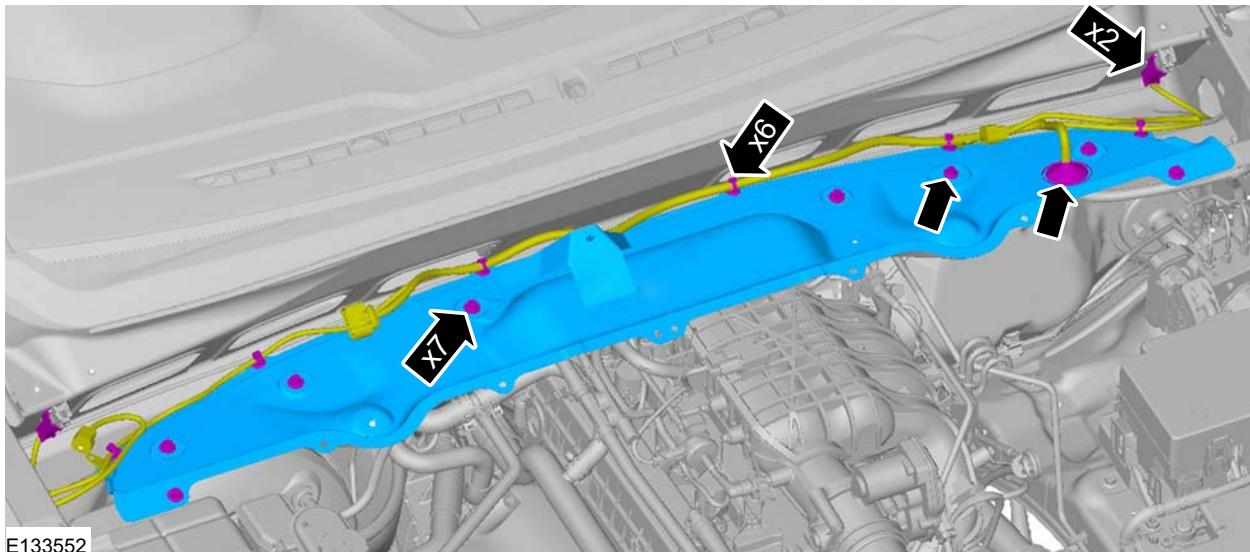
REMOVAL**10.****11.**

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

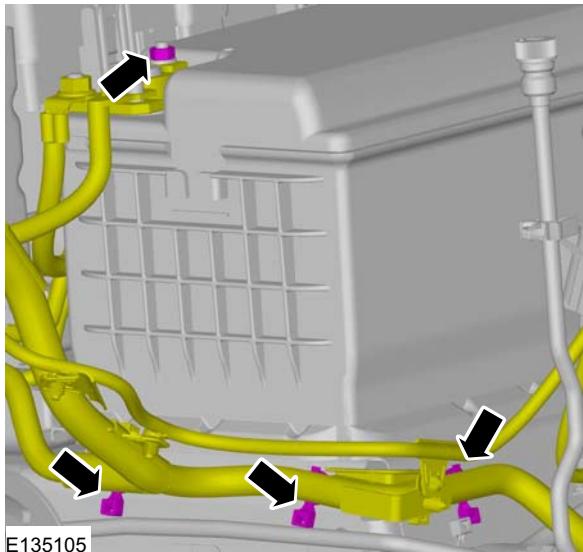
13.

14. On both sides.

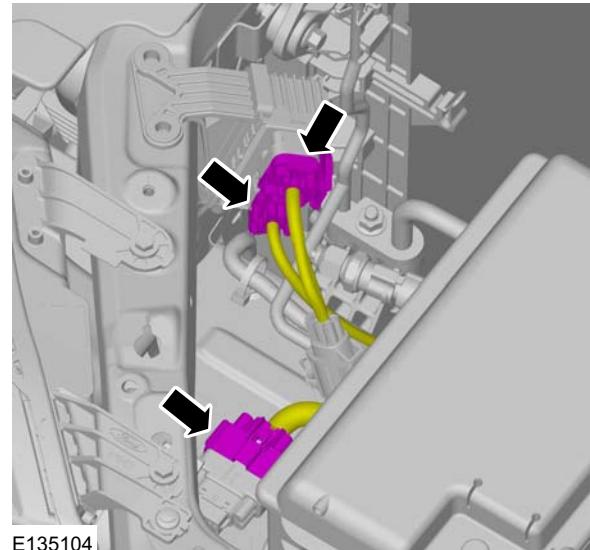
**15.**

REMOVAL

16.



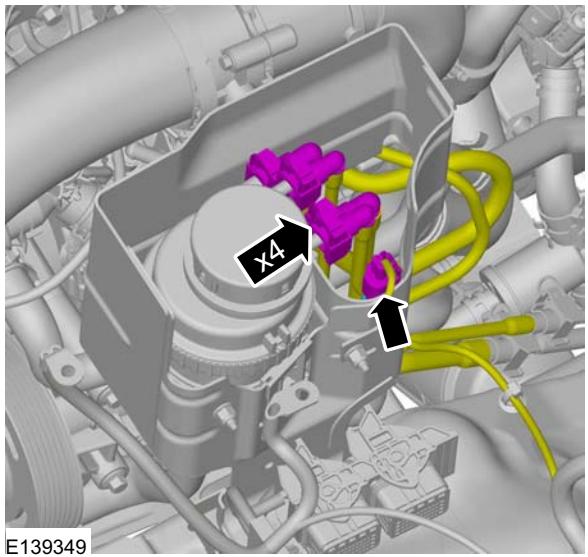
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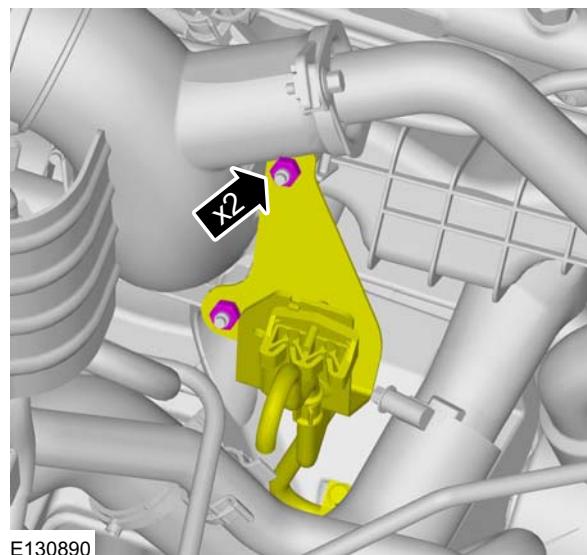
REMOVAL

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).

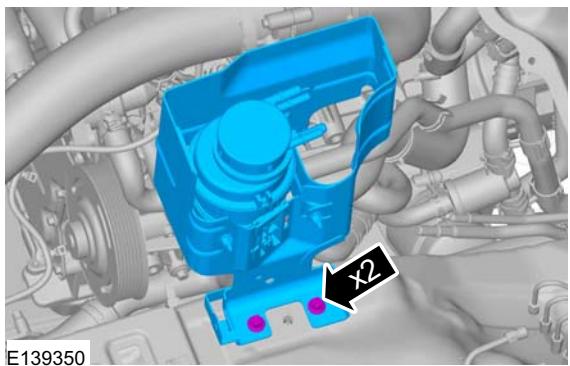
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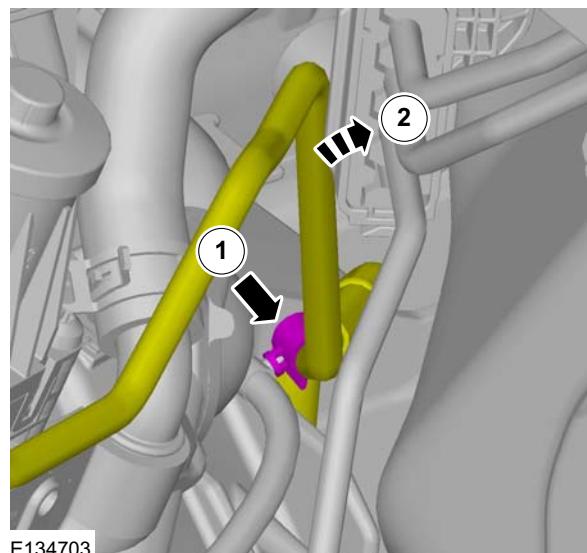
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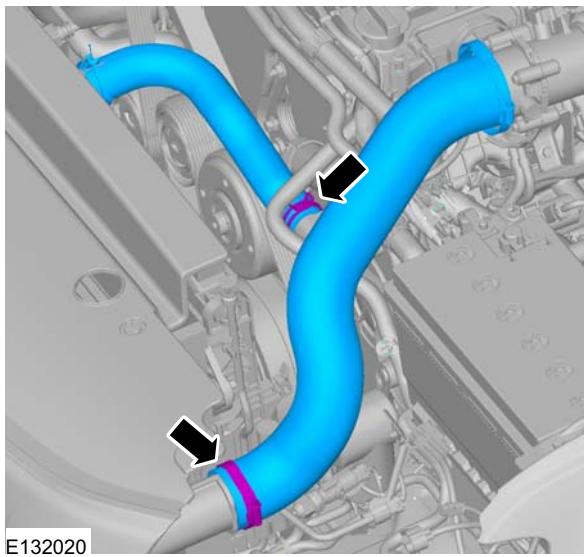


22.



24.

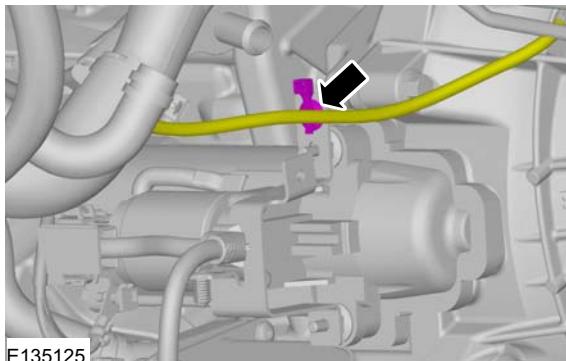


REMOVAL**25.**

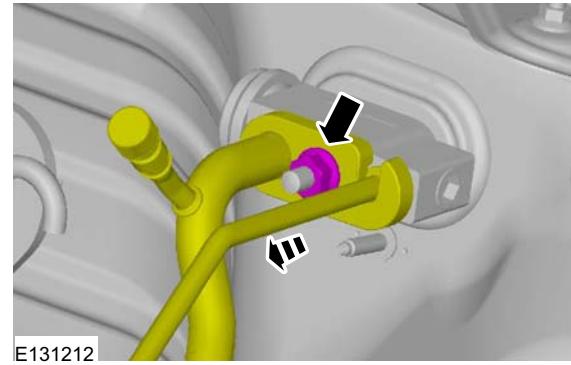
26. Refer to: **Cooling Fan Motor and Shroud** (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

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

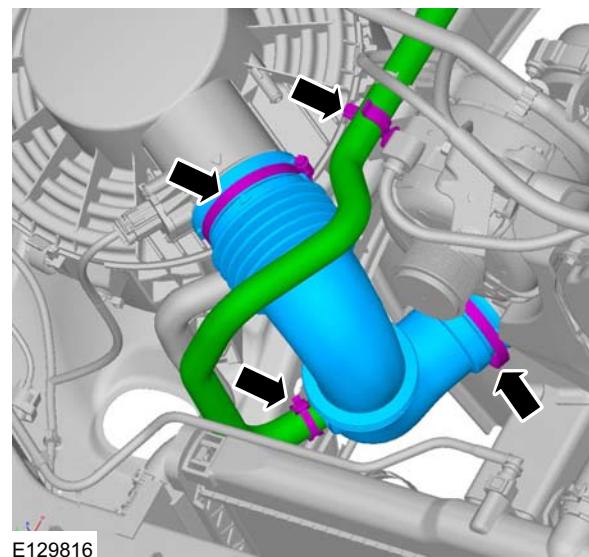
28. Refer to: **Condenser - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma** (412-01 Climate Control, Removal and Installation).

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.

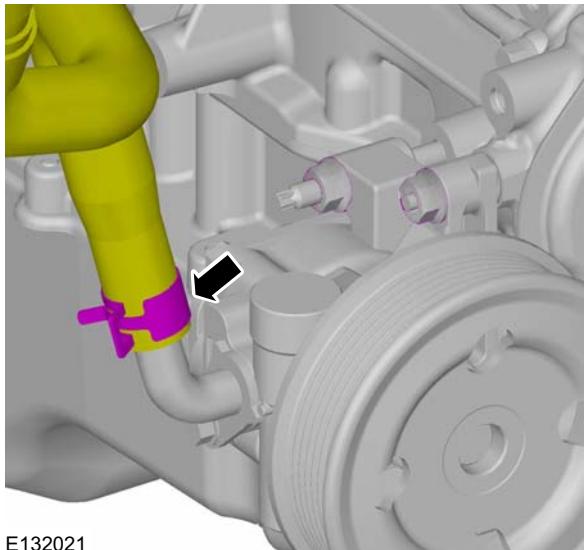
32. Refer to: **Transmission Fluid Cooler** (307-02 Transmission/Transaxle Cooling, Removal and Installation).

33.

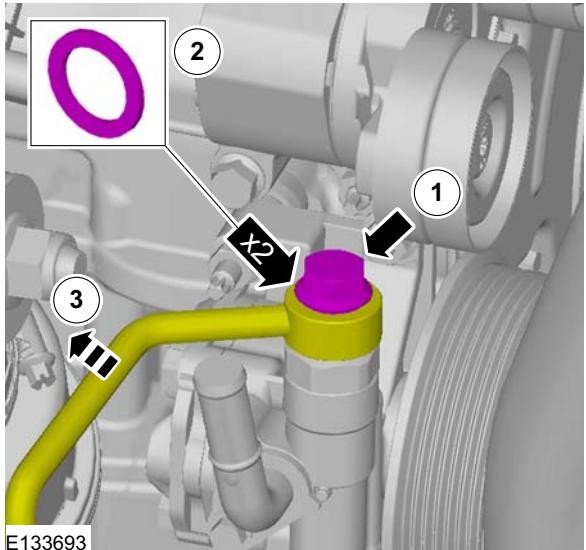
REMOVAL

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\).](#)

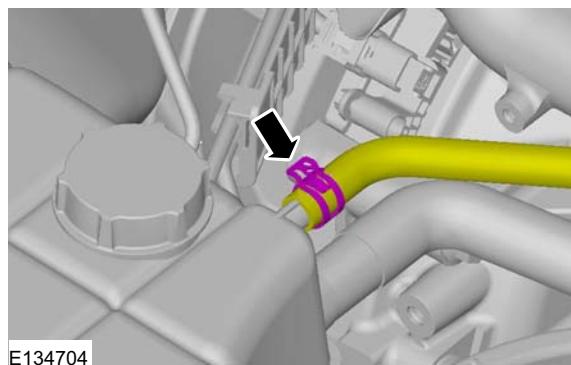
35. NOTE: Make sure that all openings are sealed.



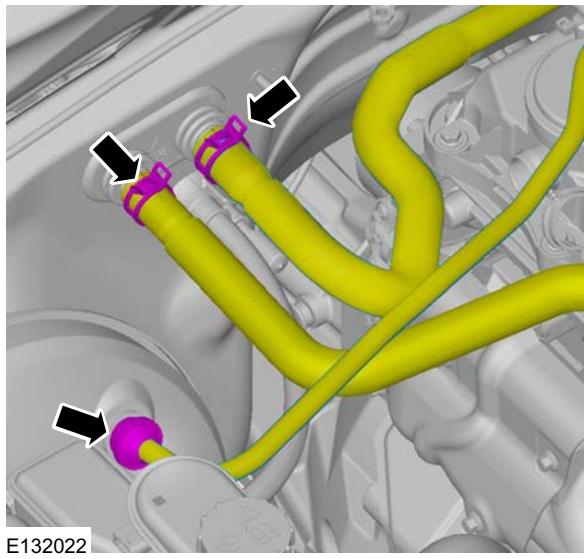
36. **⚠ CAUTION:** Cap the power steering line to prevent fluid loss or dirt ingress.



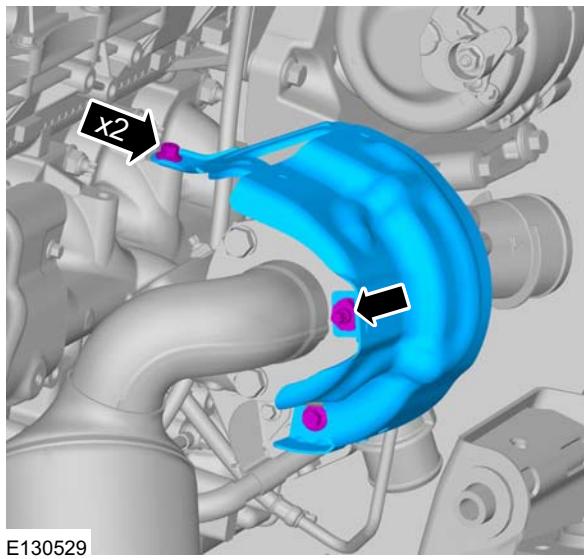
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38.



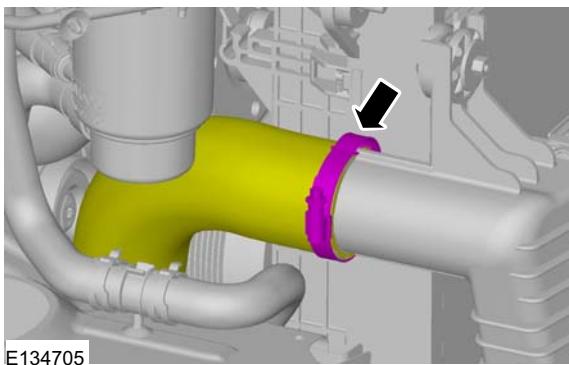
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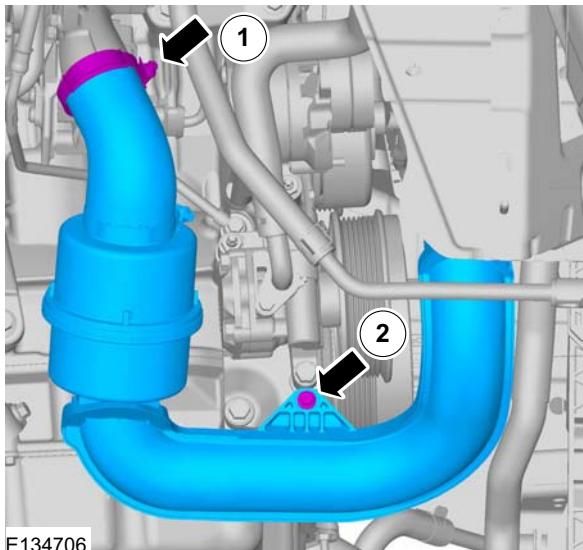
REMOVAL

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).

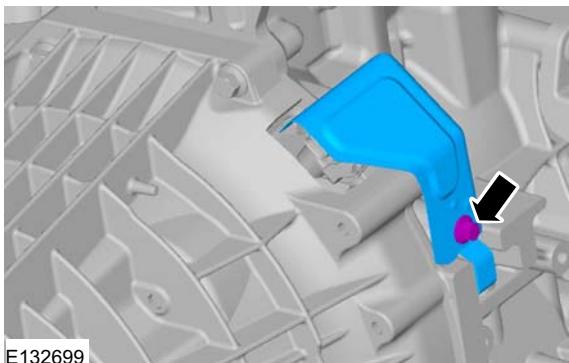
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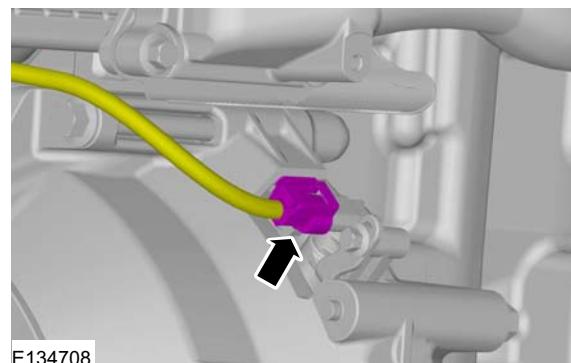
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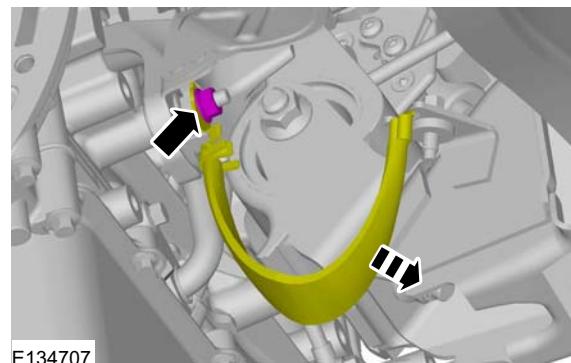
43.



44.



45.



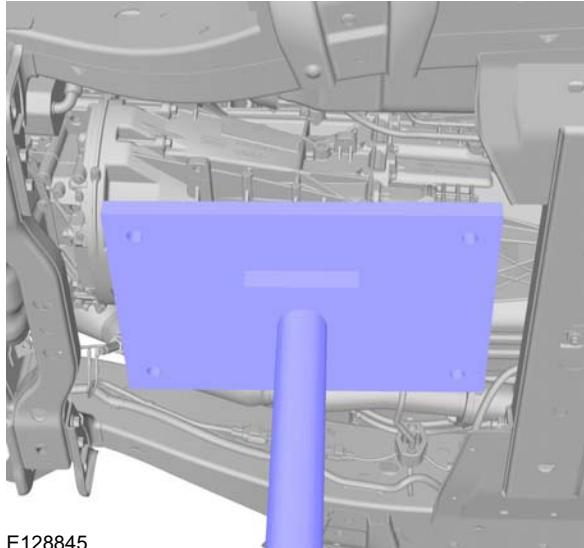
46. ⚠ WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.

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

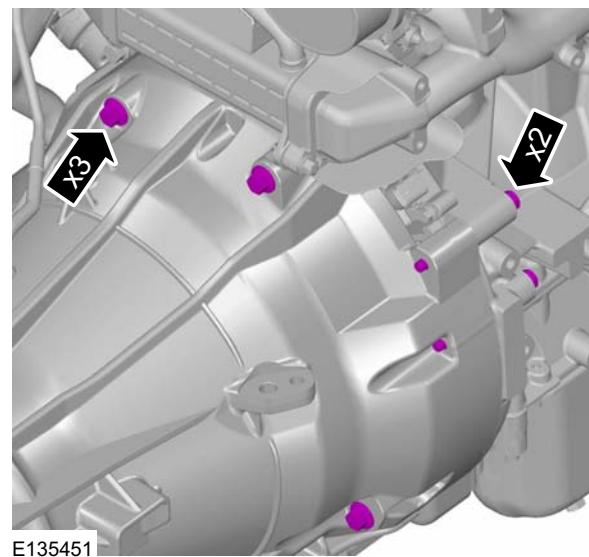
REMOVAL

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

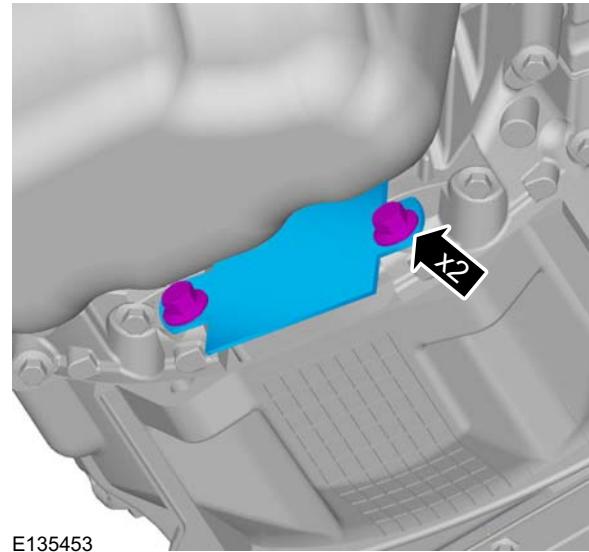
General Equipment: Transmission Jack



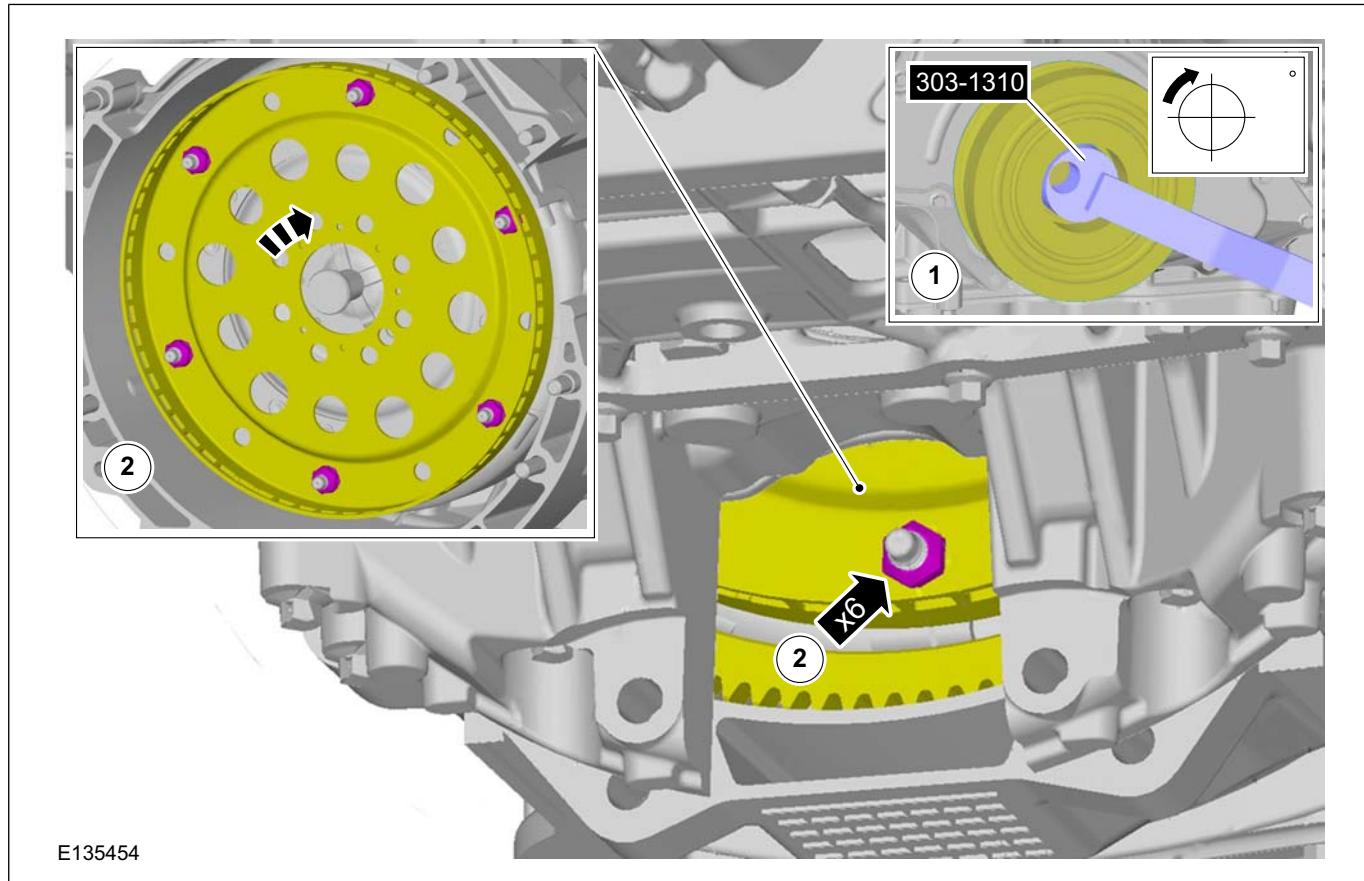
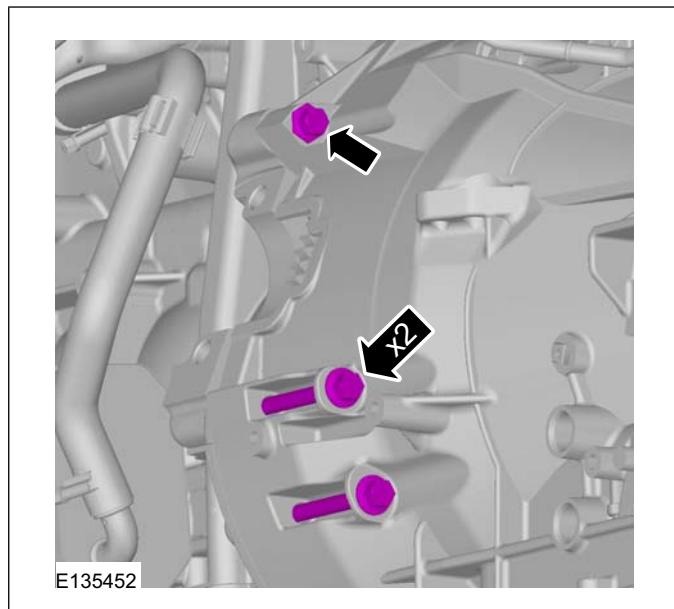
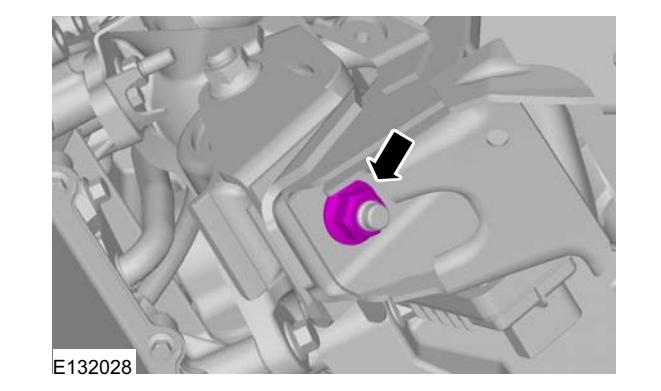
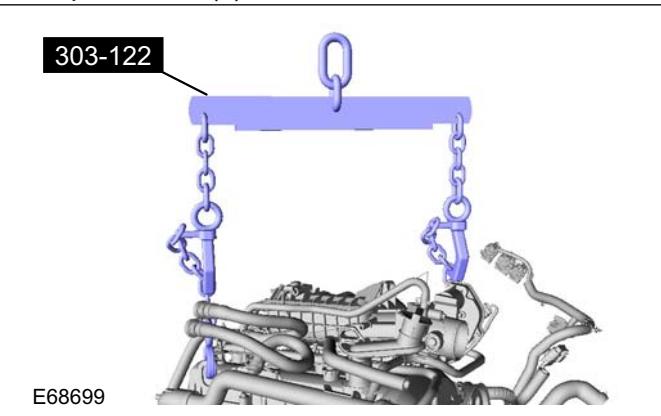
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48.

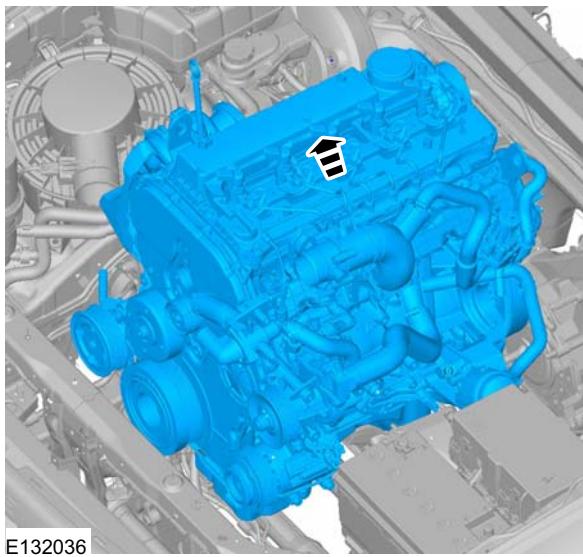


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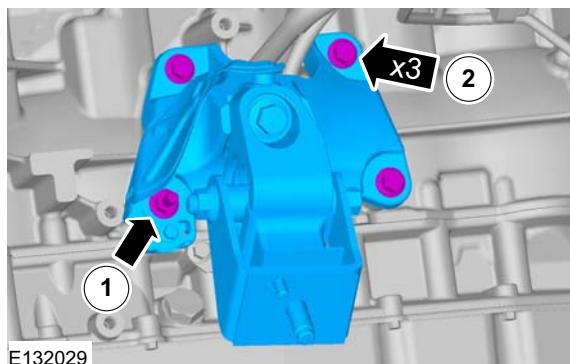
REMOVAL**50.****51. On both sides.****52. Special Tool(s): 303-122**

REMOVAL

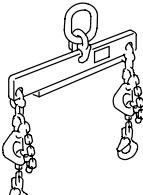
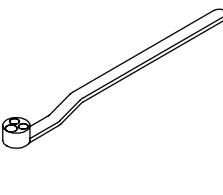
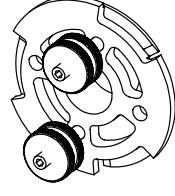
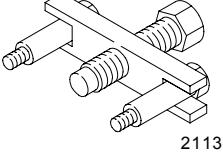
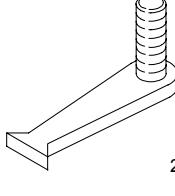
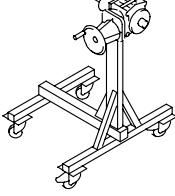
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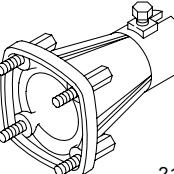
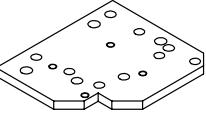
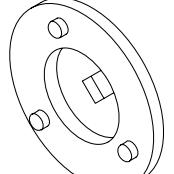
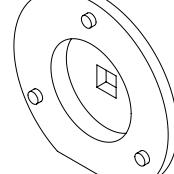
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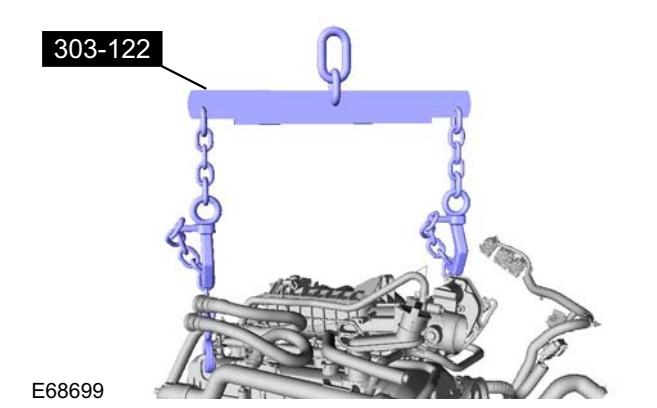


REMOVAL**Engine Accessories(21 139 4)****Removal****Special Tool(s) / General Equipment**

	303-122 Lifting Bracket, Engine 21068A
	303-1310 Holding Wrench, Crankshaft E87614
	303-1317 Locking Tool, Fuel Injection Pump Sprocket E75376
	303-249 Remover, Crankshaft Timing Pulley 21132
	303-254 Locking Tool, Flywheel 21135
	303-435 Mounting Stand 21187

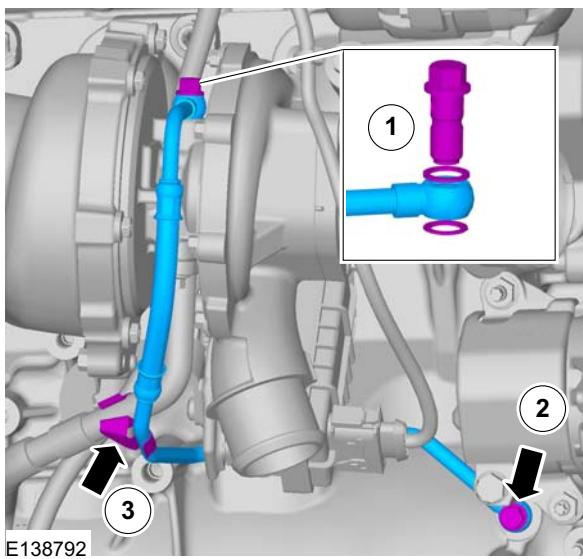
Special Tool(s) / General Equipment

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

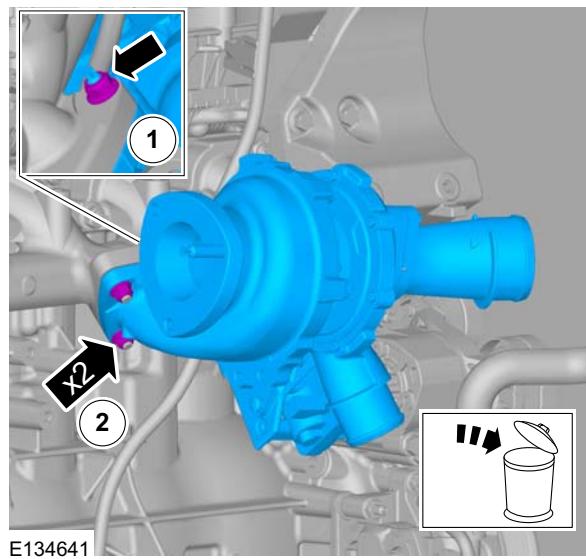
1. Install the Special Tool(s): 303-122

REMOVAL

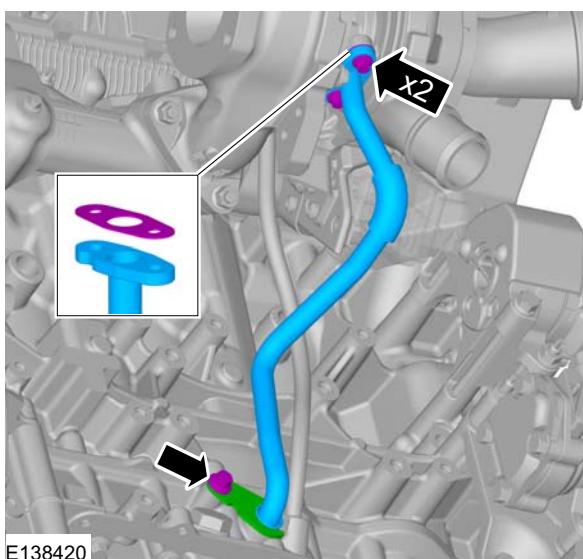
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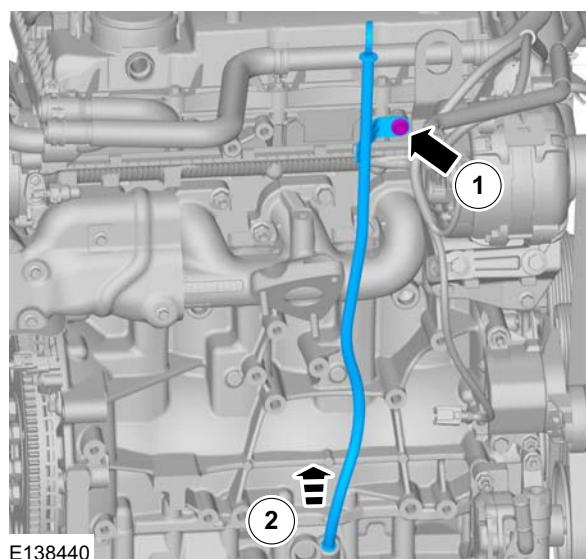
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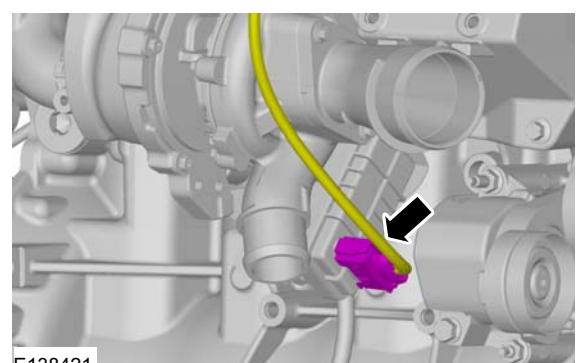
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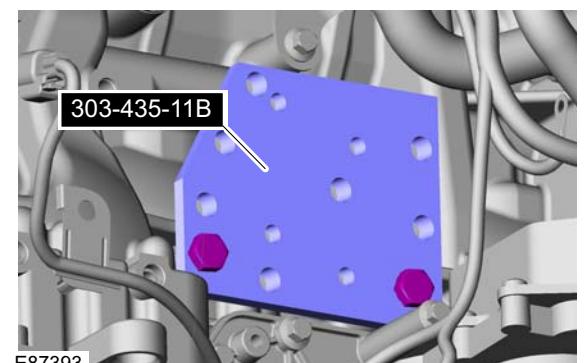
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4.

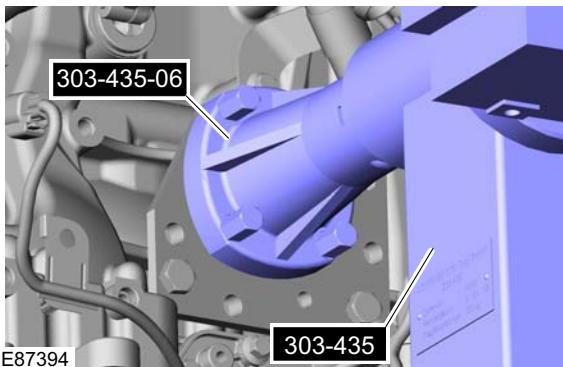


7. Install the Special Tool(s): 303-435-11B

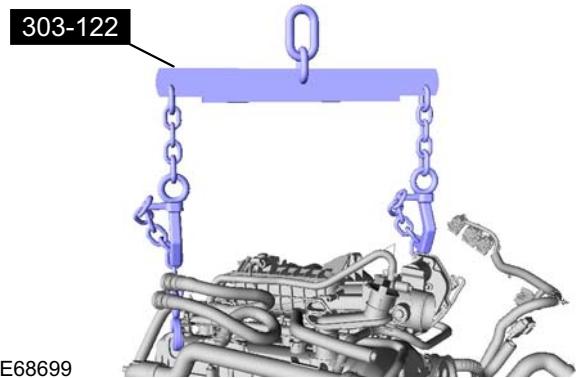


REMOVAL

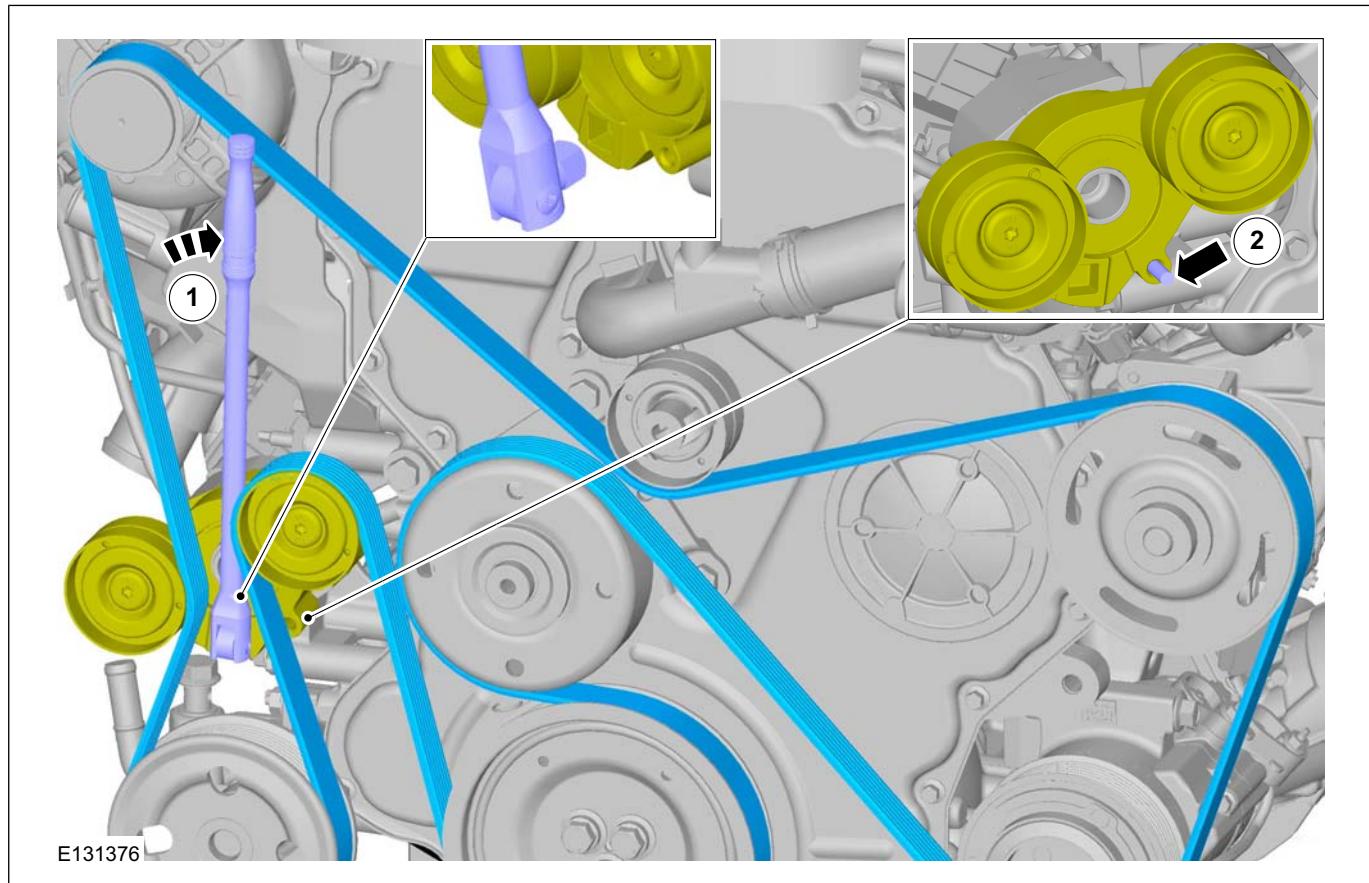
8. Install the Special Tool(s): 303-435-06, 303-435



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

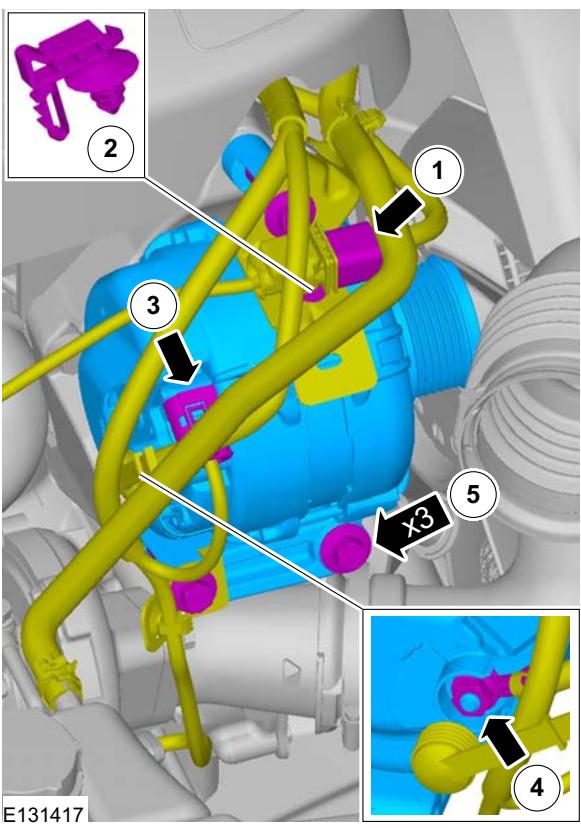
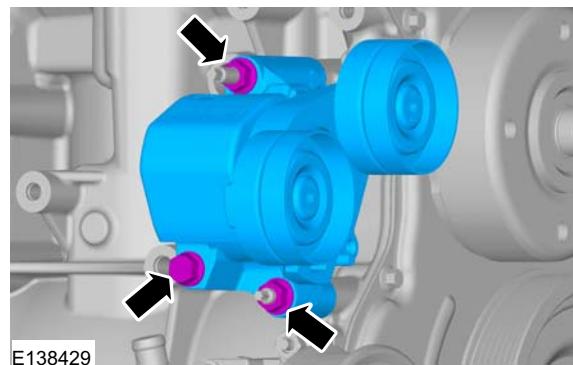
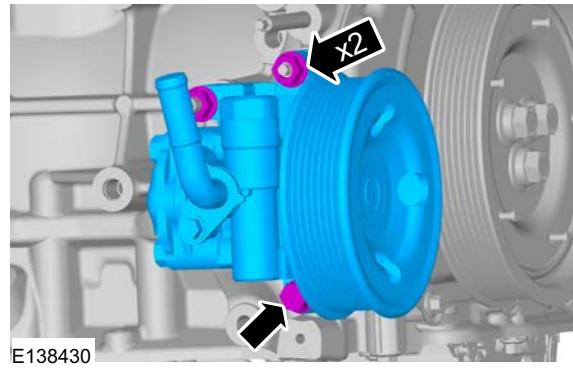
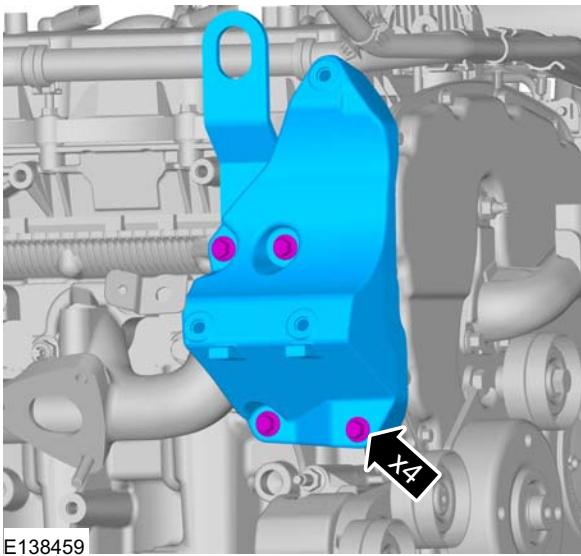
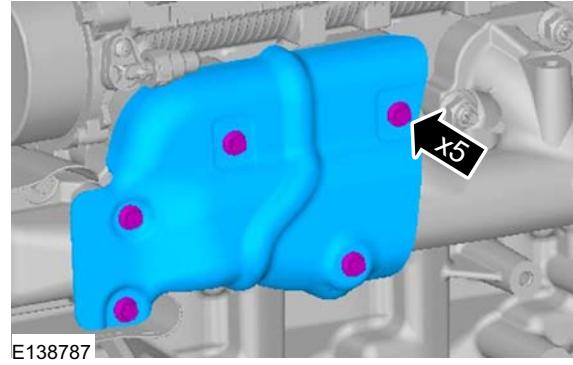


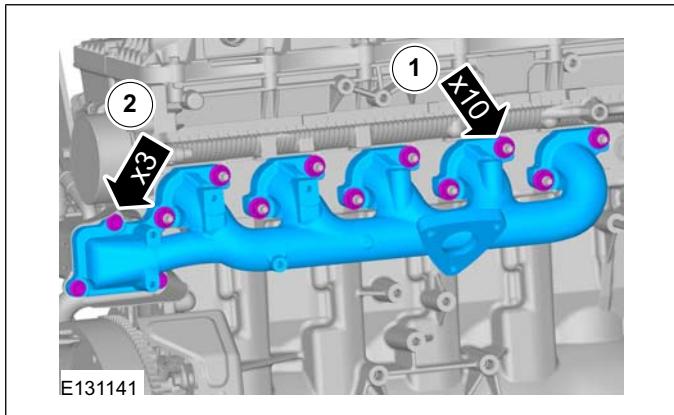
10. General Equipment: 1/2 Inch Square Drive Breaker Bar
General Equipment: Dowel with a Diameter of 6 mm



REMOVAL

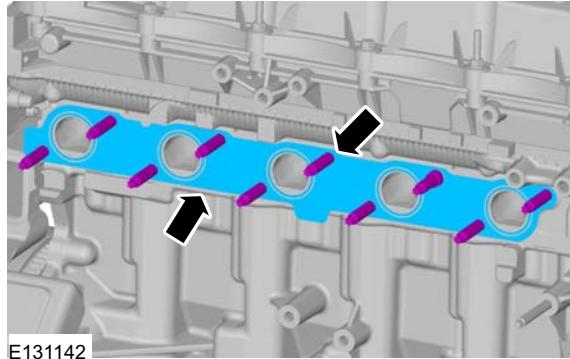
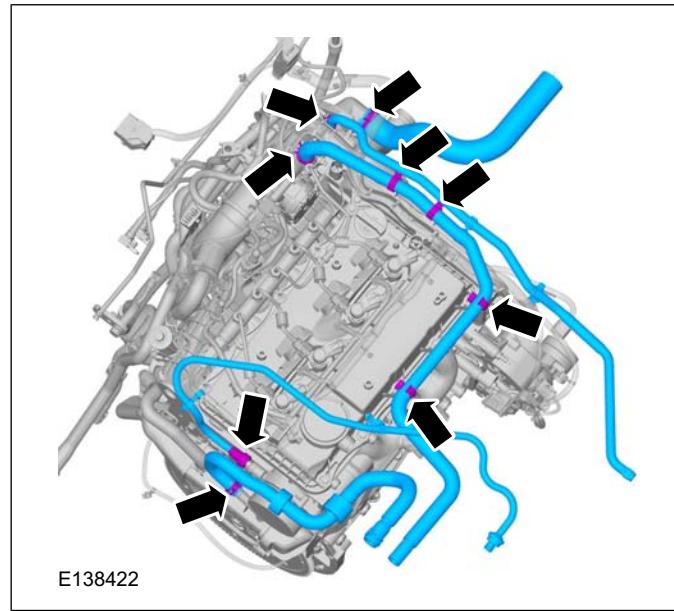
11.  **CAUTION:** Take extra care not to damage the wiring harnesses.

**13.****14.****12.****15.**

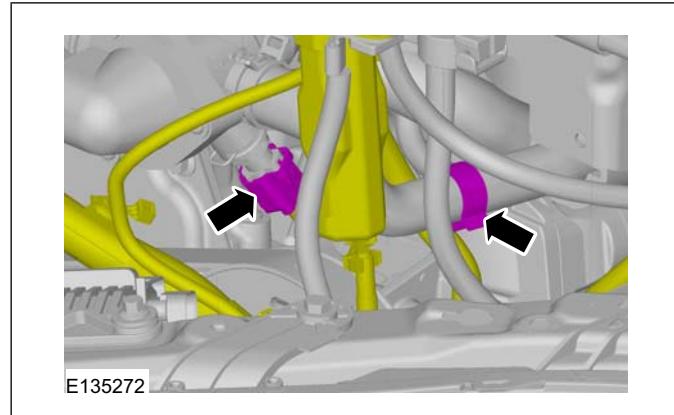
REMOVAL**16.**

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

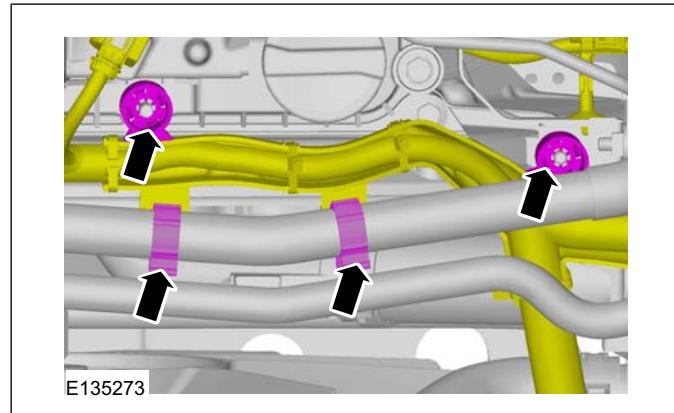
NOTE: The studs are to be reused unless damaged.

18.

E131142

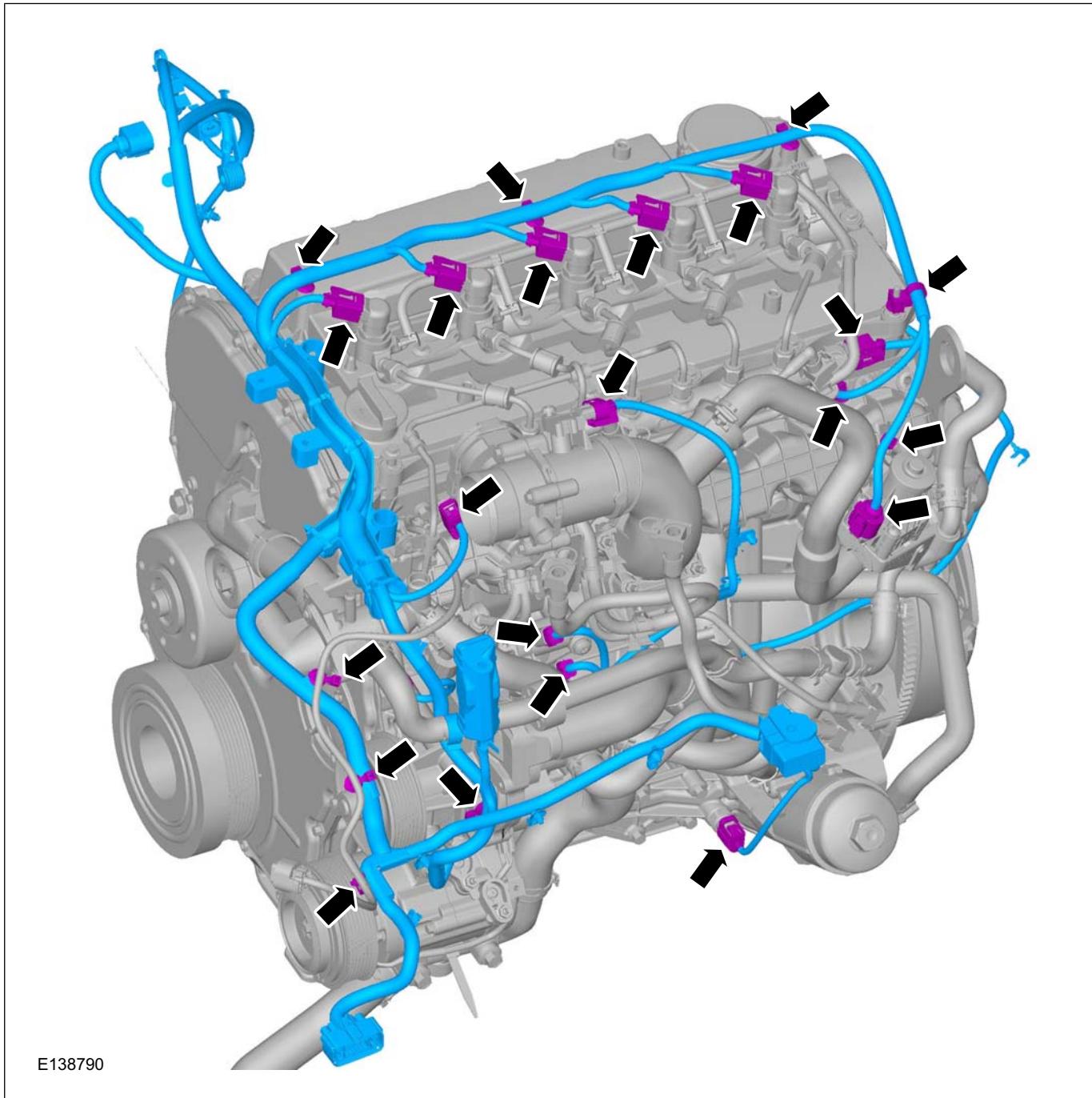
19.

E135272

20.

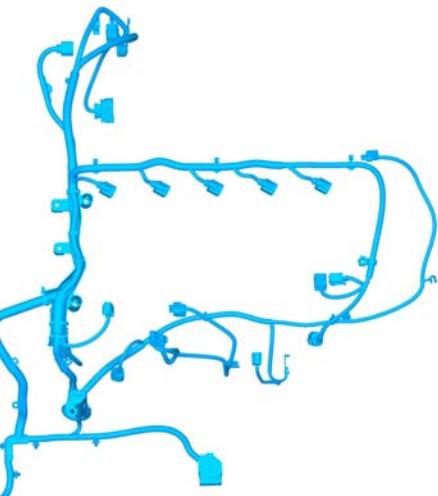
E135273

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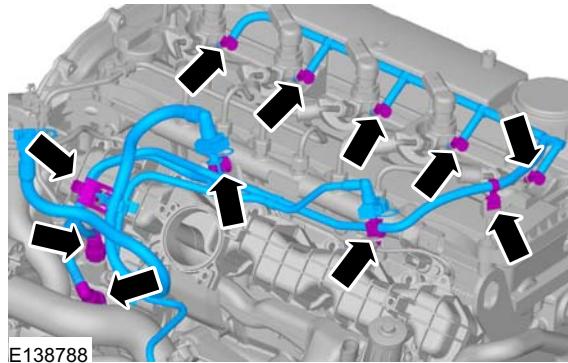
REMOVAL

REMOVAL

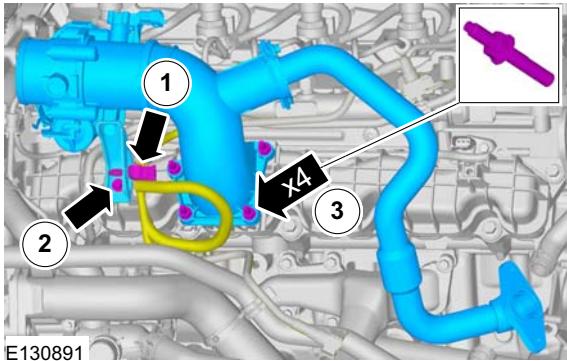
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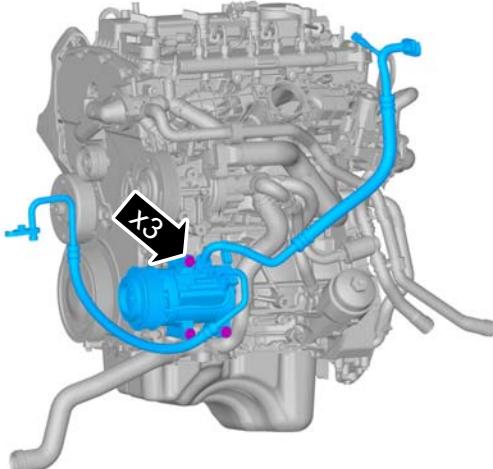
25. **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.



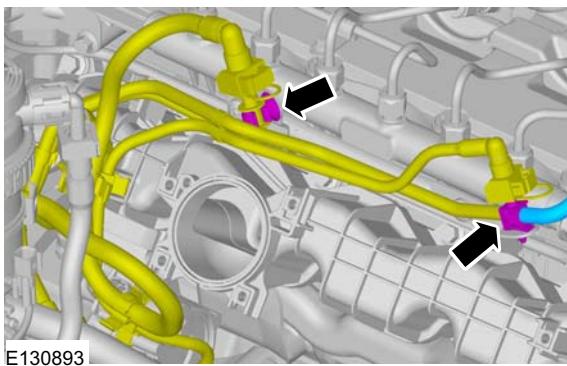
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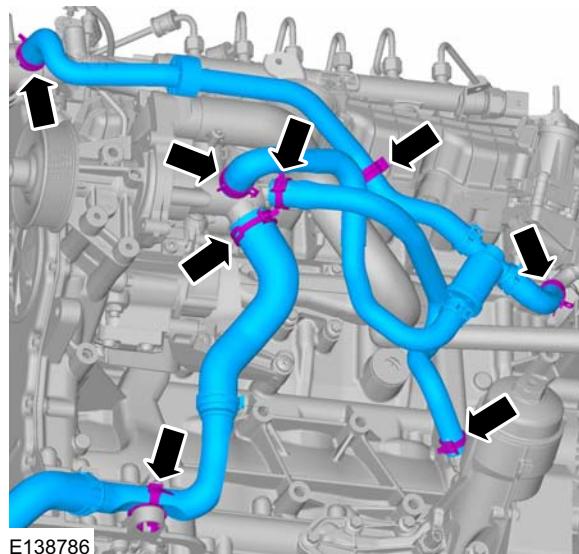
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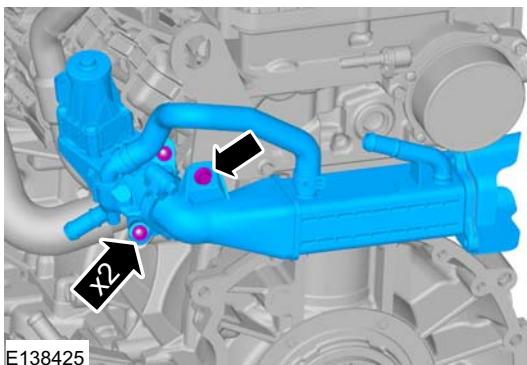
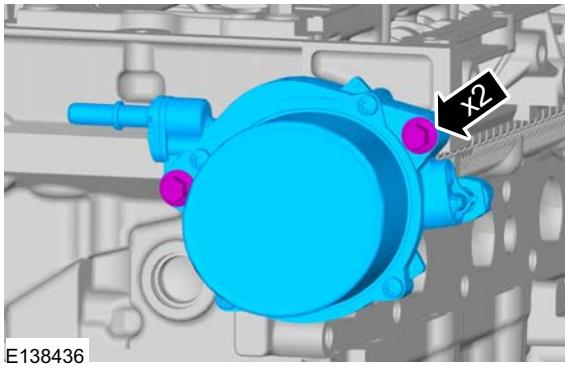
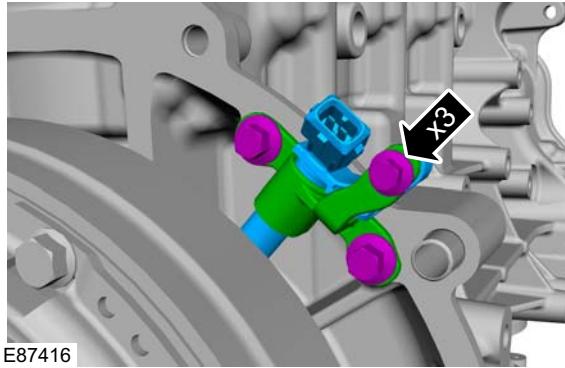
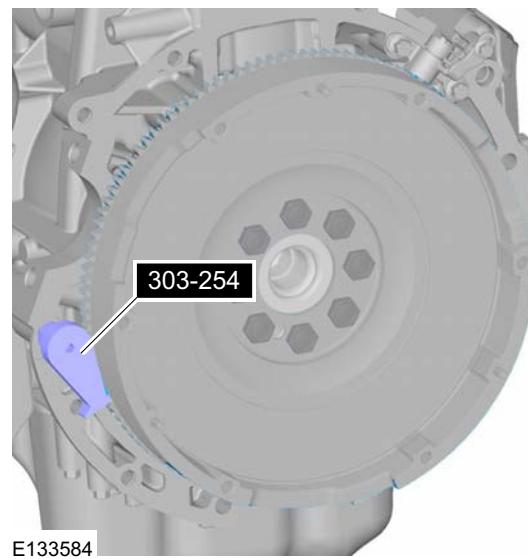


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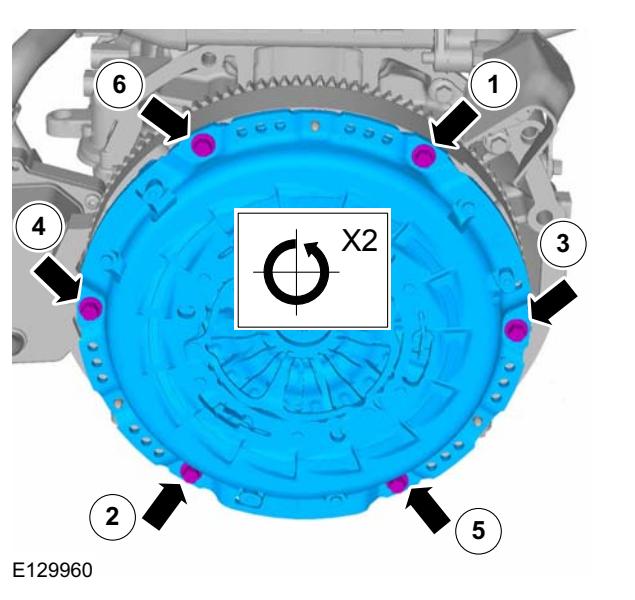


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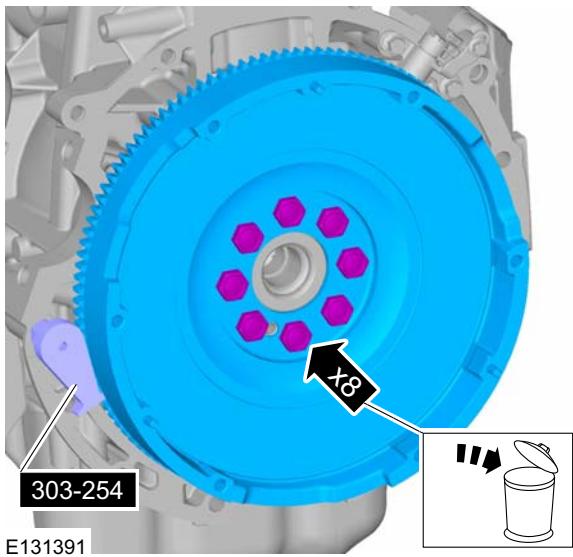
REMOVAL**28.****29.****30.****31. Special Tool(s): 303-254**

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

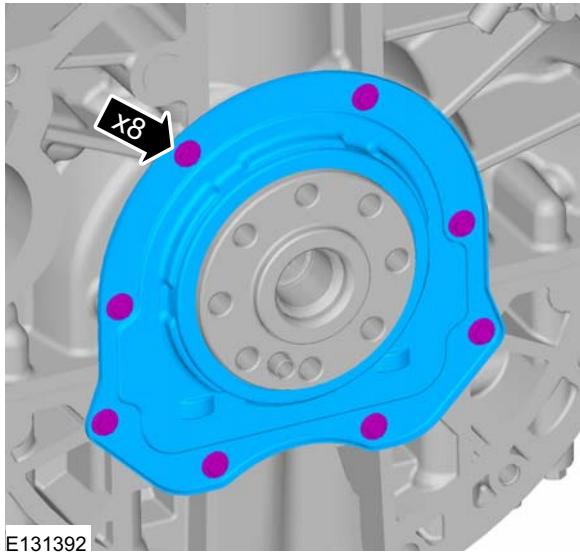


REMOVAL

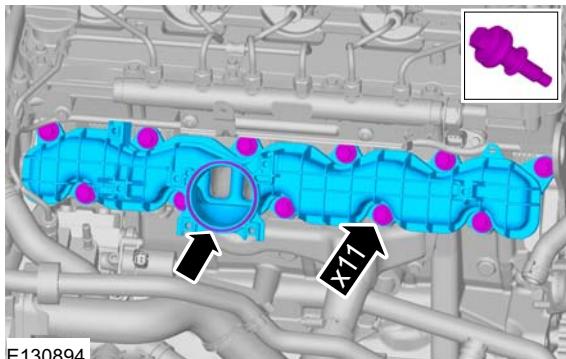
33. Special Tool(s): 303-254



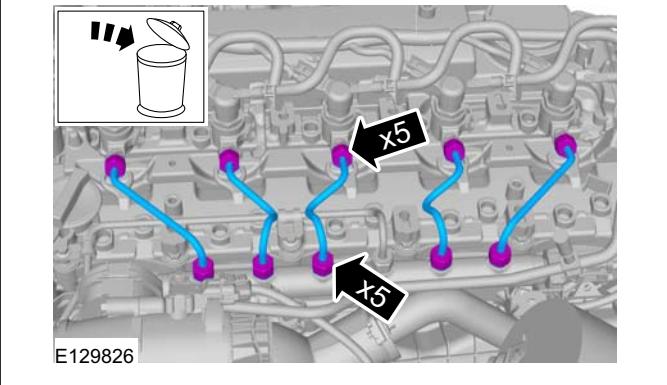
34.



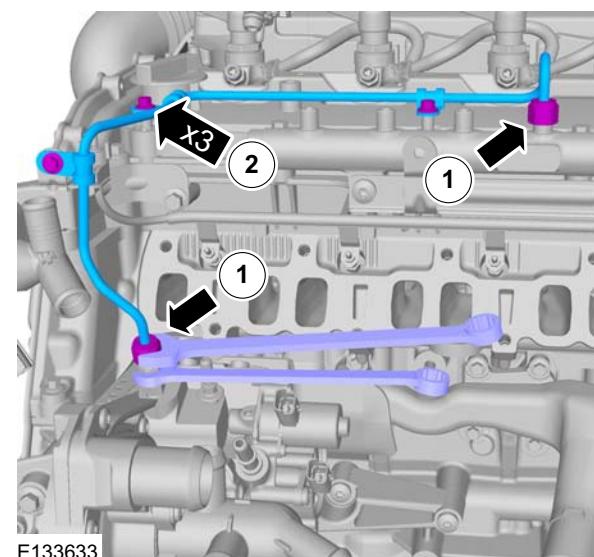
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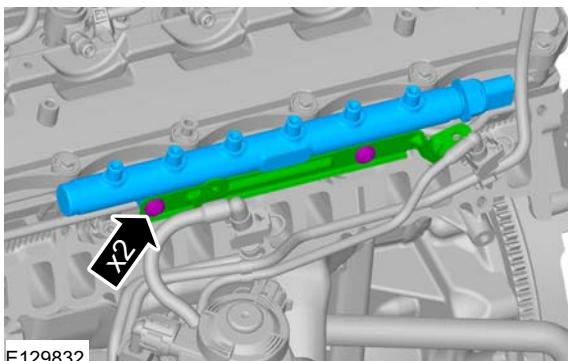
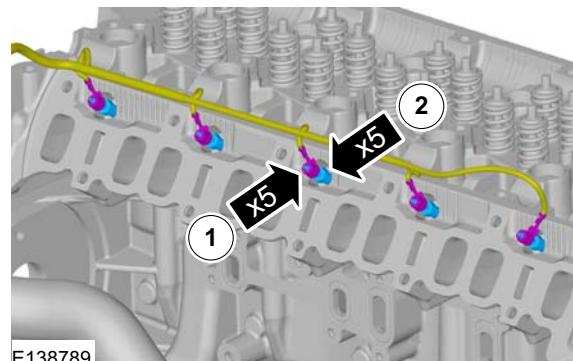
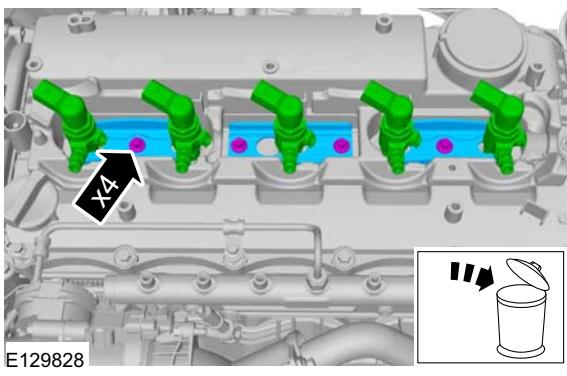
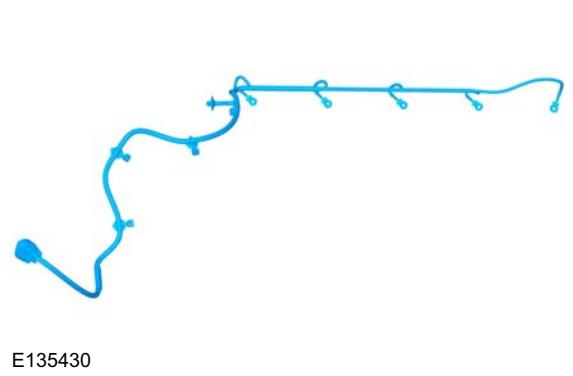
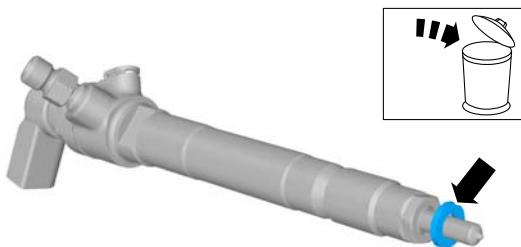
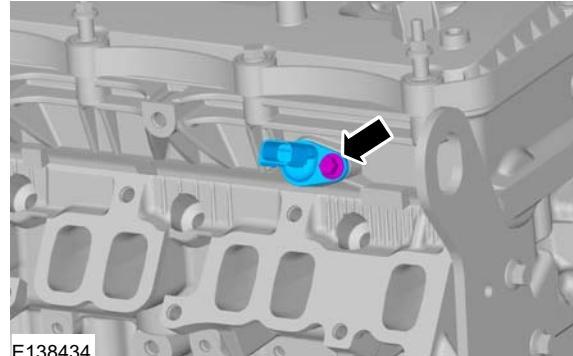


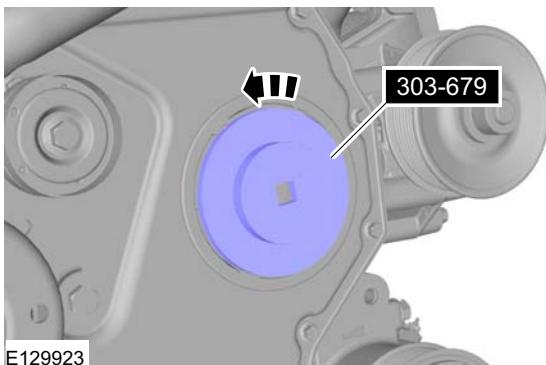
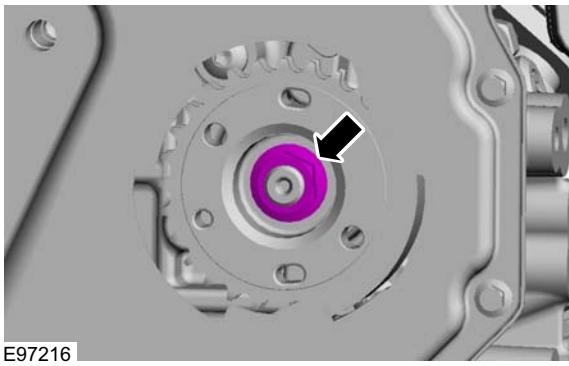
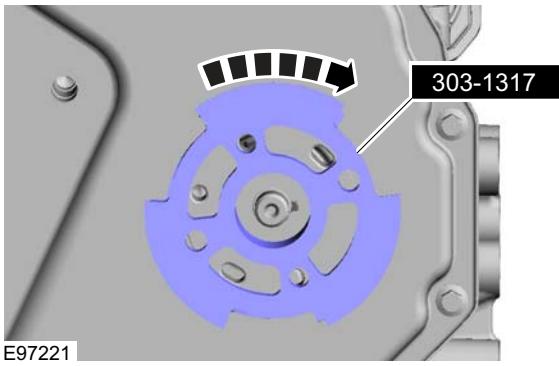
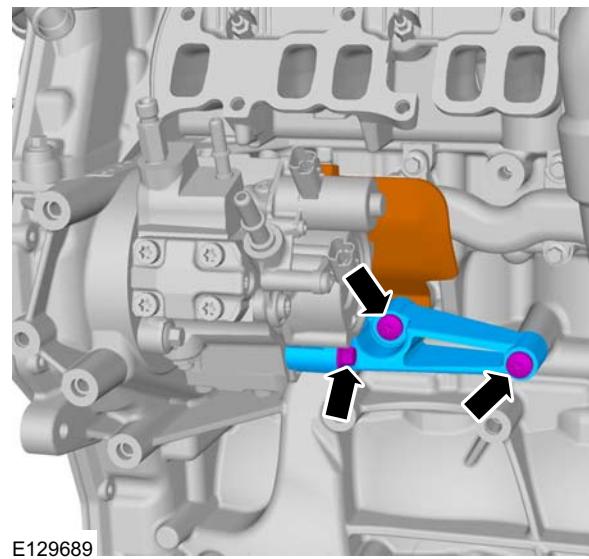
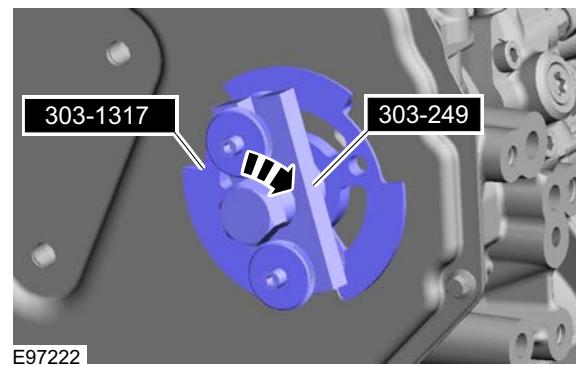
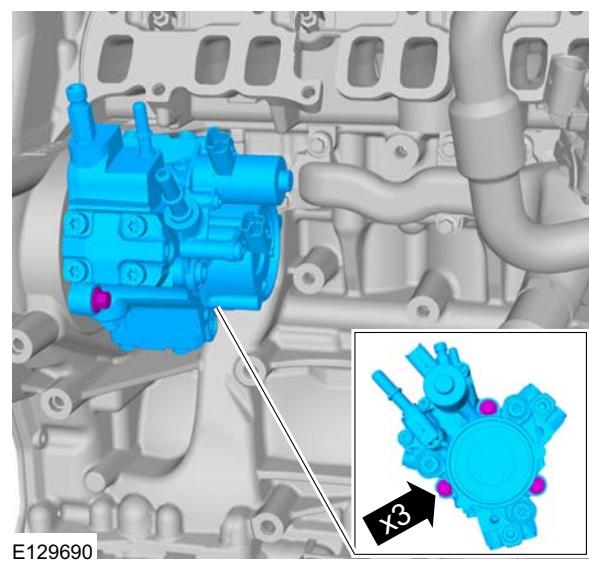
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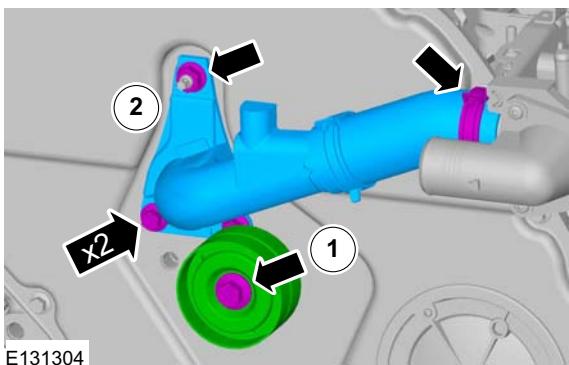
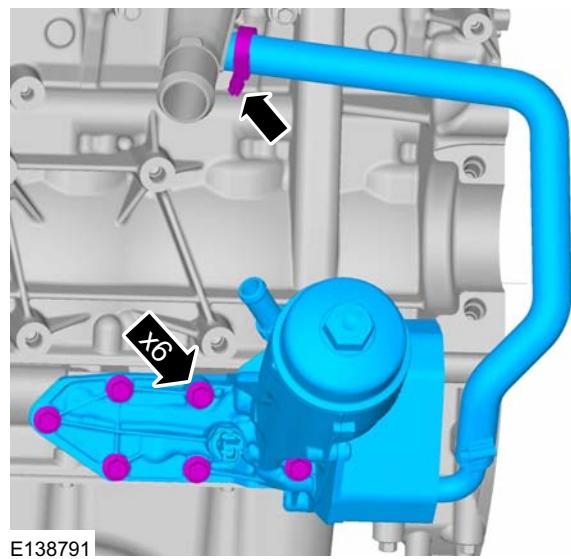
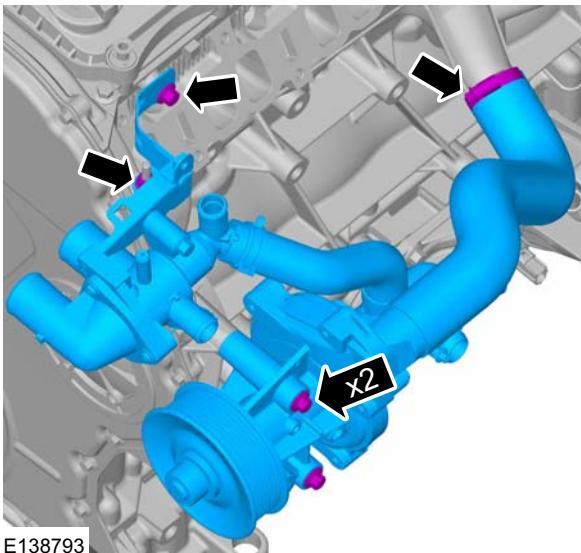
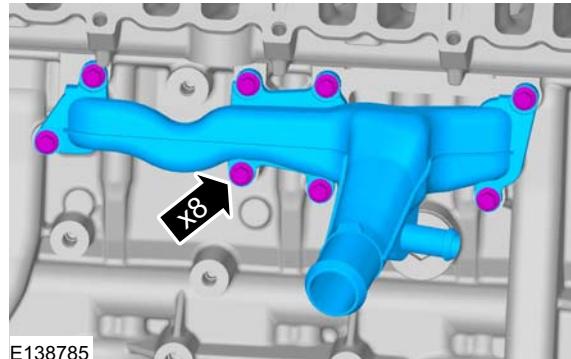
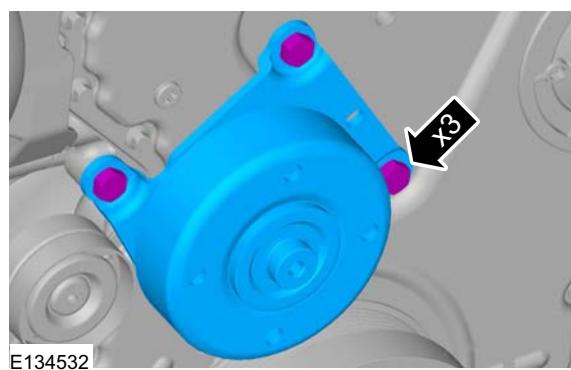
**37. CAUTIONS:**

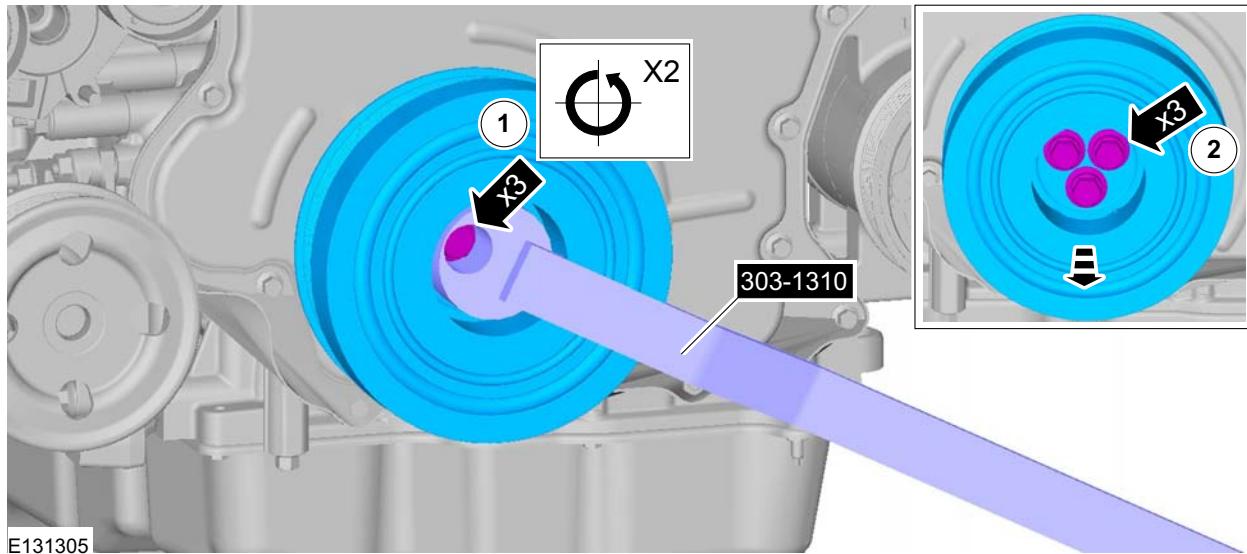
- !** Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.
- !** Make sure that the high-pressure fuel supply line remains in contact with both the fuel pump and the fuel rail until both unions have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



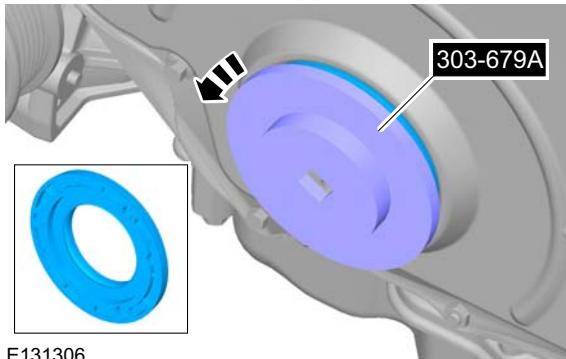
REMOVAL**38.****41.****39.****42.****40.****43.**

REMOVAL**44.** Special Tool(s): 303-679**45.****46.** Special Tool(s): 303-1317**47.****48.** Special Tool(s): 303-1317, 303-249**49.**

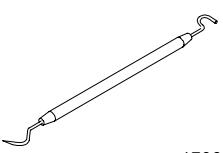
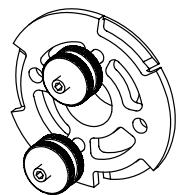
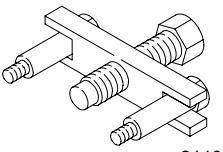
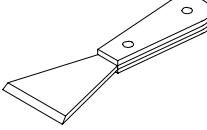
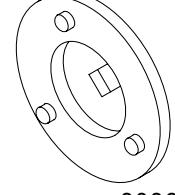
REMOVAL**50.****52.****51.****53.****54.****55.** Special Tool(s): 303-1310

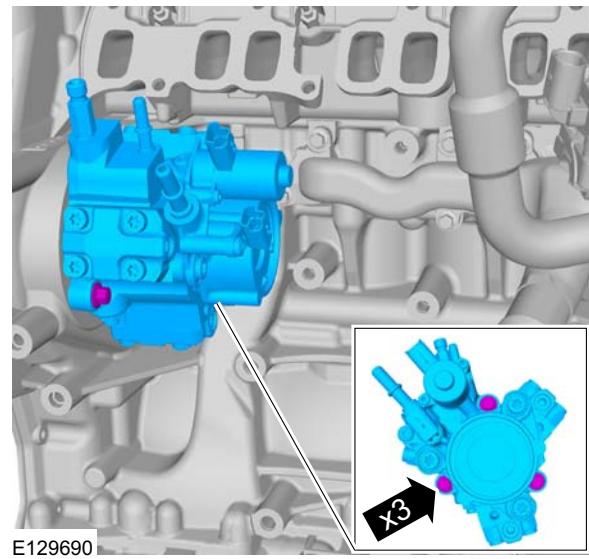
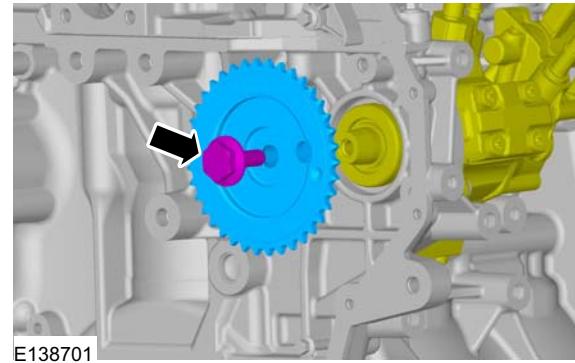
REMOVAL

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



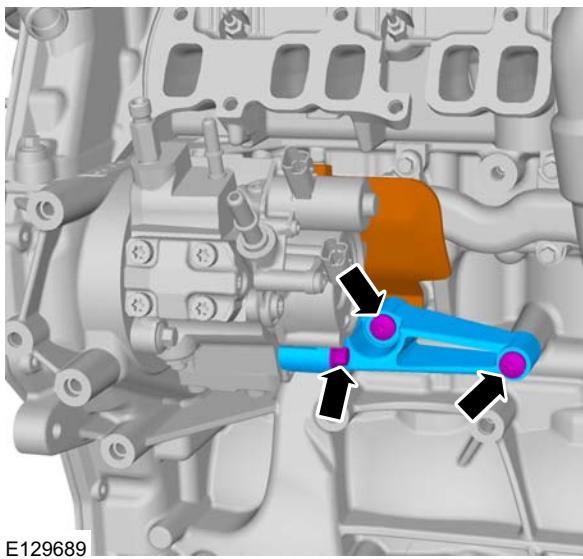
DISASSEMBLY**Engine(21 134 8)****Disassembly****Special Tool(s) / General Equipment**

 17063	100-010 Remover, O-Ring Seal
 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 21132	303-249 Remover, Crankshaft Timing Pulley
 21179	303-428 Separator, Oil Pan
 303679	303-679 Remover/Installer, Engine Front Cover Inspection Plate
2 mm Punch	

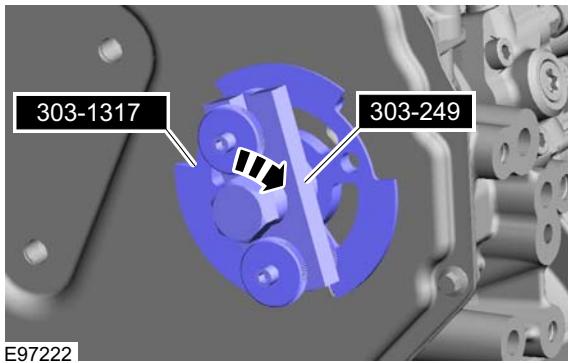
1. Torque: 23 Nm**2. NOTE: Make sure that a new component is installed.****Torque: 45 Nm**

DISASSEMBLY

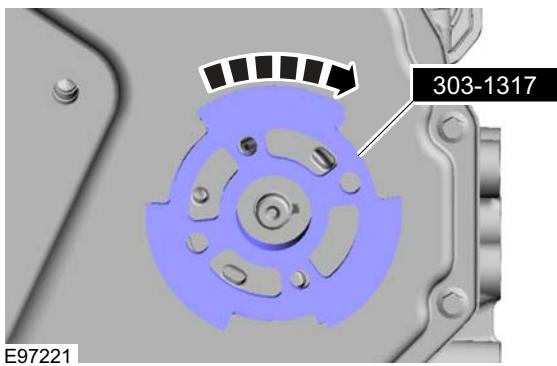
3. Torque: 22 Nm



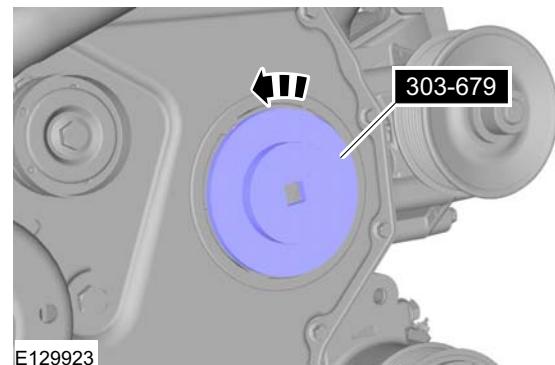
4. Remove the Special Tool(s): 303-1317, 303-249



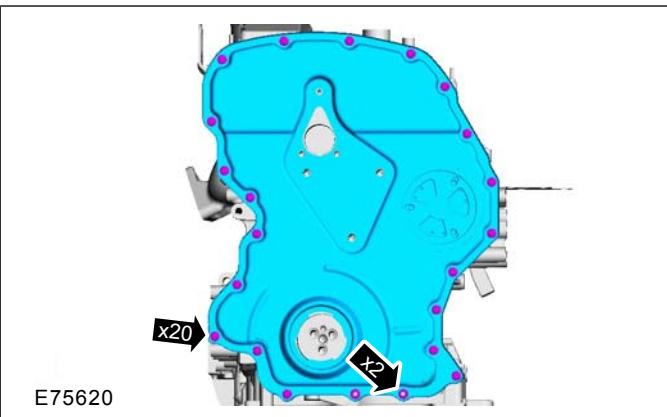
5. Remove the Special Tool(s): 303-1317



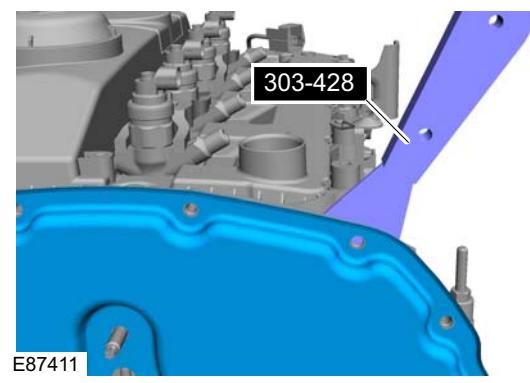
6. Remove the Special Tool(s): 303-679



7.

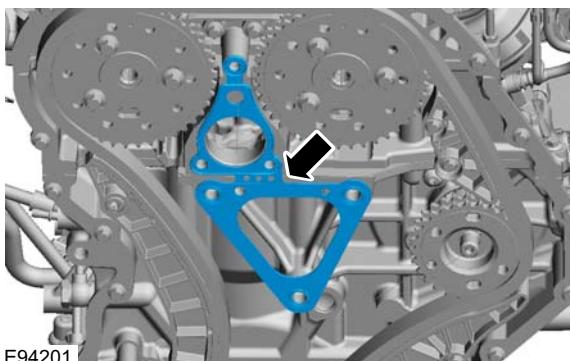


8. Special Tool(s): 303-428

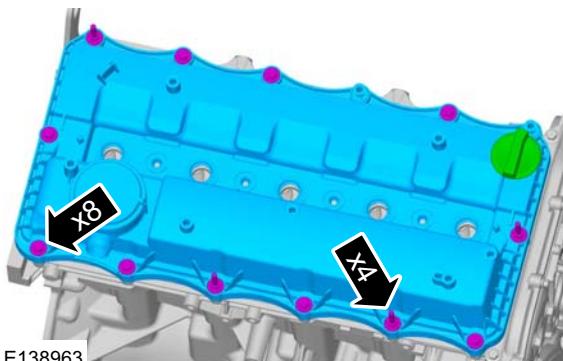


DISASSEMBLY

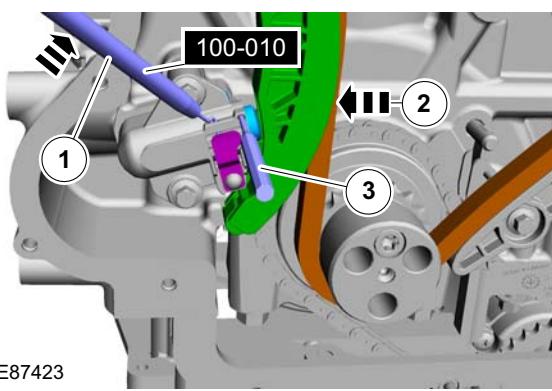
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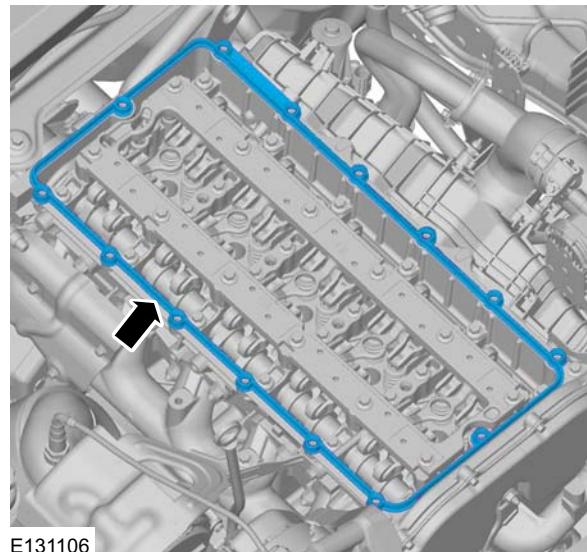
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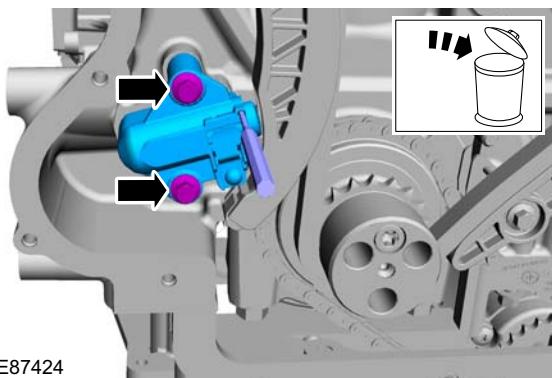
10. Special Tool(s): 100-010
General Equipment: 2 mm Punch



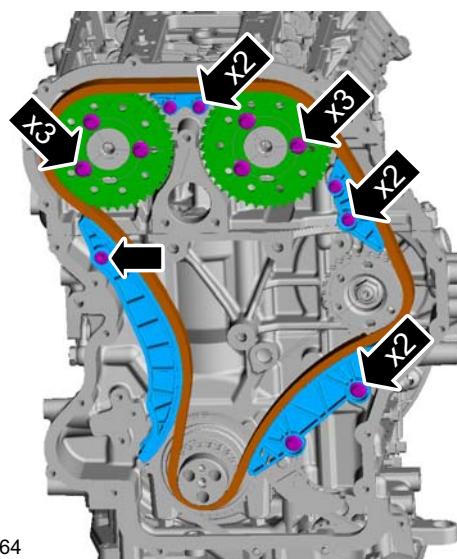
13. NOTE: The gasket is to be reused unless damaged.



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

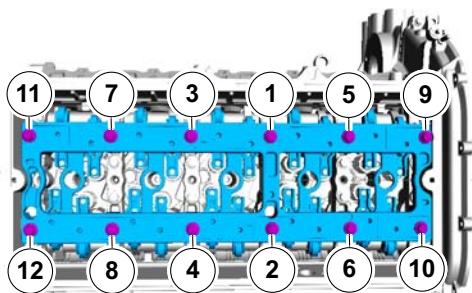


14.



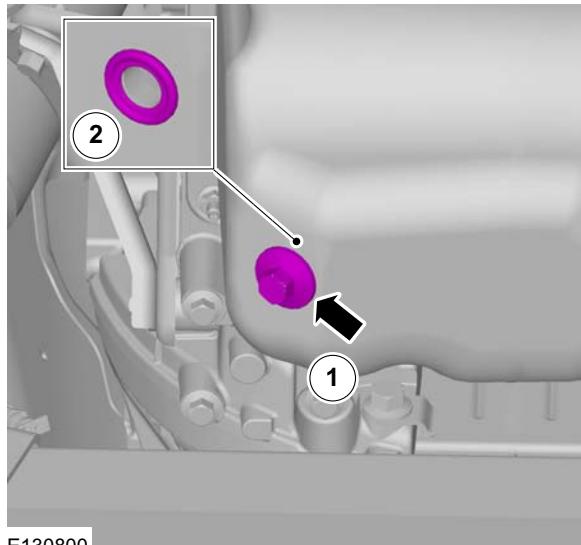
DISASSEMBLY

15.



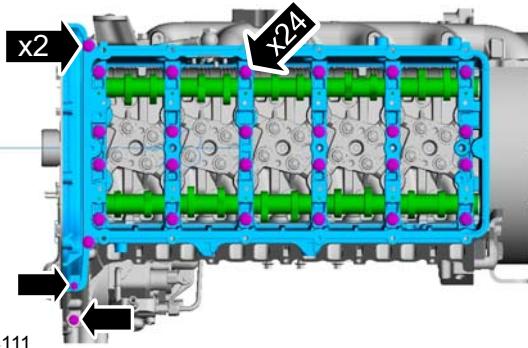
E94096

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



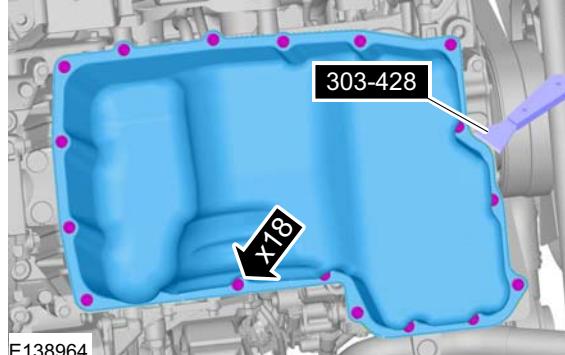
E130800

16.



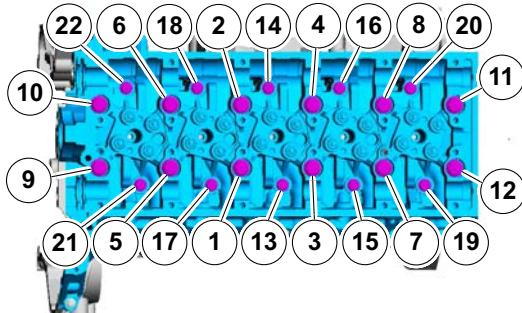
E94111

19. Special Tool(s): 303-428



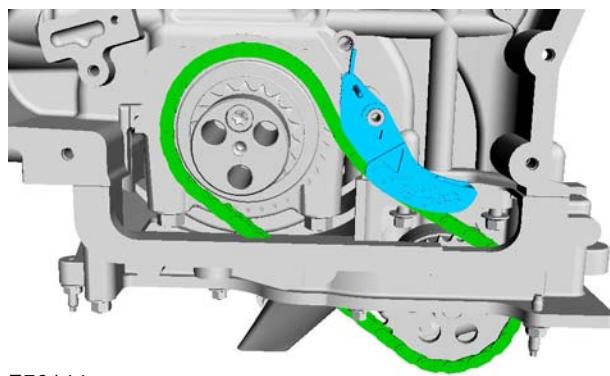
E138964

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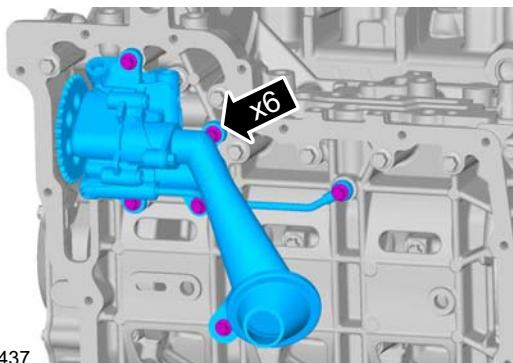


E94113

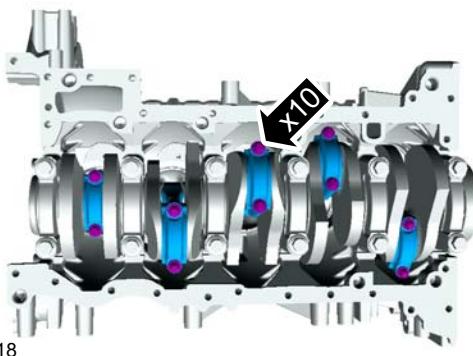
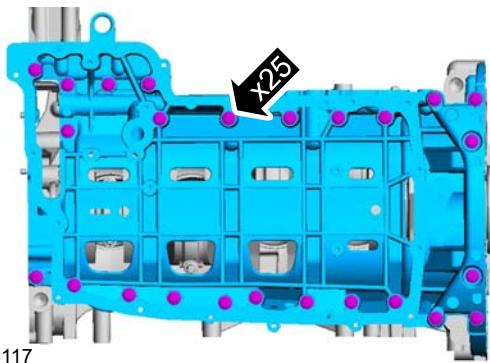
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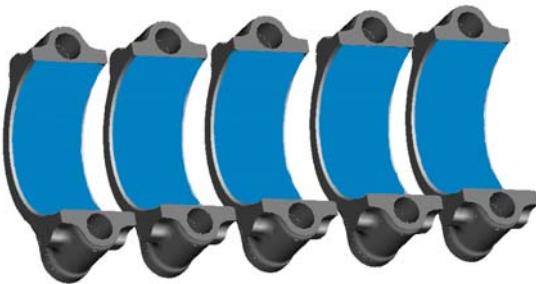
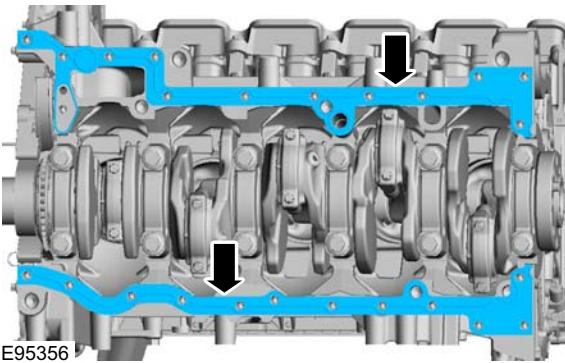
E76144

DISASSEMBLY**21.**

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

**22.**

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

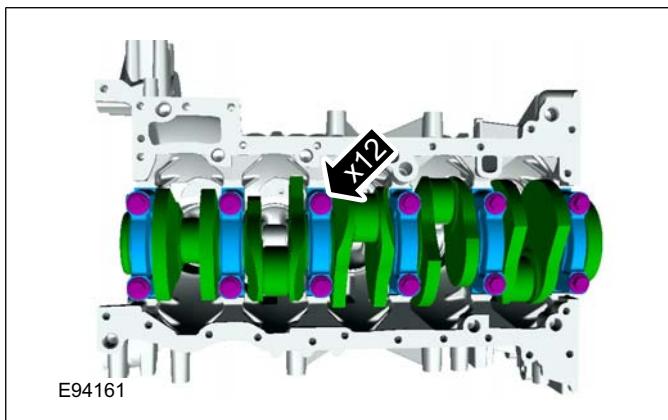
**23.**

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

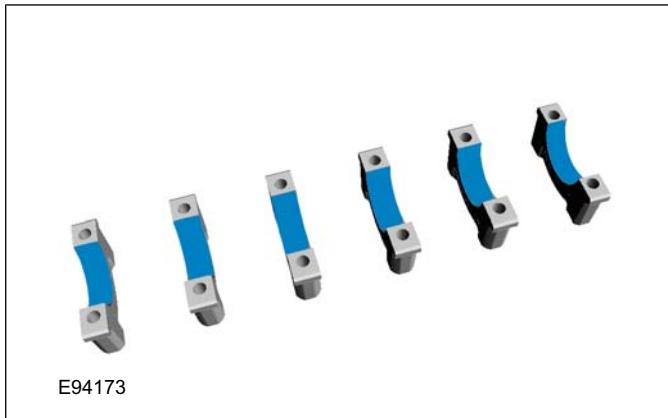


DISASSEMBLY

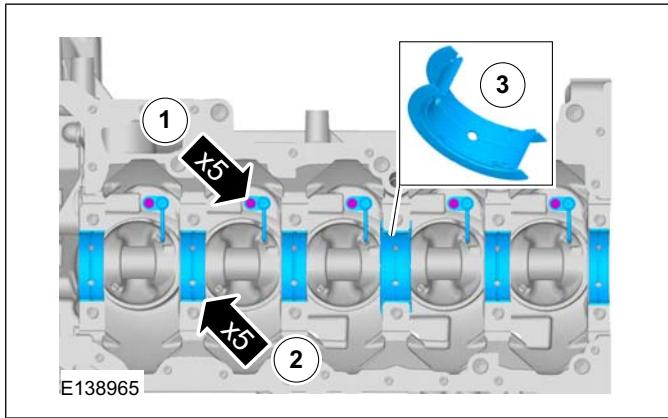
27. NOTE: Note the position of each component before removal.



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



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

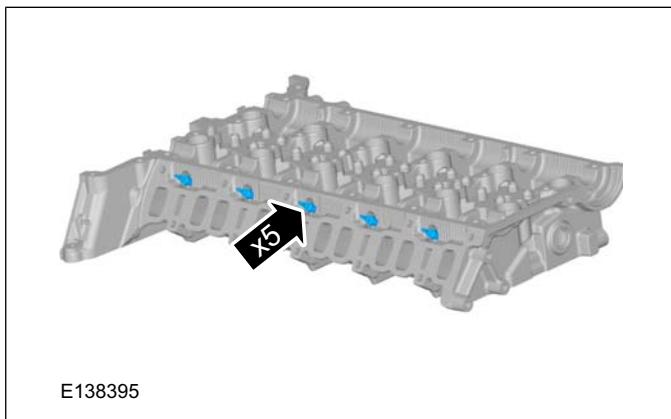


DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES**Cylinder Head(21 165 6)****Disassembly**

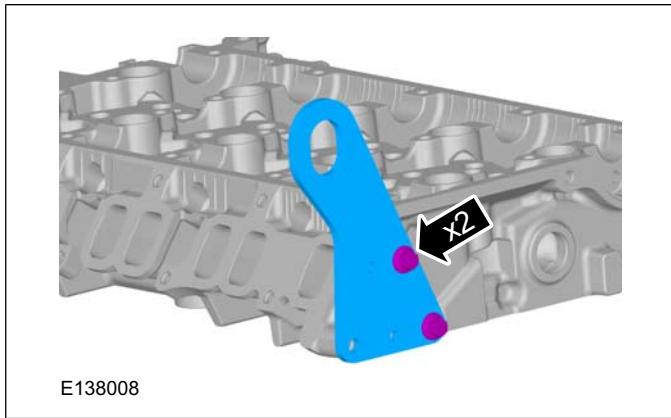
1. For additional information, refer to: **Valves**

(303-01 Engine - 3.2L Duratorq-TDCi
(148kW/200PS) - Puma, Removal and
Installation).

2. Torque : 13Nm

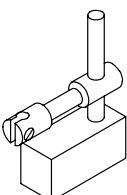
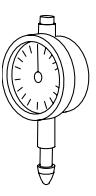
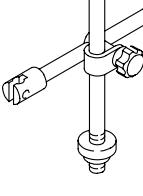
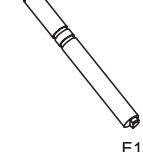
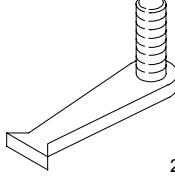
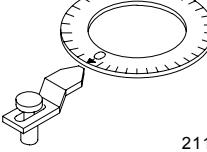


3. Torque : 23Nm

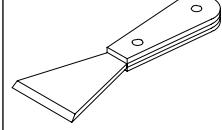
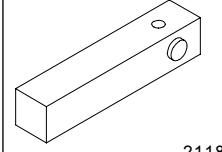
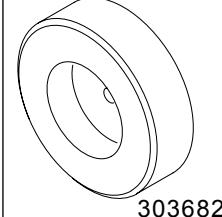
**Assembly**

1. To assemble, reverse the disassembly procedure.

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

	205-044 Holding Fixture, Dial Indicator Gauge 15008
	205-069 Dial Indicator Gauge (Metric) 15046
	205-070 Holding Fixture, Dial Indicator Gauge 15022A
	303-1562 Timing Tool E131853
	303-254 Locking Tool, Flywheel 21135
	303-391 Setting Gauge, Crankshaft 21166

Special Tool(s) / General Equipment

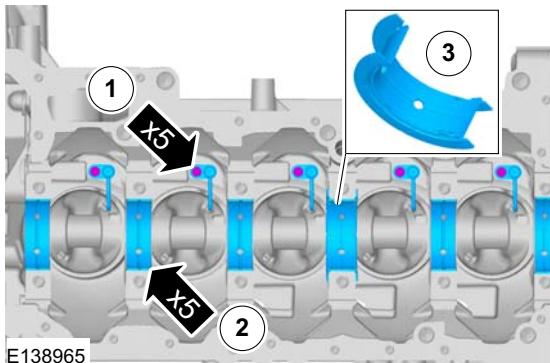
	303-428 Separator, Oil Pan 21179						
	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion) 21183						
	303-682 Aligner, Engine Front Cover 303682						
6 mm Drill Bit							
Piston Ring Compressor							
Round-Ended Steel Rule							
Materials							
<table border="1"> <thead> <tr> <th>Name</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Engine Oil - 5W-30</td> <td>WSS-M2C913-C</td> </tr> <tr> <td>Silicone Sealant LB</td> <td>WSE-M4G323-A4 / 2U7J-M4G323-AA</td> </tr> </tbody> </table>		Name	Specification	Engine Oil - 5W-30	WSS-M2C913-C	Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Name	Specification						
Engine Oil - 5W-30	WSS-M2C913-C						
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA						

ASSEMBLY

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

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

Torque: 10 Nm



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

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

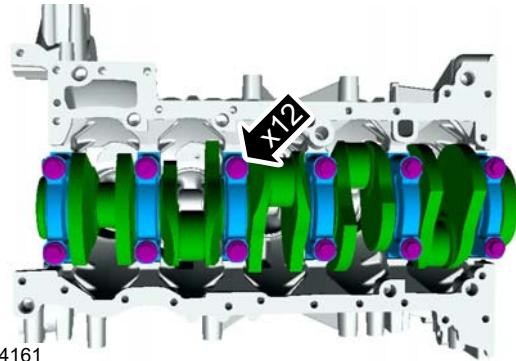


3. NOTE: Make sure that these components are installed to the noted removal position.

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

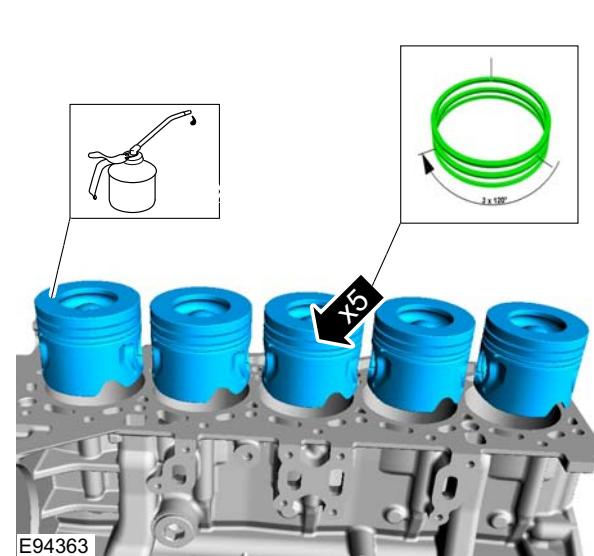
Torque:

- Stage 1: 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.

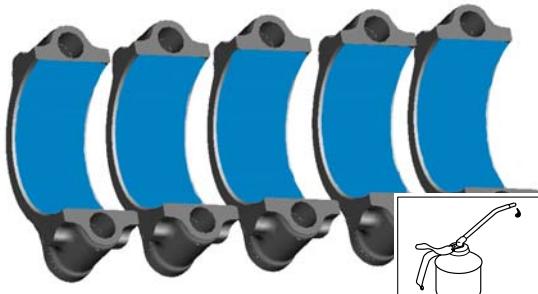
General Equipment: Piston Ring Compressor
Material: Engine Oil - 5W-30 (WSS-M2C913-C)
engine oil



ASSEMBLY

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

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



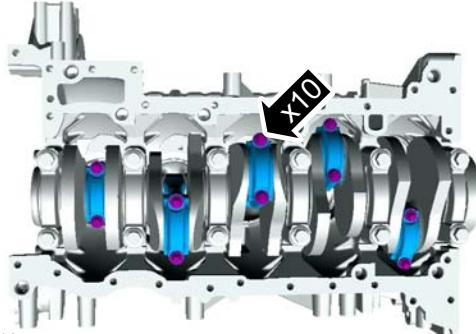
E94387

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

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

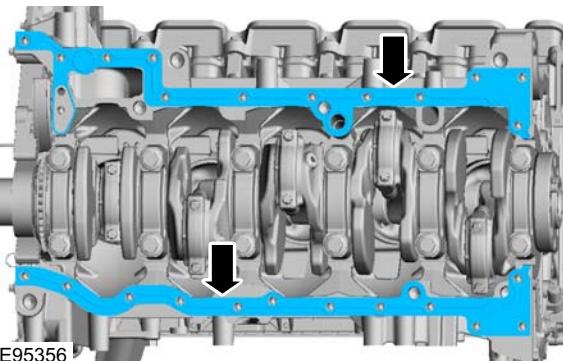
Torque:

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



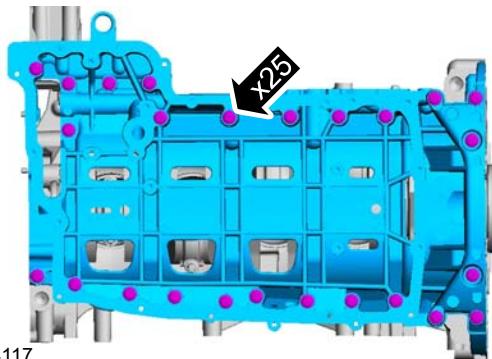
E94118

7.



E95356

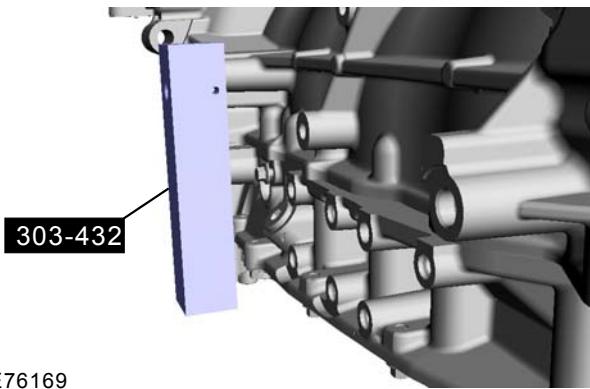
8. NOTE: Only tighten the bolts finger tight at this stage.



E94117

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.

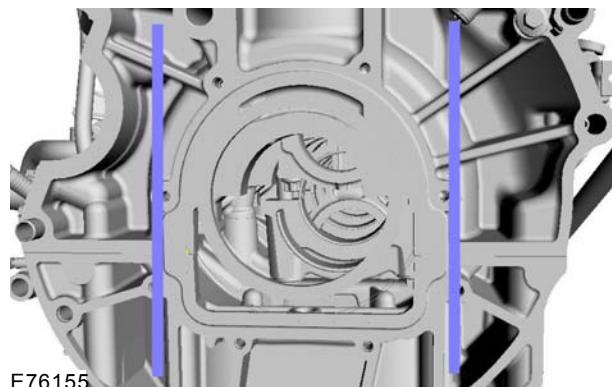
Special Tool(s): 303-432



E76169

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.

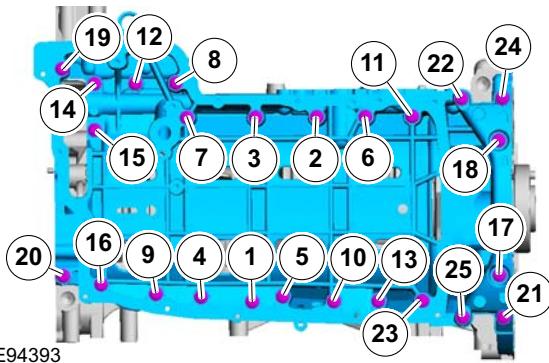
General Equipment: Round-Ended Steel Rule



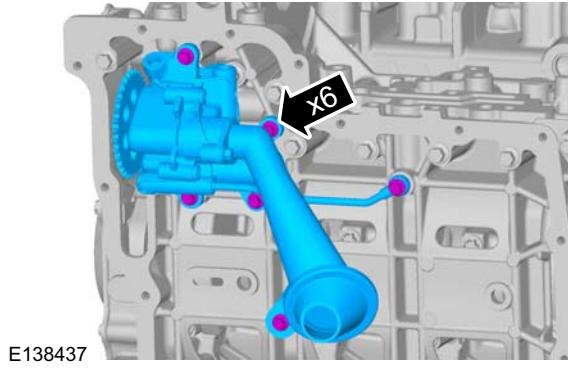
E76155

ASSEMBLY

11. Torque: 23 Nm

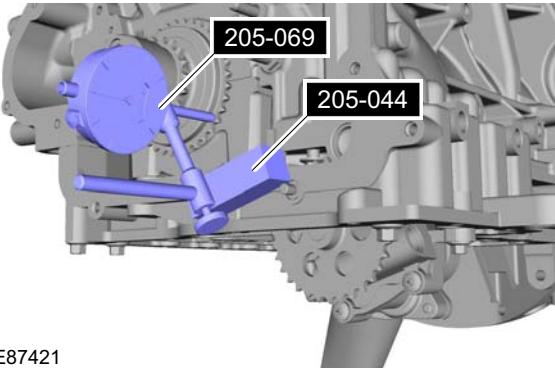


12 NOTE: Only tighten the bolts finger tight at this stage.



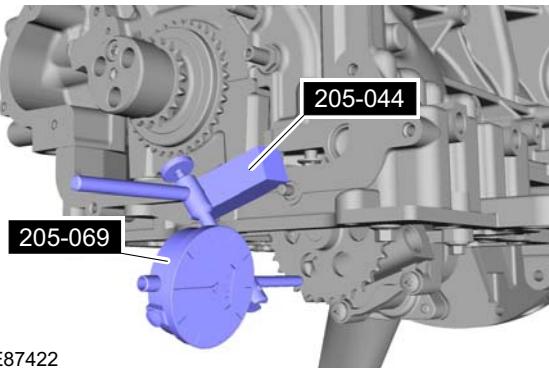
13. Take a reference measurement from the front face of the crankshaft sprocket.

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

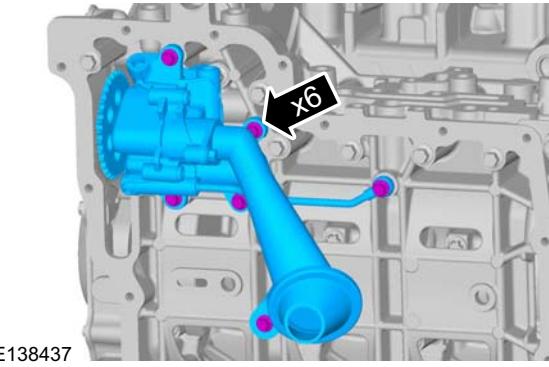


14. Take measurements at two different points on the oil pump sprocket and align the oil pump sprocket.

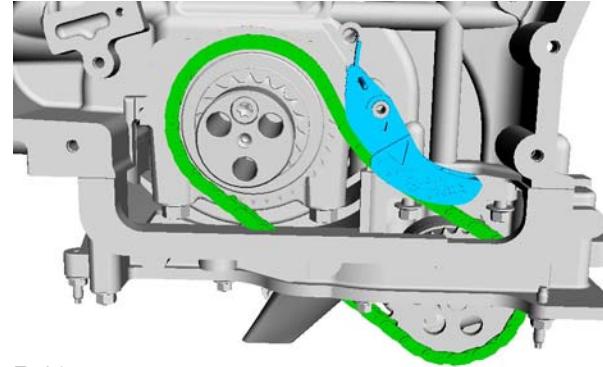
Special Tool(s): 205-044, 205-069



15. Torque: 10 Nm



16.

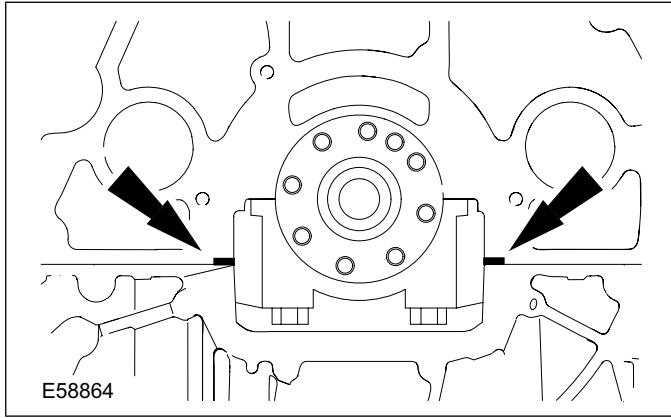


17. NOTE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully

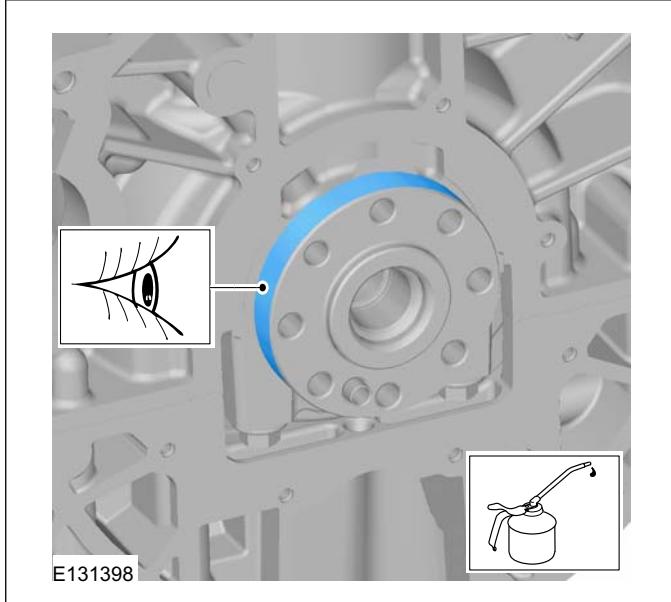
ASSEMBLY

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.

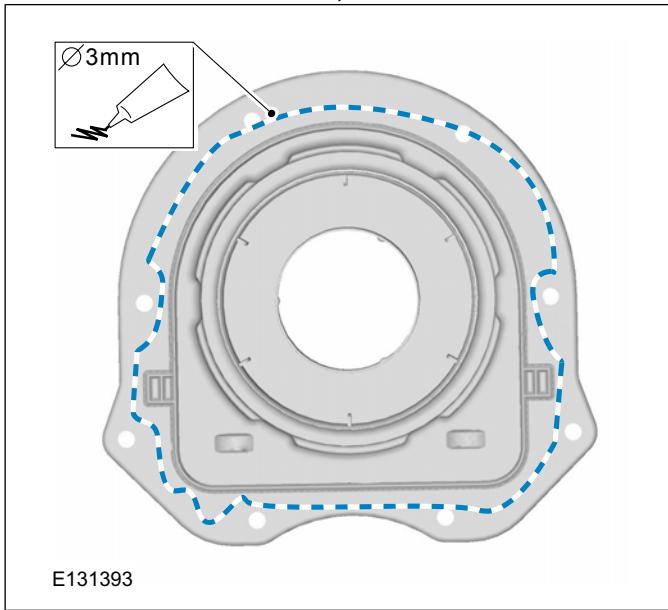


18. Material: Engine Oil - 5W-30 (WSS-M2C913-C)
engine oil



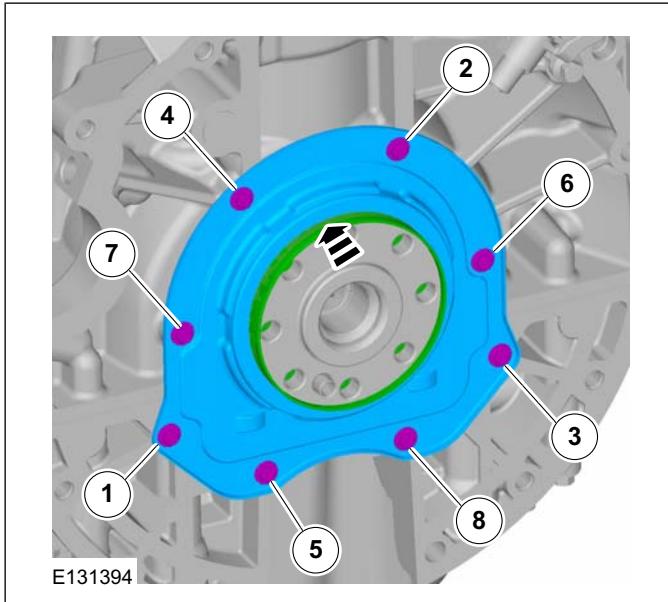
19. NOTE: Install the new crankshaft rear seal carrier within five minutes of applying the recommended sealant.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant



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.

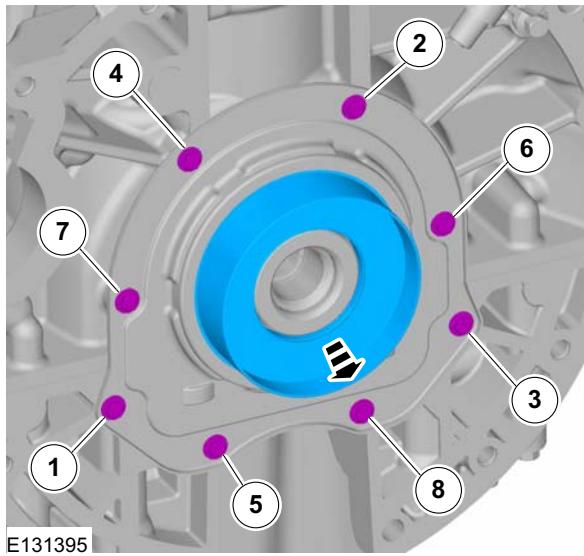
Initially hand tighten the fasteners.



ASSEMBLY

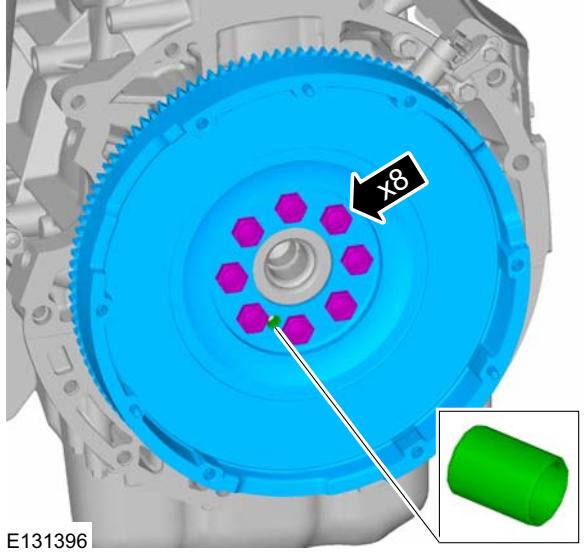
21. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

Torque: 20 Nm



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

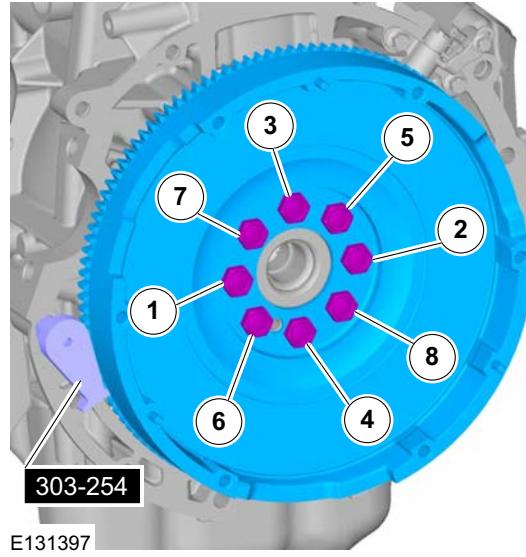
Initially hand tighten the fasteners.



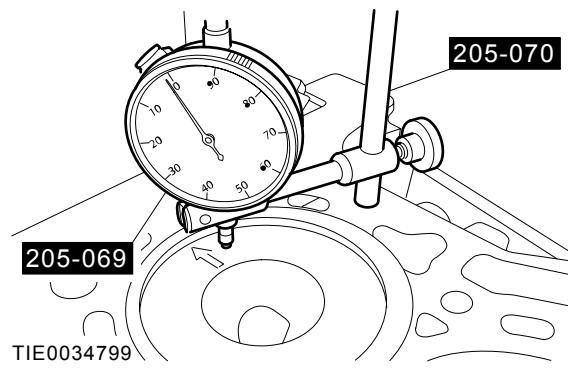
23. Special Tool(s): 303-254

Torque:

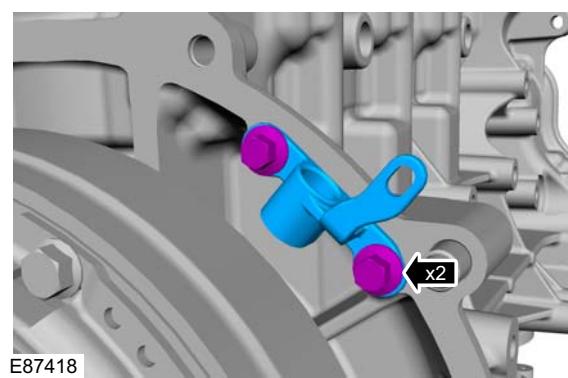
- Stage 1: 15 Nm
- Stage 2: 30 Nm
- Stage 3: 75 Nm



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



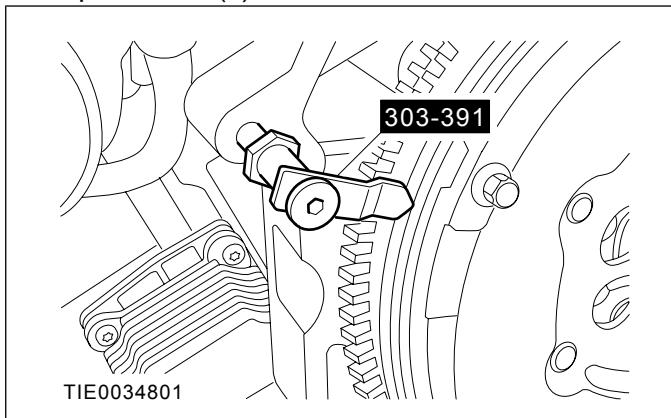
25. NOTE: Do not fully tighten the crankshaft position sensor bracket retaining bolts at this stage.



ASSEMBLY

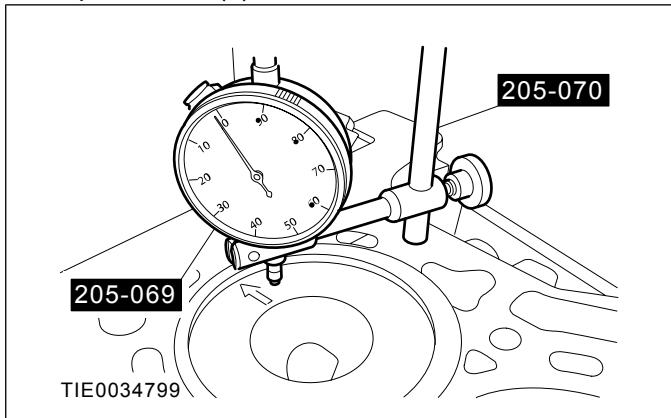
26. NOTE: After installation do not move the special tool.

Special Tool(s): 303-391



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

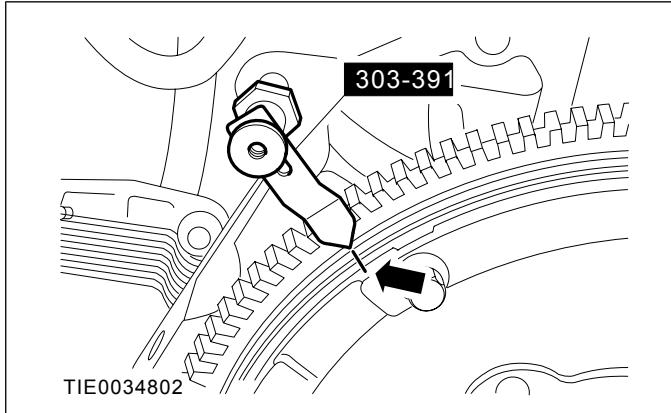
Special Tool(s): 205-069, 205-070



28. Zero the dial indicator gauge.

29. Mark the position on the flywheel primary mass.

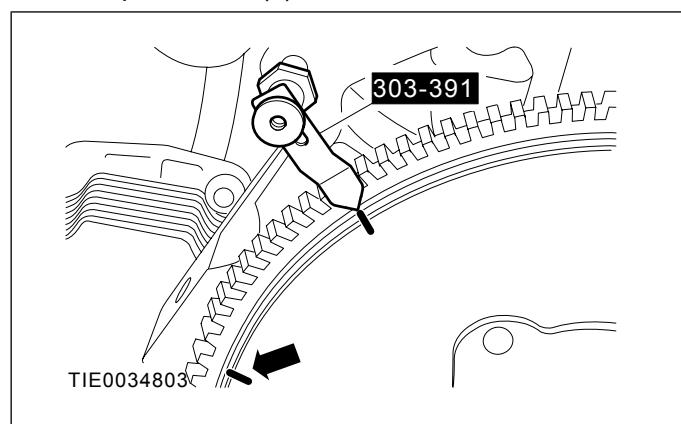
Special Tool(s): 303-391



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.

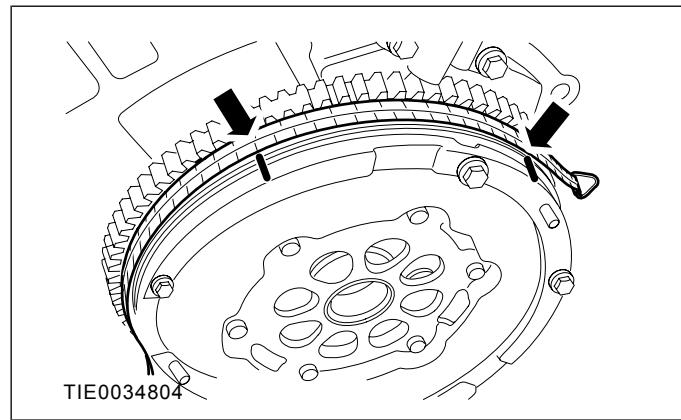
Special Tool(s): 303-391



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

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

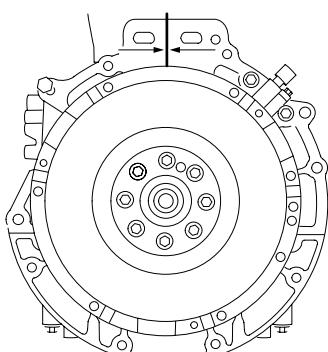
Measure the distance between the two marks.



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

ASSEMBLY

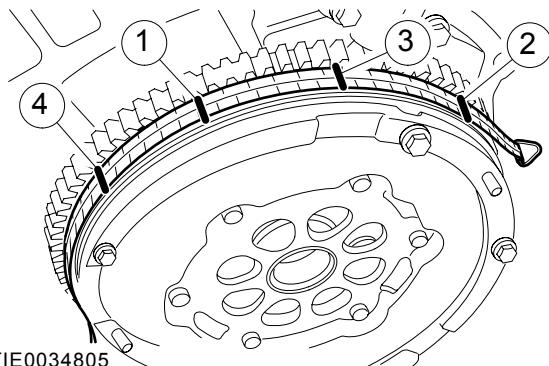
- 34.** Measure the circumference of the flywheel primary mass.



TIE0034809

- 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).



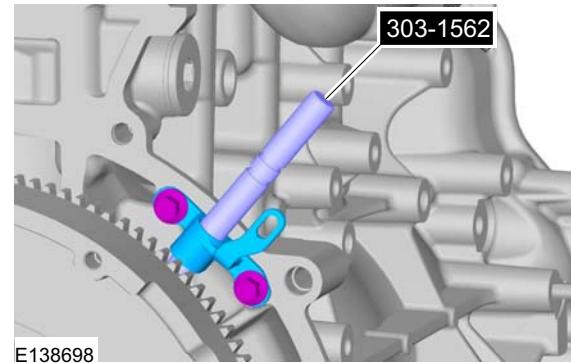
TIE0034805

- 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.

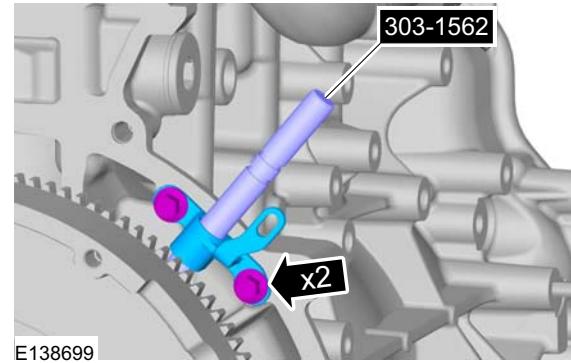
NOTE: Rotate the crankshaft in the normal direction of rotation to the mark of the calculated 50 degrees BTDC.

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

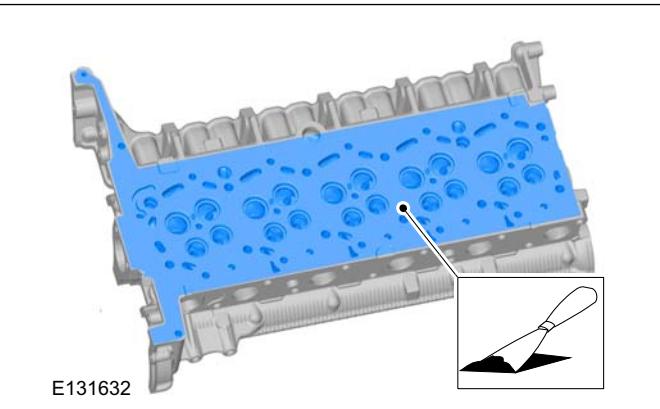
Special Tool(s): 303-1562



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



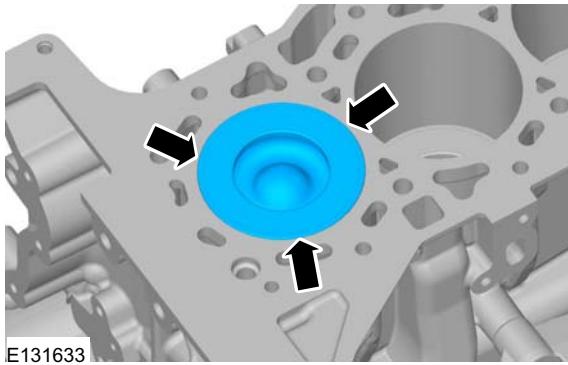
- 39.** **WARNING:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.



ASSEMBLY

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

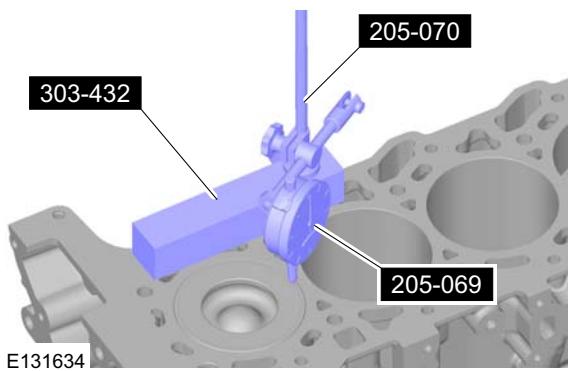
Measure the distance between the piston crown and the cylinder block at the points indicated.



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

- Using the special tools, measure the piston protrusion.

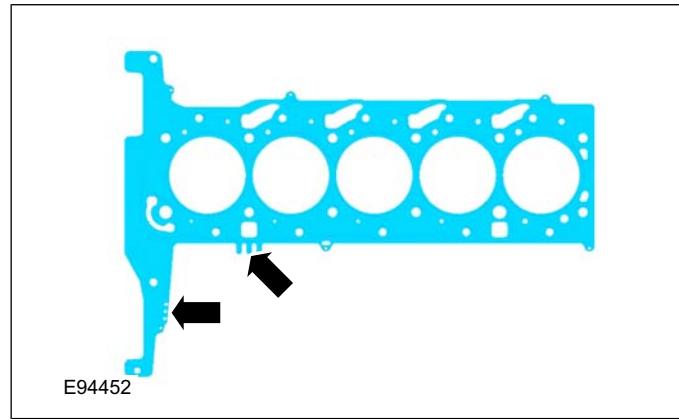
Special Tool(s): 205-070, 205-069, 303-432



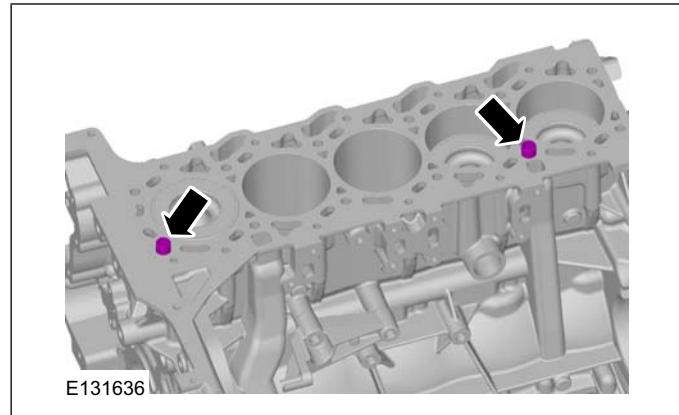
42 Determine the cylinder head gasket.

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

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



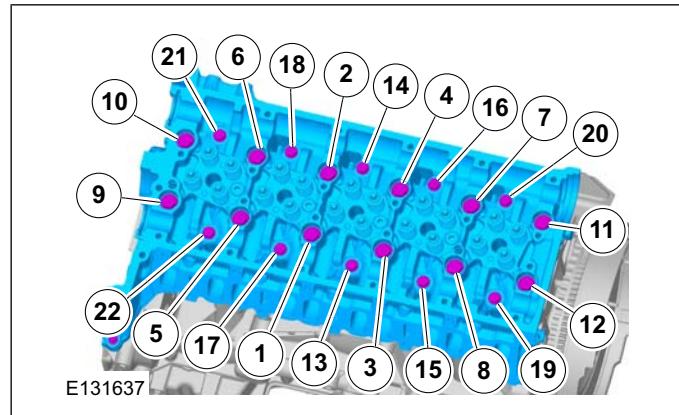
44.



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

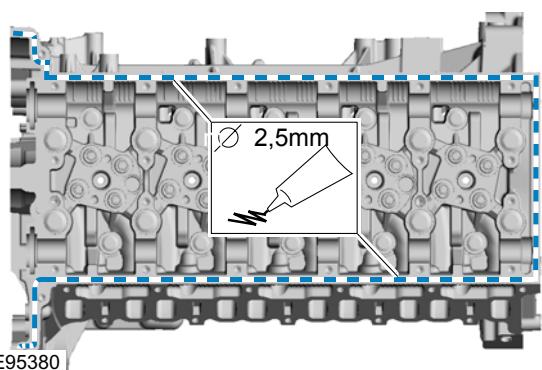
Torque:

- 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



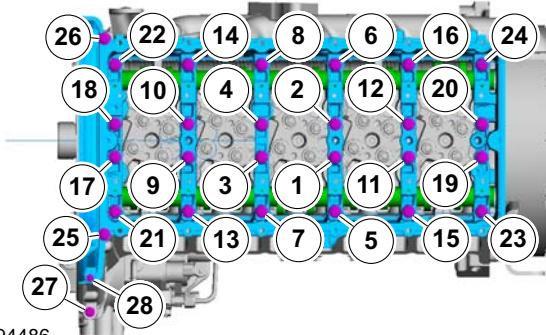
ASSEMBLY

46. Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant



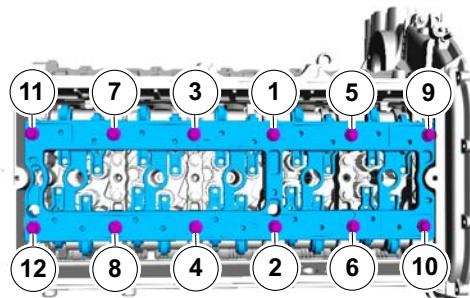
47. Torque:

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

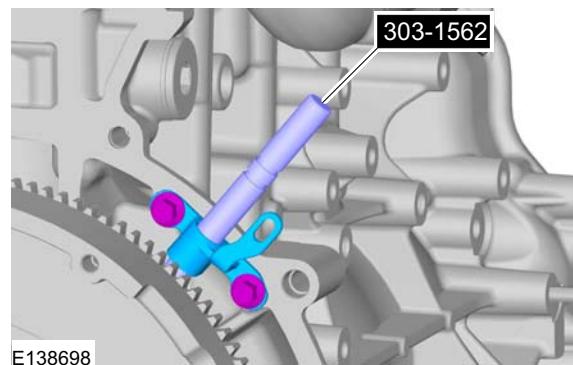


48. Torque:

- Stage 1: 10 Nm
- Stage 2: 30°

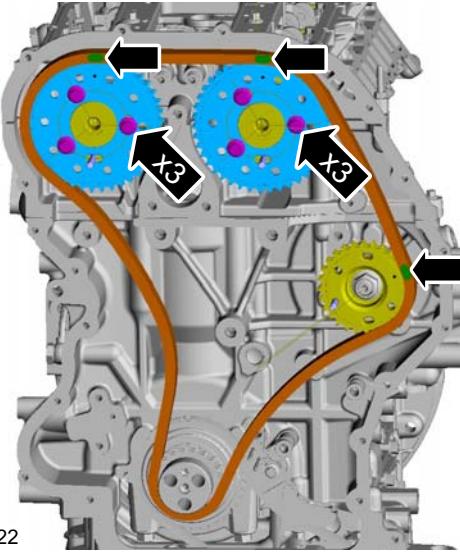


49. Special Tool(s): 303-1562



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

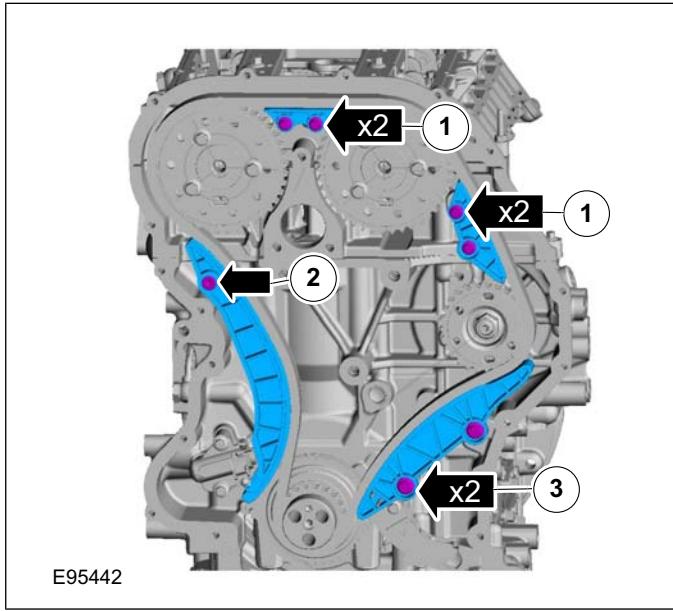
General Equipment: 6 mm Drill Bit
Torque: 33 Nm



51. Remove the 6 mm drill bits.

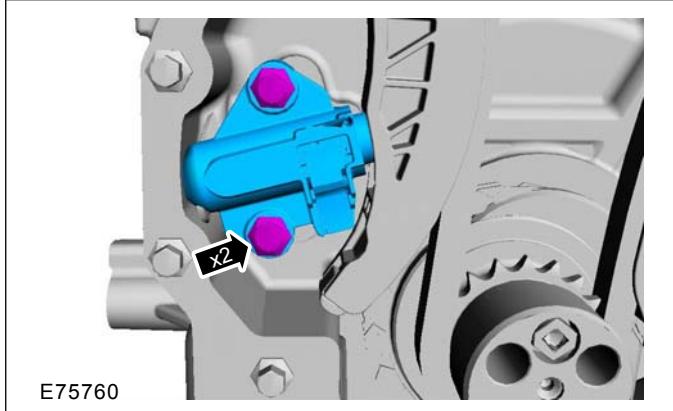
ASSEMBLY

- 52** 1. Torque: 15 Nm
 2. Torque: 40 Nm
 3.  **CAUTION:** Make sure that new bolts are installed.

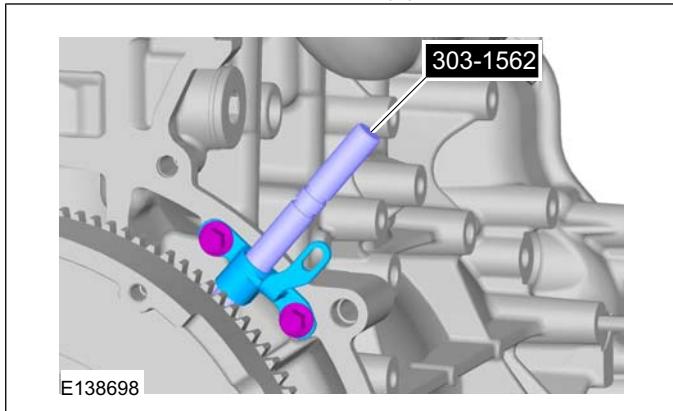


53. NOTE: Make sure that a new component is installed.

Torque: 15 Nm

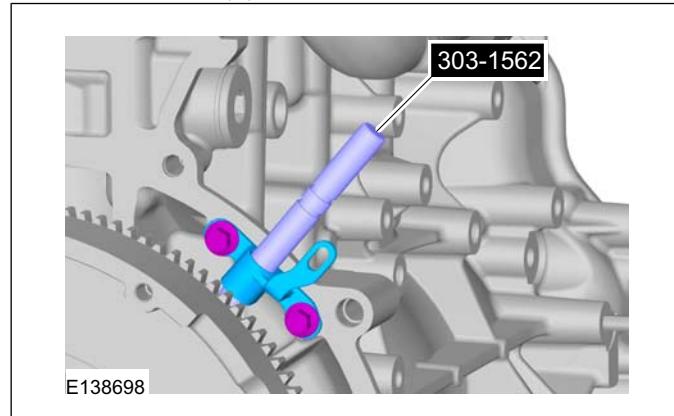


54. Remove the Special Tool(s): 303-1562



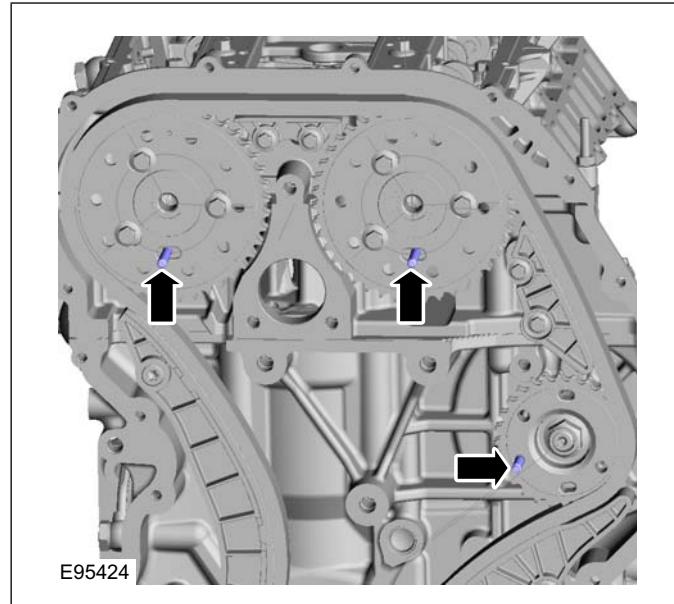
55. Rotate the engine two revolutions.

56. Special Tool(s): 303-1562



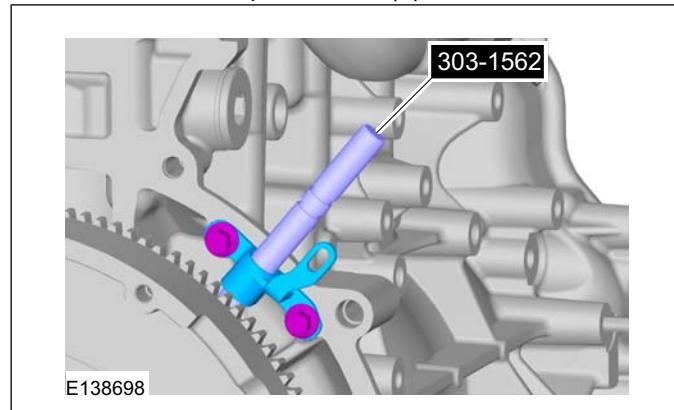
57. Check the position of the timing marks and correct if necessary.

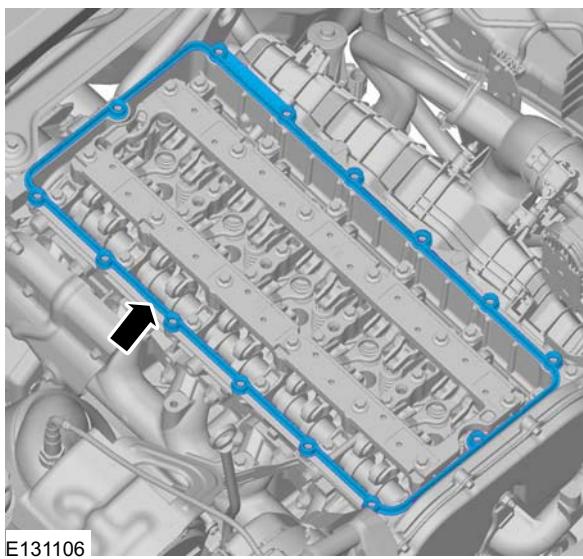
General Equipment: 6 mm Drill Bit



58. Remove the 6 mm drill bits.

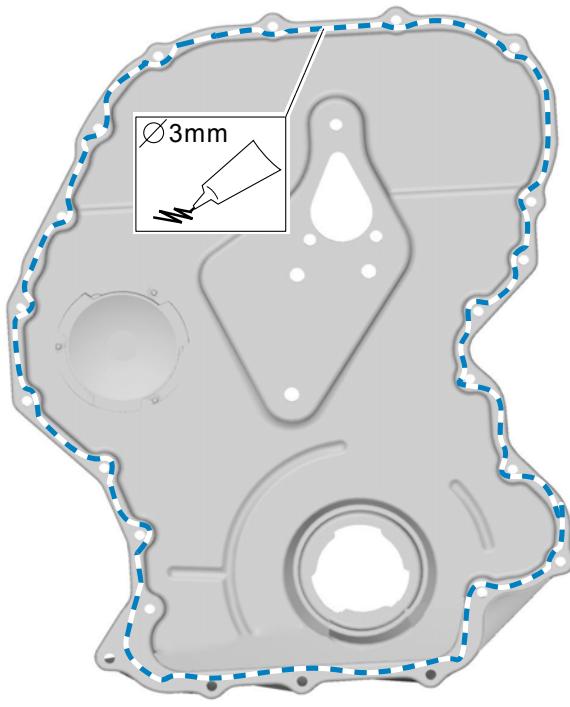
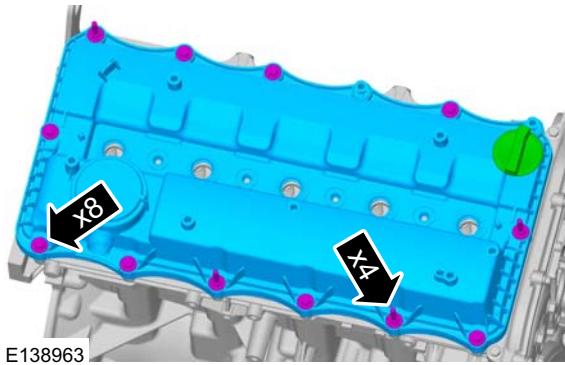
59. Remove the Special Tool(s): 303-1562



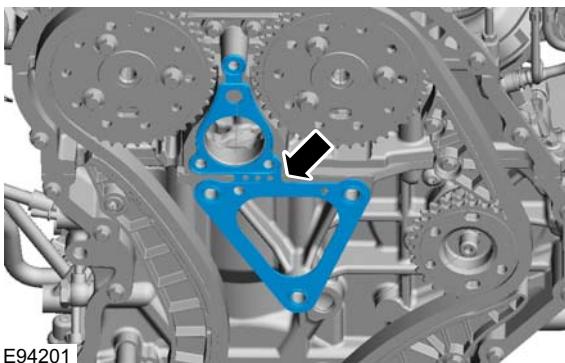
ASSEMBLY**60.**

NOTE: Make sure that a new component is installed.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant

**61.** Torque: 10 Nm

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

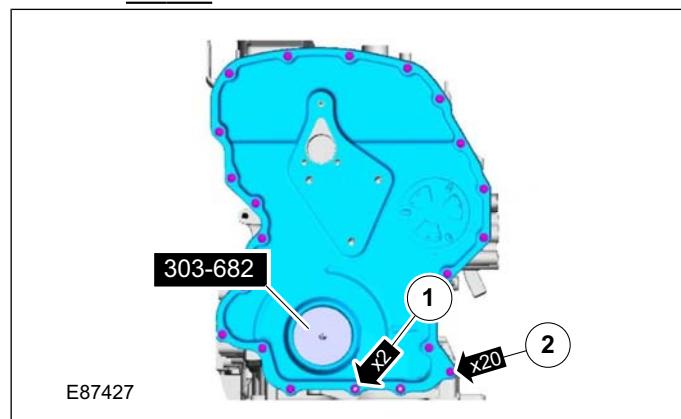


63. **NOTE:** The component must be installed within 5 minutes of applying the sealant.

64. Special Tool(s): 303-682

Torque:

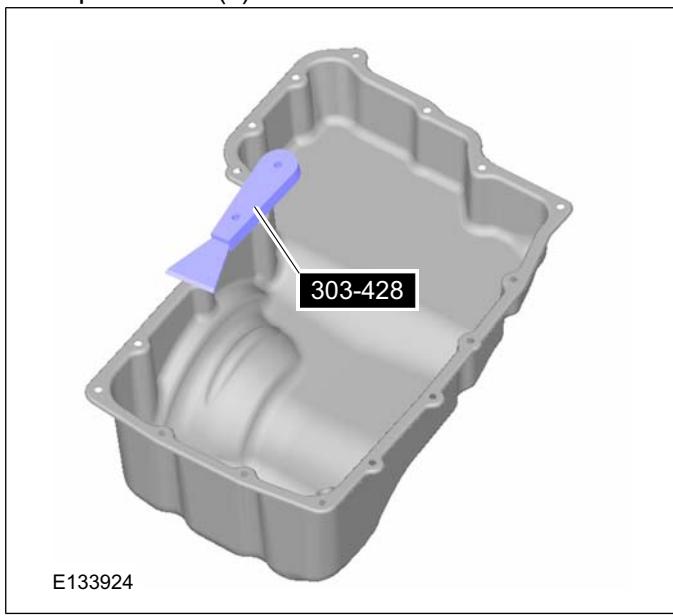
- 1 10 Nm
- 2 14 Nm



ASSEMBLY

65. NOTE: Do not damage the mating faces.

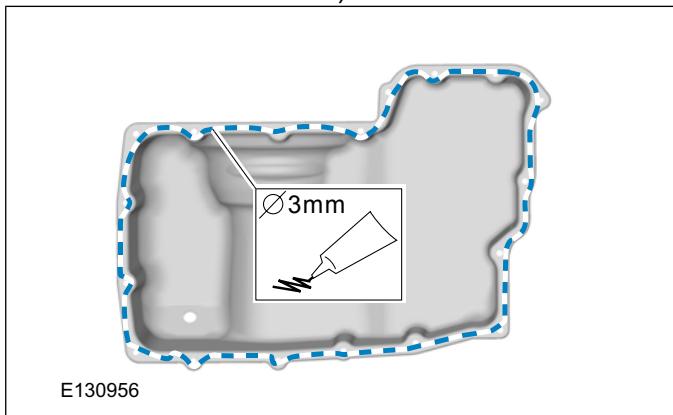
Special Tool(s): 303-428



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

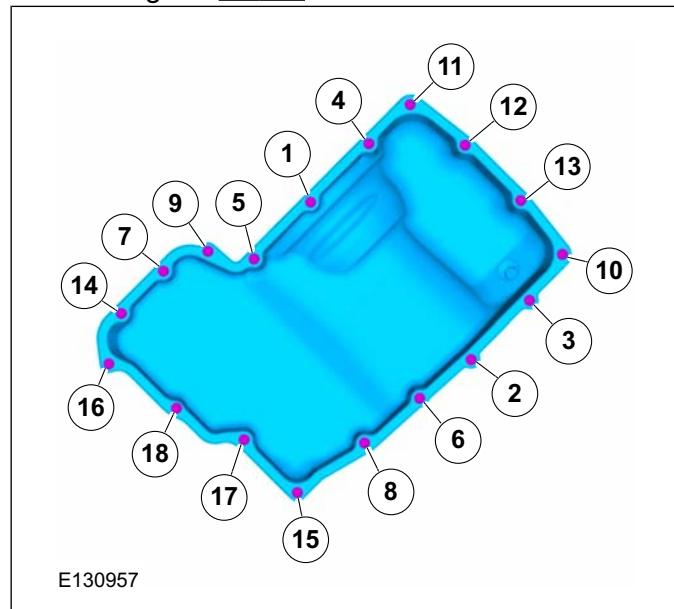
NOTE: Do not damage the mating faces.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA) sealant



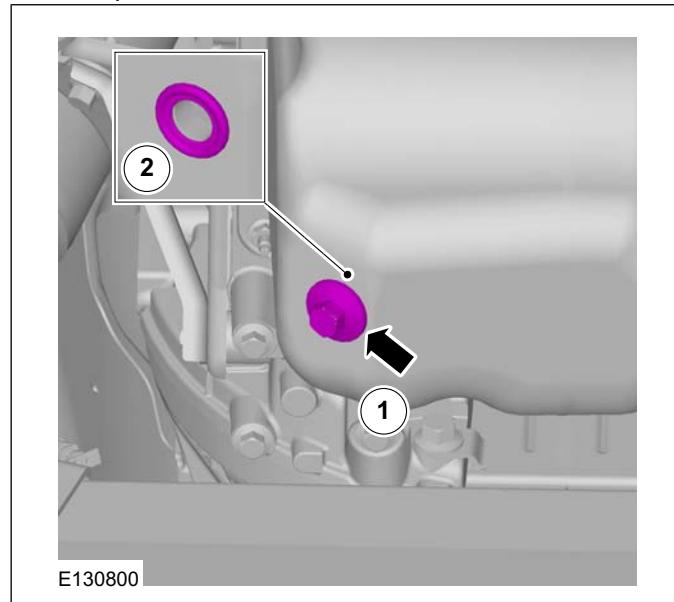
67. Torque:

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

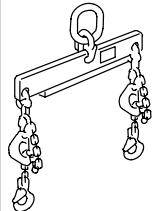


68. NOTE: The seal is to be reused unless damaged.

Torque: 35 Nm

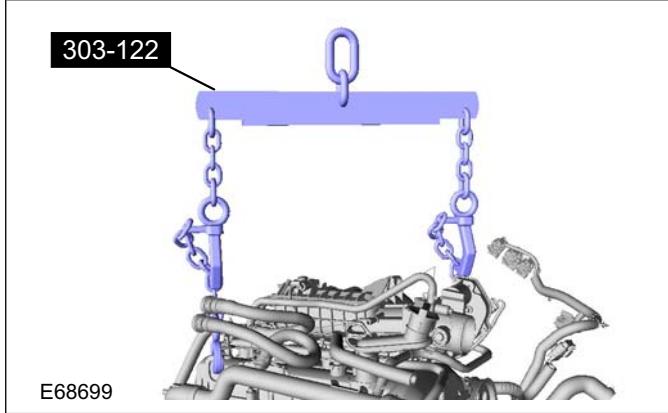


INSTALLATION**Engine — Vehicles With: 6-Speed Manual Transmission - MT82(21 132 0; 21 132 6; 21 132 7)****Installation****Special Tool(s)**

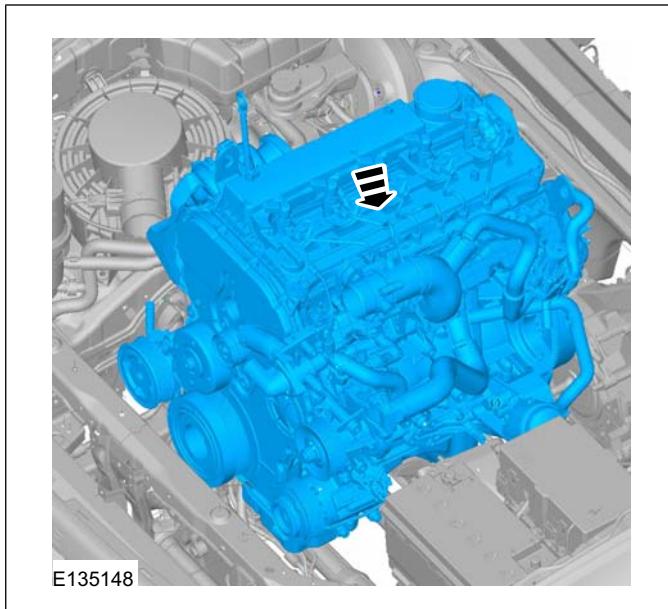
	303-122 Lifting Bracket, Engine
21068A	

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

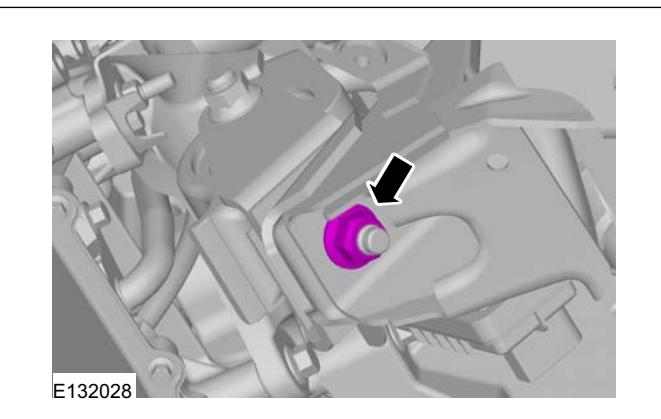
2. Special Tool(s): 303-122



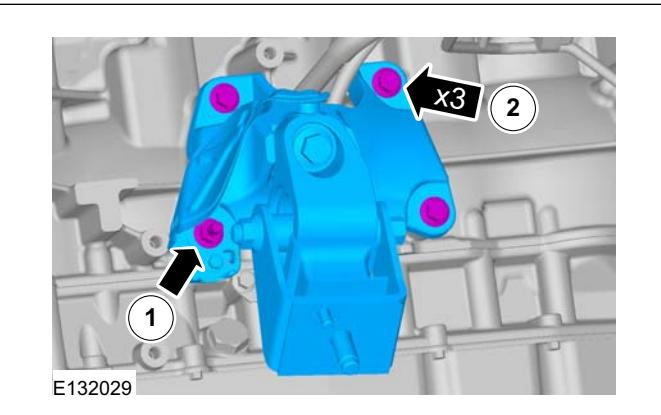
3.



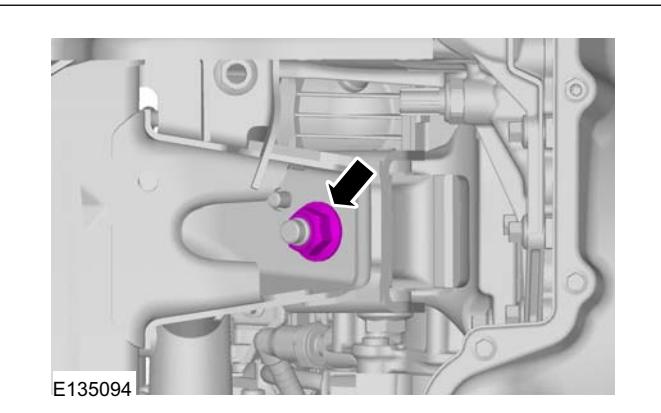
4. **NOTE:** Hand tighten the nut at this stage.



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



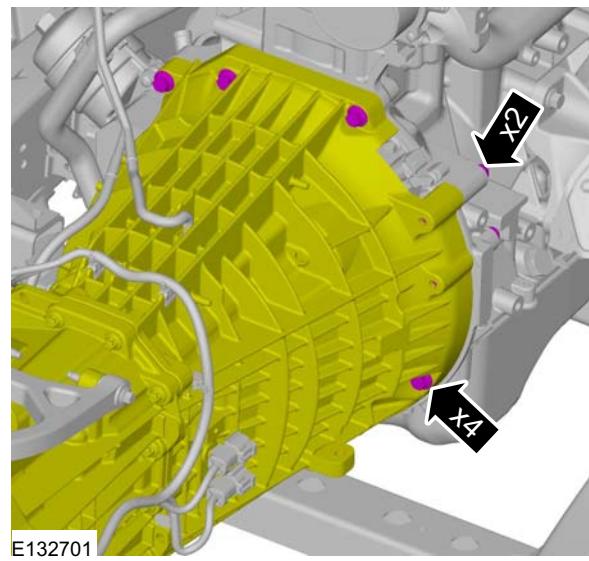
6. **NOTE:** Hand tighten the nut at this stage.



INSTALLATION

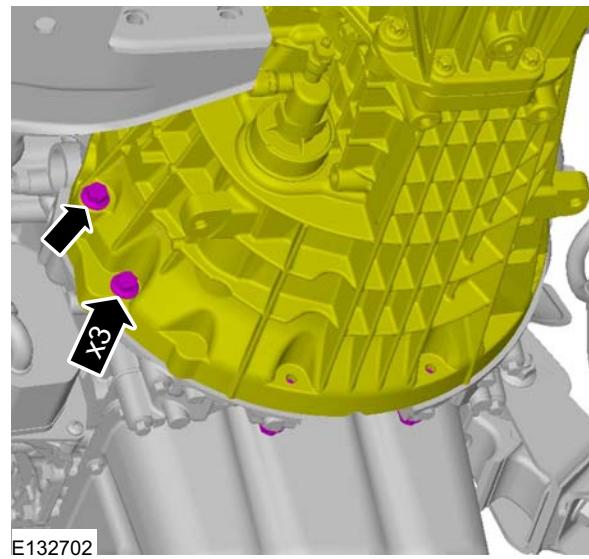
7. Initially hand tighten the fasteners.

Torque: 48 Nm

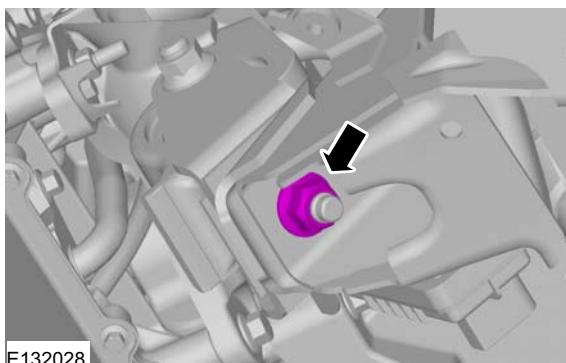


8. Initially hand tighten the fasteners.

Torque: 48 Nm

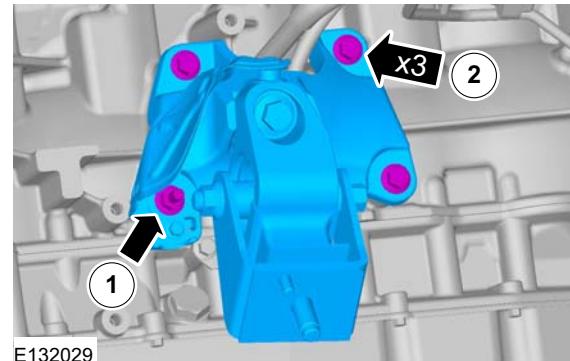


9. Torque: 80 Nm

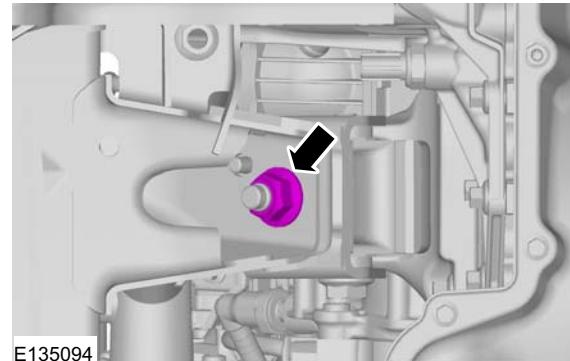


10. 1. Torque: 48 Nm

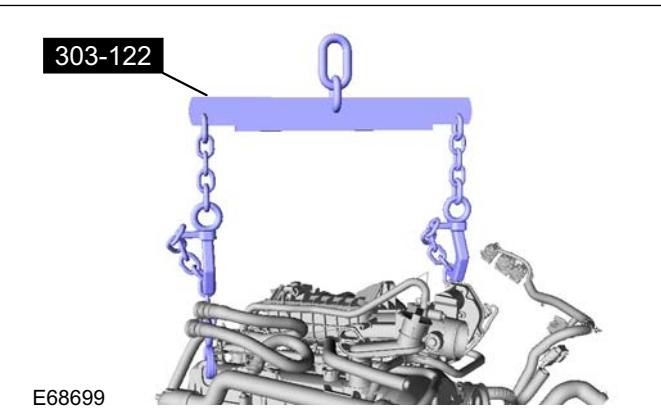
2. Torque: 25 Nm



11. Torque: 80 Nm



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

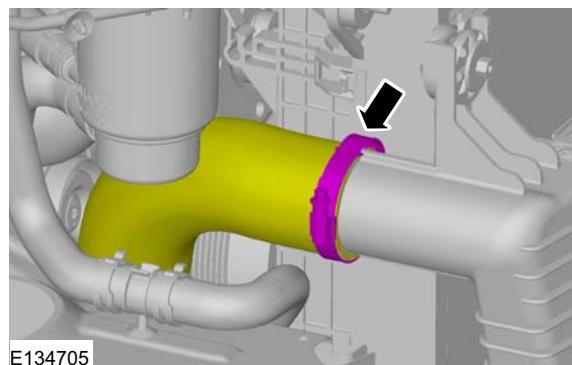


INSTALLATION

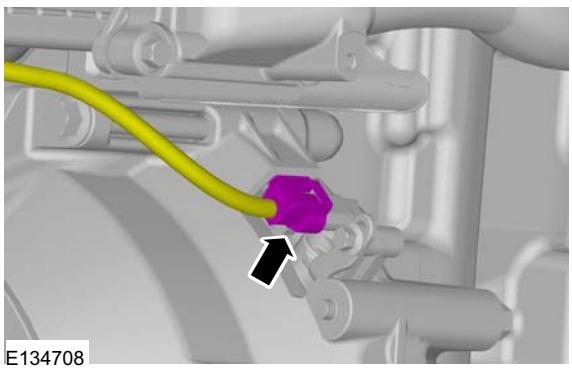
13. Torque: 13 Nm



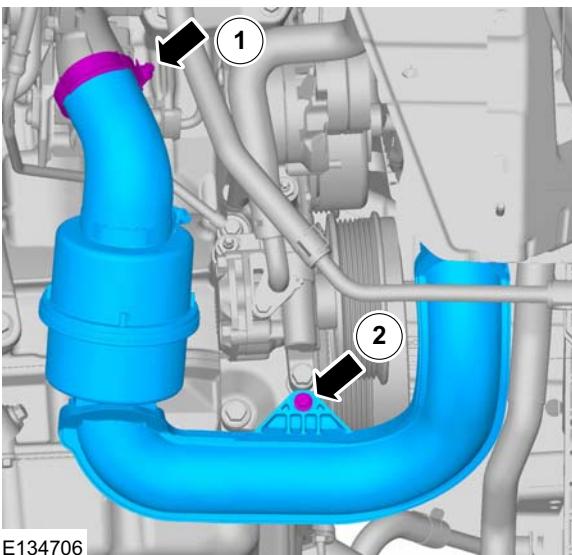
16.



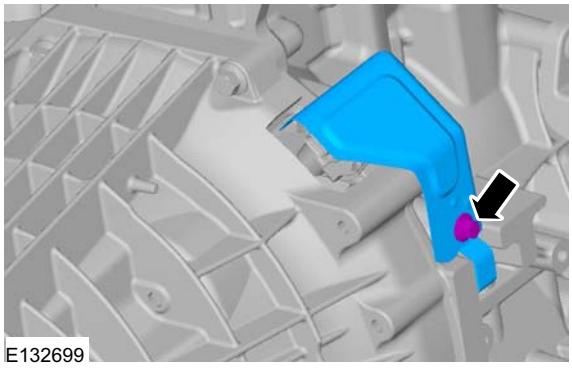
14.



17. Torque: 10 Nm



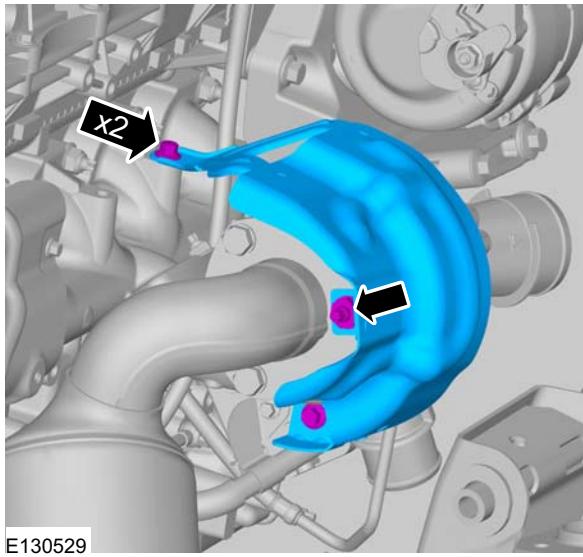
15. Torque: 12 Nm



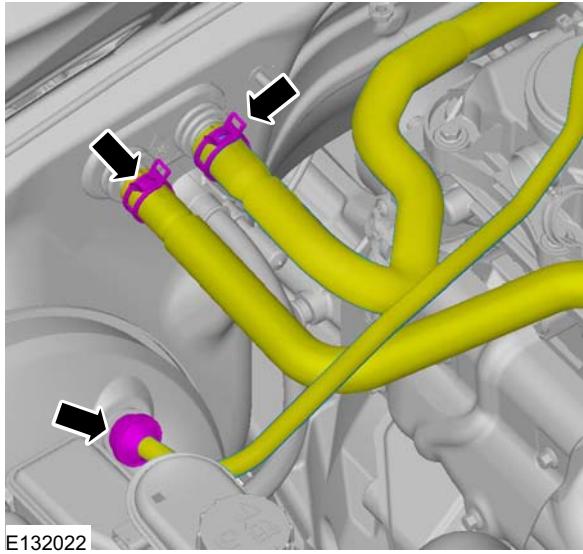
INSTALLATION

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).

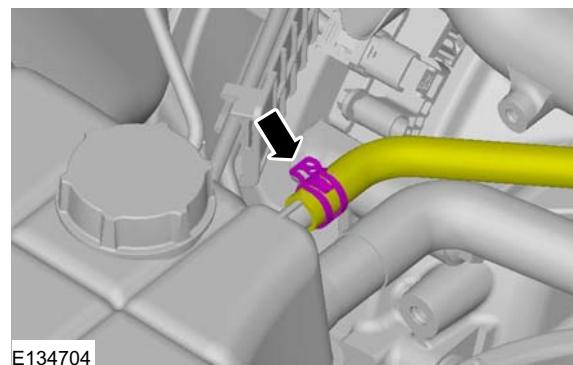
19. Torque: 22 Nm



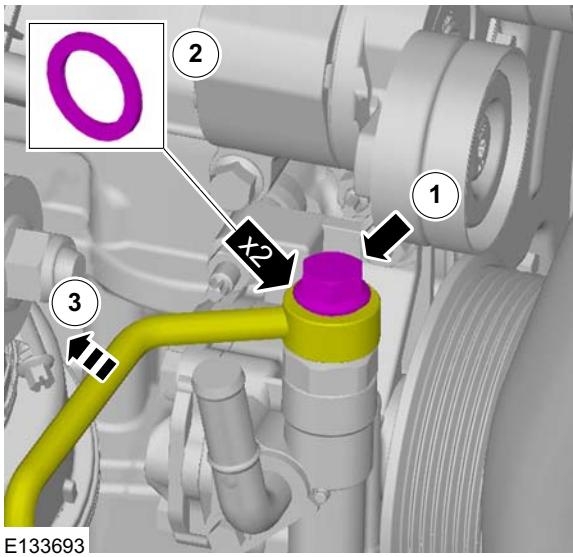
20.



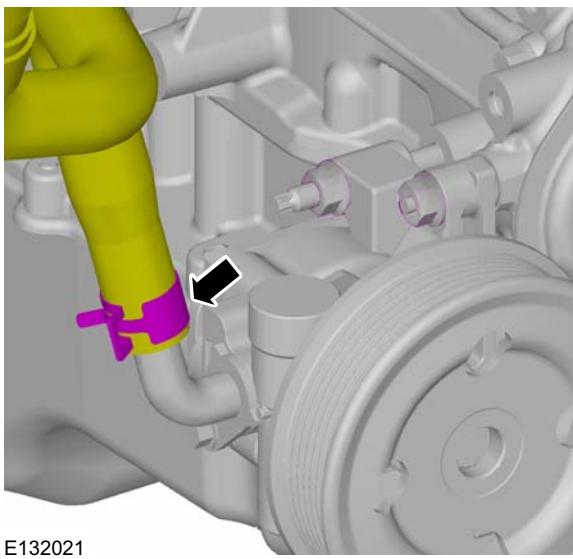
21.



22 Torque: 35 Nm

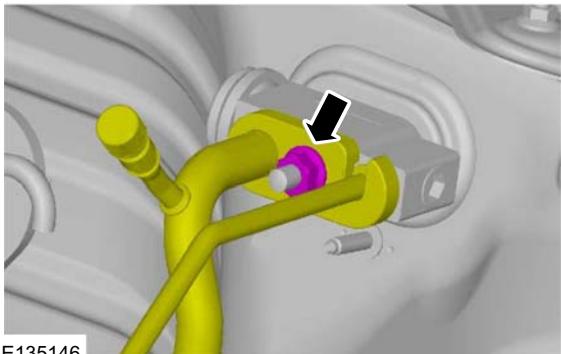


23.



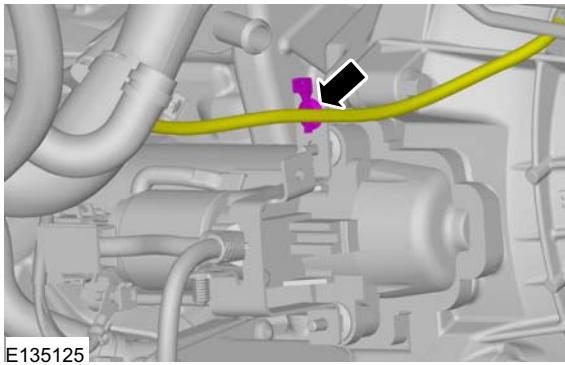
INSTALLATION

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.



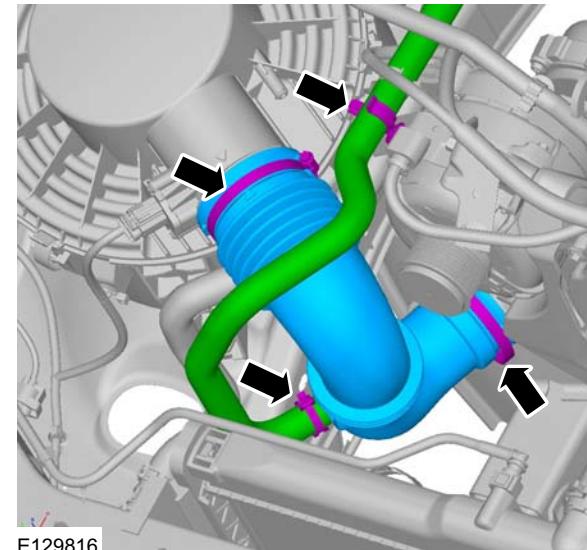
27. Refer to: **Condenser - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma** (412-01 Climate Control, Removal and Installation).

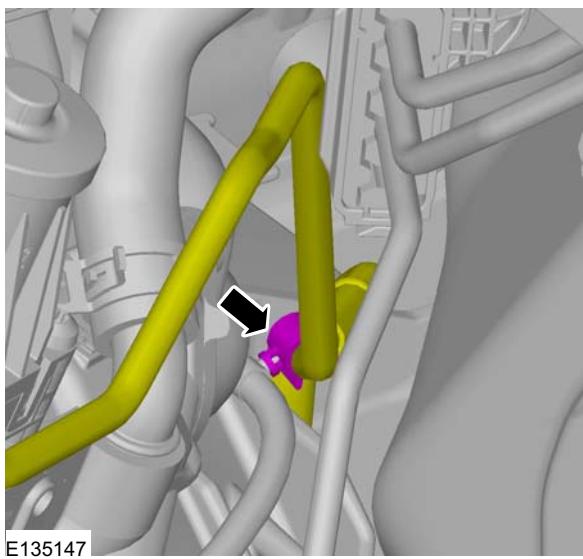
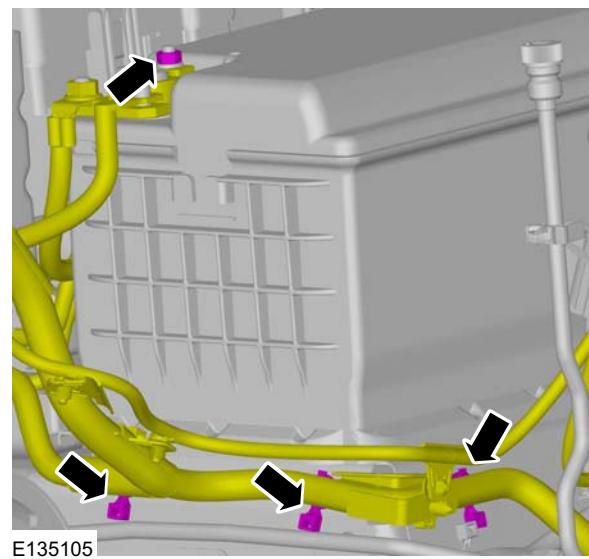
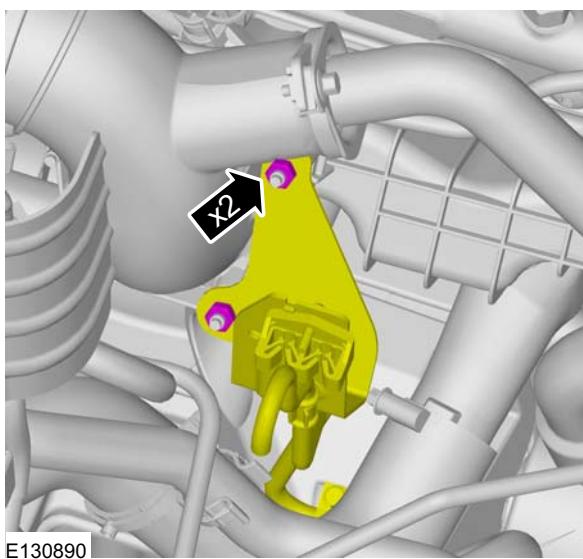
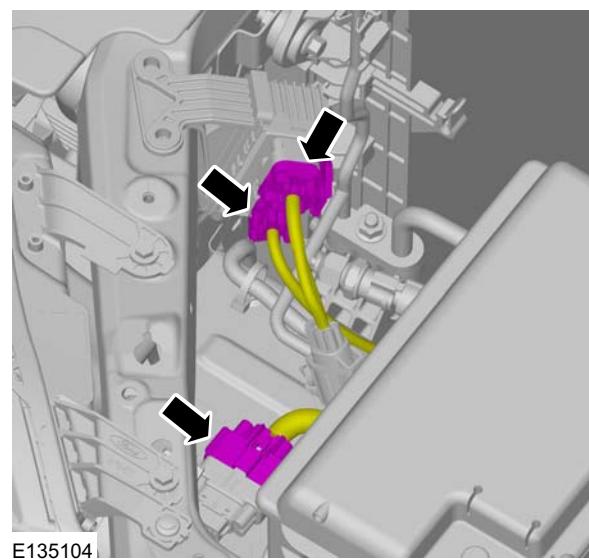
28. Refer to: **Radiator** (303-03 Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

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 Nm****33. Torque: 10 Nm****36.****34. Torque: 18 Nm**