

GROUP

3

# Powertrain

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3.1.3 Lubrication System.....3.1.3-1

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



**Specifications****Material Specifications**

Item	Specifications	Capacity
Sealant	Loctite 5900	-
Thread retaining gel	Loctite 243	-

**Component Specifications**

Item	Specifications	
Engine oil pump type	Engine oil pump with outside hanging rotor	
Engine oil pressure	Idle speed 720 rpm	100 ~ 150 kPa
	Engine speed 3,000 rpm	300 ~ 500 kPa
	Nominal speed	320 ~ 500 kPa

**General Specifications****Lubrication Specifications**

Application	Specifications		
Working temperature	-20 °C above	-25 °C above	-30 °C above
Viscosity	5W-40	10W-30	5W-30
Grade	SL	SL	SL
Capacity	3.8 L	3.8 L	3.8 L

**Torque Specifications**

Item	Nm	lb-ft	lb-in
Engine oil pan drain plug	55	41	-
Engine oil pan retaining bolt and nut	10	-	89
Engine oil pump retaining bolt	23	17	-
Engine oil filter tightening torque	20	15	-
Engine oil pressure switch tightening torque	30	22	-
Engine oil pump suction filter retaining bolt	10	-	89
Engine oil filter connecting pipe tightening torque	23	17	-

## Description and Operation

### System Overview

The outside hanging rotor oil pump is installed on the crankshaft tank and driven by the chain and the crankshaft linkage. Engine oil enters the filter through the oil pump strainer. The filtered engine oil falls into two oil ways in the cylinder. One way leads the engine oil to the crankshaft journal bearing. The engine oil from the crankshaft journal bearing flows to the connecting rod bearing through an inclined passage drilled on the crankshaft and lubricates the piston, piston ring and cylinder wall by spurting out of the hole on the connecting rod tip. The other oil way leads the engine oil to the cylinder head and lubricates the camshaft journal, then the camshaft and others through the hollow oil hole. The relief valve is installed on the oil pump. The relief valve discharges the pressure when the pressure is over 5 bar. The engine oil flows back to the engine oil pan after the pressure has been discharged.

### Components Description

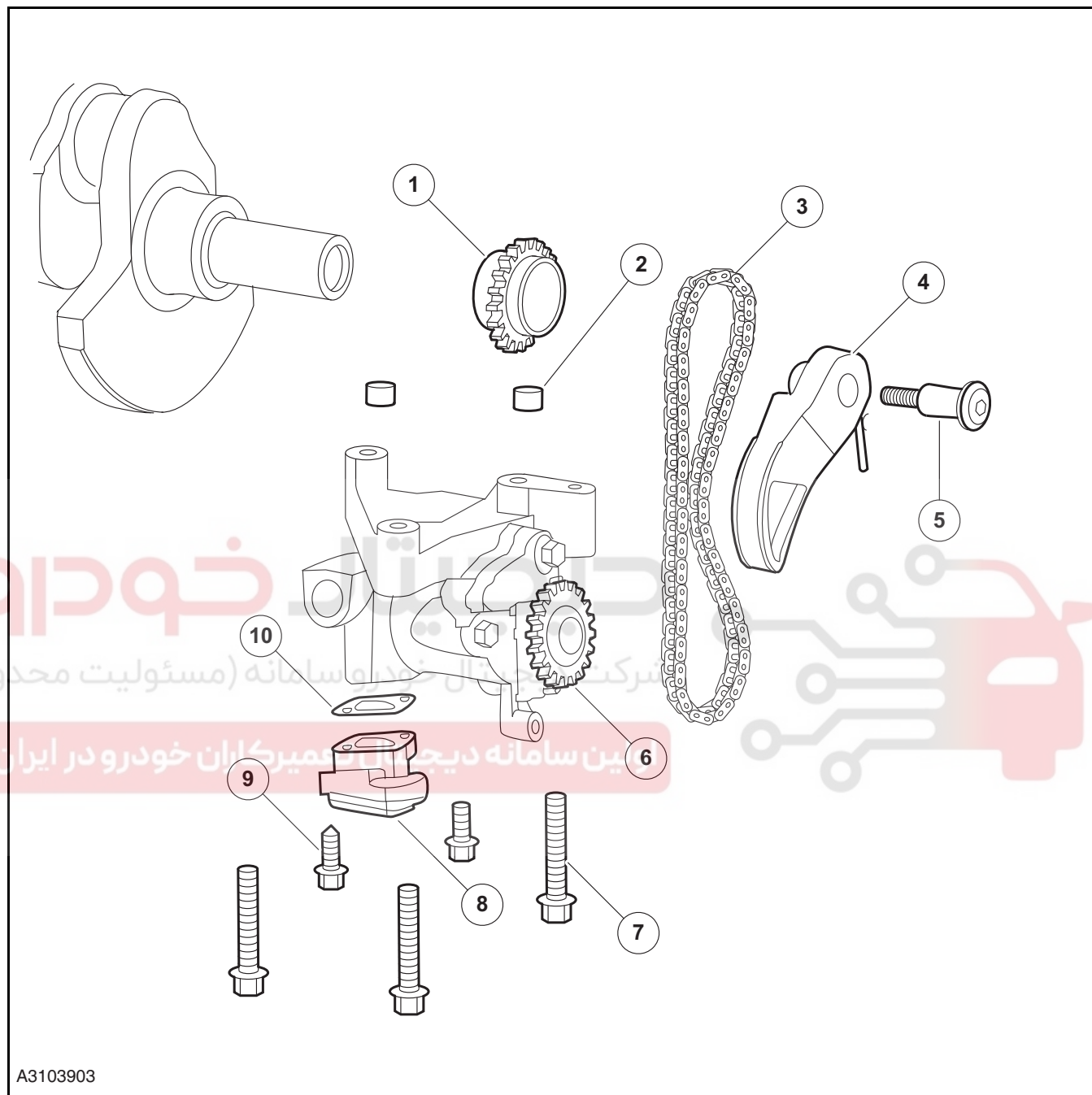
#### Engine Oil Pump

The rotor engine oil pump is installed on the crankshaft tank and driven by the chain and the crankshaft linkage. The relief valve is installed on the engine oil pump. The relief valve reduce the pressure when the pressure is over 5 bar. The engine oil flows back to the engine oil pan to keep proper pressure.



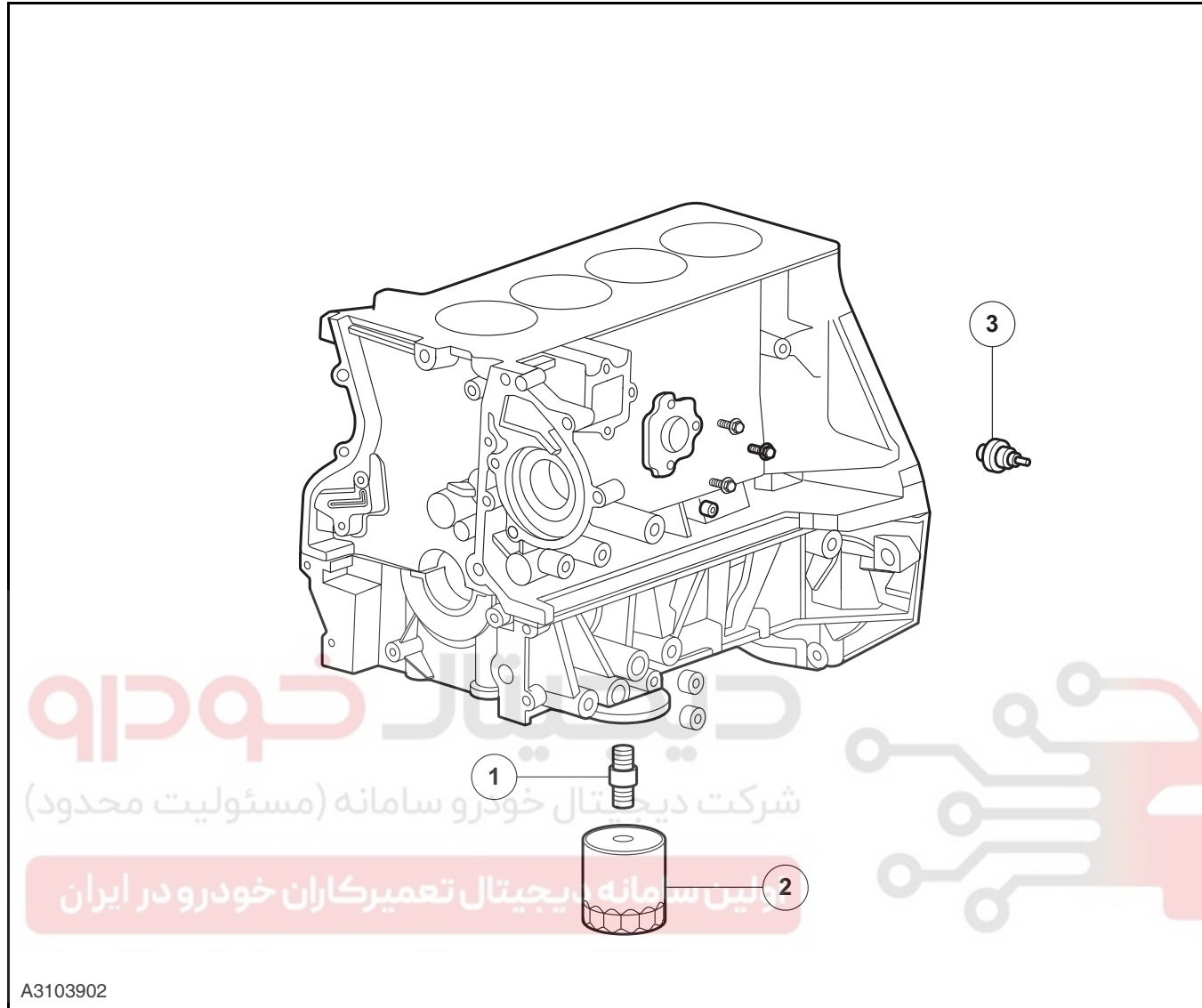
Location View

Engine Oil Pump



Item	Description	Item	Description
1	Crankshaft engine oil pump chain pulley	6	Engine oil pump assembly
2	Engine oil pump alignment pin	7	Hex flange bolt Q1840845
3	Engine oil pump chain assembly	8	Engine oil filter assembly
4	Engine oil pump chain tensioner assembly	9	Hex flange bolt Q1840620
5	Engine oil pump chain tensioner bolt	10	Engine oil filter seal

Engine Oil Filter Core and Accessory



Item	Description	Item	Description
1	Engine oil filter connecting pipe	3	Engine oil pressure alarm assembly
2	Oil filter assembly		

## General Procedures

### Engine Oil Pressure Inspection

**WARNING:** The rats in the lab have suffered from skin cancer due to a long-term contact with the used engine oil. Wash your hands with a soap and water to protect your skin immediately after the contact with the engine oil.

**WARNING:** The engine and oil at high temperature would lead to serious scalding. Shut down the engine and wait until the engine and oil cools down.

**CAUTION:** Inspect following items before the engine oil pressure inspection:

1. Engine oil level in the engine oil pan.

If the oil level is low, fill until the level reaches the full mark of the oil level indicator.

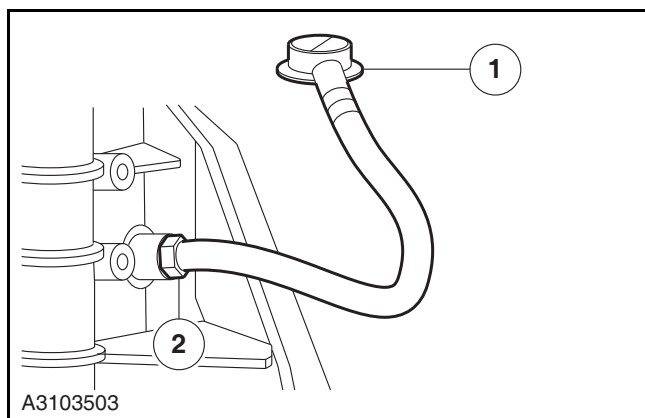
2. Quality of the engine oil.

If the engine oil color changes or is unqualified, replace the oil.

Oil leaks.

If oil leakage found, repair it.

1. Park the vehicle on a flat ground.
2. Verify that the vehicle is at a cold state.
3. Remove the engine oil pressure sensor.
4. Install the engine oil pressure gauge testing connector on the bolt hole of the engine oil pressure sensor and tighten it.



Item	Special Tool
1	09915-77310 oil pressure gauge
2	09915-78211 oil pressure gauge holder

5. Start the engine and measure the engine oil pressure when the engine reaches the normal working temperature at 80 °C .

Engine speed	Standard Engine Oil Pressure
Idle speed	100 ~ 150 kPa
3,000 rpm	300 ~ 500 kPa
Nominal speed	320 ~ 500 kPa

6. Turn off the ignition switch and remove the engine oil pressure gauge when the engine cools down.
7. Install the engine oil pressure sensor. Before reinstalling the engine oil pressure sensor, remember to wind a sealing tape at the thread and screw it down as the specified torque.

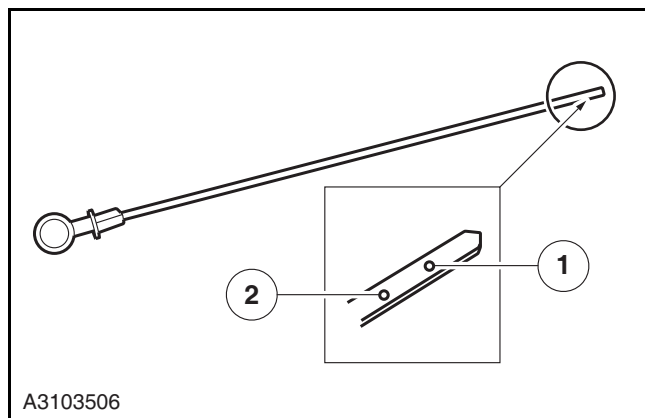
Tightening torque: 30 Nm

**CAUTION:** If the edge of the seal tape is rough, cut it even from the switch thread.

8. Start the engine and inspect the engine oil pressure sensor for any possible leaks.
9. Turn off the engine and connect the terminal to the pressure sensor terminal and cover it with a shield.

## Engine Oil Level Inspection

1. Park the vehicle on a flat ground.
2. Verify that the vehicle is at a cold state.
3. Detach the oil dipstick and inspect whether the oil level is between MAX and MIN.



1. Low oil level mark.

2. Full oil level mark.

Fill some engine oil if the oil level is below the MIN mark.

## Engine Oil Replacement

**WARNING:** Remove all the components when engine is at cold state. Otherwise, they would lead to serious scalding or injury.

**WARNING:** A vehicle which is braced by a jack but not securely supported on the bracket is very dangerous. It may slip or fall off, which leads to death or serious injury. Do not work near a vehicle which is braced by a jack but not securely supported on the bracket.

**WARNING:** The rats in the lab have suffered from skin cancer due to a long-term contact with the used engine oil. Wash your hands with a soap and water to protect your skin immediately after the contact with the engine oil.

**CAUTION:** Wipe the engine oil off completely in case you spread it over the exhaust system. If the splashed engine oil is not wiped off completely, it would become a smog due to high temperatures.

1. Park the vehicle on a flat ground.
2. Remove the oil filler cap.
3. Remove the engine oil pan purge cock.
4. Drain the engine oil into a container.
5. Install the oil pan purge cock and a new gasket, and tighten it immediately as it is specified.

Tightening torque: 55 Nm

6. Fill the engine with the engine oil, with its type and amount specified in the table.

**CAUTION:** The residual capacity in the engine would change with different installation methods and oil temperatures and other factors. Verify the oil level after replacing the engine oil.

7. Install the oil filler cap.
8. Start the engine and verify that engine oil leaks do not exist.

- Find the causes, repair them or replace new related components if any leaks are found.

9. Inspect the engine oil level.

Refer to: Oil Level Inspection (3.1.3 Lubrication System, General Procedures).

## Engine Oil Filter Replacement

**WARNING:** Remove all the components when engine is at cold state. Otherwise, they would lead to serious scalding or injury.

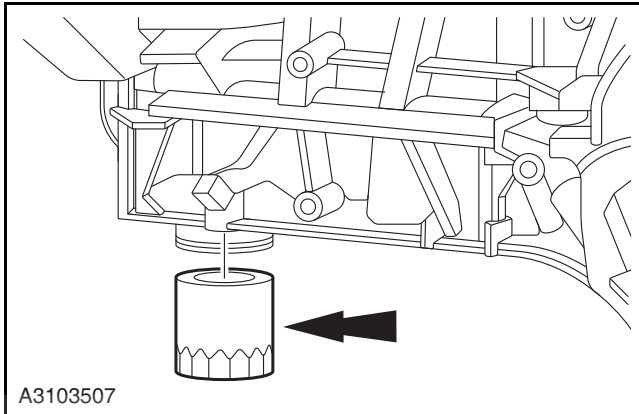
A vehicle which is braced by a jack but not securely supported on the bracket is very dangerous. It may slip or fall off, which leads to death or serious injury. Do not work near a vehicle which is braced by a jack but not securely supported on the bracket.

The rats in the lab have suffered from skin cancer due to a long-term contact with the used engine oil. Wash your hands with a soap and water to protect your skin immediately after the contact with the engine oil.



**⚠ CAUTION:** Wipe the engine oil off completely in case you spread it over the exhaust system. If the splashed engine oil is not wiped off completely, it would become a smog due to high temperatures.

1. Remove the bottom plate.
2. Using a suitable tool to remove the oil filter.



3. Using a clean rag, clean the installing surface.
4. Apply clean engine oil to the cushion of a new engine oil filter.
5. Using a suitable tool, tighten the engine oil filter in accordance with the package of it or the indication on the side.

Tightened Torque (Reference Value)

18 ~ 22 Nm (13 lb•ft ~ 16 lb•ft)

6. Start the engine and verify that engine oil leaks do not exist.
  - Repair or install the related components if any oil leaks.
7. Inspect the engine oil level.

**Refer to: Oil Level Inspection (3.1.3 Lubrication System, General Procedures).**



## Symptom Diagnosis and Test

### General Equipment

Engine Oil Gauge
Digital Multimeter

## Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage or electric damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

### Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> <li>• Engine oil pan</li> <li>• Engine oil pan cushion</li> <li>• Oil filter</li> </ul>	<ul style="list-style-type: none"> <li>• Electrical Connector</li> </ul>



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## Symptom Chart

If the fault occurs, but there is no DTC stored in the ECM for this fault, and can not confirm the cause, then follow the procedure to diagnose the fault and eliminate it.

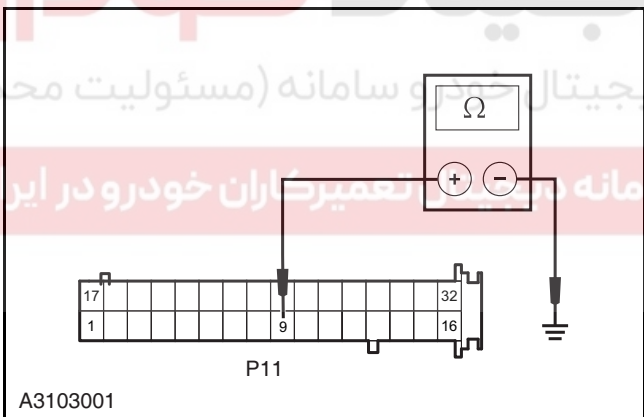
Symptom	Possible Sources	Action
The engine oil pressure warning lamp is always on	<ul style="list-style-type: none"> <li>• Oil</li> <li>• Engine Oil Pump</li> <li>• Oil filter</li> <li>• Oil pressure switch</li> <li>• Engine main bearing</li> <li>• Connecting rod bearing</li> <li>• Electrical</li> </ul>	Refer to: Engine Oil Pressure Warning Lamp Always On Diagnosis (3.1.3 Lubrication System, Symptom Diagnosis and Testing).
Engine oil pressure warning lamp cannot switch on	<ul style="list-style-type: none"> <li>• Oil pressure switch</li> <li>• Return circuit</li> <li>• Engine oil pressure warning lamp LED</li> <li>• Instrument</li> </ul>	Refer to: Engine Oil Pressure Warning Lamp Not On Diagnosis (3.1.3 Lubrication System, Symptom Diagnosis and Testing).
Abnormal oil consumption	<ul style="list-style-type: none"> <li>• Leak</li> <li>• PRV gas blowy consumption</li> <li>• Burning consumption in the combustion chamber</li> </ul>	Refer to: Abnormal Oil Consumption Diagnosis (3.1.3 Lubrication System, Symptom Diagnosis and Testing).

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## Engine Oil Pressure Warning Lamp Always On Diagnosis

**⚠ CAUTION:** Make sure that the engine oil level, and the quality and viscosity of the engine oil are normal before the diagnosis. Replace the engine oil or add some if necessary.

Test Conditions	Details/Results/Actions
1. Inspect the engine oil pressure switch	<p>A. Turn off the ignition switch.</p> <p>B. Disconnect the engine oil pressure sensor wiring harness connector E06.</p> <p>C. Turn on the ignition switch and start the engine.</p> <p>Is the engine oil warning lamp on?</p> <p><b>Y</b></p> <p>Go to step 5.</p> <p><b>N</b></p> <p>Go to step 2.</p>
2. Inspect the engine oil pressure	<p>A. Carry out the inspection procedures for the engine oil pressure.</p> <p><b>Refer to: Engine Oil Pressure Inspection (3.1.3 Lubrication System, General Procedures).</b></p> <p>Is the engine oil pressure normal?</p> <p><b>Y</b></p> <p>Replace the engine oil pressure sensor.</p> <p><b>Refer to: Engine Oil Sensor (3.1.2 Mechanical System, Removal and Installation).</b></p> <p><b>N</b></p> <p>Go to step 3.</p>
3. Inspect the oil pump	<p>A. Remove the engine oil pump.</p> <p><b>Refer to: Engine Oil Pump (3.1.3 Lubrication System, Removal and Installation).</b></p> <p>B. Inspect the oil pump.</p> <p>Is the engine oil normal?</p> <p><b>Y</b></p> <p>Go to step 4.</p> <p><b>N</b></p> <p>Install a new engine oil pump.</p>

Test Conditions	Details/Results/Actions
4. Inspect the mating clearance of the bushing	<p>A. Disassemble the main bushing and the connecting rod bushing.</p> <p><b>Refer to: Main Bearing, Crankshaft and Cylinder Block (3.1.2 Mechanical System, Disassembly and Assembly).</b></p> <p>B. Inspect the fit clearances of the main bearing shell and connecting rod bearing shell.</p> <p>Is the clearance normal?</p> <p><b>Y</b></p> <p>Verify the system is normal.</p> <p><b>N</b></p> <p>Repair the fit clearances of the main bearing shell and connecting rod bearing shell until they return to normal.</p> <p><b>Refer to: Main Bearing, Crankshaft and Cylinder Block (3.1.2 Mechanical System, Disassembly and Assembly).</b></p>
5. Inspect the circuit	 <p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the engine oil pressure switch wiring harness connector E06 and keep the terminal 1 of E06 insulated with the ground.</p> <p>C. Disconnect the instrument wiring harness connector P11. Use a multimeter to measure the resistance between the wiring harness connector P11 terminal 9 and the reliable ground.</p> <p><b>Standard Resistance Value: 10 MΩ or more</b></p> <p>Is the resistance value normal?</p> <p><b>Y</b></p> <p>Replace the instrument.</p> <p><b>N</b></p> <p>Repair the short circuit between the engine oil pressure switch wiring harness connector E06 terminal 1 and the instrument wiring harness connector P11 terminal 9.</p>

### Engine Oil Pressure Warning Lamp Not On Diagnosis

Test Conditions	Details/Results/Actions
<p>1. Inspect the circuit</p>	<p>A. Turn the ignition switch to "LOCK" position.</p> <p>B. Disconnect the engine oil pressure sensor wiring harness connector E06.</p> <p>C. Connect the terminal 1 of the engine oil pressure sensor wiring harness connector E06 to the reliable ground with the jumper wire.</p> <p>D. Turn on the ignition switch.</p> <p>Is the engine oil warning lamp on?</p> <p><b>Y</b></p> <p>Replace the oil pressure switch.</p> <p><b>N</b></p> <p>Go to step 2.</p>
<p>2. Inspect the return circuit</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">P11</p> <p>A3103001</p> </div>	<p>A. Turn the ignition switch to position "LOCK".</p> <p>B. Disconnect the engine oil pressure sensor wiring harness connector E06.</p> <p>C. Connect the terminal 1 of the engine oil pressure sensor wiring harness connector E06 to the reliable ground with the jumper wire.</p> <p>D. Disconnect the instrument wiring harness connector P11.</p> <p>E. Use a multimeter to measure resistance between the instrument connector P11 terminal 9 and the reliable ground.</p> <p><b>Standard Resistance Value: less than 5 Ω</b></p> <p>Is the resistance value normal?</p> <p><b>Y</b></p> <p>Go to step 3.</p> <p><b>N</b></p> <p>Repair the open circuit between the terminal 1 of engine oil pressure switch wiring harness connector E06 and the terminal 9 of instrument wiring harness connector P11.</p>

Test Conditions	Details/Results/Actions
3. Inspect the engine oil warning lamp LED	
	<p>A. Remove the instrument.            B. Remove the engine oil warning lamp LED.            C. Inspect and test the LED with a multimeter.</p> <p>Is the LED normal?  <b>Y</b>            Replace the instrument.  <b>Refer to: Instrument (4.3.2 Instrument, Removal and Installation).</b></p> <p><b>N</b>            Replace the LED.</p>

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## Abnormal Engine Oil Consumption Diagnosis

Test Conditions	Details/Results/Actions
1. Inspect for the leaks	<p>A. Inspect each sealing position of the engine.</p> <p>Does any engine oil leak exist?</p> <p><b>Y</b></p> <p>Repair the leak point.</p> <p>Test whether the system can operate normally.</p> <p><b>N</b></p> <p>Go to step 2.</p>
2. Inspect the PCV gas blowby capacity	<p>A. Disconnect the PCV connecting pipe from the intake pipe.</p> <p>B. Start the engine and increase the engine speed to 4,000 rpm.</p> <p>Has the PCV connecting pipe exhausted an excessive amount of exhaust gas?</p> <p><b>Y</b></p> <p>Repair the engine piston and the sealings of the engine.</p> <p><b>Refer to: Piston, Piston Ring, Connecting Rod and Cylinder (3.1.2 Mechanical System, Disassembly and Assembly).</b></p> <p><b>N</b></p> <p>Go to step 3.</p>
3. Inspect whether the engine oil is burning	<p>A. Start the engine.</p> <p>B. Visually inspect the color of the smoke exhausted from the engine exhaust pipe.</p> <p>Has the engine exhaust pipe exhausted blue smoke?</p> <p><b>Y</b></p> <p>Repair the fit clearance between the valve train gear and the cylinder on one hand, piston and the cylinder wall on the other.</p> <p><b>Refer to: Piston, Piston Ring, Connecting Rod and Cylinder (3.1.2 Mechanical System, Disassembly and Assembly).</b></p> <p><b>N</b></p> <p>The system is normal.</p>



Removal and Installation

Engine Oil Pan and Oil Pump Filter

Removal

Special Tool



Material

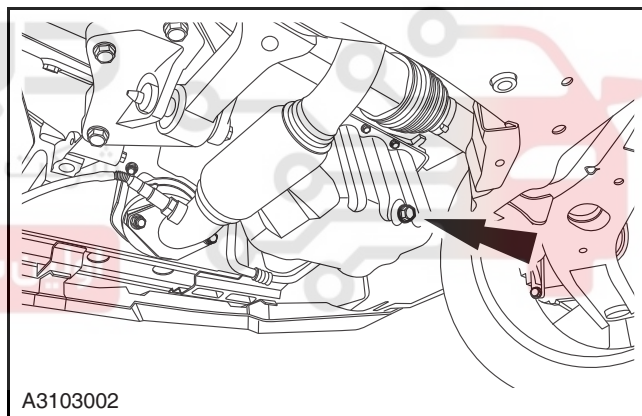
Item	Specification
Sealant	Loctite 5900

1. Lift the vehicle.

Refer to: [Lifting \(1.1.3 Traction and Lifting, Description and Operation\)](#).

2. Remove the oil drain plug to drain the engine oil.

Torque: 55 Nm



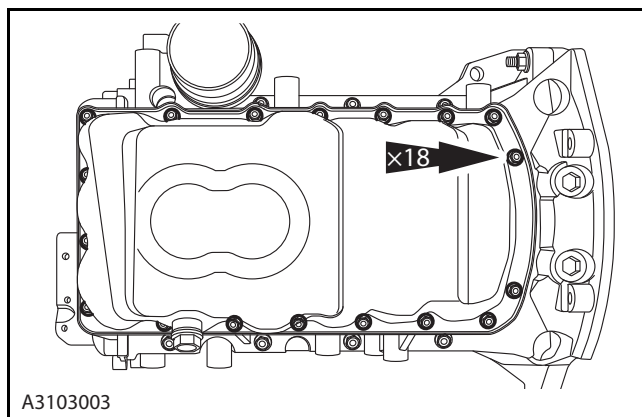
3. Remove the engine oil pan retaining bolts.

Torque: 10 Nm

4. Remove the engine oil pan.

Special Tool: Oil Pan Remover CA301-027

**CAUTION:** There is a open mouth between the engine oil pan and the crankcase, detach the engine oil pan from the crankcase at the open mouth when detaching the engine oil pan.

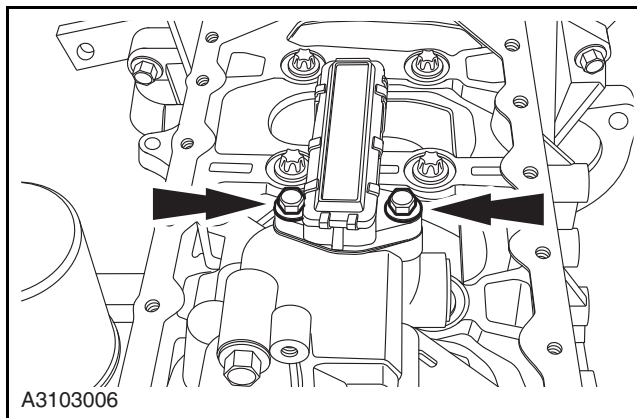


## 3.1.3-16

## Lubrication System

## 3.1.3-16

5. Remove the filter retaining bolts.  
Torque: 10 Nm
6. Remove the filter and discard the gasket.
7. Clean the matching surface between the engine oil pan and the cylinder block, remove the engine oil from the matching surface as well as the used sealant and dirt, and clean the interior of the oil pan.
8. Clean the oil pump filter strainer.

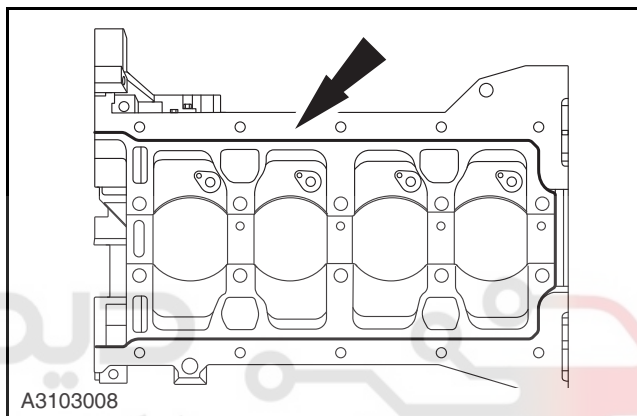


## Installation

1. Install the oil pump filter.

**⚠ CAUTION: Ensure that the new oil pump filter gasket is used.**

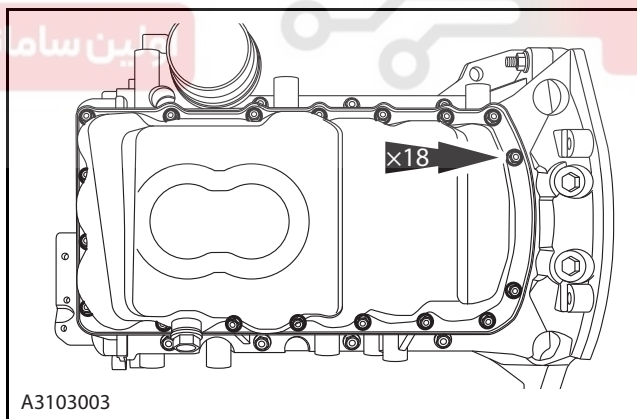
2. Smear the glue on the cylinder block surface (the matching surface with the engine oil pan) position before the installation of the engine oil pan as the glue track shown in the right illustration. Ensure to install before the sealant has not yet hardened.



3. Install the oil pan, the corss and tighten down the engine oil pan bolts and nuts with a screw machine.

Torque: 10 Nm

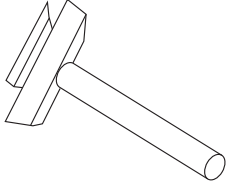
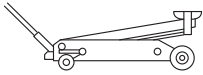


4. Lower the vehicle.
5. Fill the engine with the lubricating oil in accordance with the specifications.
6. Inspect each connector for any engine oil leaks.



## Oil Pump

### Removal

#### Special tool

 <p>CA301-027</p>	<p>Oil Pan Remover CA301-027</p>
 <p>CA301-004</p>	<p>Engine Equalizing Frame CA301-004</p>
 <p>CA301-008</p>	<p>Bolt Wrench, Crankshaft Belt Pulley CA301-008</p>
 <p>CA301-007</p>	<p>Crankshaft Belt Pulley Installation Tool CA301-007</p>

#### Material

Item	Specification
Sealant	Loctite 5900

1. Disconnect the battery negative cable.

Refer to: [Battery Inspection \(3.1.10 Charging System, General Procedures\)](#).

2. Use a special tool to fix the engine.

Special Tool: Engine Equalizing Frame CA301-004

3. Lift the vehicle.

Refer to: [Lifting \(1.1.3 Traction and Lifting, Description and Operation\)](#).

4. Remove the engine oil pan.

Refer to: [Engine Oil Pan and Filter \(3.1.3 Lubrication System, Removal and Installation\)](#).

5. Remove the timing gear.

Refer to: [Timing Gear \(3.1.2 Mechanical System, Removal and Installation\)](#).

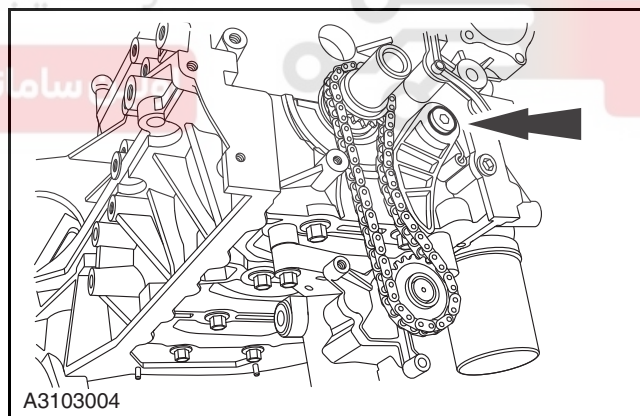
Special Tool: Bolt Wrench, Crankshaft Belt Pulley CA301-008

Special Tool: Crankshaft Belt Pulley Installation Tool CA301-007

6. Remove the engine oil pump chain tensioner.

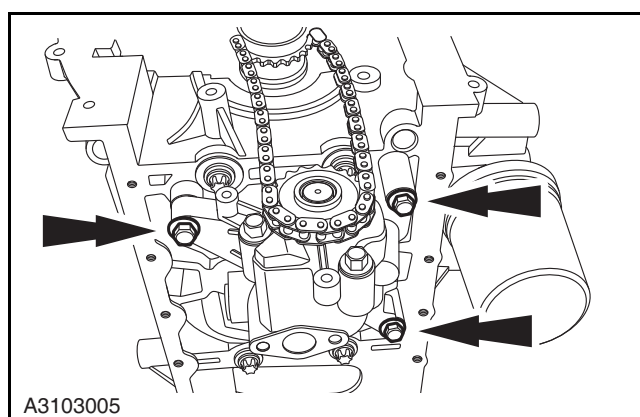
Torque: 23 Nm

- !** **CAUTION:** Be careful of the personal injury due to the spring force when removing the engine oil pump chain tensioner.




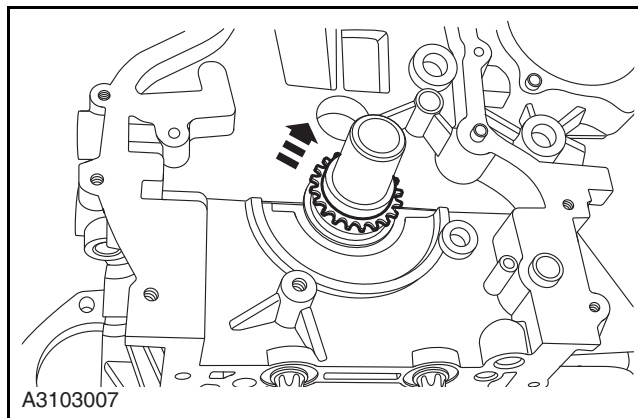
7. Remove the connection bolt between the engine oil pump and the crankcase lower body with the engine oil pump and the engine oil pump chain together.

Torque: 23 Nm



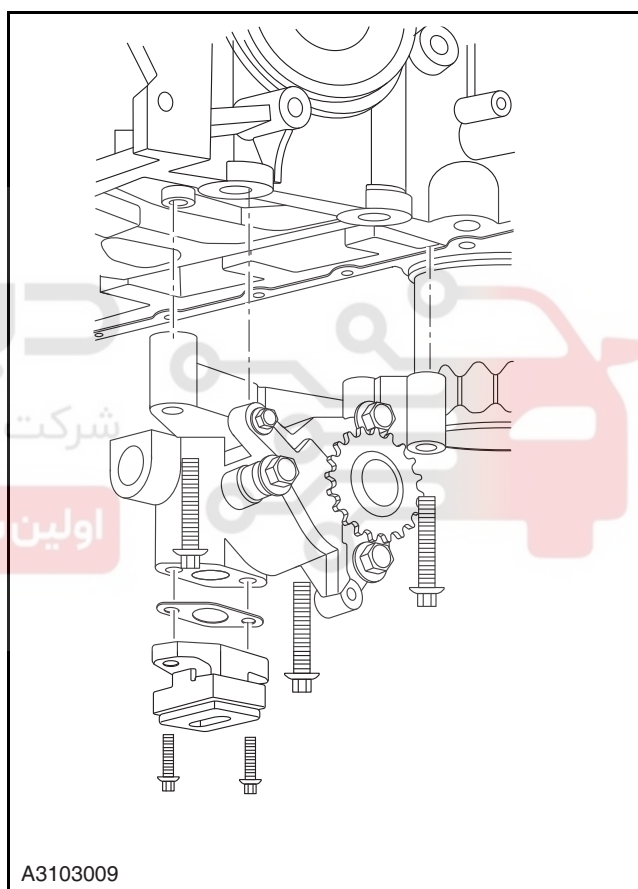
8. Remove the crankshaft engine oil pump chain wheel.

 **CAUTION:** Be careful the woodruff key drop when removing the engine oil pump chain wheel.



### Installation

1. The installation position of the engine oil filter and the engine oil pump assembly is as shown in the right illustration, and install the engine oil pump chain assembly before tightening the engine oil pump assembly bolt.



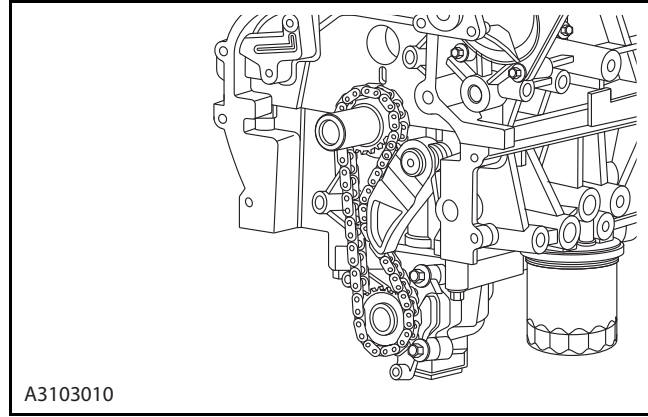
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## Lubrication System

## 3.1.3-20

2. Install the crankshaft belt pulley key, the crankshaft engine oil pump chain wheel, the engine oil pump chain assembly and the engine oil pump tensioner as the installation position schematic diagram shown in the right illustration.
3. Fill the engine with new oil.
4. Start the engine and inspect it for any oil leaks. Inspect if the engine oil pressure is normal or not.



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