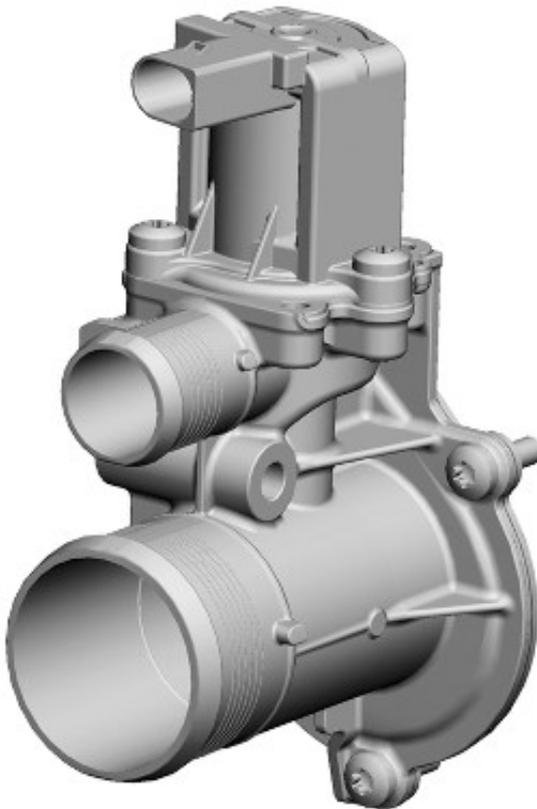


the compressor shut-off vacuum actuator located on the charge air intake manifold tube. When the vacuum is applied to the vacuum actuator, the actuator operates to open the shut-off valve allowing charge air to flow into the air intake pipe.

Operation of the secondary turbocharger compressor shut-off valve is controlled by a PWM signal from the ECM; 0% is off and 100% is on (solenoid activated). The solenoid valve is opened when bi-turbocharger operation is required allowing compressed charge air from the secondary turbocharger compressor to enter the air intake system.



E 116426

The secondary turbocharger compressor recirculation valve motor is located on the compressor recirculation valve housing, adjacent to the compressor shut-off valve. The solenoid valve is attached to the compressor recirculation valve with 3 screws.

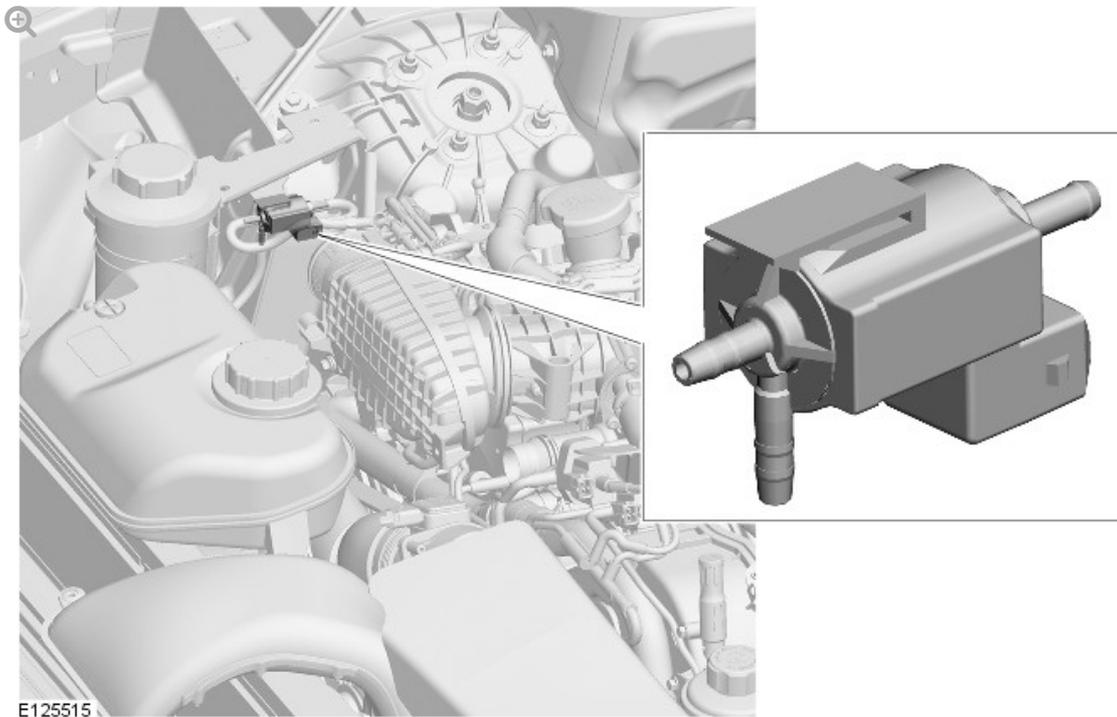
The secondary turbocharger compressor recirculation valve motor is controlled by the ECM. The valve is used during operation of the secondary turbocharger. When the ECM is switching to bi-turbocharger operation, the valve motor is operated which opens the recirculation path to the primary turbocharger. This allows the secondary turbocharger to increase its speed. When the secondary turbocharger has reached its optimum operating speed the recirculation valve motor is operated, closing the recirculation path to the primary turbocharger.



E116760

The secondary turbocharger turbine position sensor is located on the turbine vacuum shut-off valve. The sensor has three connections to the ECM; a 5V reference voltage, a ground and a signal return.

The sensor is connected to the turbine shut-off vacuum actuator and senses when the actuator has operated. The sensor returns a 0 - 5V analogue position signal to the ECM to confirm that the vacuum actuator has operated.



The active engine mount solenoid is attached to the power steering reservoir bracket, adjacent to the glow plug module. The solenoid is connected to the vacuum pump, located at the rear of the engine, by pipes. Further pipes connect the solenoid to the active engine mounts.

The active engine mount system is designed to reduce force transmitted to the body of the car by engine vibration at idle. The engine mounts are 2 state hydromounts. They are operational throughout the operating range of the engine and can change from soft (on) to hard (off) between engine idle speed and engine load conditions respectively, via a control output from the ECM.

This output controls a single solenoid that either softens or stiffens the LH and RH engine mounts by applying or removing a vacuum through the solenoid.

When the engine is at idle speed, the solenoid is energized (on) and vacuum from the pump is applied, via the solenoid, to the engine mounts, changing their state to soft. At engine speeds above idle speed, the solenoid is de-energized (off) and the vacuum is lost, changing the engine mounts state to hard. The ECM strategy is designed to control when the active engine mounts solenoid should be energized or de-energized in relation to the following vehicle operating parameters:

- Engine speed
- Vehicle speed
- Engine speed gradient
- Vehicle speed gradient
- Engine coolant temperature
- Ignition state
- Cranking state
- Engine running status
- Transmission selector position.

ELECTRONIC ENGINE CONTROLS - TDV6 3.0L DIESEL

PRINCIPLES OF OPERATION

For a detailed description of the 3.0L Diesel electronic engine controls and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to: (303-14A Electronic Engine Controls - TDV6 3.0L Diesel)

[Electronic Engine Controls](#) (Description and Operation),
[Electronic Engine Controls](#) (Description and Operation),
[Electronic Engine Controls](#) (Description and Operation).

INSPECTION AND VERIFICATION

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

Verify the customer concern.

Visually inspect for obvious signs of damage and system integrity.

<ul style="list-style-type: none"> ▪ Engine oil level ▪ Cooling system coolant level ▪ Fuel level ▪ Fuel contamination ▪ Fuel leaks ▪ Air ingress into fuel system ▪ Fuel filter ▪ Front End Accessory Drive (FEAD) belt ▪ Air filter and induction hoses ▪ Boost air circuit and intercooler ▪ Exhaust system including oxidation catalyst and particulate filter ▪ Primary turbocharger vane control linkage 	<ul style="list-style-type: none"> ▪ Battery charge and condition ▪ Fuses ▪ Wiring harness ▪ Electrical connector(s) ▪ Sensor(s) ▪ Actuator(s) ▪ Engine Control Module (ECM) ▪ Transmission Control Module (TCM)
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If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

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

SYMPTOM CHART

- Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.
- Place the vehicle in a well ventilated, quarantined, area and arrange "No Smoking/Fuel Fumes" signs about the vehicle.

- Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.
- Do not carry out any repairs to the fuel injection system with the engine running. The fuel pressure within the system can be as high as 2000 bar. Failure to follow this instruction may result in personal injury.
- Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapours are always present and may ignite. Failure to follow these instructions may result in personal injury.
- After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury
- If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.
- If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.
- Wash hands thoroughly after handling fuel, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.
- This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

- Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always fit blanking plugs to any open orifices or lines.
- Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow these instructions may result in foreign matter ingress to the fuel injection system.
- Do not disconnect an injector wiring connector when the engine is running. The fuel injectors are operated by piezo elements controlled by an electrical signal, they can latch open if disconnected when the engine is running. Failure to observe this caution may result in severe engine damage.
- The low pressure fuel system bleeding procedure must be carried out before this procedure is carried out, or the engine is attempted to be started, following removal or replacement of any low pressure fuel system component. Failure to follow this instruction may result in damage to the fuel injection pump.

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

<p>Engine does not crank</p>	<ul style="list-style-type: none"> ▪ Battery discharged/charging fault 	<p>Refer to the owner literature and ensure that the correct start up procedure is being adhered to. Refer to the battery care manual, ensure the</p>
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	<ul style="list-style-type: none"> ▪ Starting system fault/power distribution fault ▪ Security system/immobilizer engaged ▪ Engine Control Module (ECM) relay ▪ Transmission Shift Control module ▪ Pedal switch fault ▪ Engine seized/hydraulically locked 	<p>vehicle battery is in fully charged and serviceable condition. Check battery cables are correctly connected. Check high current power distribution fusible links are in serviceable condition. Check for DTCs and refer to the relevant DTC index. Check that the security system/immobilizer is disarmed. Check transmission shift controls and pedal switches to ensure starter operation is not being inhibited. Check the engine is not seized or hydraulically locked.</p>
<p>Engine cranks, but does not start</p>	<ul style="list-style-type: none"> ▪ The common 5 volt sensor power to both crankshaft position sensor and camshaft position sensor is missing ▪ Battery discharged, starter circuit or motor fault ▪ Low/contaminated fuel ▪ Air leakage ▪ Fuel system low pressure circuit fault ▪ Fuel pump module fault ▪ Blocked fuel filter ▪ Fuel Volume Control Valve (FVCV) blocked/contaminated ▪ Fuel Pressure Control Valve (FPCV) blocked/contaminated ▪ Fuel injection pump failure ▪ Crankshaft position (CKP) sensor ▪ Engine Control Module (ECM) fault 	<p>Check the 5 volt sensor power is present at both crankshaft position sensor and camshaft position sensor. Refer to the battery care manual and the workshop manual, check that the battery is fully charged and serviceable. Check that the cranking speed is within specification. Investigate and repair start and charge faults as required. Check that the fuel level is sufficient and that the fuel is not contaminated. Check the fuel pump module operation, check the fuel system low pressure circuit for leaks/damage/air ingress. Check the fuel filter for water, blockage. Check the Fuel Volume Control Valve and Fuel Pressure Control Valve. Check the fuel injection high pressure pump. Check the integrity of the air intake system and boost air circuit for correct installation. Check the crankshaft position sensor and circuits. In cold conditions with no indications of combustion when cranking, check the glow plug circuits. Refer to the new module/component installation note at the top of the Symptom Chart if an Engine Control Module (ECM) is suspect.</p>

<p>Engine stops, will crank, but will not start, no DTCs logged in Engine Control Module (ECM)</p>	<ul style="list-style-type: none"> ▪ The common 5 volt sensor power to both crankshaft position sensor and camshaft position sensor is missing 	<p>Check the 5 volt sensor power is present at both crankshaft position sensor and camshaft position sensor.</p>
<p>Difficult to start</p>	<ul style="list-style-type: none"> ▪ Glow plug system fault (cold engine start) ▪ Low/contaminated fuel ▪ Air leakage ▪ Fuel pump module fault ▪ Fuel system low pressure circuit fault ▪ Blocked fuel filter ▪ Fuel Volume Control Valve (FVCV) blocked/contaminated ▪ Fuel Pressure Control Valve (FPCV) blocked/contaminated ▪ Exhaust Gas Recirculation (EGR) valve(s) fault 	<p>If the fault is related to cold starts only check the glow plugs and associated circuits first. Check the fuel level/possibility of contamination. Check the integrity of the air intake system and for correct installation. Check the fuel pump module operation, check the fuel system low pressure circuit for leaks/damage. Check the fuel filter, Fuel Volume Control Valve (FVCV) and Fuel Pressure Control Valve (FPCV). Check the Exhaust Gas Recirculation (EGR) system valves/actuators.</p>
<p>Rough idle</p>	<ul style="list-style-type: none"> ▪ Glow plug system fault (cold engine start) ▪ Low/contaminated fuel ▪ Air ingress into fuel system low pressure circuit ▪ Fuel system low pressure circuit delivery fault ▪ Blocked fuel filter 	<p>If the rough idle is from cold, and improves as the engine warms up, check the glow plug system is operating correctly on all cylinders. Check the fuel level/condition. Check the fuel system low pressure circuit for leaks/damage. Check the fuel filter, Fuel Volume Control Valve and Fuel Pressure Control Valve. Check the integrity of the air intake system and for correct installation. Check the Exhaust Gas Recirculation (EGR) system valves/actuators.</p>

	<ul style="list-style-type: none"> ▪ Fuel Volume Control Valve (FVCV) blocked/contaminated ▪ Fuel Pressure Control Valve (FPCV) blocked/contaminated ▪ Exhaust Gas Recirculation (EGR) valve(s) fault ▪ Exhaust Gas Recirculation (EGR) electric throttle valve fault 	
<p>Lack of power when accelerating</p>	<ul style="list-style-type: none"> ▪ Low fuel level (in torque derate mode) ▪ Fuel level sender fault ▪ Blocked fuel filter ▪ Low fuel pressure ▪ Blocked air filter ▪ Air intake system fault ▪ Boost air circuit leak or blockage ▪ Restricted exhaust system ▪ Diesel particulate filter (DPF) blocked/restricted ▪ Exhaust Gas Recirculation (EGR) valve(s) fault ▪ Exhaust Gas Recirculation (EGR) electric throttle valve fault ▪ Secondary Variable Geometry Turbocharger (VGT) fault ▪ Primary Fixed Geometry Turbocharger fault ▪ Turbine shut off valve fault 	<p>Check the fuel system for level/contamination/drain water from filter. Validate fuel level sender reading against actual tank contents. Check fuel filter for blockage. Check the fuel pressure. Check the integrity of the air intake system and for correct installation. Check for a blocked Diesel Particulate Filter or catalytic converter, Check the Exhaust Gas Recirculation (EGR) system. Check the turbochargers for operation including all valves/actuators used to control mono-turbo and bi-turbo mode transitions.</p>

	<ul style="list-style-type: none"> ▪ Compressor recirculation valve fault ▪ Compressor shut off valve fault 	
Engine stops/stalls	<ul style="list-style-type: none"> ▪ Fuel level low (in run dry mode) ▪ Fuel level sender fault ▪ Contaminated fuel ▪ Air ingress into fuel system ▪ Fuel system low pressure circuit fault ▪ Fuel Volume Control Valve (FVCV) blocked/contaminated ▪ Fuel Pressure Control Valve (FPCV) blocked/contaminated ▪ High pressure fuel leak ▪ Exhaust Gas Recirculation (EGR) valve(s) fault ▪ Exhaust Gas Recirculation (EGR) electric throttle valve fault 	Check the fuel level/condition/drain water from filter. Validate fuel level sender reading against actual tank contents. Check the fuel system low pressure circuit for leaks/damage. Check for fuel system leaks, Fuel Volume Control Valve and Fuel Pressure Control Valve. Check the Exhaust Gas Recirculation (EGR) system.
Engine judders	<ul style="list-style-type: none"> ▪ Low fuel level (in torque derate mode) ▪ Fuel level sender fault ▪ Contaminated fuel ▪ Fuel filter blocked ▪ Air ingress into fuel system ▪ Fuel system low pressure circuit fault ▪ Fuel Volume Control Valve (FVCV) blocked/contaminated 	Check the fuel level/condition/drain water from filter and check for blockage. Validate fuel level sender reading against actual tank contents. Check the fuel system low pressure circuit for leaks/damage. Check for fuel system leaks, Fuel Volume Control Valve and Fuel Pressure Control Valve. Check the fuel injection high pressure pump. Check fuel injector(s).

	<ul style="list-style-type: none"> ▪ Fuel Pressure Control Valve (FPCV) blocked/contaminated ▪ High pressure fuel leak ▪ Fuel injection pump fault ▪ Injector fault 	
Excessive fuel consumption	<ul style="list-style-type: none"> ▪ Tire pressures are incorrect ▪ Vehicle brakes are binding/not releasing ▪ Fuel system leak ▪ Fuel system low pressure circuit fault ▪ Fuel Volume Control Valve (FVCV) blocked/contaminated ▪ Fuel Pressure Control Valve (FPCV) blocked/contaminated ▪ Fuel temperature sensor leak ▪ High pressure fuel leak ▪ Injector(s) failure ▪ Exhaust Gas Recirculation (EGR) valve(s) fault ▪ Exhaust Gas Recirculation (EGR) electric throttle valve fault 	<p>Check and adjust tire pressures. Check brakes are releasing correctly and do not cause excessive drag. Check the fuel system for obvious leaks/damage. Check the Fuel Volume Control Valve and Fuel Pressure Control Valve. Check for injector DTCs. Check for restricted induction system and air filter. Check the Exhaust Gas Recirculation (EGR) system including electric throttle plate. Check boost air circuit and intercooler for ineffective cooling or partial blockage. Check for restricted exhaust flow including catalytic converter and diesel particulate filter.</p>

DTC INDEX

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Engine Control Module

3.0L Tdv6 (PCM) (100-00 General Information, Description and Operation).

ELECTRONIC ENGINE CONTROLS - TDV6 3.0L DIESEL

Camshaft position (CMP) sensor retaining bolt	10	7	-
Crankshaft position (CKP) sensor retaining bolt	5	-	44
Engine control module (ECM) retaining bolts	7	-	5
ECM to bracket retaining nuts	7	-	5
Engine oil pressure (EOP) sensor	14	11	-
Engine oil level sensor retaining nut	11	8	-
Mass air flow (MAF) sensor	2	-	18
Manifold absolute pressure (MAP) sensor	3	-	27
Exhaust gas temperature sensor RH	35	26	-
Pre catalytic converter temperature sensor	35	26	-
Post catalytic converter temperature sensor	35	26	-
Pre diesel particulate filter (DPF) exhaust gas temperature sensor	35	26	-
Post DPF exhaust gas temperature sensor	35	26	-
Heated oxygen sensor (HO2S)	48	35	-
Steering gear to subframe retaining bolts	100	74	-
Lower steering column to steering gear pinch bolt	35	26	-
Toe link ball joint to wheel knuckle retaining nut	133	98	-

ENGINE - TDV6 3.0L DIESEL

CAMSHAFT FRONT SEAL [G1272037]

REMOVAL

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

1.

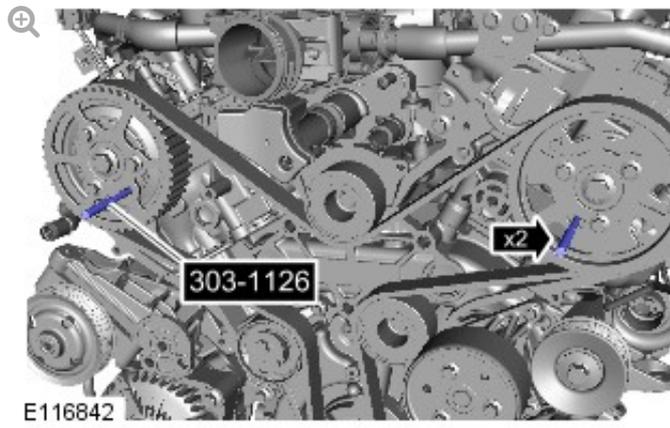
Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: Timing Belt (303-01, Removal and Installation).

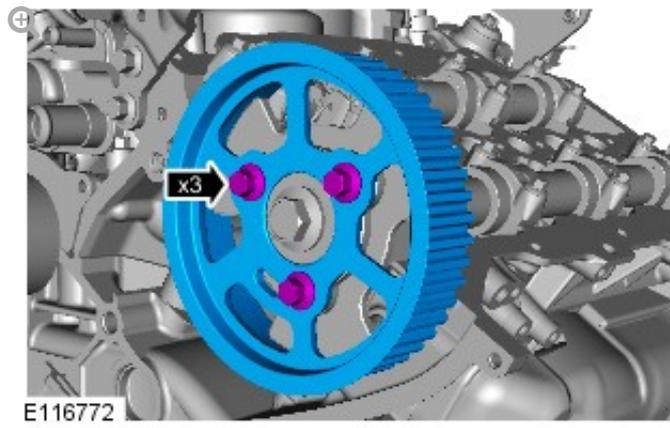
3.

Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

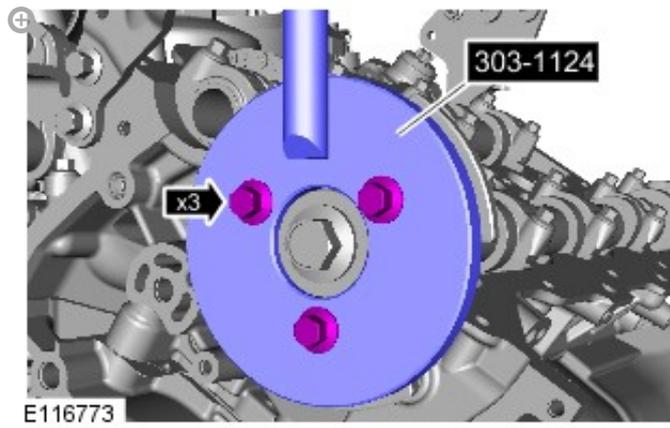


Remove the special tool.

4.

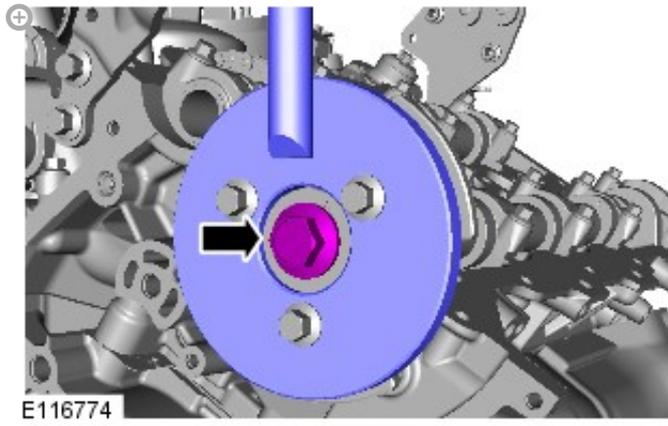


5.

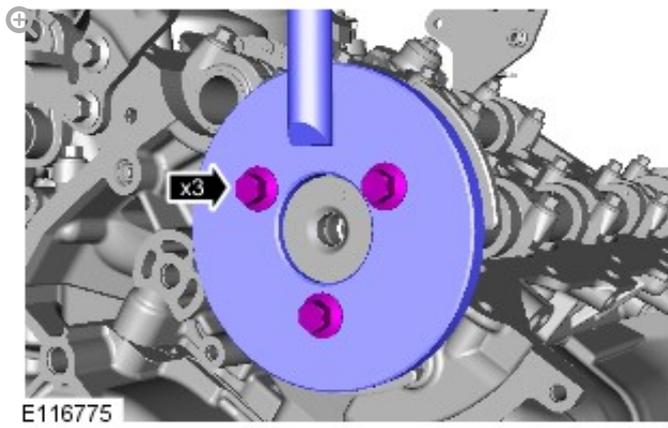


Install the special tool.

6.

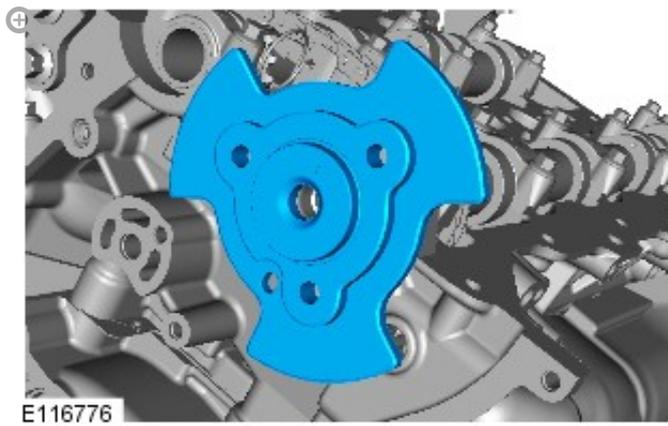


7.



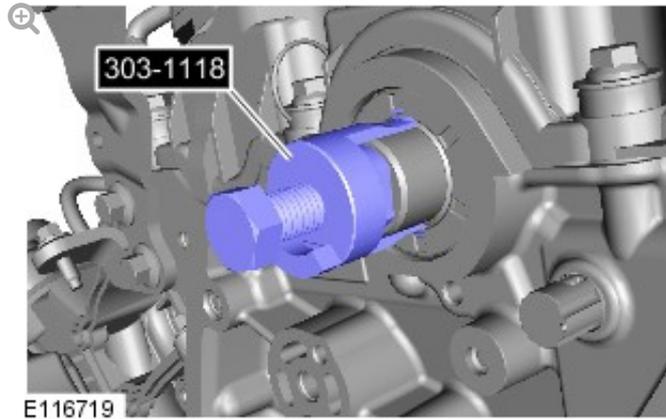
Remove the special tool.

8.



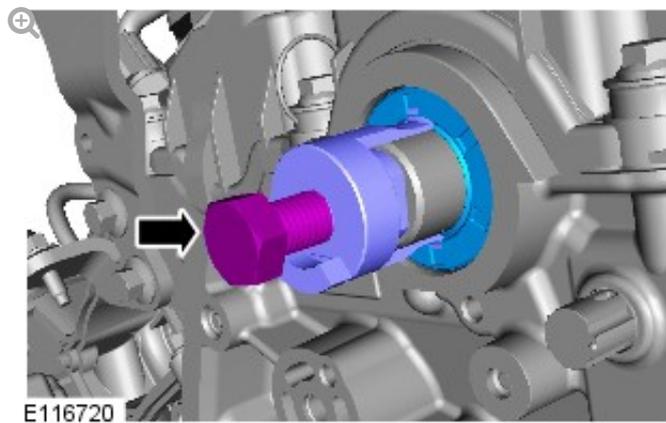
9.

Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.



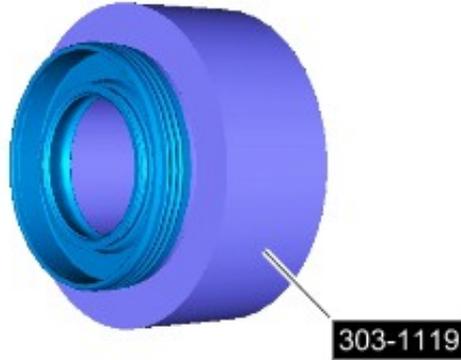
Install the special tool.

10.



INSTALLATION

1.



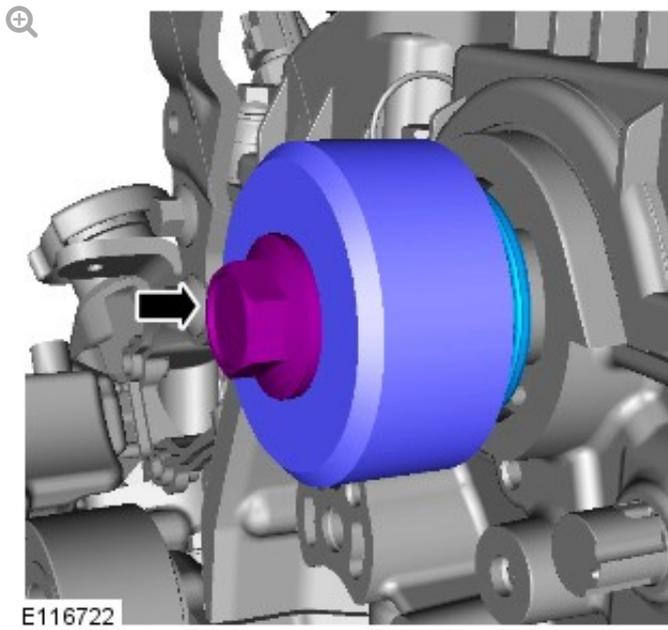
E116721

Install with the special tool.

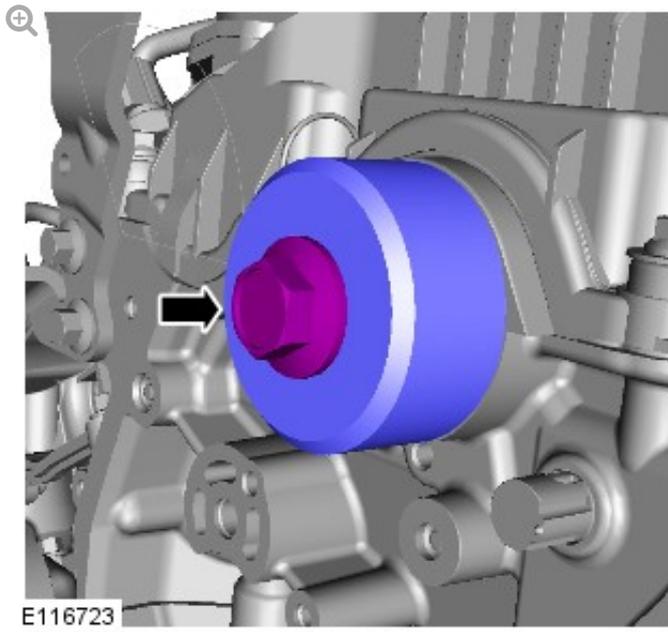
2.

- Make sure the seal is installed correctly.
- Make sure that the mating faces are clean and free of corrosion and foreign material.
- Do not use any lubricant on the camshaft front seal or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

Make sure that the seal is 1mm below the face of the cylinder head.

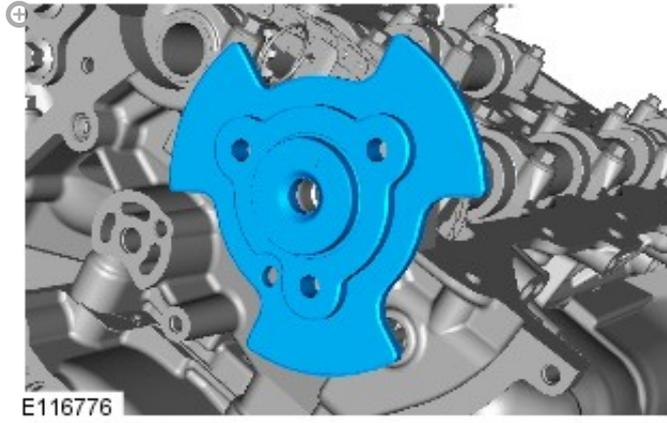


3.

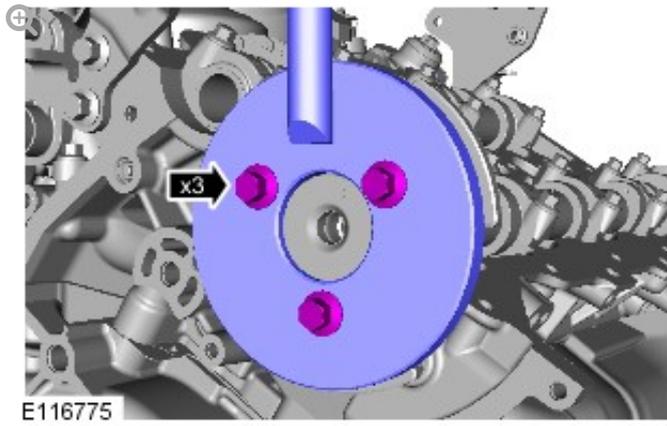


Remove the special tool.

4.

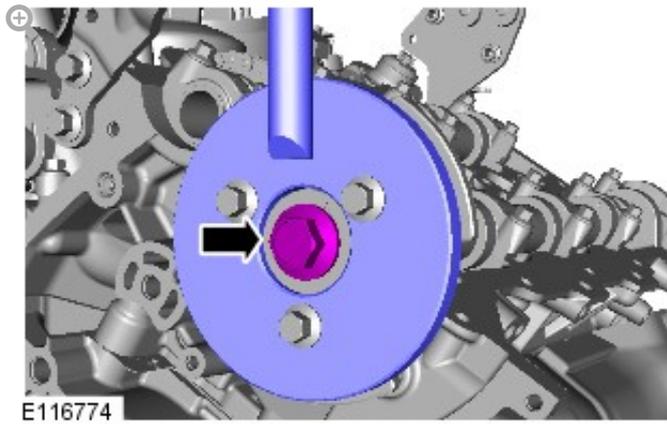


5.



Install the special tool.

6.

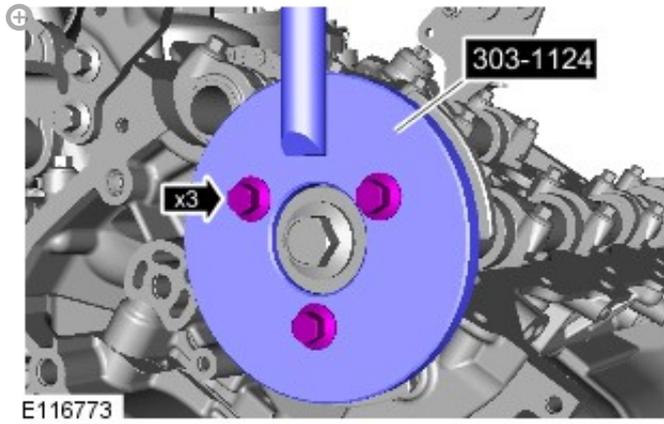


Torque:

Stage 1: **80 Nm**

Stage 2: **80°**

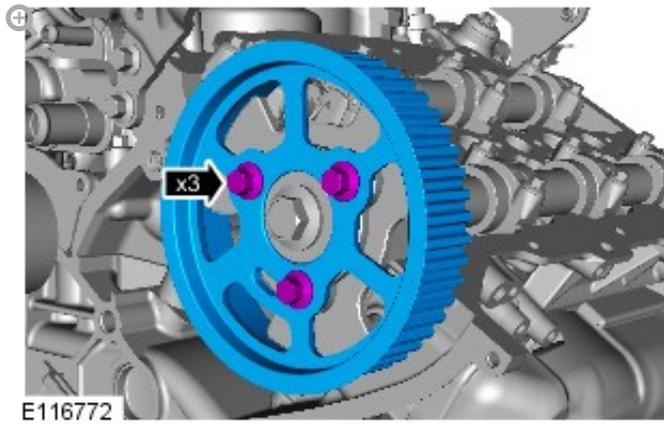
7.



Remove the special tool.

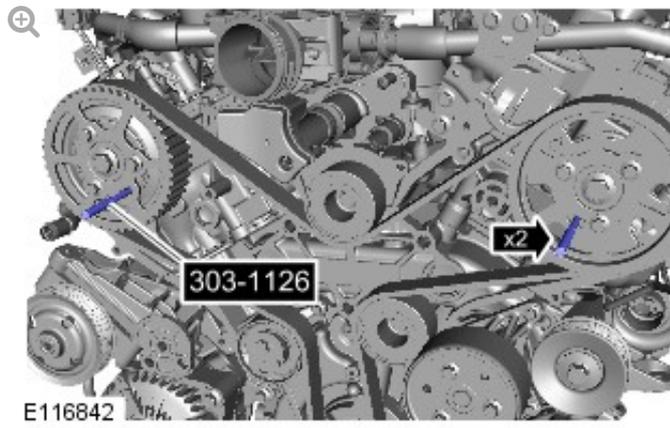
8.

Only tighten the bolt finger-tight at this stage.



9.

Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.



Install the special tool.

10. Refer to: Timing Belt (303-01, Removal and Installation).

ENGINE - TDV6 3.0L DIESEL

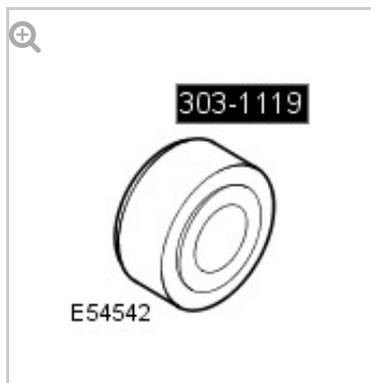
CAMSHAFT REAR SEAL [G1272038]

SPECIAL TOOL(S)



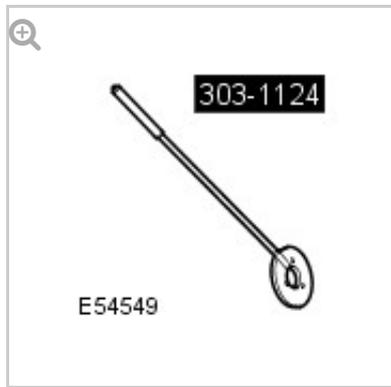
303-1118

Remover, Camshaft
Seal



303-1119

Installer, Camshaft
Seal



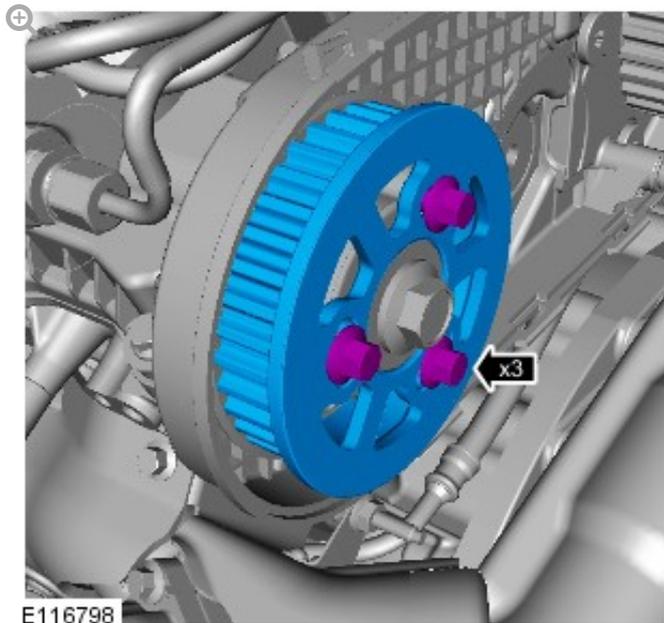
303-1124

Holding Tool,
Camshaft Front
Pulley

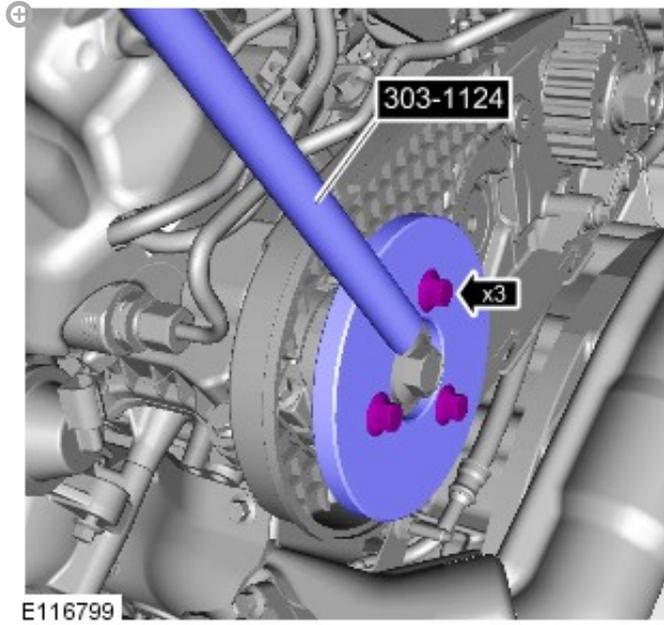
REMOVAL

1. Refer to: [Rear End Accessory Drive](#) (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

2.



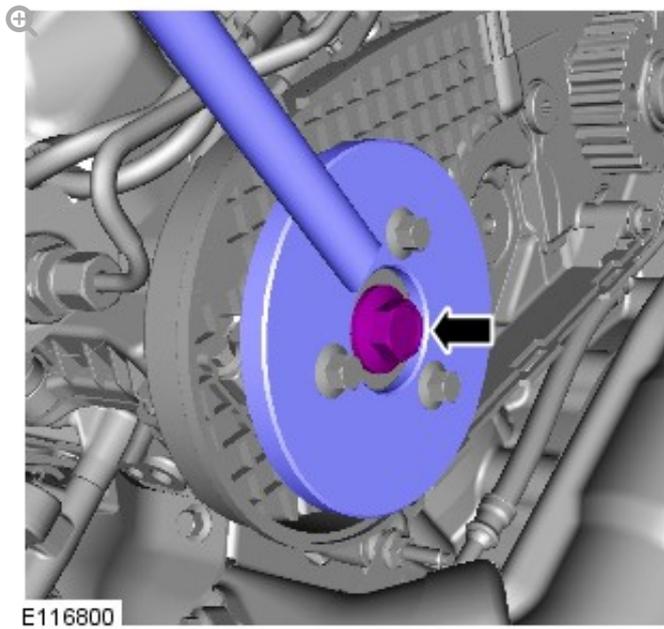
3.



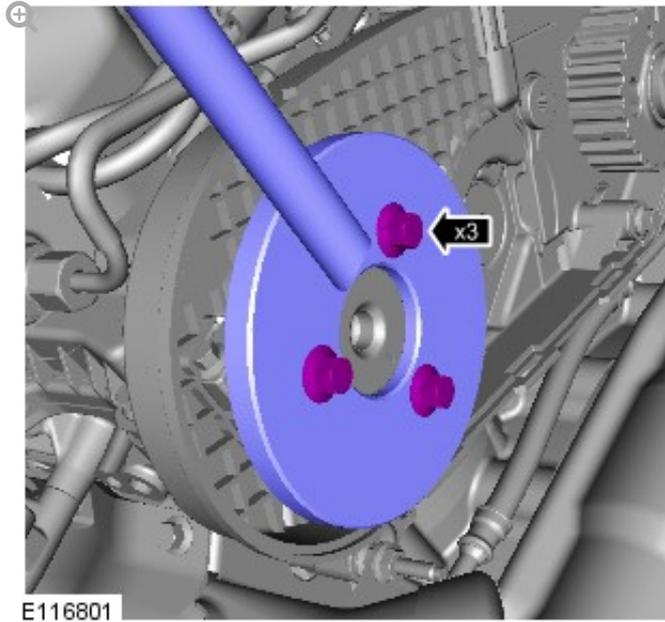
Install the special tool.

Special Tool(s): [303-1124](#)

4.

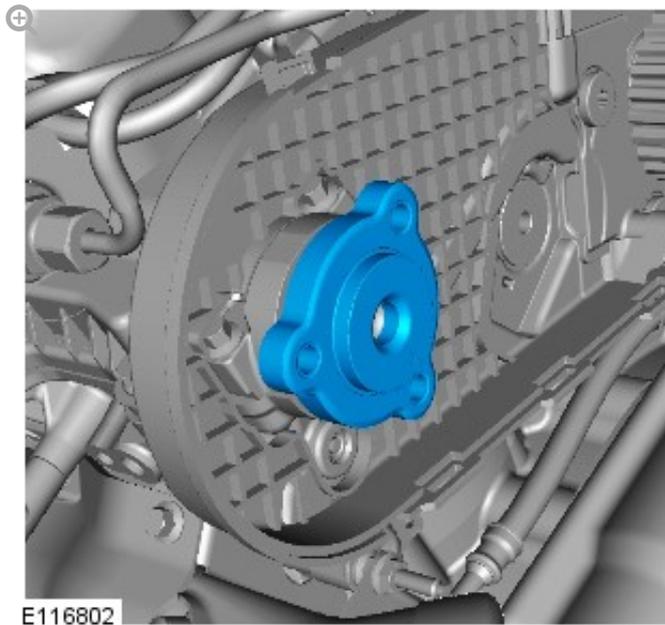


5.



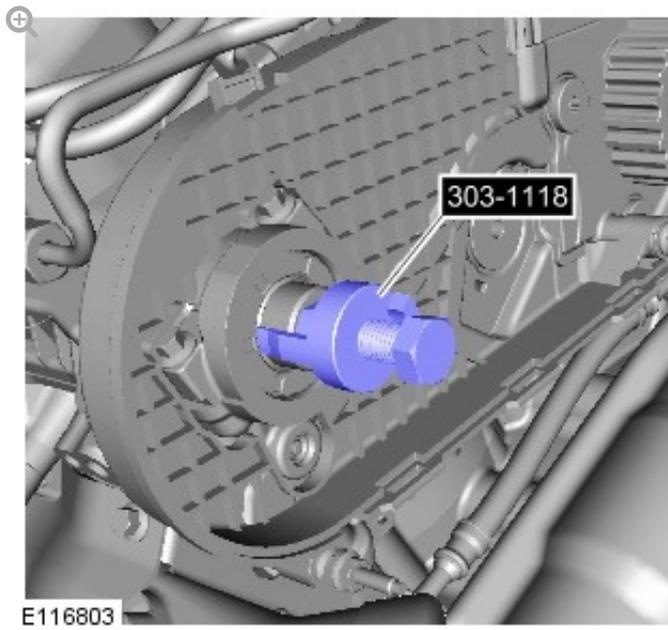
Remove the special tool.

6.



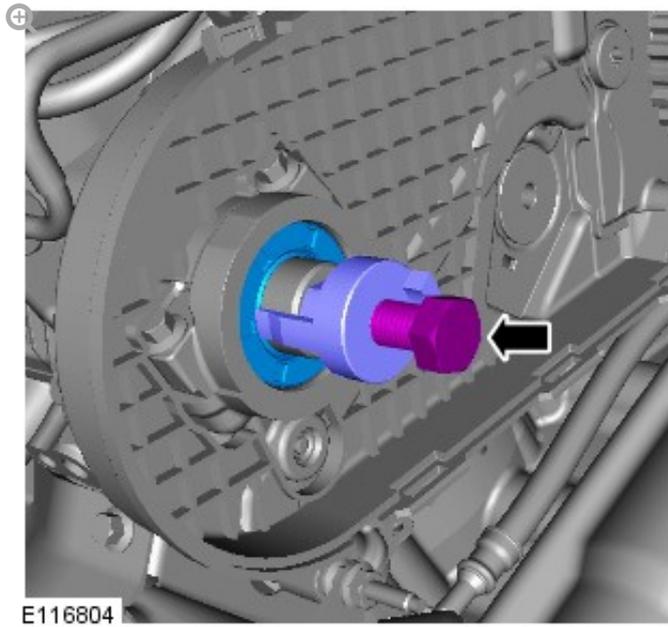
7.

Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.



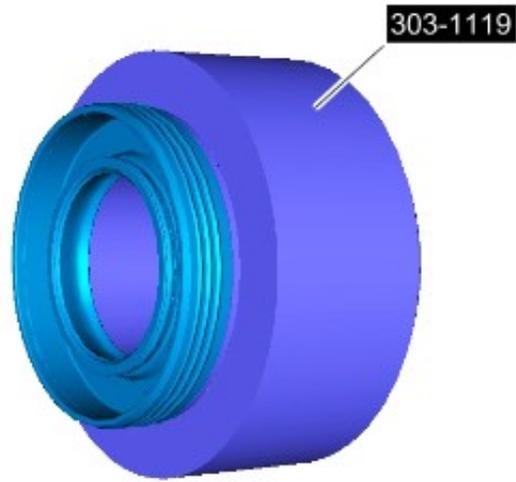
Install the special tool.
Special Tool(s): [303-1118](#)

8.



INSTALLATION

1.



E116805

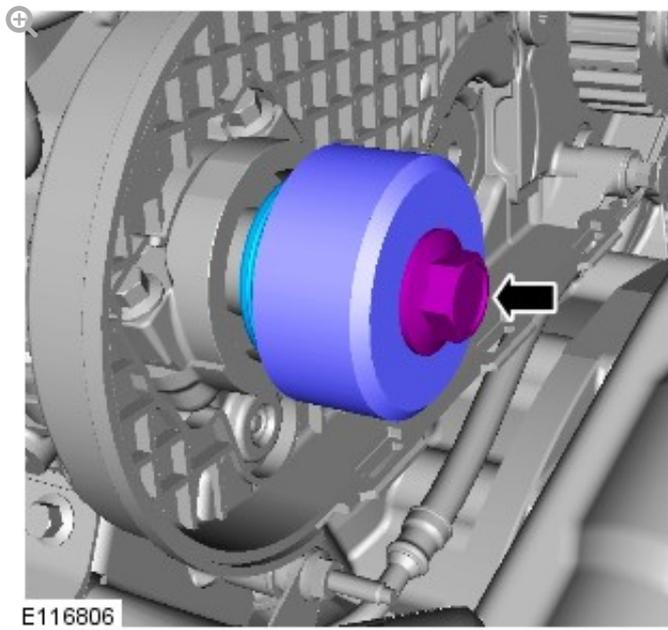
Install with the special tool.

Special Tool(s): [303-1119](#)

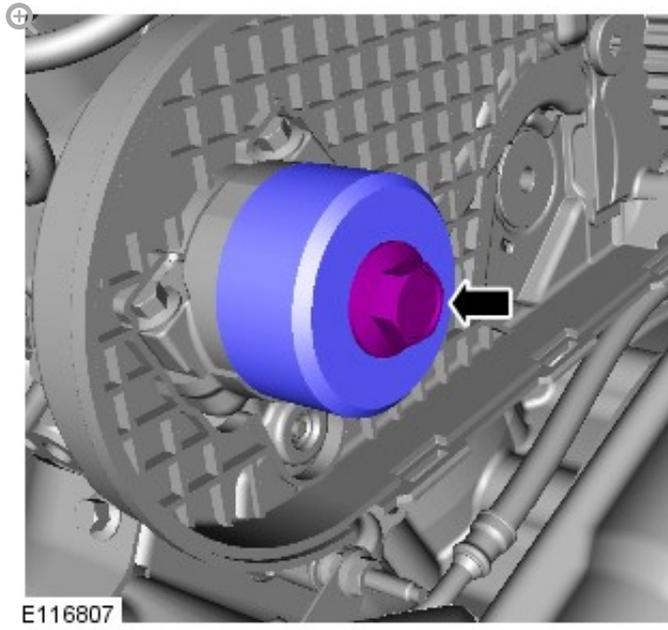
2.

- Make sure the seal is installed correctly.
- Make sure that the mating faces are clean and free of corrosion and foreign material.

Make sure that the seal is 1mm below the face of the cylinder head.

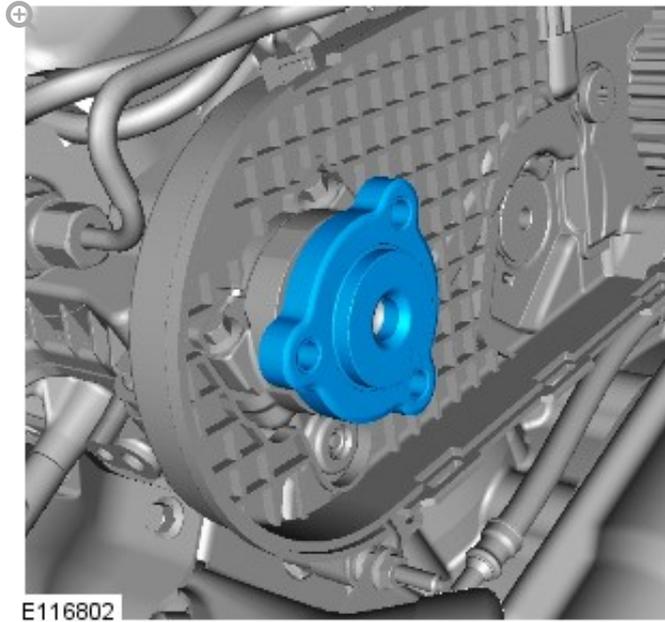


3.



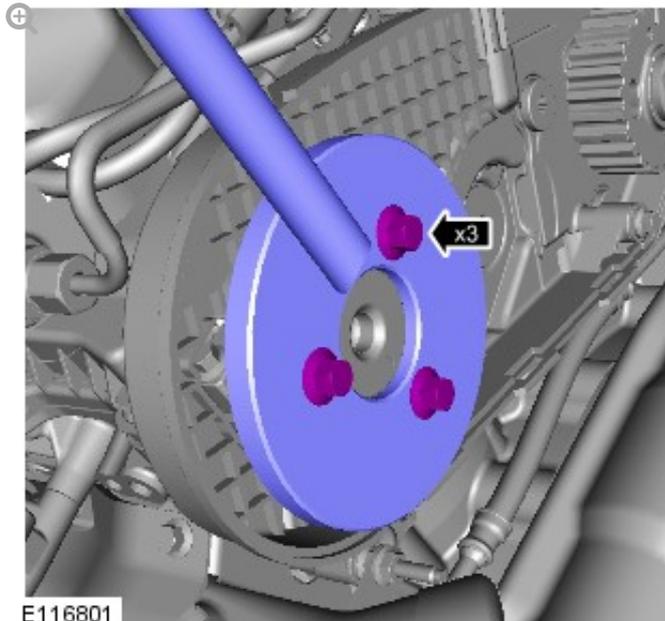
Remove the special tool.

4.



E116802

5.

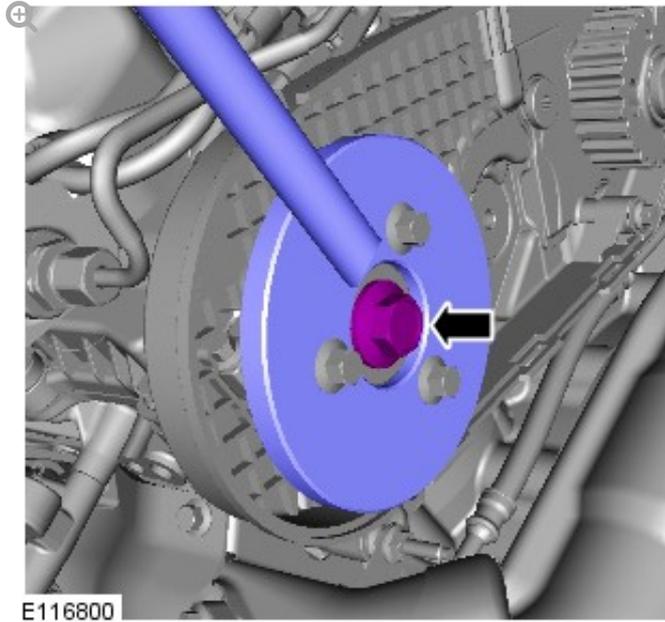


E116801

Install the special tool.

Special Tool(s): [303-1124](#)

6.

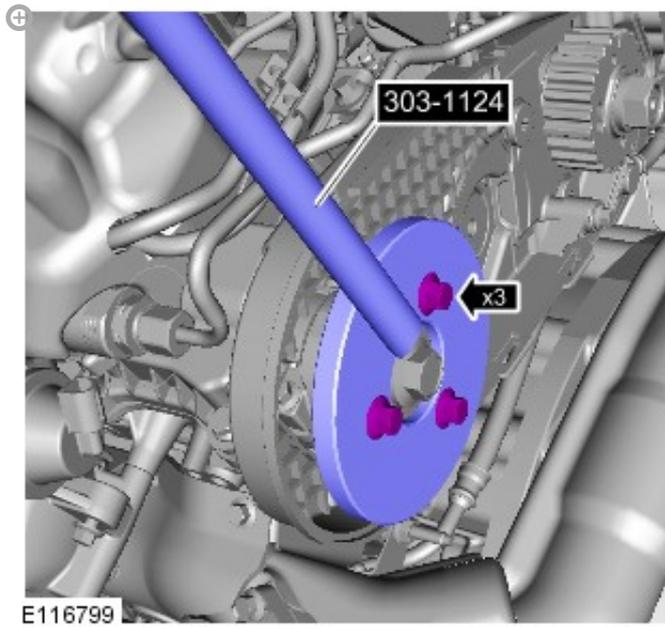


▪ *Torque:*

Stage 1: **80 Nm**

Stage 2: **80°**

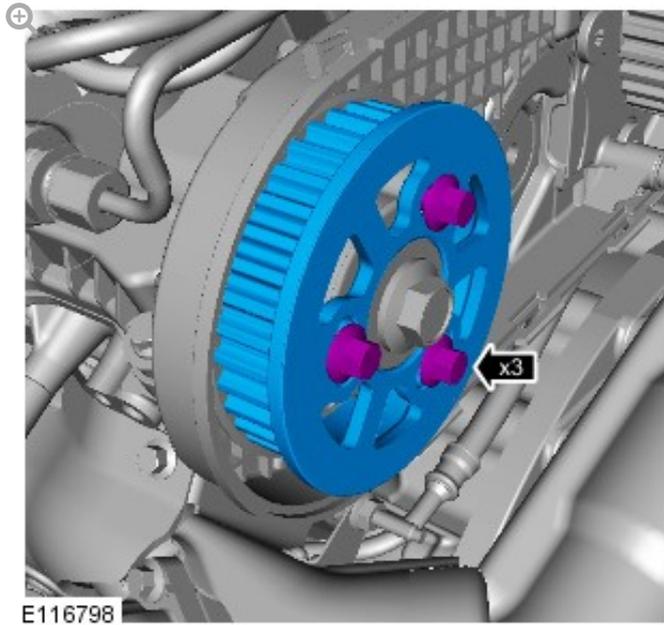
7.



Remove the special tool.

8.

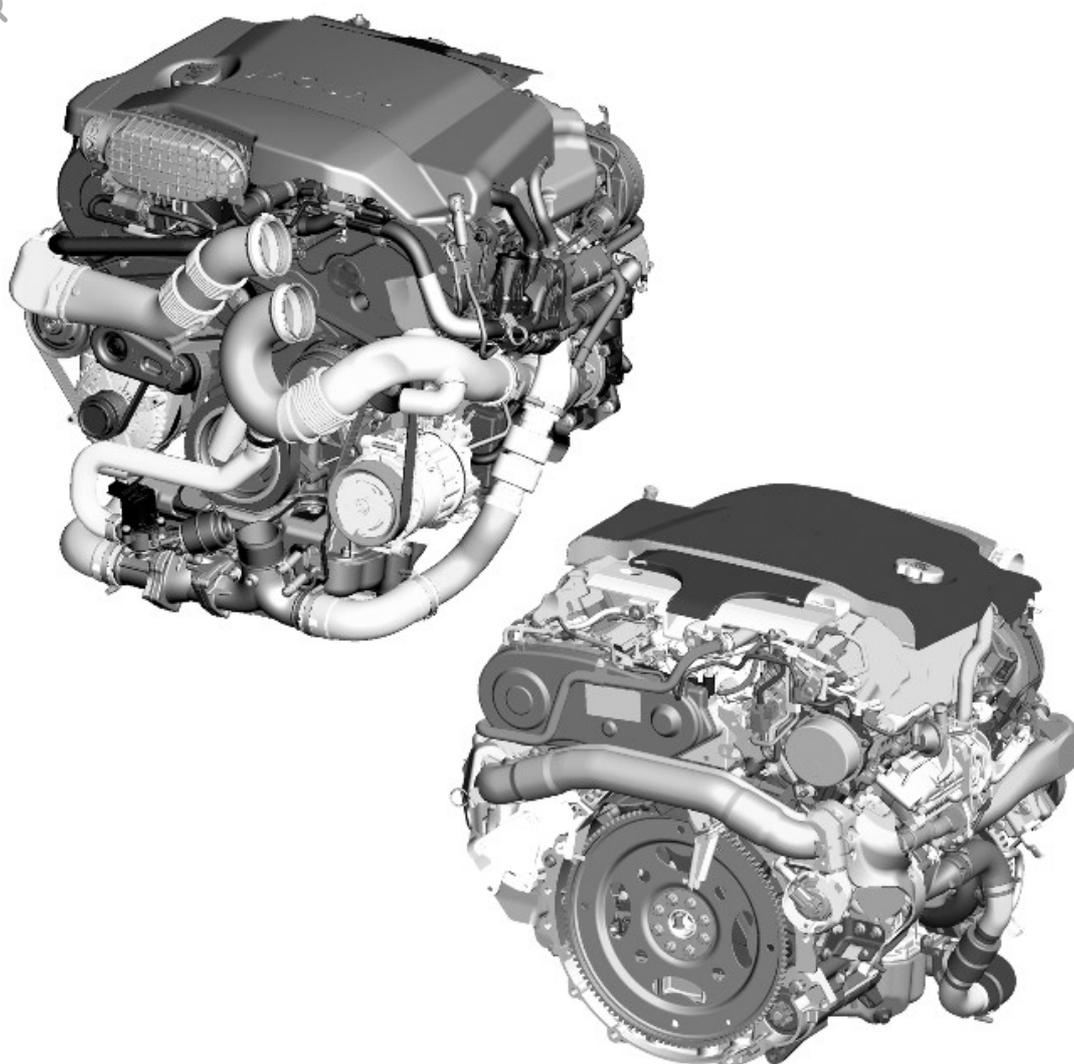
Only tighten the bolt finger-tight at this stage.



- ⇒ Refer to: [Rear End Accessory Drive](#) (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

ENGINE - TDV6 3.0L DIESEL

ENGINE - COMPONENT LOCATION [G1245353]



E114525

ENGINE - TDV6 3.0L DIESEL

CRANKSHAFT FRONT SEAL

[G1272039]

SPECIAL TOOL(S)



303-1120

Remover, Crankshaft
Front Seal



303-1121

Installer,
Crankshaft Seal



303-1122

Installer, Crankshaft
Front Seal

REMOVAL

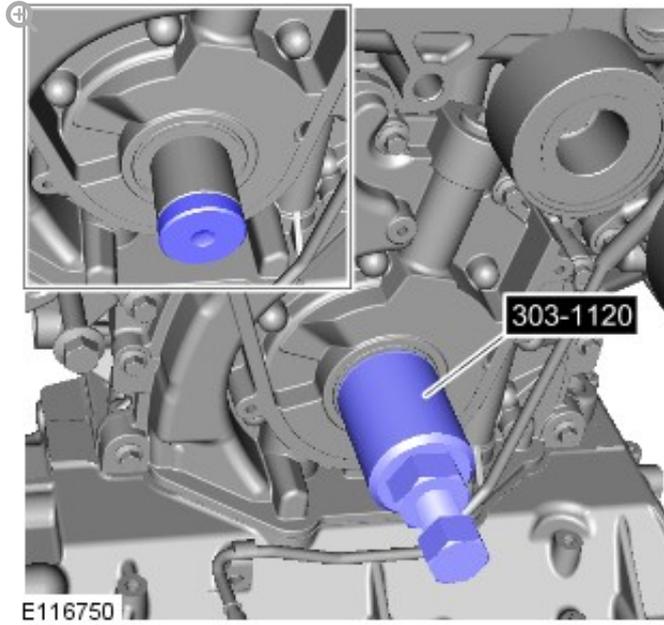
1.

Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: [Crankshaft Pulley](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

3.

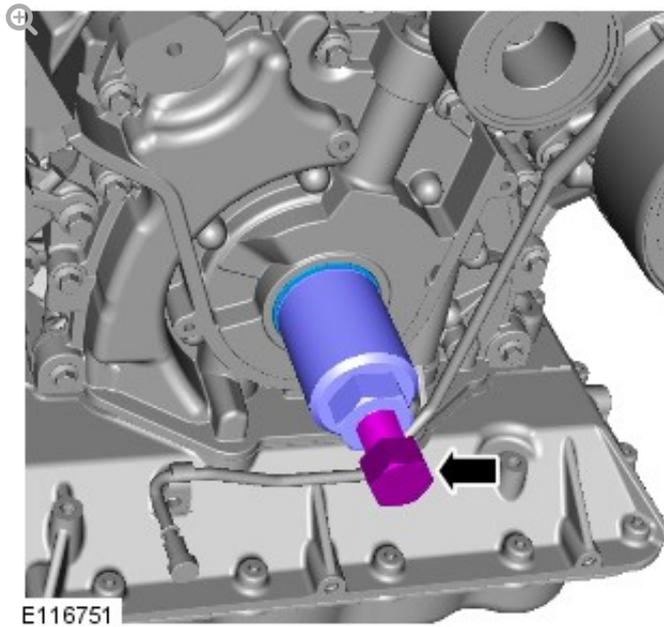


Install the special tool.

Special Tool(s): [303-1120](#)

4.

Discard the seal.



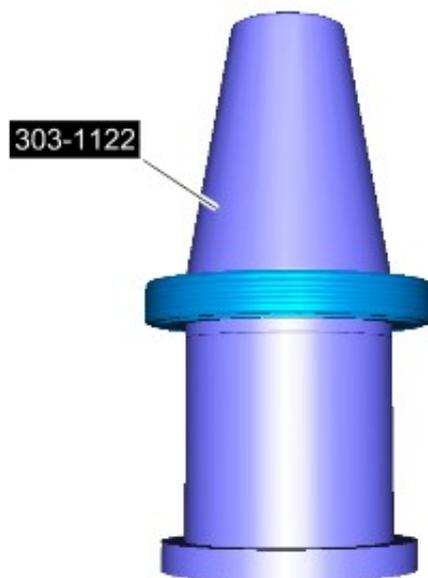
Using the special tool, remove the crankshaft front seal.

INSTALLATION

1.

Do not use any lubricant on the crankshaft front seal, special tools or the crankshaft. Failure to follow this instruction may result in damage to the vehicle.

Make sure that all the component mating faces are clean.

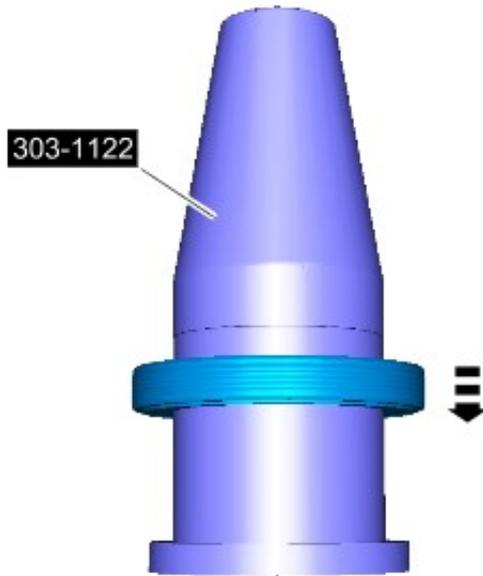


E116752

Install a new crankshaft front seal to the special tool.

Special Tool(s): [303-1122](#)

2.

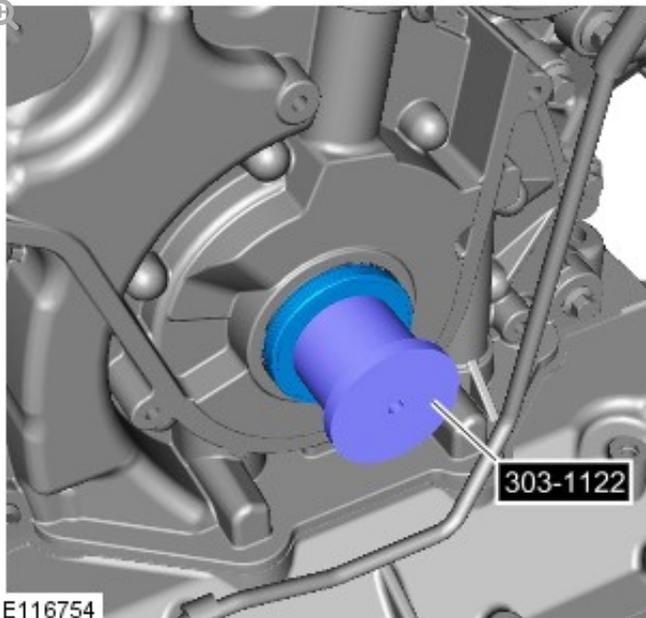


E116753

Reposition the crankshaft front seal along the special tool.

Special Tool(s): [303-1122](#)

3.

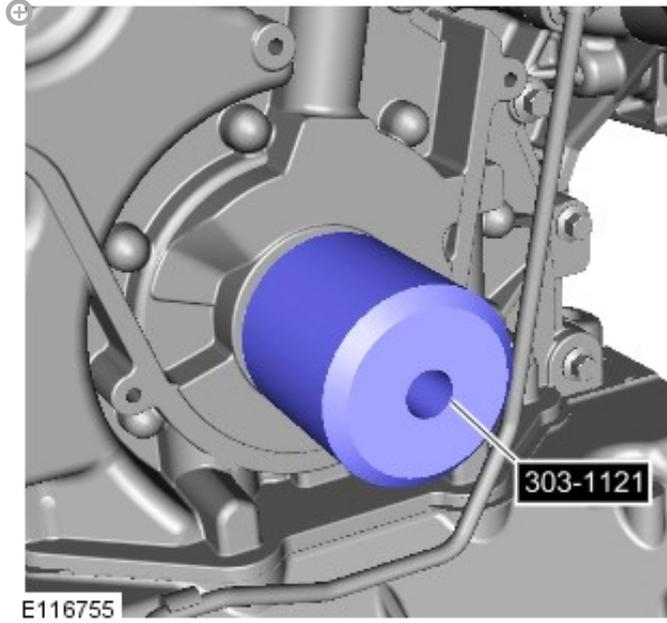


E116754

Install the special tool to the crankshaft.

Special Tool(s): [303-1122](#)

4.

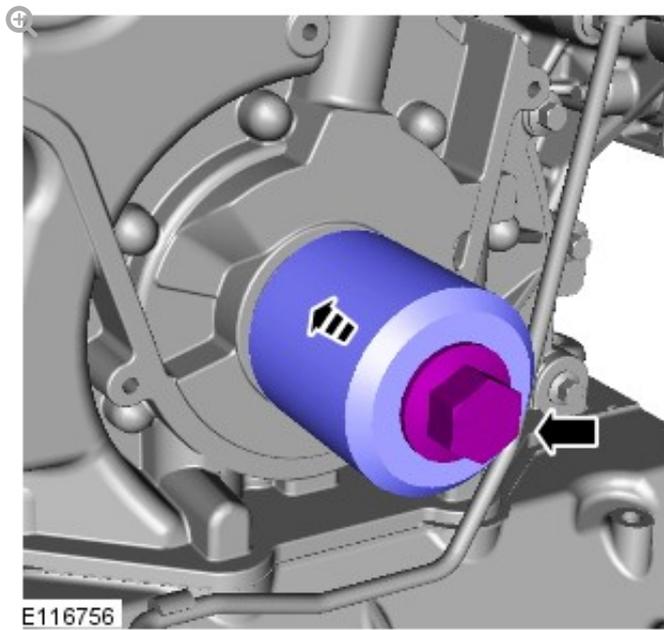


Install the special tool to the crankshaft.

Special Tool(s): [303-1121](#)

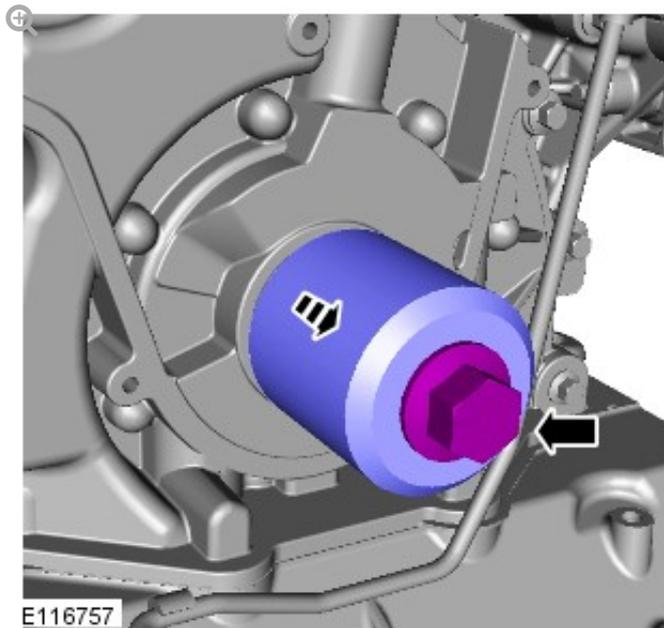
5.

- Make sure the seal is installed correctly.
- Make sure that the seal is seated 1mm under flush.
- Discard the bolt.



Using the special tool, install the crankshaft front seal.

6.



Remove the special tool.

7. Refer to: [Crankshaft Pulley](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

ENGINE - TDV6 3.0L DIESEL

CRANKSHAFT PULLEY [C1272040]

+

SPECIAL TOOL(S)



303-1117

Timing Peg,
Automatic
Transmission



**303-
1123**

Locking Tool,
Flywheel



303-D121

Puller, General Purpose

REMOVAL

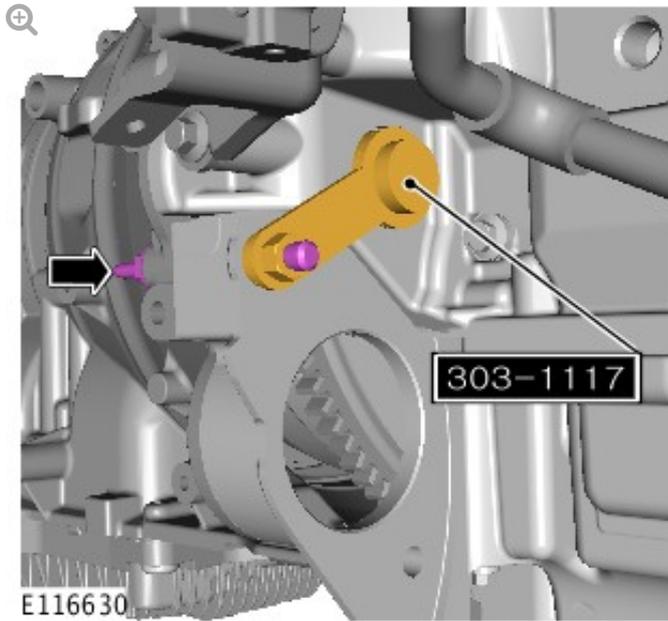
1.

Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

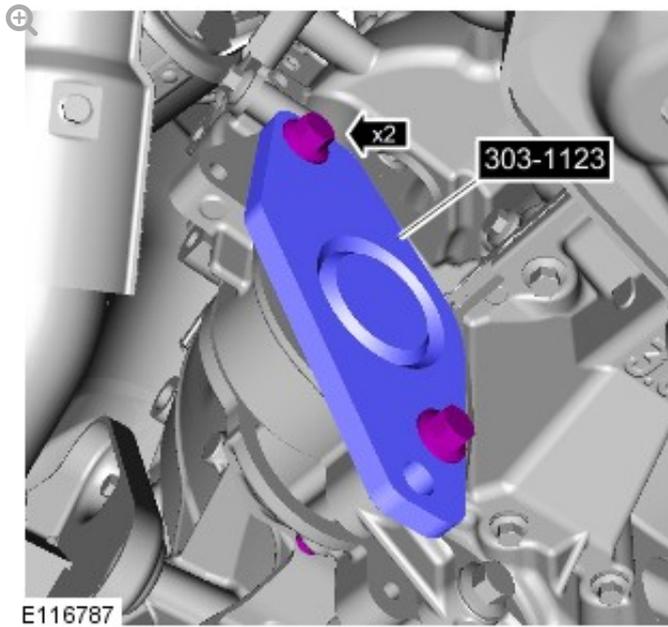
2. Refer to: [Timing Belt](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).
3. Refer to: [Cooling Fan Motor and Shroud](#) (303-03A Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

4.



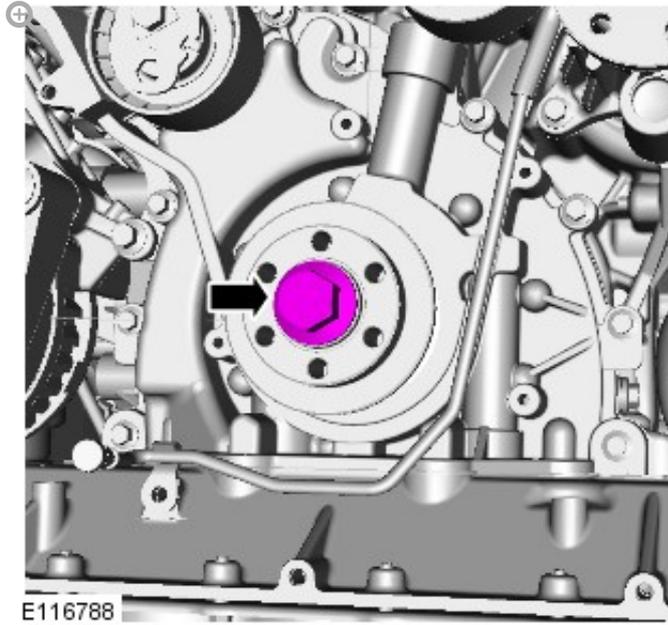
- Remove the special tool.
- *Special Tool(s):* [303-1117](#)

5.

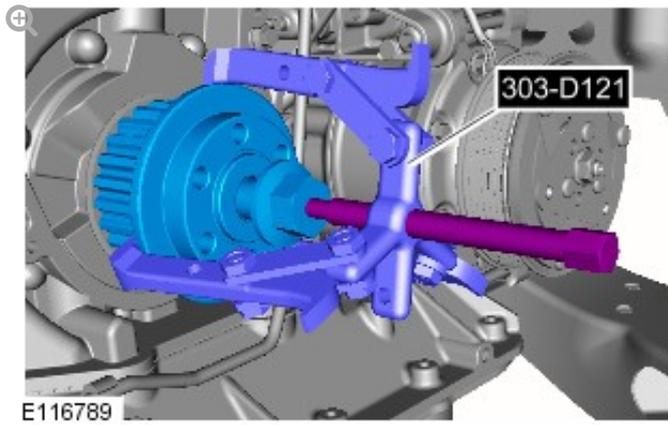


- Install the special tool.
- *Special Tool(s):* [303-1123](#)

6.



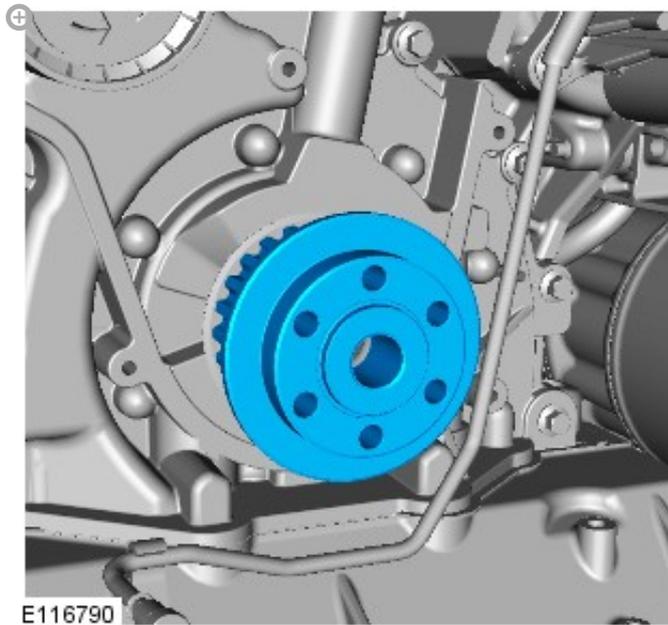
7.



- Install the special tool.
- *Special Tool(s):* [303-D121](#)

8.

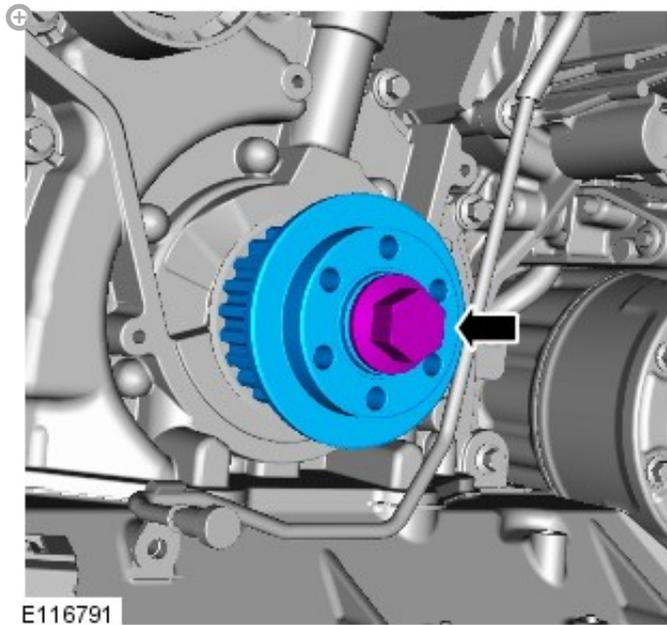
Discard the bolt.



INSTALLATION

1.

- Make sure that the pulley washer is correctly seated before installing the pulley.
- Do not lubricate the components.
- Make sure that a new bolt is installed.



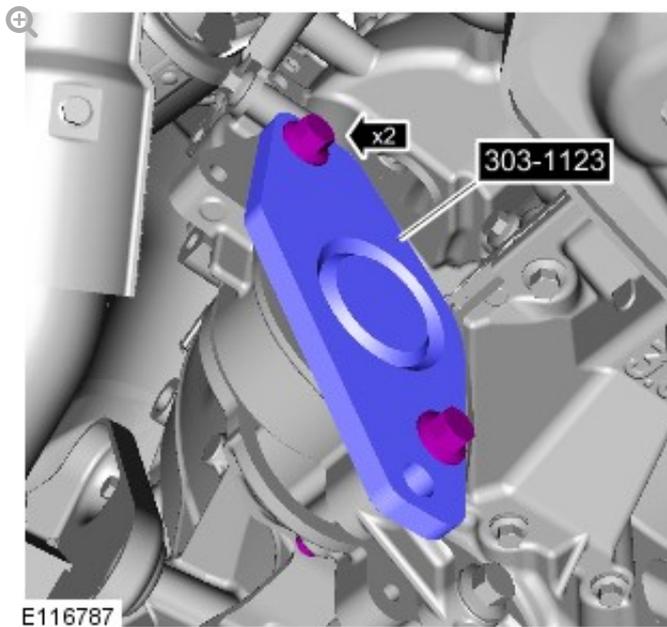
Torque:

Stage 1: **150 Nm**

Stage 2: **300 Nm**

Stage 3: **90°**

2.



- Remove the special tool.
- *Special Tool(s):* [303-1123](#)