2.9 Lubricating System JL4G18-D

2.9.1 Specifications

2.9.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Oil Pan and Cylinder Block Connecting Bolts	M6	8-10	6-7.4
Oil Filters and Cylinder Block Connecting Bolts	M6	8-10	6-7.4
Oil Sensor Plug and Cylinder Block Connecting Bolts	R1 / 8	11.5-19.5	8.6-14.4
Oil Filter and The Cylinder Pipe Fittings	UNF3 / 4 "-16	16-24	11.8-17.8
Oil Filter Fittings	M28 × 1.5	33-37	24.4-27.4
Oil Pump Retaining Bolt	M6	8-10	6-7.4
Oil Pan Drain Plug	M12	25-35	18.5-25.9

2.9.1.2 Oil Pump Specifications

Side Clearance	0.025-0.062 mm (0.0010-0.0024 in)
Tooth Clearance	0.030-0.099 mm (0.0012-0.0039 in)
Engine Oil Pressure Sensor Plug Pressure	≤40 kPa (≤6 psi)
Oil Pump Output Pressure	0.6 MPa (87 psi)
Oil Pump Relief Valve Opening Pressure	0.42-0.58 MPa (61-85 psi)

2.9.2 Description and Operation

2.9.2.1 Description and Operation

Oil Pan

The oil pan is installed at the bottom of the engine crankcase. The engine oil pump draws engine oil from the oil pan. After filtered by the oil filter, the engine oil passes through two oil paths, lubricating cylinder block and cylinder head cover respectively. In an oil path, the engine oil passes through the crankshaft oil passage to the connecting rod, and then to the piston and cylinder, finally, return to the oil pan. In the other oil path, the engine oil passes through the engine oil passage to the camshaft, through the oil path within the camshaft, lubricating valve assembly, then finally return to the oil pan.

Oil Pump

Oil pump draws the engine oil from the oil pan and then pump the engine oil with pressure to the various parts of the engine. Oil pump inlet has an oil filter - set filter. Set filter blockage may damage the oil pump and cause the pump oil inoperative, and the lubricating system will be unable to establish a normal oil pressure, which will cause the engine mechanical damage.

Oil pump is driven by the crankshaft concave. As long as the crankshaft rotates, the oil pump will be working. The oil pump displacement is fixed, so when the engine speed is high, the oil pump output pressure will exceed the needs of the engine lubrication system. There is a safety valve in the oil pump assembly. The safety pressure relief valve cavity is connected with the oil pump intake chamber. When the output pressure exceeds 0.5 MPa (73 psi), the security valve is open, the excess oil returns to the oil pump through the valve. With the normal oil supply, the safety valve bypass is closed.

Lubrication Descriptions

The oil filter seat is integrated on the crankcase. Engine oil passes through the oil filter seat bottom oil path to the oil filter. After being filtered, engine oil passes through the oil filter seat upper oil path to return to the cylinder block.

Engine oil passes through the oil path to the cylinder block front. These oil paths will supply engine oil to the cylinder head, main bearing oil path, VVT solenoid valves and camshaft position actuators.

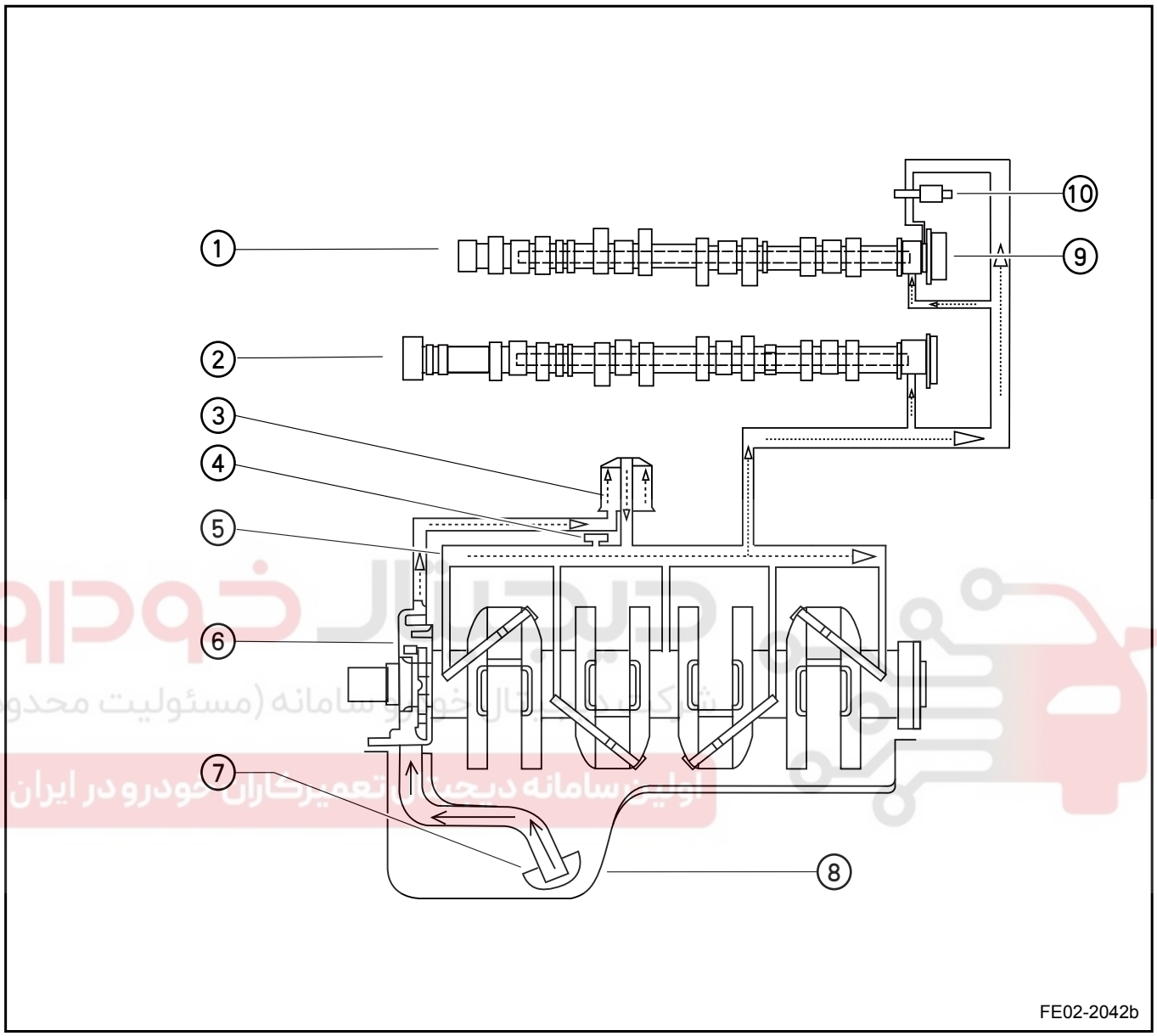
Each cylinder head oil path introduces engine oil into the cylinder head cover and camshaft bearing journal. Engine oil passes through the main oil path to the VVT solenoid valve, VVT solenoid valve oil cavity, to the VVT actuator. VVT solenoid valve is used to control the intake camshaft position actuator. Engine Control Module (ECM) controls the VVT solenoid valve. When the engine control module provides power to the VVT solenoid valve, the solenoid valve guides the engine oil to flow through the cylinder head cover camshaft front bearing caps. Engine oil passes through the intake camshaft bearing caps into the camshaft journal drilled hole and flows to the intake camshaft front installation surface. Then, the engine oil flows to the camshaft position actuator corresponding oil path. VVT solenoid valve guides engine oil into the system corresponding oil path, so that the engine oil pressure acting on the intake camshaft position actuator internal blades. The intake camshaft (installed on the camshaft position actuator inner rotor) rotates relative to the sprocket (mounted on the intake camshaft position actuator housing). At idle, the internal pin will lock the rotor to the intake camshaft actuator housing. When starting, the cam actuator position will maintain the original position or the default position. VVT solenoid valve guides engine oil hydraulic pressure to loose the lock pin, so that the intake camshaft position actuator works.

Oil pump contains a small engine oil nozzle, which sprays the engine oil to timing chain components.

Engine oil passes through the camshaft timing chain drive belt area or cylinder head cover and cylinder block casting oil return path and returns to the oil pan.

2.9.3 System Working Principle

2.9.3.1 Lubrication Schematic



Legend

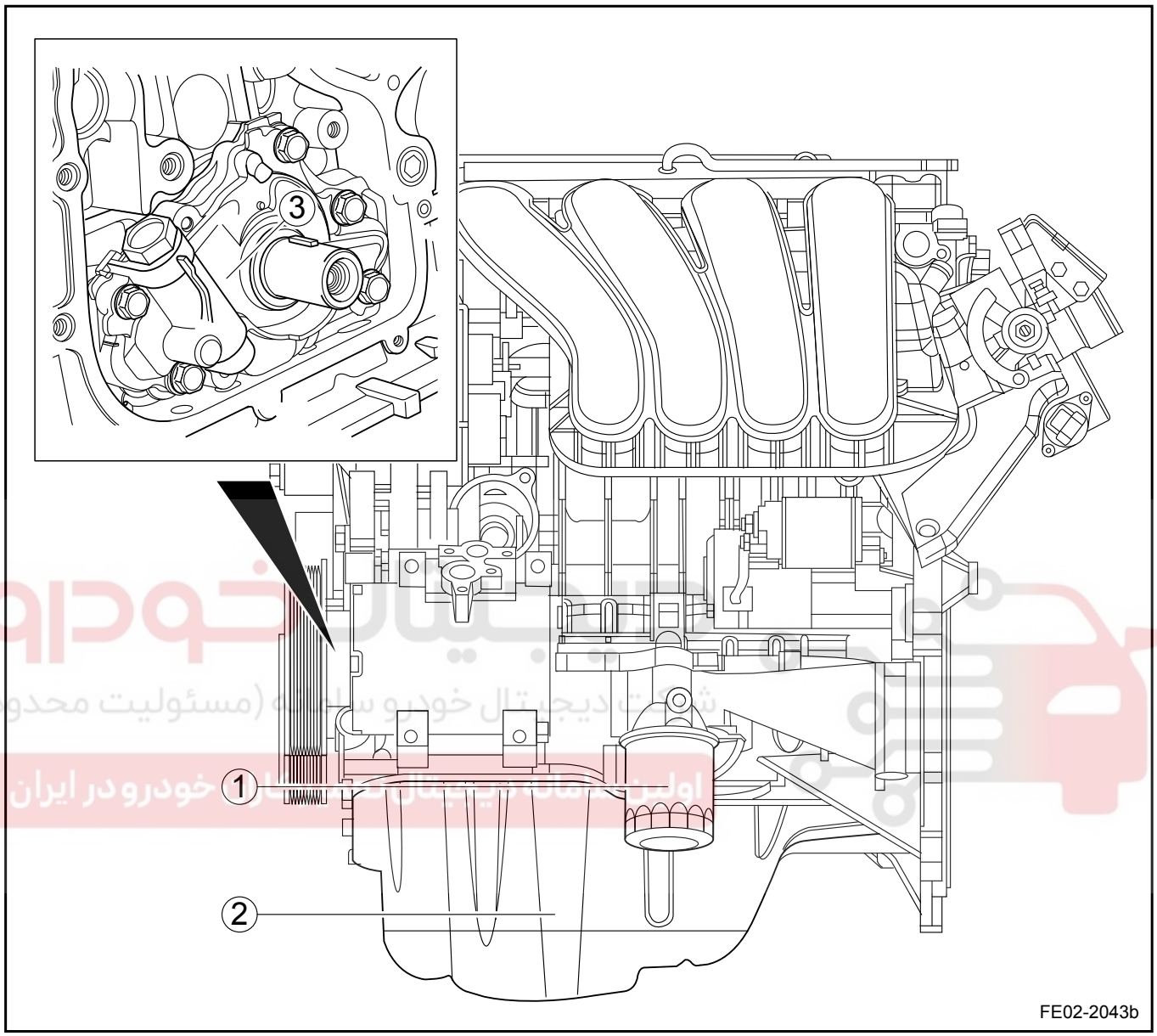
1. Intake Camshaft
2. Exhaust Camshaft
3. Oil Filter
4. Oil Pressure Sensor Plug
5. Main Oil-Channel
6. Oil Pump
7. Oil Collection Filters
8. Oil Pan
9. VVT Actuator
10. VVT Solenoid Valve

2.9.3.2 Engine Oil Pressure Sensor Plug Control Principle

Engine oil pressure sensor plug is a pressure switch and is set on the oil filter. When the engine oil pressure is below the specified value, this switch is switched off and the engine oil pressure warning lamp will be on. When the car starts normally, the oil pump transfers the oil pressure to the system, so this switch is switched off and the engine oil pressure warning lamp will be off.

2.9.4 Component Locator

2.9.4.1 Component Locator

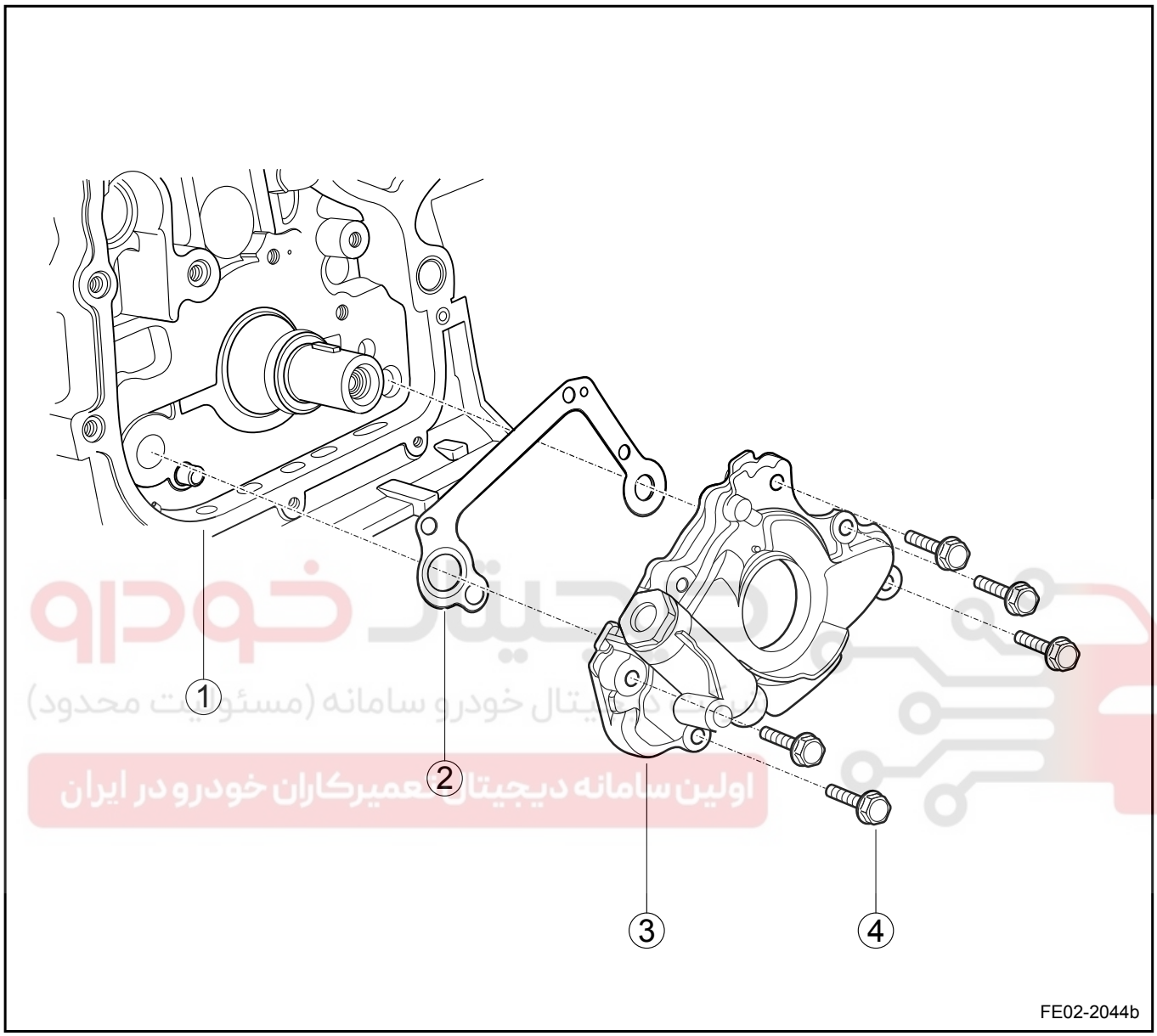


Legend

1. Oil Filter
2. Oil Pan
3. Oil Pump

2.9.5 Disassemble View

2.9.5.1 Disassemble View

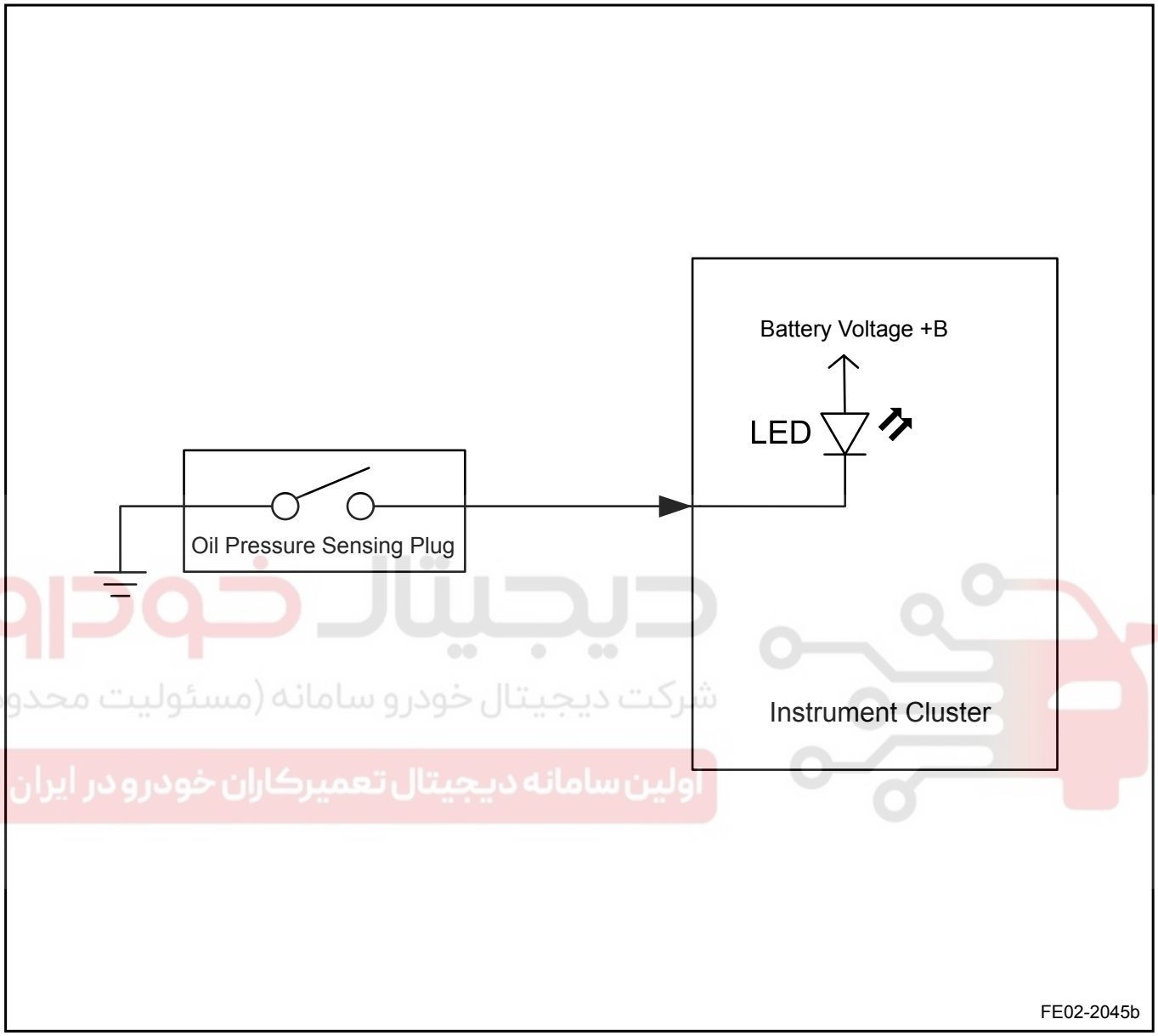


Legend

1. Engine Block
2. Oil Pump Gasket
3. Oil Pump Assembly
4. Oil Pump Bolts

2.9.6 Schematic

2.9.6.1 Schematic



2.9.7 Diagnostic Information and Procedures

2.9.7.1 Diagnosis Description

Refer to 2.9.2.1 Description and OperationGet familiar with the system functions and operation before start system diagnostics, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the customer described situation is normal.

2.9.7.2 Visual Inspection

- Check installed aftermarket equipment that may affect the operation of the lubrication system.
- Check easy to access system components to identify whether there are significant blockages or leakage. If there is leakage, confirm whether it is engine oil leak.
- Check whether the oil filter is dirty or blocked. If necessary, replace it.

2.9.7.3 Abnormal Engine Oil Consumption Diagnostic

When the engine oil consumption (non-leaking) exceeds the acceptable range, abnormal engine oil consumption diagnostic must be carried out.

Step 1	Check whether there is engine oil leakage.
Yes	Refer to 2.9.7.5 Engine Oil Leak Diagnostic
No	
Step 2	Check whether the engine oil viscosity is abnormal. Check whether poor quality engine oil is used.
Yes	Replace the oil filter and engine oil
No	
Step 3	Check whether the vehicle sustained high speed / or excessive use.
Yes	Service the engine.
No	
Step 4	Check whether the crankcase ventilation system is blocked and whether the components are working correctly.
Yes	Replace the faulty parts.
No	
Step 5	Check whether the valve conduit / or the valve rod is worn, whether the valve rod oil seal is worn, missing or improperly installed.
Yes	Repair the faulty part.

No

Step 6	Check whether the piston and piston rings in the cylinder are improperly installed.

Yes → Repair the faulty part.

No

Step 7	Check whether there is correct piston ring seal, whether there are broken or worn piston rings. If necessary, repair the faulty part.

Next

Step 8	Confirm that the fault has been fixed.

2.9.7.4 Engine Oil Pressure Diagnostic and Test

Step 1	Check whether engine oil viscosity is abnormal. Check whether poor quality engine oil is used.

Next

Step 2	Park the vehicle on a level ground and let the engine run for a few minutes, waiting for a long enough period of time (2-3 min) to let the engine oil return. Measure whether the engine oil is too low.

Next

Step 3	If necessary, add the recommended grade engine oil, until the engine oil level reaches the full scale.

Next

Step 4	Let the engine run for 10-15 s. Confirm the vehicle indicator does not show that the pressure is too low or no engine oil pressure.

Next

Step 5	Check whether there is noise or knock sound in the valve system.

Next

Step 6	Check whether there are following conditions:

(a) Engine oil has bubbles.
(b) Idle speed is too low.
(c) Oil filter is blocked.
(d) Engine oil is diluted by water or the engine coolant and so on.
(e) Oil filter bypass valve is faulty.
(f) Oil pressure warning lamp is incorrect or faulty.
(g) Oil pressure sensor plug is incorrect or faulty.
(h) Engine oil viscosity is not suitable for the expected temperatures.

Yes → Refer to the user manual, according to local temperatures, use the Geely Automobile recommended grade and viscosity engine oil

No

Step 7	Turn the ignition switch to "OFF" position, remove the oil pressure sensor plug.

Next

Step 8	Install the engine oil pressure test tool to the oil pressure sensor plug on the oil filter.

Next

Step 9	Start the engine and measure engine oil pressure.

Next

Step 10	Compare the readings with the pressure value in 2.9.1.2 Oil Pump Specifications. If the engine oil pressure is less than the specified value. Check whether there are one or more of the following conditions:

(a) Oil filter bolts loose.
(b) Oil filter seat O-ring or seal is missing or damaged.
(c) Oil pump is worn or dirty.
(d) Oil pump to cylinder block bolts are loose.
(e) Oil pump filter loose,blocked or damaged.
(f) Oil pump filter O-ring missing or damaged.
(g) Oil Pump Oil Filter pipes damaged or leaking.
(h) Oil pump pressure regulating valve faulty.
(i) Engine oily channel plug missing or improperly installed.
(j) Camshaft intermediate shaft bolts loose.
(k) The following components bearing clearance exceed the acceptable tolerance range:
1. Link
2. Crankshaft
3. Camshaft
4. Camshaft Intermediate Shaft Sprocket
(l) Engine oil channel cracking. There are pores or blockage.
(m) Valve Lifter fracture.
When necessary, repair or replace the relevant parts.

Step 11	End of the test.

2.9.7.5 Engine Oil Leak Diagnostic

Once a vehicle engine oil leak occurs, the following conditions must be checked:

Step 1	Check whether the engine oil level is too high.

Yes → Discharge engine oil to the specified level

No

Step 2	Check whether the engine oil pressure is too high.

Yes → Check whether the pressure oil filter or the bypass valve is blocked or malfunction.

No

Step 3	Check whether the engine ventilation system is blocked or malfunction.

Yes → Repair the faulty part.

No

Step 4	Check whether the fasteners are not fastened properly or damaged.

Yes → Replace the damaged parts, tighten the fasteners again if required.

No

Step 5	Check whether the related parts have gaps or pores.

Yes → Repair the faulty part.

No

Step 6	Check whether the sealing surface is worn. Check whether the sealing gasket is installed properly.

Yes → Repair the faulty part.

Next

Step 7	Confirm that the fault has been fixed.

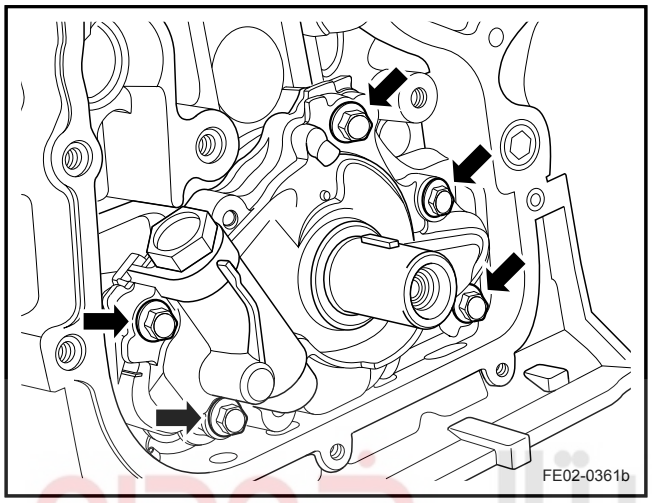
2.9.8 Removal and Installation

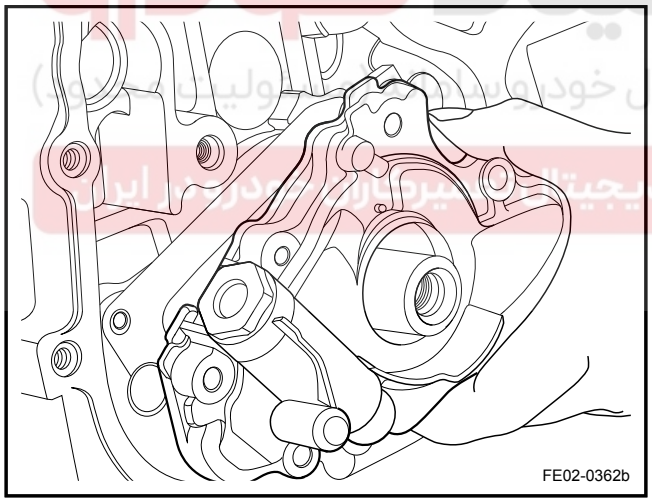
2.9.8.1 Oil Pump Replacement

Removal Procedure:

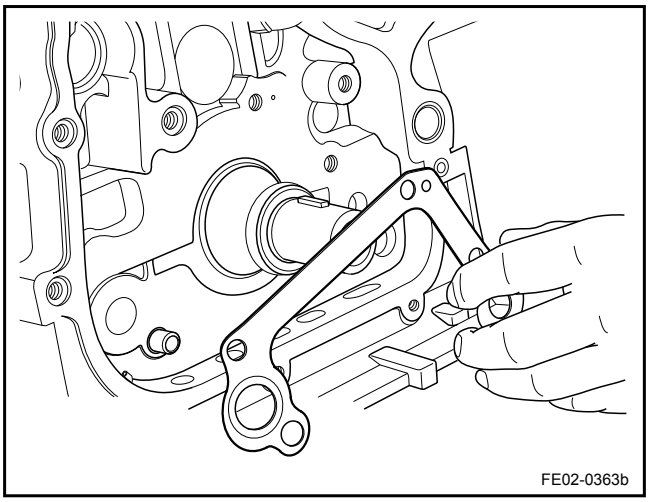
Warning!

After a new oil pump is installed, the oil collection filters, must be inspected. Refer to engine oil pan replacement and oil collection filters replacement.



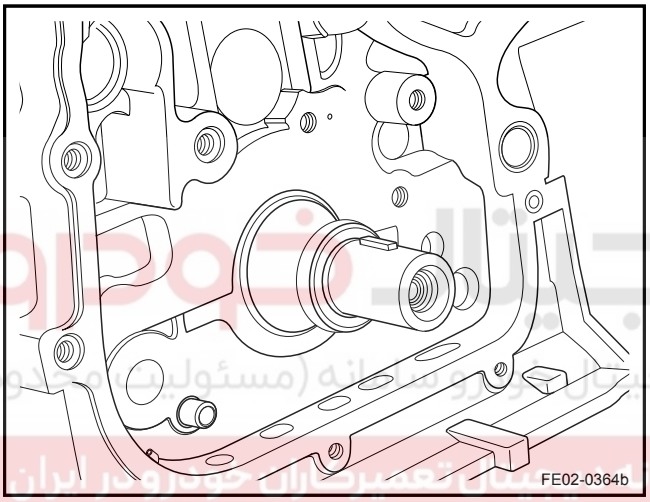


1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the timing chain cover. Refer to 2.6.8.9 Timing Chain Cover Replacement.
3. Remove the timing chain. Refer to 2.6.8.10 Timing Chain Replacement.
4. Remove oil pump bolts.
5. Remove the oil pump from the engine block.

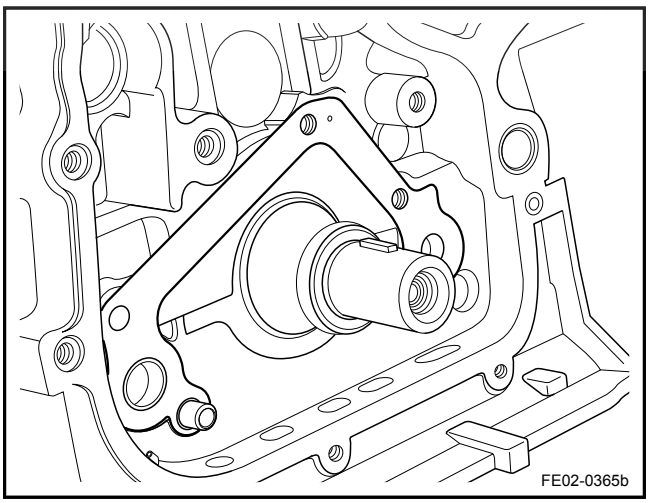


6. Remove the oil pump gasket from the engine block.

Installation Procedure:



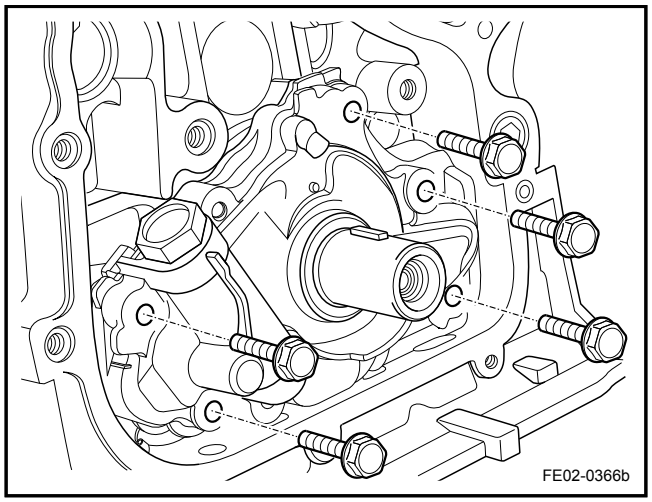
1. Before installation, clean the engine oil pan oil collection filters. Refer to 2.9.8.3 Oil Pan Replacement.
2. Clean engine block oil pump installation surface.



3. Install the oil pump gasket.

Note

The gasket is a single used part, it must be replaced after removal.



4. Install and tighten the oil pump retaining bolts.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)

5. Install the timing chain.

6. Install the timing chain cover.

7. Connect the battery negative cable.

2.9.8.2 Oil Pump Cleaning and Inspection

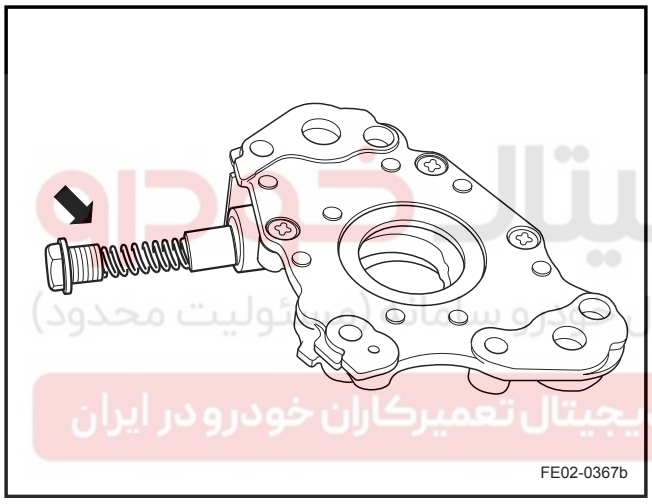
Cleaning Procedures:

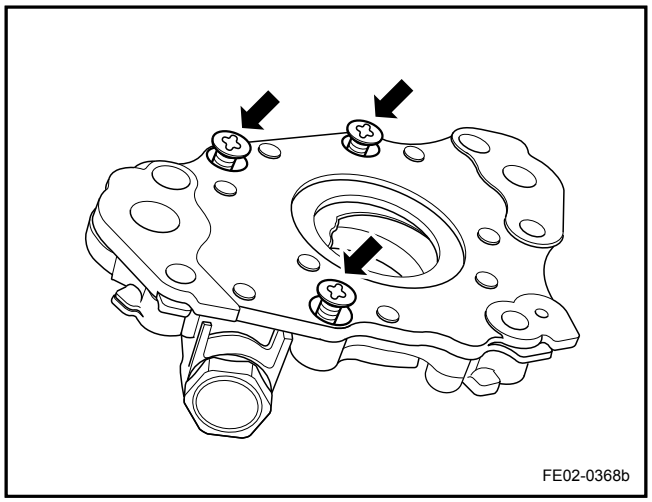
1. Oil Pump Valve Inspection:

   a. Remove the valve safety bolts, remove the springs and the slide valve.

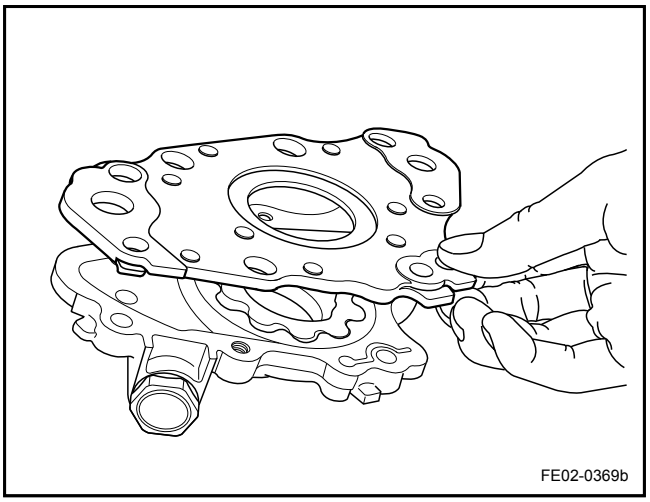
   b. Check whether the surface of slide valve is worn. whether the hole wall is worn. Whether the slide valve and the inner hole clearance is normal.

   c. Apply oil on the slide valve, install slide valves and springs, tighten valve bolts.





2. Remove oil pump rear cover bolts.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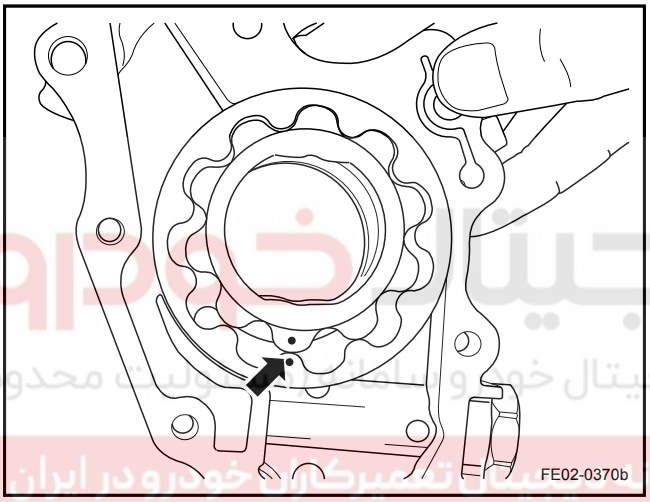
3. Remove the oil pump cover.
4. Clean oil pump housing and internal parts.

Inspection Procedure:

1. Check all oil pump parts for worn and torn.
2. Apply clean engine oil to all oil pump parts.

Note

A: Apply grease to the oil pump gear chamber in order to ensure initial oil pump lubrication.
B: Install oil pump gears so that the side with a dot faces up and align internal and external gears.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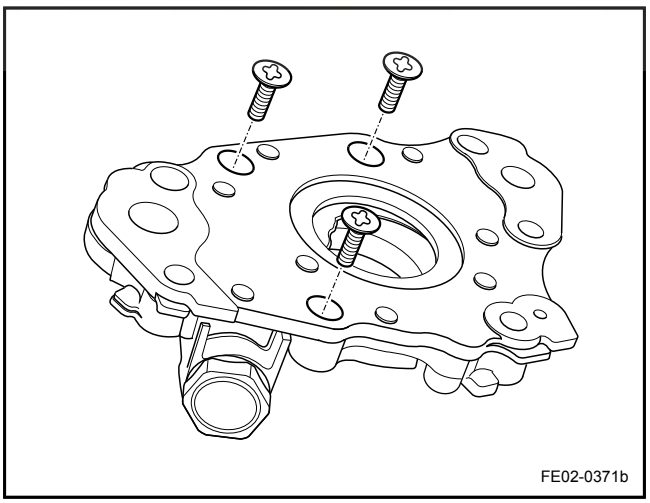
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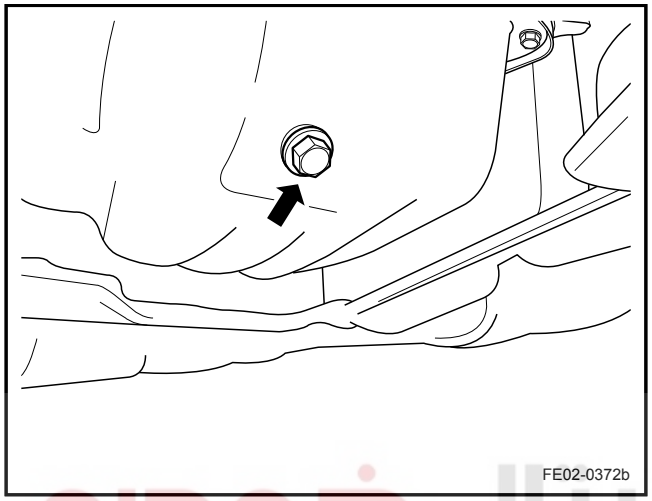
3. Install the oil pump rear cover and tighten connecting bolt.

2.9.8.3 Oil Pan Replacement

Removal Procedure:

Warning!

Refer to "Battery Disconnection Warning" in "Warnings and Notices".
Refer to "Vehicle Lifting Warning" in "Warnings and Notices".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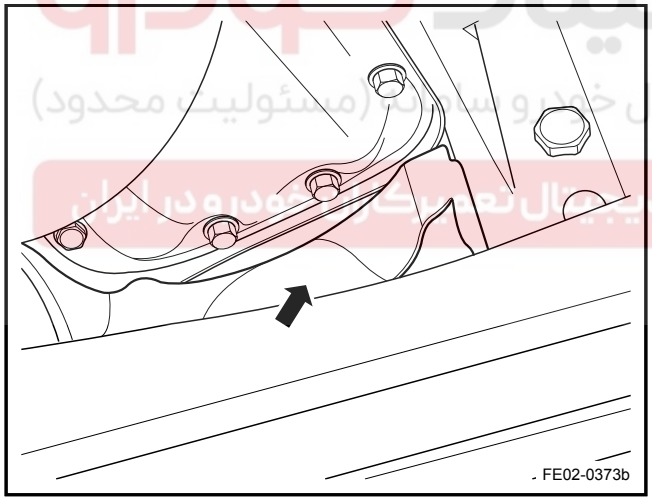
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Lift the vehicle.
3. Release the engine oil pan oil discharge bolt, discharge the engine oil from the crankcase.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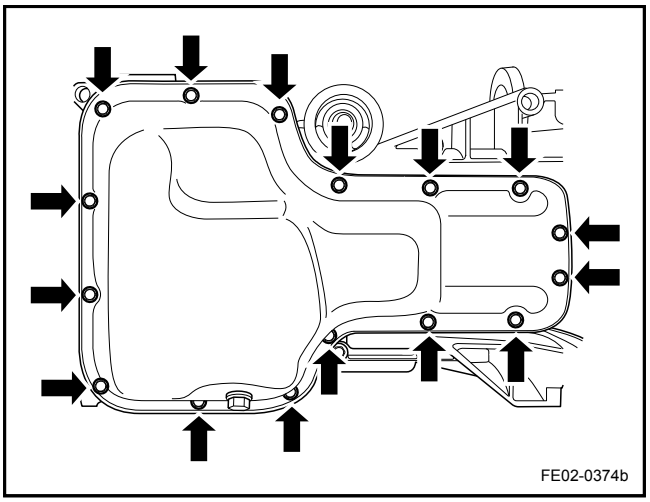
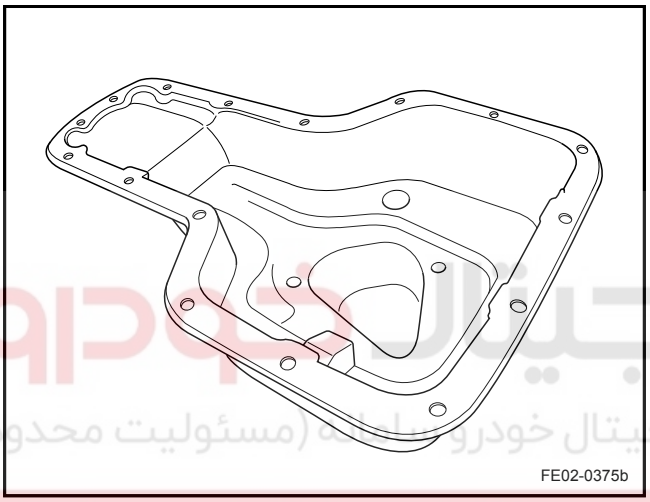
4. Remove the crankcase dust shield.

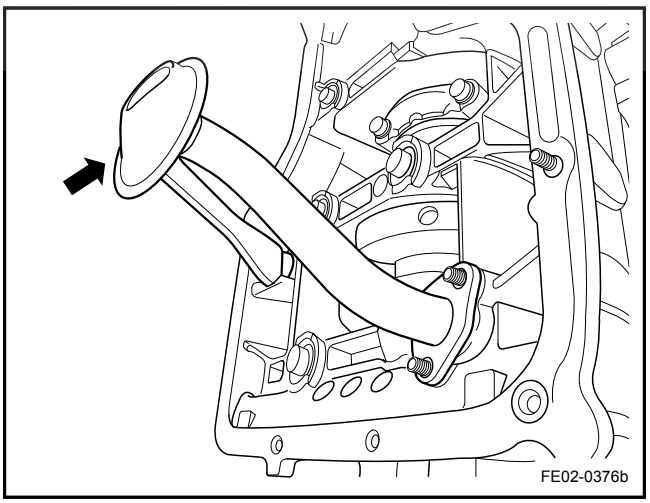


5. Remove the oil pan retaining bolts and nuts.

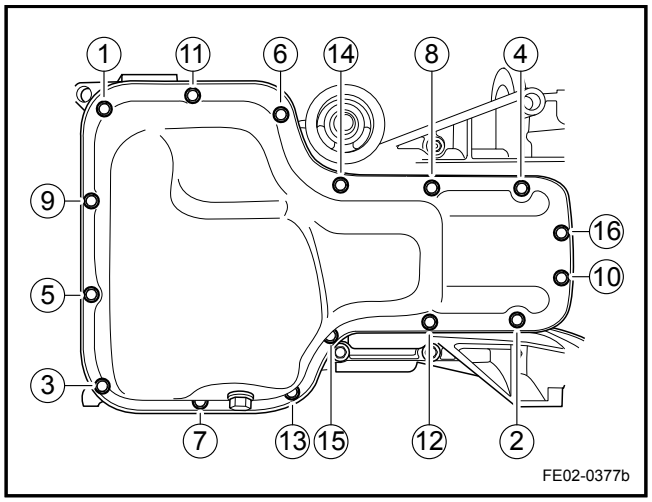


6. Remove the oil pan from the cylinder block.

Installation Procedure:

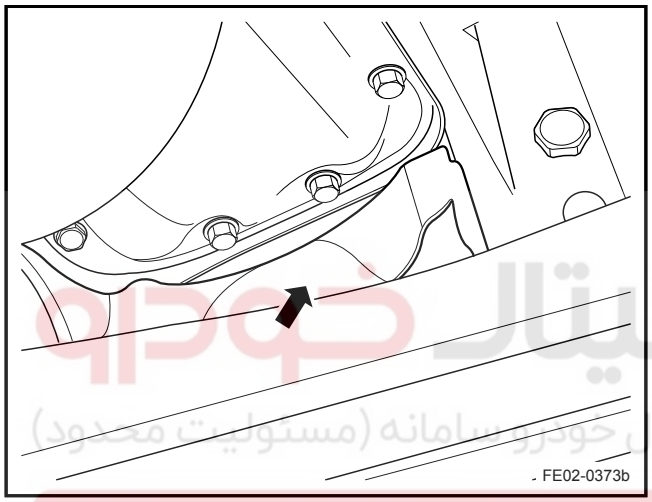


1. Inspect and clean set of filters before installing the oil pan.

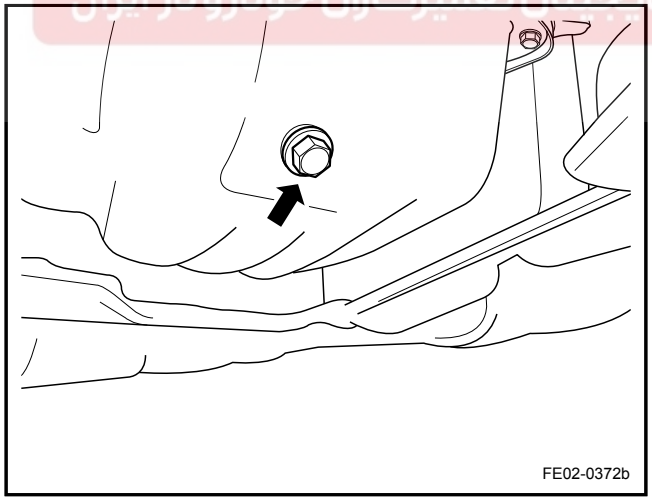


2. Clean oil pan and cylinder block mating surface.
3. Apply sealant on the new engine oil pan evenly.
4. Install the oil pan and tighten the bolts and nuts according to the sequence in the graphic.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)



5. Install the flywheel shield.



6. Install and tighten oil pan oil discharge bolts.

   Torque: 30 Nm (Metric) 22.2 lb-ft (US English)
7. Connect the battery negative cable.